प्रगति प्रतिवेदन
Progress Report
2016-17

अखिल भारतीय समन्वित गेहूँ एवं जौ सुधार परियोजना
AICRP on Wheat and Barley Improvement

उत्पादन वृद्धि से किसान समृद्धि
Higher Productivity for Farmers' Prosperity

फसल सुरक्षा
Crop Protection

भा.कृ.अनु.प. - भारतीय गेहूँ एवं जौ अनुसंधान संस्थान, करनाल
ICAR – Indian Institute of Wheat and Barley Research, Karnal

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AICRP on Wheat & Barley

PROGRESS REPORT
2016-17

CROP PROTECTION

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Correct Citation:

ICAR-IIWBR 2017. Progress Report of AICRP on Wheat and Barley 2016-17, Crop Protection. Eds: D.P. Singh, Sudheer Kumar, Subhash Katare, Poonam Jasrotia, P.L. Kashyap, Priyanka Chandra, M.S. Saharan and Gyanendra Pratap Singh. ICAR-Indian Institute of Wheat and Barley Research, Karnal, Haryana, India. P. 200.

Issued on the occasion of 56th All India Wheat & Barley Research Workers' Meet at
Banaras Hindu University, Varanasi during August 25-28, 2017.

ACKNOWLEDGEMENT

With great pleasure and honour I convey my sincere gratitude to Hon. Dr. J.S. Sandhu, Former DDG (CS), for his professional guidance, keen interest and constant support to the Crop Protection prorgramme which helped us to perform high and keeping wheat crop in good health. We are highly grateful to Hon. Dr. A. K. Singh, DDG (HS and CS) for his guidance and support to Wheat Crop Protection Programme. I am thankful to Dr. I.S. Solanki, ADG (FFC) and Dr. P.K. Chakrabarty, ADG (PP &B) for their regular support in conducting different activities of Crop Protection under the AICW&BIP.

Our sincere thanks are due to Dr. G.P. Singh, Director of the institute for providing great leadership, support and facilities to take up different activities in crop protection programme.

I am highly thankful to my colleagues of crop protection programme of AICW&BIP whose untiring efforts and hard work indeed helped us in successful implementation of the Crop Protection Programme during 2016-17 crop season and keeping the wheat crop health in excellent condition. My special thanks to Dr. S.C. Bhardwaj, Principal Scientist and Incharge, and his team of scientists, Drs. O.P. Gangwar, Pramod Prasad, and Hanif Khan as well as technical and administrative staff, ICAR-IIWBR Regional Station, Flowerdale, Shimla, for contributing significantly in wheat rusts research, survey and surveillance, coordination of monitoring nurseries and supply of inocula of rust pathotypes. I am thankful to team members of special teams for recording of PPSN and monitoring of diseases. Their names are shown in programme of work and different issues of Wheat Crop Health Newsletter. I am highly thankful to my female colleagues, Drs. Priyanka Chandra, Sunita Mahapatra, Kanak Srivastava, Ritu Bala, Jaspal Kaur, Poonam Jasrotia and Ranjana Chakravarti for their commitment in conducting survey and surveillance activities and support to the programme. The scientists, Drs. Vikas Gupta, Raj Kumar, Amit K. Sharma, Dhiman Mukherjee, J. P. Jaiswal, Anil Kumar and Charan Singh who belong to other programmes deserve full appreciation for their readily help in different activities of Crop Protection Programme whenever requested. I am grateful to my younger professional, Mr. Pankaj Kumar, SRF, for his assistance in performing different activities at coordinating centre.

Technical and administrative support is of utmost importance in implementation of programmes and preparation of report. I therefore take this opportunity to convey my thanks to Dr. Mangal Singh, Assistant Chief Technical Officer for preparing IPPSN and PPSN nurseries and conduct of these at Karnal. Appreciations to Shri. Ishwar Singh, Technical Officer had been very helpful and highly supportive to the programme and conducted most of nurseries and trials at Karnal and assisted in preparation of data books, inocula, tabulation, data analysis and reporting. Thanks to Shri. Nandan Singh (SSS) for their full support and working for the successful implementation of programme. Ms. Hemlata, P.A., deserves good appreciation for her professional and regular secretarial assistance to PI (CP) in coordinating different activities of AICW&BIP, report preparation, e filling, record keeping and matter related to human resource management. I thank Shri Rajinder Kumar for helping in conducting poly houses and field experiments as well as seed storage. Special thanks to Shri Rajinder Kumar, Secretarial Help of PME cell for assisting in report preparation.

I am acknowledge the help came from Dr. Ravish Chatrath and Dr. Ajay Verma (Team leaders) and their team members, Shri Yogesh Sharma, Shri P. Chandrababu, Shri Ravinder, Shri Bhim Sen, Shri Raunak and other colleagues for their services related to internet, web page facilities, data analysis, reprography and report binding as well as arranging multiple copies of report.

ICAR-IIWBR, Karnal
Dated: 08.08.2017

(D. P. Singh)
Principal Investigator
(Crop Protection Programme)

C O N T E N T S

PROGRAMME OF WORK, 2016-2017

The programme for the crop year 2016-2017 was chalked out in the 55th All India Wheat and Barley Research Workers Meet held at CCS HAU Hisar during August 21-24, 2016. The various activities to be executed at respective centres are given below:

PROGRAMME 1: HOST RESISTANCE: IPPSN AND PPSN

Adult Plant Resistance for rusts & other diseases

i. Initial Plant Pathological Screening Nursery (IPPSN)

Objectives

To evaluate breeding materials generated at various centres against rusts and foliar blights for promoting to coordinated multi-location trials. (Under artificial inoculated conditions)

(a) Rusts:

North:

Leaf Rust: Delhi, Hisar, Karnal, Durgapura, Ludhiana (5)

Yellow Rust: Gurdaspur, Dhaulakuan, Malan, Karnal, Durgapura, Ludhiana and Jammu (7)

South:

Stem Rust + Leaf Rust: Mahabaleshwar, Wellington, Powarkheda, Niphad and Indore (5)

(b) **Leaf Blight:** Faizabad, Pusa (Bihar), Varanasi, Kalyani, Sabour, Ranchi and Coochbehar (7)

ii. Plant Pathological Screening Nursery (PPSN)

Objectives

Promotion of entries from one stage to the other in the coordinated trials and identification of varieties for release after AVT level on the basis of their level of disease resistance.

Rusts:

North:

Stripe Rust: Dhaulakuan, Gurdaspur, Malan, Bajaura, Karnal, Delhi, Ludhiana, Pantnagar, Durgapura, Jammu, Kudwani (Kashmir) (11)

Leaf Rust: Delhi, Hisar, Jammu, Kanpur, Karnal, Ludhiana, Pantnagar, Durgapura(8)

South:

Leaf and Stem Rusts: Wellington, Mahabaleshwar, Niphad, Vijapur, Pune, Junagarh, Powarkheda, Dharwad and Indore (9)

Note: The samples of leaves of AVT IInd year entries in PPSN and the varieties (checks) showing resistance in the past but now showing rust severity of 40S or more at any of the centres, should be sent immediately to the Incharge, IIWBR Regional Station Flowerdale, Shimla for pathotype analysis, with information to P.I. (Crop Protection). The stripe rust has to be recorded every month from mid January – mid March.

Monitoring of PPSN

A team of Plant Pathologists was constituted during the work-planning meeting for effective monitoring and data recording in PPSN at various locations in NWPZ. The team consists of

Drs. P.L. Kashyap, Vikas Gupta and M. K. Pandey will monitor PPSN at Ludhiana, Gurdaspur and Jammu centres.

Drs. P.L. Kashyap, Rajender Singh Beniwal and Anil Kumar will monitor PPSN at Pantnagar.

Drs. Sudheer Kumar, Vaibhav K Singh and P.S. Shekhawat will monitor, Karnal, Hisar, Durgapura and Delhi centres.

The Plant Pathologists of other zones will monitor PPSN during Zonal monitoring tours.

iii AUDPC based identification of slow rusters in AVT material:
Leaf and Stripe rusts - IIWBR, Karnal; stem and leaf rusts -Mahabaleshwar; stem rust -Indore; Stripe rust - Ludhiana.

PROGRAMME 2: RUSTS (Leaf, stripe and stem)

A. APR: Race specific and slow rusting

i. Leaf rust: AVT entries of NWPZ, NHZ and NEPZ, along with the check entries of the respective zones.
Centres: New Delhi and Ludhiana under field conditions and Flowerdale, Shimla (under glass house conditions)

ii. Stem rust: AVT of CZ and PZ, along with the check varieties of the respective zone.
Centres: Indore, Pune, Powarkheda and Mahabaleshwar

iii. Stripe rust: AVT entries of NWPZ and NHZ alongwith the checks of the respective zones.
Centres: Ludhiana and N. Delhi under field conditions and Flowerdale (under controlled condition),

Race inoculum to be supplied by Flowerdale: Races should be the same for all the respective centres.

(i) Leaf rust: 77-5 and 77-9
(ii) Yellow rust: 46S119 and 110S119
(iii) Stem rust: 40A and 117-6

B. Seedling Resistance Tests and postulation of Rust Resistance Genes

i. Leaf, Stem and Yellow rusts (All races): IIWBR, Regional Station, Flowerdale, Shimla for AVT's (*T. aestivum*) entries. Flowerdale centre to generate data on rust resistance genes of all the AVT entries. Besides, this, identification of Rust Resistance genes to be done in selected entries of MDSN, MPSN and EPPSN.

ii. Stem and Leaf rusts: Mahabaleshwar for SRT on AVT entries of CZ, PZ and NIVT (durum entries).

PROGRAMME 3: LEAF BLIGHT

i. Leaf Blight Screening Nursery (LBSN): No. of Centres: 14

This nursery will consist of earlier identified resistant materials as well as the AVT's and special trials. It will have all the released varieties and material found resistant in preceding years. It will have entries sent to CIMMYT for screening against wheat blast also.

NWPZ: Pantnagar, Ludhiana, Karnal and Hisar.

NEPZ: Varanasi, Faizabad, IARI Pusa, Coochbehar, Shillongani, Ranchi and Kalyani, Naini (Allahabad)

PZ: Dharwad

ii. **Foliar and head diseases monitoring nursery:** It will be planted adjoining at key locations of Indo-Bangladesh borders and different centres of NEPZ, NWPZ and PZ. This will help in monitoring of leaf blight, head blight / head scab and wheat blast.

iii. **Monitoring of wheat blast:** The following teams are constituted to monitor wheat crop in West Bengal and Assam along the Indo-Bangladesh borders for the presence of wheat blast.

Team 1: Drs. D.P. Singh, Raj Kumar, A. K. Sharma and Dhiman Mukherjee
Team 2: Drs. Sudheer Kumar, Charan Singh and Satyajit Hembram
Team 3: Drs. P.L. Kashyap, Javed Bahar Khan and H. C. Lal

iv. Leaf blight samples to be sent from all the centres to PI (CP) for pathogen monitoring from naturally infected fields.

PROGRAMME 4: KARNAL BUNT
Karnal Bunt Screening Nursery (KBSN): This nursery will consist of the earlier identified resistant materials, released varieties alongwith AVT entries of 2016-2017 under artificially inoculated conditions.
Dhaulakuan, Ludhiana, New Delhi, Pantnagar, Hisar, Karnal and Jammu (7).
Ludhiana and Dhaulakuan will also evaluate NIVT entries.

PROGRAMME 5: LOOSE SMUT
Loose smut Screening Nursery: It will contain resistant materials identified in the past released varieties and AVT Ist year entries.
Centres: Ludhiana, Almora, Durgapura and Hisar.

PROGRAMME 6: POWDERY MILDEW
Powdery Mildew Screening Nursery: All entries of AVT, previously identified resistant Material and released varieties (NHZ, NWPZ) Almora, Pantnagar, Shimla, Malan, Bajaura, Dhaulakuan, Wellington (8)

Virulence analysis of powdery mildew pathogen with available international differential set will be initiated at Malan.

Chemical control of powdery mildew will be taken up at Malan

PROGRAMME 7: REGION SPECIFIC DISEASES
Host Resistance
Disease Screening Nurseries of the region specific diseases will include resistant materials identified during the past, along with AVT entries at the locations given below:

i. **Head scab:** Karnal, Gurdaspur, Dhaulakuan Pusa (Bihar) and Wellington (AVT). At Gurdaspur and Wellington, evaluation for head scab will be done under natural conditions.
ii. **Flag smut:** Ludhiana, Hisar, Karnal and Durgapura
iii. **Foot rot:** Sagar and Dharwad
iv. **Hill bunt:** Malan, Bajaura and Almora

Chemical Control: A trial on chemical control of flag smut will be conducted at Karnal, Hisar, Ludhiana and Durgapura using commonly available system fungicides.

PROGRAMME 8: CROP HEALTH

i Crop Health Monitoring: Pre harvest surveys

- All the centres associated with Crop Protection Programme will supply information fortnightly on crop health from the areas of their jurisdiction to P.I. Crop Protection starting from November 2016 till the harvest of crop.
- 'Wheat Crop Health Newsletter' will be issued on monthly basis by PI (CP) IIWBR, Karnal, during the crop season. Information on off season crop will also be included.

Monitoring of new virulences of rusts in NWPZ by specially constituted teams:
Specially constituted teams will visit the areas as per the schedules given below for effective monitoring of crop health in general and appearance and spread of yellow rust in particular, along the areas near the western border and foothills / sub-mountainous areas in NWPZ. Entomologists will also accompany the teams.

Team I (14 Dec. 2016): Dr. Poonam Jasrotia, Dr. Priyanka Chandra, Mr. Ishwar Singh
Outward: Karnal-Indri-Ladwa-Yamunanagar
Inward: Ambala Road-Mustafabad-Karnal
Team II (12-15 Dec. 2016): Dr. D. P. Singh, Mr. Pankaj Kumar
Outward journey route: Karnal- Ambala-Khanna- Ludhiana-Phillaur-Jalandhar-Dhilwan-Amristsar-Batala-Gurdaspur-Kathua-Jammu
Inward journey route: Jammu-Kathua-Pathankot-Mukerian-Dasuya-Jalandhar-Phgawara-Ludhiana-Fatehgarhsaheb-Ambala-Kurukshetra-Karnal
Team III (4-5 January, 2017): Dr. Sudheer Kumar, Principal Scientist (Plant Pathology), Dr. Subhash Katare, Senior Scientist (Entomology) IIWBR and Dr. P.L. Kashyap Scientist (Plant Pathology) RS-IIWBR, Flowerdale, Shimla
(Karnal to Rupnagar via Indri, Ladwa, Yamunanagar, Bilaspur, Sadhaura, Naraingarh, Panchkul and Kharar-Garhshankar, Nawanshahar, Machhiwara, Samrala, Khanna, Ambala, Kurukshetra)
Team IV (25 January, 2017): Dr. D. P. Singh, Dr. Charan Singh and Mr. Pankaj Kumar of ICAR-IIWBR Karnal)
(Karnal-Muzaffarnagar, Western U. P.)

Team V (29-31 January, 2017): Dr. Vaibhav Kumar Singh, ICAR-IARI New Delhi, Dr. O. P. Gangwar, ICAR-IIWBR RS Flowerdale, Shimla Dr. Ritu Bala, PAU, Ludhiana and Dr. Poonam Jasrotia, ICAR-IIWBR Karnal)
(Karnal-Ludhiana-Bhatinda-Mansa-Kaithal-Karnal)
Team VI (31st January to 2nd February, 2017): Dr. Sudheer Kumar, Principal Scientist (Plant Pathology), Dr. Subhash Katare, Senior Scientist (Entomology) IIWBR and Dr. Rajender Singh Beniwal (Plant Pathologist) CCS, HAU Hisar
(Karnal to Bathinda via Patiala, Barnala, Sangrur and Bathinda to Sirsa via Abohar Sri Ganganagar, Hanumangarh and in returning surveyed Sirsa, Hisar, Jind) .
Team VII (1st February, 2017): Dr. Prem Lal Kashyap, Scientist (Plant Pathology), and Dr. Satyavir Singh, Principal Scientist, IIWBR, Karnal
(Village Chaoganwa, Karnal)

Team VIII (3rd February, 2017): Dr. Sudheer Kumar, Principal Scientist (Plant Pathology), Dr. Prem Lal Kashyap, Scientist (Plant Pathology), and Mr. Om Prakash, (Technical officer), IIWBR Karnal
(Village Taprapur, Sarswatinagar block, Yamunanagar)

Monitoring the pathotype distribution of rust pathogens: It will be undertaken by IIWBR, Regional Station, Flowerdale, Shimla (all three rusts from all zones) and Rust Research Station, Mahabaleshwar (brown and black rust from CZ and PZ). All the cooperating centres are required to send the rust infected samples (natural infection) for pathotype analysis to the concerned centres according to recommended protocol.

Wheat Disease Monitoring Nursery (To be co-ordinated by Flowerdale, Shimla): The nursery will be planted at 38 locations including Kudwani (Srinagar), Varanasi KVK, Rampur and Yamunanagar (Haryana). Samples from this nursery should be sent regularly to IIWBR RS Flowerdale, Shimla for virulence analysis and information. Information on rust appearance to be provided at monthly intervals, starting from end of December to the P.I. (Crop Protection).

Reconstitution of Wheat Disease Monitoring Nursery (WDMN): Keeping into account the changed varietal situation, the zone specific varieties of NWPZ and NEPZ were recasted. The detailed constituents of WDMN from 2014 onwards would be as given below:

Common set of varieties of wheat disease monitoring nursery

WL 711, HD 2329, Agra Local, HD 2160, Lal Bahadur, WL 1562, HW 2021(*Sr26/Sr24*), HD 2204, C 306, WH 147, HW 2008 (*Sr24/Lr24*), Kharchia mutant, HP 1633, DL 784-3 and RNB 1001.

Zone specific varieties

NWPZ: WH 1105, WH 542, PBW 343, DPW 621-50 and WH 896

NEPZ: K 8804, HD 2402, HP 1102, HUW 468 and NW 1014

CZ: HI 8663, HI 1544, GW 366,Lok -1, GW273 and GW322

PZ and SHZ: MACS 2496, Bijaga Yellow, HW 971, HD 2501 and HW 2022 (*Sr24/Lr24*)

NHZ and High Altitude Zone: HPW 349, VL892, HS 420, Sonalika, HS 507 and Barley Local

Off-season Disease Monitoring Nursery (To be coordinated by IIWBR Reg. Station, Flowerdale): This nursery will be planted in Dalang Maidan, Kukumseri, Sangla, Sarahan (HP) and Leh (J&K). High altitude varieties and one hulless barley variety will also be included in this nursery.

SAARC- Nursery (To be coordinated by Flowerdale, Shimla): Nursery will be planted at 15 Indian locations, *viz*., Ludhiana, Delhi, Dhaulakuan, Gurdaspur, Dera-Baba-Nanak, Abohar, Sri Ganganagar, Chattha, Kathua, Rajouri, Almora, Durgapura, Faizabad, Pantnagar and Wellington.

Monitoring of Karnal bunt and black point in harvested grains

Post harvest monitoring will be undertaken by cooperating centres by analysing samples from grain *mandies* in each district of their respective states. Centres from C.Z. (Indore, Sagar, Powarkheda, Junagarh, Vijapur) and PZ (Pune, Niphad and Dharwad) may also supply grain samples to IIWBR Karnal for analysis to PI (CP)

PROGRAMME 9: CONFIRMED SOURCES OF RESISTANCE TO BIOTIC STRESSES AND THEIR SHARING WITH BREEDERS

A. CONFIRMED SOURCES OF RESISTANCE

a. THREE RUSTS

Elite Plant Pathological Screening Nursery (EPPSN):

North: No. of Centres, 9

Delhi, Malan, Karnal, Ludhiana, Pantnagar, Durgapura, Hisar, Chattha and Almora

South: No. of Centres, 4

Wellington, Mahabaleshwar, Dharwad and Indore.

b. MULTIPLE DISEASES

Multiple Disease Screening Nursery (MDSN): It will be subjected to artificial epiphytotics as detailed below:-

(i) DISEASES

North: No. of Centres, 14

Stripe rust: Karnal, Ludhiana, Dhaulakuon, Malan, Pantnagar

Leaf rust: Karnal, Ludhiana, Delhi, Hisar

Karnal Bunt: Karnal, Ludhiana, Dhaula kuan, Pantnagar

Powdery mildew: Dhaulakuan, Almora, Pantnagar, Malan, Chattha

Foliar blights: Faizabad, Varanasi, Coochbehar, Sabour, Hisar

Loose smut: Hisar, Durgapura, Ludhiana, Almora

Flag smut: Hisar, Durgapura, Ludhiana

Head scab: Karnal, Dhaulakuan and Wellington

South: No. of Centres, 3

Leaf and Stem rust: Mahabaleshwar, Indore Dharwad, Niphad and Wellington

(ii) Nematodes (CCN) : Durgapura, Hisar, Ludhiana and Wellington

c. CONTRIBUTION TO NGSN: The seed of resistant entries to major diseases identified after multilocation & over years of testing will be multiplied and contributed to NGSN for the use of breeders in crossing programme.

PROGRAMME 10. Basic studies on use of Rhizosphere and Phyllosphere microbes for the management of wheat diseases (rusts, leaf blight, powdery mildew, loose smut, Karnal bunt, flag smut) centre- Karnal.

PROGRAMME 11. WHEAT ENTOMOLOGY

The programme for the crop year 2016-2017 formulated out in the 55th All India Wheat and Barley Research Workers Meet held at CCS HAU Hisar during August 21-24, 2016. The various activities to be executed at respective centres after the deliberations with all the Entomologists are given below:

(A) HOST PLANT RESISTANCE

EXPT.1. ENTOMOLOGICAL SCREENING NURSERY FOR

(a) Shoot fly: Dharwad, Ludhiana, Kanpur and Niphad

(b) Brown wheat mite: Durgapura and Ludhiana

(c) Wheat Aphids: Niphad, Ludhiana, Karnal, Shillongani, Pantnagar, Kharibari and Kanpur
(d) Root aphid: Karnal and Ludhiana

EXPT.2 MULTIPLE PEST SCREENING NURSERY
(a) Shoot fly : Dharwad, Ludhiana, Kanpur, Niphad and Kharibari
(b) Brown mite: Durgapura and Ludhiana
(c) Foliar aphids: Niphad, Ludhiana, Karnal, Shillongani, Pantnagar Kharibari and Kanpur
(d) Root aphid: Entkhedi, Niphad, Karnal and Ludhiana

(B) CHEMICAL CONTROL

EXPT.3. Effect of insecticidal seed treatment on germination, termite damage and yield. (Centres: Durgapura, Kanpur, Ludhiana and Vijapur).

EXPT.4. Management of termite damage through broadcasting of insecticides in standing wheat crop. (Centres: Durgapura, Ludhiana, Kanpur and Vijapur).

EXPT.5. Chemical control of foliage feeding wheat aphids. (Centres: Karnal, Ludhiana, Niphad, Kharibari and Pantnagar).

EXPT.6. Eco-friendly management of aphids through biorational approaches. (Centres: Pantnagar and Khoribari).

EXPT.7. Management of brown wheat mite with different pesticides/acricides. (Durgapura and Ludhiana)

EXPT.8. Integrated management of shoot fly in wheat (Dharwad, Niphad)

EXPT. 9. Compatibility of different insecticides used for aphid control with fungicide, Propiconazole (Tilt)

EXPT. 10. Integrated pest management (Karnal, Ludhiana and Niphad)

(C) INTEGRATED PEST MANAGEMENT

EXPT.11. Survey of pests infesting wheat and barley and their natural enemies
(All centres)

EXPT.12. Incidence and population build of major insect pest indifferent dates of sowing. (Niphad, Ludhiana, Kharibari and Karnal)

EXPT.13. Basic studies for development of IPM strategies
(a) Pest modeling for Foliage aphids (Niphad, Ludhiana, Karnal & Pantnagar)
(b) Brown mite ETL (Durgapura)
(c) Thrips (Pantnagar)
(e) *Helicoverpa armigera* (Pantnagar)

EXPT.14. Development of IPM modules at zone level by Karnal, Kanpur, Niphad centres

(D) STORED GRAIN PESTS

EXPT.15. Management of stored grain insect pest (Durgapura, Pantnagar, Karnaland Ludhiana)

Monitoring Teams alongwith rust and blast: Teams will monitor insect pests in different zones. (January last week and 20th February, 2017)

PROGRAMME 12. WHEAT NEMATOLOGY

The Nematology programme for the crop year 2016-2017 formulated out in the 55th All India Wheat and Barley Research Workers Meet held at CCS HAU Hisar during August

21-24, 2016. The various activities to be executed at respective centres after the deliberations with all the Nematologists are given below:

1. **Monitoring of Nematodes:**
   - i) ***Anguina tritici*:** Pusa (Bihar), Durgapura, Ludhiana, Varanasi
   - ii) ***Heterodera avenae*:** Durgapura, Hisar, Ludhiana
   - iii) **Mapping of nematode population:** Durgapura, Delhi, Hisar, Ludhiana. The wellington centre will use molecular tools to identify populations of CCN from different centres.
   - iv) **Soil borne nematodes:** Survey will be conducted in Bihar (RAU Pusa centre), Varanasi commissionery (BHU Centre), parts of Rajasthan (Durgapura centre), southern Haryana (Hisar centre), Punjab (Ludhiana centre)
2. **System based Research:**
   - **i) Population monitoring in wheat based systems:**
     Rice-Wheat: Ludhiana, Pusa (Bihar), Varanasi
     Cotton - Wheat: Hisar and Ludhiana.
     Bajra - Wheat: Durgapura.
     Groundnut - Wheat: Durgapura.
     Til - Wheat: Pusa (Bihar)
     Cowpea - Wheat:. Durgapura.
     Wheat - Moong: Durgapura
   - ii) **Diversification in existing wheat based systems for CCN management-** Durgapura, Ludhiana and Hisar
   - iii) **Testing of advanced breeding materials generated at Durgapura and Delhi against CCN:** Durgapura, Hisar, Ludhiana and Delhi.
   - iv) **Evaluation of ecofriendly approaches in management of CCN:** Hisar, Ludhiana and Durgapura.
3. **Evaluation of resistance against nematodes parasitizing wheat**
   - I) ***Heterodera avenae*:** Hisar, Durgapura and Delhi,
   - II) ***Heterodera filipjevi*:** Ludhiana.
   - III) **Screening against *M graminicola*:** Pusa (Bihar), Ludhiana.

Estimation of losses caused by *Pratylenchus* spp. and *Tylenchorhynchus* spp. in wheat

Estimation of economic thresh hold level for lesion nematode, *Pratylenchus spp.* and stunt nematode, *Tylenchorhynchus spp.* on wheat crop

Centres: Durgapura, Hisar, Ludhiana

4. **Eco-friendly management of root knot and CCN nematodes in wheat**: Biological agents will be evaluated for managing above nematodes.
   Root Knot Nematode: Ludhiana, Pusa (Bihar)
   CCN: Durgapura, Hisar, Ludhiana

Monitoring of Nematodes: Dr Damanjeet Kaur, Dr RS Kanwar, Dr SP Bishnoi and Dr K.N. Pathak will monitor nematodes in their respective state.

List of Cooperators
Plant Pathology Programme

NHZ

ICAR-IIWBR, Regional Station, Flowerdale, Shimla.
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JAU, Junagadh
I.B. Kapadia

SDAU, Vijapur
S.I. Patel

JNKV Research Station, Powarkheda

K.K. Mishra

PZ

ARI, Pune
B.K.Honrao

P.S. Shekhawat
SKUAST-J, Chatha, Jammu
M.K. Pandey

UAS, Dharwad
P.V. Patil

MPKV, Mahabaleshwar
S.G. Sawashe, Nilkanth Vitthal Savant

ARS, Niphad
B.C. Game

SHZ

ICAR-IARI, Regional Station, Wellington
P. Nallathambi, C. Umamaheshwari

NEMATOLOGY PROGRAMME

ICAR-IARI, New Delhi
Pankaj

PAU, Ludhiana
Ramanna Koulagi

ARS, Durgapura
S.P. Bishnoi

CCS HAU, Hisar
R.S. Kanwar, Priyanka

RAU, Pusa
K.N. Pathak

ENTOMOLOGY PROGRAMME

ICAR-IIWBR, Karnal
Subhash Katare, Poonam Jasrotia

PAU, Ludhiana
Beant Singh

GBPUA&T, Pantnagar
R.S. Bisht, Ruchira Tiwari

RARS, Assam Agricultural University, Shillongani
K. K. Sarma

Wheat Research Station, Vijapur
A. A. Patel

ARS, Durgapura
A.S. Baloda
CSAUA&T, Kanpur
J. K. Singh

UAS, Dharwad
P.V. Patil

ARS, Niphad
S.D. Patil

Kharibari, WB
Wasim Reza

Summary of trials and nurseries allotted and conducted at different cooperating centres during 2016-17 in Crop Protection Programme (Plant Pathology & Nematology)

S. No.	CENTRE	COOPERATORS	NAME OF NURSERIES & TRIALS	Total trials/nurseries		Data not considered
NHZ				Allotted	Conducted	
1.	Almora	K.K. Mishra	MDSN, EPPSN, PMSN, LSSN, HBSN	5	3	EPPSN, PMSN
2.	Dhaulakuan	V.K. Rathee	IPPSN, PPSN, MDSN, KBSN, PMSN, FHB	6	5	PPSN, KBSN, IPPSN (YR)
3.	Malan	A.K. Basandrai, Sachin Upmanyu	IPPSN, PPSN, MDSN, EPPSN, PMSN, HBSN, CHEMICAL CONTROL OF POWDERY MILDEW	7	6	PMSN, IPPSN (YR)
4.	Bajaura	Rakesh Devlash	PPSN, PMSN, HBSN	3	3	PPSN
5.	Shimla	S.C.Bhardwaj, Pramod Prasad, O.P. Gangwar, Subodh Kumar, Hanif Khan	PMSN, SRT, APR	3	3	
6.	Kudwani (J & K)	M. Najeeb Mughal	PPSN	1	1	
NWPZ						
1.	Chattha (Jmmu)	M. K. Pandey	IPPSN, PPSN, MDSN, EPPSN, KBSN, LSSN	6	6	
2.	Ludhiana	Jaspal Kaur, Ritu Bala, Dhaman Jeet Kaur, Ramanna Koulagi	IPPSN, PPSN, LBSN, MDSN, EPPSN, KBSN, LSSN, FSSN, APR, FLAG SMUT CHEMICAL CONTROL, CCNSN, SYSTEM BASED RESEARCH, NEMATODE SURVEY	14	12	
3.	Gurdaspur	Rajinder Bal	IPPSN, PPSN, FHB	3	3	FHB, IPPSN (YR)
4.	Pantnagar	Deepshikha, K.Srivastava	PPSN, LBSN, MDSN, EPPSN, KBSN, PMSN	6	6	EPPSN, KBSN MDSN(KB), PPSN (LR)
5.	Duragupra	P.S. Sekhawat, S.P. Bishnoi	IPPSN, PPSN, MDSN, EPPSN, LSSN, FSSN, FLAG SMUT CHEMICAL CONTROL, NEMATODE SURVEY, CCNSN	9	7	EPPSN, PPSN (LR), IPPSN (LR)
6.	Karnal	D.P.Singh, M. S. Saharan, Sudheer Kumar, S. Katare, Poonam Jasrotia, P.L. Kashyap, Priyanka Chandra, G. P. Singh	IPPSN, PPSN, LBSN, MDSN, EPPSN, KBSN, LSSN, FSSN, FHB, CHEMICAL CONTROL OF FLAG SMUT	10	8	
7.	New Delhi	M. S. Saharan, V.K. Singh, Pankaj	IPPSN, PPSN, MDSN, ,PPSN, KBSN, APR, FHB, CCNSN	8	8	FHB
8.	Hisar	R.S. Beniwal, S.S. Karwasra, R. S. Kanwar, Priyanka	, LBSN, EPPSN, IPPSN, PPSN, LSSN, FSSN, MDSN, KBSN, CHEMICAL CONTROL OF	12	12	IPPSN (LR)

S. N o.	CENTRE	COOPERATORS	NAME OF NURSERIES & TRIALS	Total trials/nurseries		Data not conside red
			FLAG SMUT, ECO FRIENDLY NEMATODE MANAGEMENT, SYSTEM BASED RESEARCH ON NEMATODES, CCNSN			
NEPZ				**Allott ed**	**Condu cted**	
1.	Faizabad,	S.P. Singh, J. Verma	IPPSN, LBSN, MDSN	3	3	
2.	Varanasi	S.S. Vaish	IPPSN, LBSN, MDSN, NEMATODE SURVEYM SYSTEM BASED RESEARCH	5	3	
3.	Coochbeha r	Satyajit Hembram	IPPSN, LBSN, MDSN	3	3	IPPSN, LBSN
4.	Ranchi	H.C. Lal	IPPSN, LBSN	2	2	IPPSN,L BSN
5.	Shillongani	R. Chakravarty	LBSN	1	2	LBSN
6.	Kalyani	Sunita Mahapatra, Dhiman Mukherjee	IPPSN, LBSN	2	2	IPPSN
7.	IARI, Pusa	Ashish Kumar Gupta	IPPSN, LBSN, FHB	3	3	LBSN
8.	Naini (Allahabad)		LBSN	1	0	LBSN
9.	Kanpur	Javed Bahar Khan	PPSN	1	1	PPSN (LR)
10.	Sabour	C.S. Azad	IPPSN, MDSN	2	2	
11.	RAU, Pusa	K.N. Pathak	NEMATODE SURVEY, SYSTEM BASED RESEARCH, CCNSN	3	0	LBSN
CZ						
1.	Indore	Prakasha,T.L.	IPPSN, PPSN, MDSN, EPPSN, APR	5	5	PPSN
2.	Powarkhe da	K.K. Mishra	IPPSN, PPSN, APR	3	3	
3.	Vijapur	S.I. Patel	PPSN	1	1	
4.	Junagarh	I.B. Kapadia	PPSN	1	1	
PZ & SHZ						
1.	Dharwad	P. V. Patil	PPSN, LBSN, MDSN, EPPSN, FRSN	8	8	LBSN,E PPSN, FRSN, PPSN
2.	Wellington	P. Nallathambi, C. Umamaheshwari, J. Berliner	IPPSN, PPSN, MDSN, EPPSN, PMSN, FHB	6	6	IPPSN (SR),
3.	Mahabales hwar	S.G. Sawashe, N. V. Savant, M. A. Gud	IPPSN, PPSN, MDSN, EPPSN, SRT, APR	6	6	
4.	Niphad	B.C. Game, P. E. More	IPPSN, PPSN, MDSN	11	11	IPPSN (SR),
5.	Pune	B.K. Honrao	PPSN, APR	2	2	

ENTOMOLOGY PROGRAMME

S. No.	CENTRE	COOPERATORS	NAME OF NURSERY	Total trials/nurseries		DATA NOT CONSIDERED	Other Trials	
NWPZ				Allotted	Conducted		Allotted	Conducted
	Ludhiana	Dr. Beant Singh	ESN, MPSN	2	2		10	10
	Pantnagar	Dr. R.S. Bisht	ESN, MPSN	2	2	Aphid screening data not considered due to its low population	3	2
	Duragupra	Dr. A.S. Baloda	ESN, MPSN	2	2		5	5
	Karnal	Dr. Poonam Jasrotia	ESN, MPSN	2	2		7	7
NEPZ								
	Shillongani	Dr. K.K.Samra	ESN,MPSN	2	2	Aphid screening data not considered due to its low population	1	1
	Kanpur	Dr. J.K.Singh	ESN,MPSN	2	2		5	5
	Kharibari	Dr. Wasim Reza	ESN, MPSN	2	2		3	3
CZ								
	Vijapur	Dr. A.A. Patel	-	-	-		6	6
PZ								
	Dharwad	Dr. P.V.Patil	ESN, MPSN	2	2		1	1
	Niphad	Dr. Sanjay D. Patil	ESN, MPSN	2	2		6	6

SUMMARY

Crop Protection Programme was given mandate to minimize the losses caused by biotic stresses (Diseases, insect pests and nematodes) so that maximum yield and quality potentials of wheat cultivars may be harnessed. Additionally, programme also worked hand in hand with wheat breeders to evaluate status of resistance to biotic stresses against rusts and leaf blight in pre coordinated yield trial entries (IPPSN) and against major diseases, insect pests and nematodes in coordinated yield trial entries along with check varieties aiming to assist breeders for promotions of their entries in yield trials and proposing a variety for identification as well as release. The crop health of wheat was maintained very good during 2016-17 by keeping vigil on new pathotypes of rusts and other diseases, any exotic diseases, survey and surveillance of rusts, Karnal bunt and wheat blast as well as other insect pests and negligible losses could happened due to biotic stresses thus contributed in the record wheat production. The resistant genotypes identified were shared with breeders and resistant varieties were deployed strategically in disease prone areas in different agro ecological zones. Different agencies (DAC & FW, ICAR, State Agriculture Departments, KVKs, Farmers etc.) were sensitized about the potent diseases and insect pests and their management through regular strategy planning meetings, trainings, field days, discussions and distributions of literature and use of mobile phones and IT tools. The Wheat Crop Health Newsletters were issued regularly and distribute as well as put on web page of ICAR-IIWBR (http://dwr.res.in) now renamed as http://iiwbr.icar.gov.in . Likewise, advise was given to farmers on crop health management on Toil free No. Integrated Pest Management (IPM) was worked out to manage biotic stresses in case of susceptible varieties and to use these under emergency conditions to avoid epidemics of rusts and other biotic stresses. Human Resource development was carried out. The achievements of programme, 2016-17 are as below:

HOST RESISTANCE

For providing support to the wheat breeding programme, evaluation of disease/pest screening nurseries was undertaken at various hot spot locations under artificially inoculated conditions. The major nurseries were: Initial Plant Pathological Nursery (IPPSN), PPSN, Elite PPSN, Multiple Disease Screening Nursery (MDSN), Multiple Pest Screening Nursery (MPSN), and disease/pest specific nurseries.

AVT entries were also evaluated at specific locations for Race Specific Adult Plant Resistance (APR) to three rusts (brown, black and yellow). Slow rusting lines for different rusts were identified by calculating the Area Under Disease Progress Curve (AUDPC) at Ludhiana centre against stripe rust.

Entries and check varieties identified resistant in PPSN:

Rust Resistance materials in AVT IInd and Ist Year (2015-16) with ACI upto 10.0 are given below:

Stem, Leaf and Stripe Rusts

AVT IInd Year

WH 1080 (C), WH 1142 (C), HI 1612, MACS 6222(C), UAS 446 (C), DBW 71(C), TL 2942 (C), TL 2969 (C)

AVT Ist Year

HS 630, UP 2993, VL 1011, VL 1012, VL 3013, VL 3014, HD 3226, HS 611, DBW 187, HI 8791 (d), UAS 462 (d), TL 3011, TL 3012, TL 3013, TL 3014, TL 3015, PBW 777, PBW 778, WH 1232

Stem and Leaf Rusts

AVT IInd Year

HPW 251 (C), HS 375 (C), HS 490 (C), HD 2967 (C) DBW 39 (C), HD 2888 (C), K 1317 (I) (C), DBW 110 (C), HI 8627 (d) (C), MP 3288 (C), DBW 168, UAS 375, NIAW 1415 (C), HW 2044 (C), HW 5216 (C), CoW (W) -1 (C), DDK 1029 (C), HW 1098 (C), PBW 550 (C)

AVT Ist Year

HPW 448, HPW 449, HS 644, HS 646, MP 1318, HD 3219, DDK, 1052, DDK 1053, MACS 5047, MACS 5049, HS 375 (C)

Leaf and Stripe rusts

AVT IInd Year

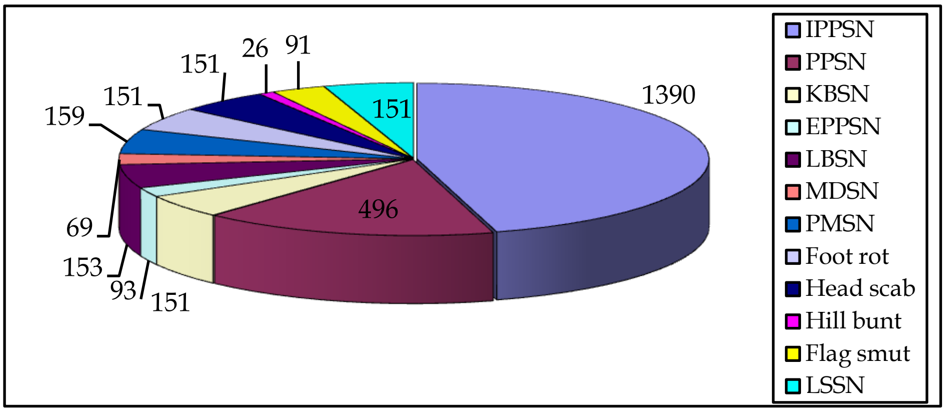
HS 507 (C), HS 542 (C), VL 829 (C), VL 892 (C), HI 8777 (d), AKDW 2997-16 (d)(C), KRL 210 (C)

AVT Ist Year

HS 648, HD 1620, PBW 750, KRL 370, PBW 780, WH 1316, DBW 251, HD 3271, HD 3272, PBW 757, WH 1233

Seedling resistance in wheat genotypes

To identify rust resistant lines of wheat and characterize resistance genes, 151 lines of AVT I and II were evaluated at seedling stage using an array of pathotypes of black (*Puccinia graminis tritici*), brown (*P. triticina*) and yellow rust (*P. striiformis*) having varying avirulence/virulence structures. These studies were conducted under controlled conditions of temperature and light. None of the lines was resistant to all the rusts. In addition to all the lines having *Sr31* were resistant to black rust of wheat, whereas lines possessing *Lr24*, some with *Lr26* were resistant to brown rust and few lines with *Yr9* showed resistance to yellow rust of wheat. Details of the wheat rust resistant lines are given below:



Constitution of different plant pathological nurseries during 2016-17

Rust resistance in AVT lines

Rust resistance to all the pathotypes of black, brown and yellow rust was not observed in any of entries of AVT II. There was no entry in the AVT II which showed resistance to all the pathotypes of yellow rust. Seven entries *viz.* Cow (W)(C), HW2044(C), HW5216(C), MACS6222(C), MP3288(C), NIAW1415(C) and UAS446 confer resistance to all the pathotypes of brown rust, whereas five entries (VL892(C), HD3043(C), DBW110, TL2942(C) and TL2969(C)) were resistant to all the pathotypes of black rust.

AVT IInd year

Resistant to yellow rust only	:	None
Resistant to brown rust only	:	Cow (W)(C), HW2044(C), HW5216(C), MACS6222(C), MP3288(C), NIAW1415(C), UAS446
Resistant to black rust only	:	VL892(C), HD3043(C), DBW110, TL2942(C), TL2969(C)

All the lines carrying *Sr31* were resistant to black rust. Like AVT II entries, rust resistance to all the pathotypes of black, brown and yellow rust was not observed in any of entries of AVT I. Entries HS630 and VL3013 were found to be resistant to all the pathotypes of black and brown rusts; whereas resistance to black and yellow rusts was conferred by VL1012. Six entries *viz.* DBW246, PBW757, PBW752, PBW777, UP2993 and WH1233 confer resistance to all the pathotypes of yellow rust, whereas nine entries (HS643, VL4002, HD3226, HD3237, MP1318, HD3219, KRL377, TL3012 and TL3015) were resistant to black rust.

AVT I

Resistant to black and brown rusts	:	HS 630, VL3013
Resistant to black and yellow rusts	:	VL1012
Resistant to yellow rust only	:	DBW246, PBW757, PBW752, PBW777, UP2993, WH1233
Resistant to black rust only	:	HS643, VL4002, HD3226, HD3237, MP1318, HD3219, KRL377, TL3012, TL3015

Based on rigorous screening of multiple diseases screening nursery at multilocations, following genotypes have been identified for multiple disease resistance:

Confirmed sources of resistant

Rusts (ACI 0-10.0 only), Source: EPPSN, 2016-17

A. Resistant to all three rusts: HI 8759 (d), PBW 723 (Source: AVT IInd year 2015-16), HI 8774 (d), HPPAU 05, HPW 423, HPW 433, HS 622, HS 623, HS 626, HS 628, PBW 725, PBW 756, PBW 760, RKD 283 (d), TL 3006 (T), TL 3007 (T), TL 3008 (T), TL 3009 (T), VL 3002, VL 3012, WH 1181, WH 1216, WH 1310, HS 627, WH 1184,

B. Resistant to Stem and Leaf rusts: HD 3171, HD 3209, WB 2 (Source: AVT IInd year 2015-16), AKAW 4842, DBW 179, DBW 216, DBW 217, DBW 219, DDK 1051 (dic.), MACS 5044 (dic.), MACS 5046 (dic.), NW 6094, PBW 621, RKD 292 (d), VL 4001, WH 1215, UP 2955, VL 3011

C. Resistant to Leaf and Stripe rusts: DBW 220, PBW 757, HPPAU 10, HPW 424, NW 6046, PDW 344 (d), UAS 459 (d), UP 2954 (Source: AVT Ist year 2015-16)

D. Resistant to Stem and Stripe rusts: HS 580

MDSN (2016-17)

A.Resistant to all three rust

PBW 723, HS 580,

+ Loose smut (Highest score 0-5%under artificially inoculated conditions): HI 8737 (d) (Source: AVT IInd year, 2013-14), HD 4730 (d), HI 8750 (d), HI 8751 (d), TL 2995 (T), TL 2996 (T), TL 3000 (T) (Source: AVT I YEAR 2013-14)

+ KB+FS: MACS 3970 (d), MACS 3972 (d), HI8765 (d)

+KB+PM+FS: HS 599, TL 3002(T)

+ PM+FS: TL 3001 (T), TL 3003 (T), TL 3004 (T), TL 3005 (T), K 1314, PBW 709

+LB+FS: HS 596, HS 597

+KB: HI 8765 (d)

+FS: VL 3007, WB5, HPW 422, MACS 4024.

B. Resistant to Stem and leaf rust: DBW 182, HD 3164, HPBW 01, HUW 712, K 1313, VL 3008, HI 1604.

+LB+KB: K 1315

+LB+PM: BW- 1

+PM: PBW 719

+**FS:** HPBW 02, HUW 695, HPBW 08, WH 1309, HS 600,

+KB+FS: DDK 1048 (dic), MACS 5041, MACS 5043, K 1312, GW 463, UP 2383

+KB+PM+FS: DDK 1049 (dic.), GW 1315 (d), MACS 4020 (d),DDW31

+LB: DBW 150,KRL 350,KRL 351,PBW 716,VL 4001,HPBW 09

C. Resistant to leaf and stripe rust: HD 3165, PBW 721

+KB+FS: UAS 453 (d), UAS 455 (d)

+PM+FS: PBW 718

+FS: DDW 32, DBW 147

D. Resistant to stem and stripe: PBW 707, HD 3159

+KB+FS: UAS 428 (d)

+FS: DBW 184, HPBW 07

+KB: HS 583

(Abbreviations: EPPSN: Elite Plant Pathological Screening Nursery, MDSN: Multiple Disease Screening Nursery, KB: Karnal bunt, LB: leaf Blight, PM: Powdery Mildew, FS: Flag Smut, LS: Loose Smut, FHB: Fusarium Head Blight, HB: Hill Bunt, FR: Foot Rot, d: *T. durum*. dic. *T. dicoccum*, C: released check variety, T: Triticale)

LEAF BLIGHT

Moderately resistance (average leaf blight score below 35 and the HS of 57 in 0-9 dd scale)

HI 1612, VL 829 (C), C 306 (C), VL 4001, UP2955, HD 3184, VL 4001

Moderately resistant except that HS at one location was higher than 57

HD 2967 (C), HS 375 (C), HS 507 (C) and HD 3043 (C), HS 645, VL 1013, UP 2942, UP 2993, VL 4002 and HS 630, HS 643, UAS 462 (d), DBW 247, UP 2992, MP 1318, HD 3272, WH 1233, PBW 778, HS 646 and DBW 189

KARNAL BUNT

Resistant (Av. KB incidence upto 5% under artificially inoculated conditions):

HI 8777 (d), TL 2969 (C), WR 544 (C), CoW (W) -1 (C), DBW 14 (C), WH 1021 (C), UAS 446 (C), HPW 251 (C), TL 2942 (C), DBW 110 (C), HS 490 (C), K 1006 (C), KRL 210 (C), HI 8627 (d) (C), HD 2733 (C) and AKDW 2997-16 (d) (C), HI 1619, TL 3014, VL 3013, VL 4002, TL 3012, VL 1013, VL 3014, HS 644, HD 3219, HS 647, VL 3015, TL 3011, TL 3015, WH 1202, DBW 187, HPW 448, MP 1318, WH 1316, HPW 439, CG 1023, RL 377, DBW 251, HD 3271, HD 3237, DBW 250, HS 630, HS 643, PBW 780, DDK 1052, HS 645, UP 2942, VL 1011, HS 629, HS 646, PBW 777, HPW 440, HS 648, BRW 3775, UAS 387, DBW 247, WH 1233, UAS 385, PBW 779, VL 4003, HP 1963, PBW 757, WH 1232, HPW 449, KRL 384, HD 3226, HS 611, DBW 196, KRL 370, TL 3013, HI 1620, KRL 386, DBW 249, BRW 3773, PBW 752, MACS 5049, HD 3272, DBW 189, HI 1617, HI 1621, DBW 248, PBW 778, DBW 246, UP 2993, MACS 6677, DDK 1053, HS 375 (C) and HS 490(C)

POWDERY MILDEW

Resistant (Av. PM score 0-3, highest score upto 5):

DBW 173, TL 2942 (C), TL 2969 (C), DDK 1029 (C), HPW 251 (C), VL 829 (C), HD 3043 (C) and DBW 14 (C), TL 3011, TL 3012, TL 3013, TL 3014, TL 3007, MACS 5047, MACS 5049, TL 3015, DDK 1050, TL 3008, HS 630, DDK 1053, WB 2 , MACS 5044, DBW 179, HPW 448, HPW 449, HS 644, HS 645, HS 646, VL 3013, VL 3014, HI 1619, HS 611, DBW 247, DDK 1052, HD 3272, PBW 737 and KA 1427

LOOSE SMUT

Highly resistant (Free from LS) (No infection at any location):

HI 8759 (D), HD 4728 (D) (I) (C), HI 8498 (D) (C) and UAS 446 (d) (C)

Resistant (Average score: 0.1-5.0 % LS infection):

UAS 428 (d) (C), VL 829 (C), HI 8737 (D) (C), TL 2969 (C), DDK 1029 (C), TL 2942 (C), WH 1124 (C), HW 1098 (C), KRL 210 (C) and HD 3086 (C), TL 3009, TL 3010, UP 2955, TL 3007, VL 3002, DDK 1051, PDW 344 (D), RKD 283 (D), MACS 5046, HPW 433, MACS 4028 (D), HPW 432, VL 3011, UAS 459 (D) and MACS 5044

FLAG SMUT

Highly resistant (Free from FS infection): HI 8777 (d), UAS 304 (C), HW 2044 (C), CoW (W) -1 (C), DDK 1029 (C), HW 1098 (C), TL 2942 (C), TL 2969 (C) and WR 544 (C), HI 8791 (d), UAS 462 (d), DDK 1052, KRL 384, MACS 5047, TL 3011, TL 3012, TL 3013, TL 3014, TL 3015, DBW 249 and DBW 250

FOOT ROT

Highly resistant (upto 5 % disease):

HI 8777 (d), VL 829 (C), HD 3043 (C), WH 1021 (C), DBW 39 (C), K 1006 (C), K 1317 (I) (C), HI 8627 (d) (C), PBW 550 (C), DBW 110 (C), MP 3288 (C) and KRL 210 (C), HPW 449, HS 643, HS 646, UP 2992, UP 2993, VL 1013, VL 4002, BRW 3773, HP 1963, PBW 750, DBW 248, DDK 1052, KRL 370, KRL 377, KRL 384, WH 1316, WH 1233 and HD 3272

HILL BUNT

Resistant (1-10 % HB disease): HS 490 (C), HPW 251 (C) and HS 542 (C) UP 2993, VL 1012, HS 644 and HPW 448

Utilization of resistance sources through NGSN

A total of 41 multiple disease resistant entries were contributed in NGSN for utilization in breeding programme at 23 main breeding centres. Out of these 40 entries were utilized in the range of 4.2-58.3% centres.

Rust resistance genes in AVT material

Details of the wheat rust resistant genes identified are given below:

***Yr* genes**

AVT II

Five *Yr* genes/patterns (*Yr2, 9, 18, 27* and *A*) were characterized in 52 lines of AVT II entries either alone or in combinations. *Yr2* was found to confer resistance in maximum number of lines (29). However, this gene is susceptible to many of the virulent pathotypes. *Yr9* which is linked to *Lr26* and *Sr31* was postulated in 10 lines. Other resistance genes like *Yr*A, *Yr18*, *Yr27* were postulated in few lines only.

AVT I

Three patterns of *Yr* genes in different combinations or alone were inferred in 73 lines of AVT I. Among these, *Yr2* was characterized in 42 lines. *Yr9* which is linked to *Lr26* and *Sr31* was identified in 7 lines. *Yr*A was characterized in 18 lines and *Yr9*+*A*+ in 6 lines.***Lr* genes**

AVT II

Lr genes characterized in 83% of the AVT II lines. Eight *Lr* genes *Lr1, 3, 10, 13, 23, 24, 26* and *34* were identified either alone or in different combinations in 50 lines. Among these *Lr* genes *Lr13* was postulated in 20 lines followed by *Lr26* in 16, *Lr13* and *Lr 1* in 13 lines each. Except for *Lr10* which was observed in 11 lines, other *Lr* genes like *Lr34*, *Lr24* and *Lr3* were inferred in 3-5 lines.

AVT I

Eight *Lr* genes (*Lr1, 2a, 3,10, 13, 19, 23* and *26*) were postulated in 84 of the 91 AVT I lines. It is quite interesting that *Lr26* was postulated in 17.7 % of the AVT I lines, which is the lowest proportion ever. *Lr13* was characterized in maximum number of lines i.e. nearly half of the entries followed by *Lr23* in 33, *Lr10* in 30, *Lr1* in 28 lines. *Lr3* was inferred in 19 lines whereas *Lr2a* which is based on linkage to *Sr30* was postulated in 8 lines only.

***Sr* genes**

AVT II

Twelve *Sr* genes (*Sr2, 5, 7b, 8a, 8b, 9b, 9e, 11, 13, 24, 28* and *31*) were characterized in 56 AVT II lines. *Sr2*, a known APR gene whose postulation is based on characteristic micro-flecking, was postulated in 37 lines followed by *Sr31* in 17, *Sr11* in 15 and *Sr7b* in 11 lines. *Sr24* and *Sr9b* were identified in 3 lines each, whereas *Sr8b* and *Sr13* were conferred in one line each. *Sr5* and *Sr28* were postulated in 5 and 4 lines, respectively.

AVT I

Twelve *Sr* genes (*Sr2, 5, 7b, 8a, 9b, 9e, 11, 13, 25, 28, 30* and *31*) were characterized in 75 lines of AVT I . *Sr2* was highly frequent in AVT I material and postulated in 31 lines followed by *Sr*5 and *Sr11*, which were postulated in 22 and 20 lines, respectively. Most of the durum wheat varieties had resistance based on *Sr7b* and *Sr11*. *Sr31*, which confer resistance to all the known pathotypes from India including SAARC countries, was conferred in 14 lines. *Sr25* and *Sr9e* were characterized in two lines each, whereas *Sr8a* and *Sr13* were postulated in three lines each. *Sr30*, *Sr28* and *Sr7b* were postulated in seven, eleven and fifteen lines, respectively

SURVEY AND SURVEILLANCE

Crop health was rigorously monitored during the crop season. Major focus was on the occurrence of yellow rust and surveillance for wheat blast. Status of other diseases, including leaf rust was also monitored during these survey trips. The extensive surveys were also conducted by the wheat crop protection scientists of different cooperating centers including ICAR-IIWBR Karnal. Special teams of scientists were also constituted during the 55th All India Wheat & Barley Workers' Meet held at CCS HAU Hisar during 21-24 August, 2016. Advisory for stripe rust management was issued during December-March regularly. Information on wheat crop health was disseminated through the "*Wheat Crop Health Newsletter*", Vol. 22 which was issued during the crop season. This was also put on ICAR-IIWBR website (http://dwr.res.in) now known as http://iiwbr.icar.gov.in All the issues of the Newsletter brought out during the crop season, are given as an annexure at the end of this report.

The overall crop health status was excellent in the country. The yellow rust could not make any dent on wheat production and was very well controlled at initiation in adjoining districts in Punjab close to foot hills of H.P. The exotic diseases and pathotypes like Ug99 race of stem rust and wheat blast were not reported from any part of the country.

Strategy Meetings: A strategy planning meeting was held at Kolkata on "Occurrence of blast disease on wheat" on 28thSeptember, 2016 organised by DAC &FW and Govt. of West Bengal and was attended by ICAR and IIWBR scientists and Director. A meeting on "Evolving strategies for enhancing wheat production with special reference to management of wheat rusts and Karnal bunt" was organized by DAC &FW on 5.10.2016 at Krishi Bhavan, New Delhi. Dr. G. P. Singh, Director, presented a talk entitled "Evolving strategies for enhancing wheat production with special reference to manage wheat rust and Karnal bunt". Dr. D. P. Singh along with Hon. DDG (CS) and ADG (PP&B) participated in a meeting called by Hon. Secretary, DAC & FW on the topic occurrence of wheat blast in Bangladesh in Krishi Bhavan New Delhi on 4.3.2017 and given IPM and latest update on wheat blast survey report. Dr. D. P. Singh also participated in the meeting with hon. AS (Ad), DAC & FW, Krishi Bhavan, New Delhi on label claim of fungicides for wheat blast control on 27.3.2017 and given technical inputs. On 1.8.2017, another wheat blast planning meeting was attended by Dr. D. P. Singh at DAC & FW Krishi Bhavan, New Delhi under chairmanship of Hon. Secretary, DAC & FW.

Advisory for stripe rust management: Advisory for stripe rust management was issued three times i.e. in December, January and February for northern states. Awareness among farmers for stripe rust management was created through mobile, internet, toll free number, newspapers, discussions and delivering lectures in farmers training programmes. The details of survey and surveillance done are presented in wheat crop health newsletter vol. 22 issues 1-5 in annexure.

Preparedness for wheat blast disease

Wheat blast present in the primary wheat production areas of Brazil, Bolivia, and Paraguay, and recently identified in a small area in northeast Argentina, wheat blast is a potential threat to wheat production worldwide. The disease was first reported from Brazil in 1985. Wheat blast pathogen is a distinct population of *M. oryzae* (referred as *M. oryzae* Triticum population).

- The first report of wheat blast in South Asia came from Bangladesh in last week of March, 2016, ICAR took note of the disease. Since then ICAR worked hand in hand with DAC&FW and Govt. of West Bengal.
- So far wheat blast is not found in India during 2015-16 and 2016-17 crop seasons.
- During 2016-17, vigorous survey and surveillance programme as per the guidance of ICAR authorities, a team of scientists (Dr. D. P. Singh, Dr. Raj Kumar, Dr. A. K. Sharma of IIWBR and Dr. Dhiman Mukherjee of BCKVV Kalyani conducted extensive survey in West Bengal on 4th Feb. 2017 and found spike blight like symptoms on spikes of two local wheat varieties, Prodip and Satabdi in Murshidabad and Nadia districts close to Bangladesh borders. It was followed by other visits of UVKVV and BCKVV Scientists, PI (CP) and higher officials of DAC & FW and Directorate of Plant Quarantine and Storage as well as State Agric. Department officials of Govt. of West Bengal.
- The samples collected were however negative to wheat blast.
- The affected crop in these districts was sprayed with tebuconazole+ trifloxystrobin @ 0.4g/lit of water. The crop was also sanitized. The farmers were compensated for their damaged crop.
- The surveys conducted from other parts of West Bengal revealed no such symptoms except one field in Malda district. No such symptoms were found from crop grown in other Eastern states as well as other agro ecological zones of India.
- The high yielding variety HD 2967 was found resistant to spike blight like symptoms in Murshidabad district of West Bengal during 2016-17 crop season.
- The farmers in Murshidabad and Nadia districts were told not to use seeds of any exotic variety of wheat in near future as well as their own produced wheat seed for at least three years.
- The state government was asked to keep no wheat corridor of up to 5 km from Bangladesh borders, not to allow any wheat seed or grain to enter in state from Bangladesh and diversify cropping system by replacing wheat with oilseeds and pulses during next crop season in Nadia and Malda districts.
- The seed of wheat will be supplied from north in West Bengal during 2017-18 crop season.
- As an immediate step, in collaboration with CIMMYT, Mexico, evaluation of Indian released varieties / advance wheat lines in Latin America (Bolivia) – the hot spot for this disease has been approved by DARE, Ministry of Agriculture and Farmers Welfare on May 19, 2016. For this, a set of 40 Indian popular varieties and advance lines has been sent immediately to CIMMYT for evaluation against blast disease. These were being evaluated under field conditions in Bolivia and under grass house conditions in USA.
- The varieties with 2NS translocation are showing promise against wheat blast in Bolivia and USA.
- During 2017, 100 more varieties of wheat will be sent to CIMMYT for evaluation against wheat blast.
- Adhoc Integrated Pest Management for Wheat Blast Disease (2016-17 Crop Season) was prepared.

POST HARVEST SURVEYS

KARNAL BUNT (KB)

A total of 7144 grain samples collected from various mandies in different zones, and were analyzed at cooperating centers. Among different states samples taken from M.P., Maharashtra and Gujarat were found free from Karnal bunt infection. The overall infection was 17.7%. The samples from Haryana showed maximum infection (57.4%) followed by Rajasthan (42.8%) and U.P. (36.5%)

Pathotype distribution of wheat rusts during 2016-17

It was practically a rust free year. With the help of cooperators, different wheat growing areas were monitored regularly to keep an eye on the occurrence of India and neighbouring countries. Of the odd 1302 wheat and barley rust samples received during the year from 12 states of India and two adjoining countries, 854 have been analyzed so far. The pathotype situation is presented below:

Yellow (Stripe) rust (*Puccinia striiformis*)

During 2016-17, 400 samples of yellow rust of wheat and barley were analyzed from seven North Indian states of India. Total 11 pathotypes were identified based on Indian wheat differentials. The maximum number of samples were collected and analyzed from Punjab followed by Himachal Pradesh . The frequency of pt. 46S119 (virulent to *Yr2, Yr3, Yr4, Yr6, Yr7, Yr8, Yr9, Yr17, Yr18, Yr19, Yr21, Yr22, Yr23, Yr25* and *YrA*) was maximum (54.5%) followed by pt. 110S119 (33.0%). Barring 238S119, which was identified in 6% of the samples, remaining 6 pathotypes were observed in few samples only. It was also true for pt. 78S84 which was predominant up to 2010-11, occurred in one yellow rust sample only. *Puccinia striiformis* f. sp. *tritici* (*Pst*) population was found avirulent on *Yr*5, *Yr*10, *Yr*15, *Yr*Sp and *Yr*Sk. In barley, frequency of pt. 57 and M was nearly same as was evident from the 13 samples of barley yellow rust analyzed during the year.

Black (Stem) rust (*Puccinia graminis tritici*)

Five pathotypes of black rust of wheat were observed on 72 samples received/collected from five Indian states. Population analyzed during the year has avirulence to *Sr26, 27, 31, 32, 35, 39, 40, 43, Tt3* and *Tmp*. Most of the samples were received from Tamil Nadu followed by Gujarat and Maharashtra. 40A (62G29) was in more than 50% samples.

Brown rust of wheat (*P. triticina*)

Analyses of 382 samples of wheat brown rust was accomplished during 2016-17 from 12 states of India and neighboring countries Nepal and Bhutan. Twenty four pathotyes belonging to 4 major groups of pathotypes 12, 77, 104 & 162 were identified. There was increase in the proportion of pathotype 77-9 which was identified in about 45.8 % of the samples analyzed. Contrarily pt. 77-5, predominant pathotype of yester years was identified in 24.8 % of the samples. However, pt. 77-5 was more widely distributed than any other pathotype. Likewise there was reduction in the frequency of pathotype 104-2, 104-3. In addition a new pathotype designated as 162-4 was also observed in 3.9% of the samples. Remaining pathotypes were observed just in few samples only. Indian population of wheat brown rust was avirulent to *Lr9*, *Lr19*, *Lr*24, *Lr*25, *Lr*29, *Lr*32, *Lr*39, *Lr*45 and *Lr*47.

Wheat rust situation in Peninsular India

During *Rabi*, 2016-17, wheat rust trap nurseries were established at 24 locations *viz*, Maharashtra (18), Madhya Pradesh (2), Karnataka (2), Gujarat (1) and Tamil Nadu (1). Reports on incidence of stem and leaf rusts of wheat were received. Out of 24 Co-operating centers of wheat rust trap nurseries, incidence of stem rust and leaf rust of wheat was not reported by any centre.

Survey and surveillance was undertaken in different regions of Maharashtra state during *Rabi*-2016-17 for recording stem and leaf rust intensity. Survey was conducted in Satara, Sangli, Kolhapur districts on 3/3/2017 and 4/3/2017, Pune, Ahmednagar, Nashik, Dhule, Jalgaon districts on 16/3/2017 to 18/3/2017 and Solapur, Osmanabad, Latur, Beed, Parbhani, Hingoli, Washim, Buldhana, Aurangabad, Jalgaon on 22/3/2017 to 24/3/2017 in Maharashtra states. Wheat crop was found healthy and free from rust disease. However, leaf rust was observed on off-type wheat plant in trace at few locations. The stem rust was not observed at any location.

Virulence monitoring

The survey of off season wheat crop grown at Wellington in Tamil Nadu state was undertaken during *Kharif*, 2016. A total of 19 samples of stem rust and 28 samples of leaf rust were analyzed for pathotype detection. From these samples pathotype 40A, 117-6 of stem rust whereas 77-2, 77-3, 77-5, 77-8, 162-2 of leaf rust were detected. The survey during *Rabi* season (2016-2017) for wheat rusts on the crop grown in Maharashtra state was undertaken and 04 leaf rust affected samples were collected from different localities for pathotype analysis whereas no stem rust was observed during survey. None of the sample was received for pathotype analysis of stem rust from any location whereas no sample was received for pathotype analysis of leaf rust from any centre. From the three samples, the pathotypes of leaf rust *viz*., 77-2, 77-3 and 77-5 were found prevalent in Maharashtra.

49th wheat disease monitoring nursery (WDMN) 2016-17

Over the years wheat disease monitoring nursery (earlier trap plot nursery/TPN) is working as a logistic and effective tool for monitoring the occurrence of rusts, blights, powdery mildew and other wheat diseases across different wheat growing zones of India. Additionally, it has helped in knowing the seasonal progress of these diseases over different wheat growing zones. Wheat and barley rust samples collected from WDMN gives an overview of area wise distribution and load of rust pathotypes. The effectiveness of different wheat lines or resistance genes has been assessed through the WDMNs. The 49th wheat disease monitoring nursery was planted at 35 locations covering all the major wheat growing areas in the country, especially those situated near the bordering areas to the neighboring countries. Pathotype 11 (79G31), virulent on *Sr2, Sr5, Sr6, Sr7b Sr9a, Sr9b,Sr9c, Sr9d, Sr9f, Sr9g, Sr10, Sr13, Sr14, Sr15, Sr16, Sr17, Sr18, Sr19, Sr20, Sr21, Sr28, Sr29, Sr30, Sr34, Sr36, Sr38, SrMcN* was the second most frequent pathotype and observed in 31 samples received from Gujarat, Maharashtra and Tamil Nadu. Other pathotypes such as 21-1 (24G5), 40-3 (127G29) and 122 (7G11) were observed in few samples only. High level of diversity of black rust pathotypes was found in Tamil Nadu.

Disease incidence in WDMN

Information on wheat disease situation was received from Dhaulakuan, Bajaura, Malan & Shimla in Himachal Pradesh, Udhaywalla (Jammu), Kathua, Rajouri, & Khudwani in Jammu & Kashmir, Pantnagar & Almora in Uttarakhand, Abohar, Deenanagar, Gurdaspur, Langroya, Ludhiana & Ropar in Punjab, Hisar (Haryana), Sabour & Pusa in Bihar, Ranchi (Jharkhand), Faizabad, Kanpur and Varanasi in Uttar Pradesh, Kalyani (West Bengal), Vijapur & Junagadh in Gujarat, Indore & Powarkheda in Madhya Pradesh, Jaipur (Rajasthan), Pune, Niphad, Mahabaleshwar & Akola in Maharashtra, Dharwad (Karnataka) and Wellington (Tamil Nadu)

Wheat blast was not reported from India. Likewise there was no occurrence of black rust on *Sr31* type of resistance (Ug99 type of pathotypes). Yellow rust was noticed at all the locations of NHZ and NWPZ. It was also observed at Sabour in NEPZ. All the entries of WDMN in other locations including SHZ, where yellow rust appears regularly, were free from yellow rust. Yellow rust was very severe at many locations at NWPZ and NHZ. 100S severity of yellow rust was observed on Kharchia Mutant at Bajaura. Eleven entries had more than 30S severity of yellow rust at Malan (Kangra). Brown rust was reported from few locations of NHZ and NWPZ *viz*. Shimla in HP, Kathua, Rajauri & Jammu in J. & K., Pantnagar in Uttarakhand, Langroya & Abohar in Punjab. It was reported from all the locations of NEPZ except Ranchi and Kalyani. In central zone brown rust appeared at Vijapur, Indore and Powerkheda only. There was no brown rust on WDMN entries in PZ. At Wellington (SHZ) brown rust appeared on 18 entries of WDMN. Of the 34 locations of WDMNs black rust was observed only at Wellington in SHZ, Vijapur, Indore & Powerkheda in CZ. NHZ, NWPZ, NEPZ and PZ were free from black rust. Leaf blight is reported from WDMNs planted at Almora, Kathua, Rajouri, Jammu (Udhaywalla), Sabour, Pusa, Ranchi, Faizabad, Kanpur, Kalyani, Mahabaleshwar, Pune, Niphad, Dharwad and Wellington. Powdery mildew was appeared at Almora, Kathua, Rajauri, Jammu and Wellington in WDMNs.

Appearance of Wheat rusts in WDMN

The data on first appearance of the wheat diseases on WDMN was not available for most of the locations. As per the data available, yellow rust was first observed at Pantnagar (17.01.17) followed by Udhaywalla and Kathua (24.01.17), Durgapura (02.02.17), Hisar (05.02.17), Dhaulakuan (11.02.17) and Almora (13.02.17). Brown rust was first observed at Pusa (04.01.17) followed by Pantnagar (25.01.17), Jammu and Kathua (10.02.17), Powerkheda (15.02.17), Sabour (04.03.17), Faizabad (05.03.17) and Kanpur (09.03.17). Black rust was first observed at Vijapur (20.02.17) and then at Powerkheda (25.02.17).

Varietal Performance against wheat rusts

High Altitude and Northern Hills Zone

Maximum severity of yellow rust was observed at Bajaura, where eleven entries of WDMN were showing more than 30S severity of yellow rust. However; WL711, HW2021, HD2204, C306, WH147, HPW349, VL892 and HS 507 were yellow rust free at Bajaura. Shimla was the only center in NHZ where yellow rust was not observed on WDMN entries during offseason. Two entries *viz*. HW2021 and VL892 were yellow rust free at all the locations of NHZ. WDMN entry WL1562 was yellow rust free at all the locations of NHZ except at Bajaura, where yellow rust severity of 80S was reported on it. Brown rust appeared at Shimla on Agra Local (5S) only, Kathua and Rajauri. At Kathua thirteen entries showed brown rust infection between 5S to 40S. Seven entries *viz.* WL711, Agra local, WL1562, HD2204, C-306, RNB1001 and WH1105 were showing brown rust infection (TMS to 10S) at Rajauri.

North Western Plains Zone

Yellow rust was highly severe at Dhaulakuan, Ludhiana, Gurdaspur and Pantnagar in NWPZ. Twelve, seventeen, sixteen and eleven entries of WDMN had more than 40S severity of yellow rust at Dhaulakuan, Ludhiana, Gurdaspur and Pantnagar, respectively. All the entries except Kharchia Mutant (TS) were free from yellow rust at Abohar. Similarly at Deenanagar twelve entries (HD2329, HD2160, WL1562, HW2021, HD2204, WH147, HW2008, HP1633, DL784-3, RNB1001, DPBW621-50 and WH896) were yellow rust free. WDMN entry WH896 was yellow rust free at all the locations of NWPZ. Brown rust appeared at Hisar, Jammu, Langroya, Abohar and Pantnagar in NWPZ. Two entries viz. HW2021 and DL784-3 were free from brown rust infection at all the locations of NWPZ. At Pantnagar all the entries except HW2021, HP1633 and DL 784-3 were showing brown rust infection. Brown rust appeared only on WDMN entries HD2329, Lal Bahadur, HD2204 and WH542 at Langroya others were infection free.

North Eastern Plains Zone

Yellow rust was observed only at Sabour in NEPZ, where 10S to 20S yellow rust severity was observed on HD2329, Agra Local, Lal Bahdur, Kharchia Mutant and RNB1001. Brown rust appeared at all the locations of NEPZ except at Ranchi and Kalyani. At Varanasi it was reported only on entries WL711 (20S) and Kharchia Mutant (10S). Maximum brown rust severity was observed at Pusa as ten WDMN entries were showing more than 30S severity of brown rust. WDMN entries HW2021, HW2008 and HD2402 were free from brown rust infection at all the locations of NEPZ.

Central Zone

Brown rust was observed at all the locations of CZ except at Junagarh (Gujarat). At Indore Lal Bahadur (10S) was the only entry showing brown rust infection. WDMN entries HD2160, HI8663, HI1544 and GW366 were free from brown rust infection at all the locations of CZ. Black rust was observed at Indore, Vijapur and Powerkheda only. WL711 (30MSS), Agra Local (20S) and Lal Bahadur (60MSS) were the only entries showing black rust infection at Indore. Four entries WL1562, MACS2496, Bijaga Yellow and HD2501 were black rust free at all the locations of CZ.

Peninsular Zone and Southern Hills Zone

Brown rust appeared only at Dharwad and Wellington. At Dharwad all the WDMN entries except Lal Bahadur (5S) were brown rust free. At Wellington seven entries (WL711, HD2329, Agra Local, HD2160, Lal Bahadur, Kharchia Mutant and MACS2496) showed more than 40S severity of brown rust. Black rust appeared on all the entries of WDMN except HD2160 and RNB1001 in SHZ (Wellington). WDMN planted at Peninsular Zone was black rust free. Four entries Agra Local, Kharchia Mutant, HP1633 and Bijaga Yellow showed 100S severity of black rust at Wellington whereas 80S black rust severity was recorded on Lal Bahadur, HD2204 and C306.

Powdery mildew

Powdery mildew was reported from six locations *viz*. Almora, Kathua, Rajauri, Jammu, Malan (Kangra, HP) and Wellington only. It was first seen on 01.02.17 at Almora followed by 10.02.17 at Jammu & Kathua and on 04.03.17 at Rajauri. All the entries of WDMN were susceptible to powdery mildew at all these locations except at Wellington, where HW2021 and DL 784-3 were free from powdery mildew infection. Fifteen WDMN entries had powdery mildew score of 4 or more. Maximum severity of powdery mildew was observed at Jammu in entries showed powdery mildew severity of 4 or more.

SAARC Wheat Disease Monitoring Nursery (2016-17)

Under the umbrella of Regional Station, ICAR-IIWBR, Shimla and CIMMYT, Delhi, SAARC wheat disease monitoring nursery is being conducted in SAARC countries with the objectives similar to the wheat disease monitoring nursery (WDMN) in India. During 2016-17, SAARC wheat disease monitoring nursery was planted at 29 locations across the six SAARC countries

India

Rusts

SAARC nursery was planted at 14 locations of NHZ and NWPZ, Faizabad, Pusa and Wellington. Yellow rust was observed at all the SAARC nursery locations in India except at Abohar, Pusa, Faizabad and Wellington. Yellow rust was first observed at Pantnagar (12.01.17), followed by Udhaywalla and Kathua (24.01.17), Durgapura (14.02.17), Dhaulakuan (15.02.17), Delhi (24.02.17) and Rajauri (04.03.17). All the entries of SAARC nursery were infected at Dhaulakuan and 14 entries were showing more than 40S severity of yellow rust. At Delhi only 6 entries *viz*. Annapurna (5S), PBW343 (40S), HD2687 (10S), HP1633 (TR), Kohsar (10S) and Susceptible check (60S) were showing yellow rust infection. During last year crop season there was no yellow rust on SAARC nursery at Durgapura (Jaipur) however during 2016-17 nine entries were infected with yellow rust. Up to 30S severity of yellow rust was observed on susceptible check at Durgapura. PBW343 was showing more than 30S severity of yellow rust at 11 locations. Entry HD2189 was yellow rust free at all the locations except at Jammu, Pantnagar, Gurdaspur and Dhaulakuan.

Brown rust was observed at all the SAARC nursery locations except at Dhaulakuan, Ludhiana, Deenanagar and Durgapura. First report of brown rust was from Pusa and Pantnagar on 04.01.17 followed by Jammu and Kathua on 10.02.17, Faizabad (05.03.17) and Delhi (10.03.17). All the entries of SAARC-WDMN were brown rust free at Almora except Kohsar (10S) and susceptible check (TS). Similarly at Ludhiana and Ropar all the entries were brown rust free except Rawal 87 (20S) and susceptible check (10S). Brown rust was observed only on HD2204 (5S) and susceptible check (TS) at Gurdaspur and on Annapurna (TS) and susceptible check (TS) at Abohar; other entries were brown rust free at these two locations. Severity of brown rust was maximum at Wellington, where all the entries except Gourab were showing brown rust infection. Eight entries had more than 40S severity at Wellington .

Black rust was observed only at Wellington, where the all the entries of SAARC nursery except Inquilab 91, Rawal 87 and Bakhtawar 94 were infected with black rust. Black rust severity at Wellington was ranging from TR in PBW343 and Chakwal86 to 20S in HP1633 and susceptible check.

Other countries:

With the courtesy of Dr. A. K. Joshi, CIMMYT, India, report on SAARC Wheat disease monitoring nursery was received from Bhutan, Bangladesh, Afganistan and Nepal. Both wheat yellow and brown rusts were observed in these countries, whereas black rust was not observed.

Bhutan

Nursery was planted at one location only at Agriculture Research and Development Center, Department of Agriculture, Bajo, Wangdue (1250 masl). During 2016-17, incidence of wheat diseases was very less and yellow and brown rusts of wheat were observed. Wheat black rust was not observed anywhere. Most of the wheat lines were free from rusts, however, incidence of brown rust was more than yellow rust.

Nepal: SAARC nursery was planted at Bhairahawa and Tarahar (Nepal). At both the locations wheat brown and black rusts were not observed. Incidence of yellow rust was also low. Except for 60S brown rust on Annapuna at Bhairahawa, other entries supported little rust.

Bangladesh: The wheat blast could be recorded only in Bangladesh at Jessore and Rajshahi. However results were not conclusive since check used did not have much blast.

Management of diseases and pests through chemical control: Chemical control has gained attention under the present scenario due to the wide spread occurrence of yellow rust in most of the varieties in the NWPZ. Similarly chemical control is needed for the management of insect pests, since there is no resistance available in wheat against the insect pests. New molecules were also tested for stripe rust, leaf blight and flag smut management. Different brands of propiconazole along with other fungicides were tested for stripe rust.

MANAGEMENT OF INSECT PESTS DURING 2016-17

(A) HOST PLANT RESISTANCE

Shoot fly (SF)

The genotypes, TL 3013 had 5.7% infestation against 29.7% recorded in entry HI 1620.

Brown wheat mite (BWM)

AVT entries, K 1006 (9 mites/10cm^2 area), DBW 90, HD 2733 (42 mites/10 cm^2 area) and VL 1011 (10 mites /10 m^2 area) were promising as compared to susceptible DBW 204 (60 mites/m^2 area).

Foliar aphid (FA)

AVT entries HS-375 (c), TL-2969, WR-544 UP 2992, VL 1011, VL 3013, VL 3014,HI 1617,HI 1620,MP 1318,HS 611,DBW 246 and PBW 757 showed moderately resistance response to foliar aphid at Kharibari. HS-647 was promising at Karnal.

Root aphid (RA)

HD 2967 (C), K 8027 (C) and UAS 375, HS 646,HS 647,VL 3015,CG 1023,DBW 189,HD 3226,HI 1620,PBW 750,TL 3011,TL 3012,TL 3013,TL 3015, and WH 1232 were moderately resistant at Ludhiana against RA.

Multiple pest resistance

The promising ones were as follows:

Shoot fly: IWP 72 (C) with 6.52% infestation.

Brown wheat mite: WB1 (6.00 mites/ 10 cm^2)

Foliar aphid: PBW -723, MACS 4020 (d), MACS 5041 and MACS 5043 were moderately resistant (grade 3) at Karnal

Root aphid: At Ludhiana, the entry WB1 was found to be resistant (grade 2) while sixteen entries were also found to be moderately resistant (grade 3) to root aphid.

(B) CHEMICAL CONTROL

Termites: Three insecticides as seed treatment viz., Imidacloprid 600 FS @ 4 ml /kg, Thiamethoxam 35 FS @ 2.4 ml/kg and Fipronil 5 Sc @ 6 ml/kg were equally effective against termites. In standing crop of wheat, combination of Fipronil 5 SC +Imidacloprid 40 % WG (Lacenta) was found to be the most effective.

Brown wheat mite: For management of brown wheat mite spray of Propargite 57 SC (Omite) @ 1.5 ml/l and Spiromesifen 240 SC (Oberon) @ 1.0 ml/l of water was best.

Foliar aphid: The spray of three insecticides viz., Actara (Thiamethoxam 25 WG) @ 12.5 g.a.i./ha, Fame (Flubendamide 480 SC) @ 20 g.a.i./ha and Confidor (Imidacloprid 17.8 SL) @ 20 g.a.i./ha were found the most effective in curbing aphid population. Amongst tested bio-pesticides, *Metarhizium anisopliae* @ 3g/l and *Azadirachtin* 1500 ppm @ 3ml/l were found to be effective for the management of aphids in wheat.

(C). SURVEY AND SURVEILLANCE OF INSECT PESTS

- In Rajasthan, moderate infestation of termite, mite *H. armigera* and Pink stem borer in wheat fields was found at Jaipur. other pests like *Spodoptera*, Surface gram hopper, shootfly and jassids was occasional and were in negligible form. The cutworm population was also observed in Tank bed condition of Tonk districts.
- Medium to heavy incidence of aphids was recorded in Nasik district of Maharashtra. The Coccinellid predatory grubs, beetles and Chrysoperla feeding on the aphid infested fields were also observed. The incidence of jassids was recorded in medium intensity and stem borer infestation in traces.
- In Punjab, moderate to severe incidence of aphids was observed some fields at villages viz. Nagar (near Phillour), Lasara (SBS nagar) Langroya and Hayatpur (near Gharshankar) in the month of March, 2017. Sporadic incidences of aphids were also observed in the month of February, 2017 at villages Dburji (Deenanagar), Ladhowal (Ludhiana) and some parts of Gurdaspur.

- In Vijapur, the termite and aphid damage in wheat fields remained moderate throughout the crop season. The population of *H. armigera*, pink stem borer and surface grasshopper were very low.
- Moderate to severe incidence of foliar wheat aphid was observed in Karnal district of Haryana. The minor damage of termite and root aphids was also observed in early period of crop growth in Karnal as its nearby locations Kunjpura, Kathial, Racina and Hajwna. In some fields, incidence of pink stemborer was observed in early (December month). The grubs and adults of coccinellid beetles were seen frequently in fields infested with aphids.
- In Pantnagar, the insect-pests that were found infesting wheat crop were; Aphids (*Rhopalosiphum maidis*, *R. padi*, *Macrosiphum* sp), armyworm (*Mythimna separata*) *Helicoverpa armigera*, stem borer (*Sesamia inference*), grasshoppers, leaf miner, stink bug (*Nazara* sp), termites (*Microtermis obesi*, *Odontotermis obesus*), thrips (*Thrips hawaiiensis*, *T flavus* and *T. tabaci*), cutworm (*Agrotis* spp), wireworm and mites. Of these, wheat aphid exhibited marked predominance over all other pests. Out of three species of foliar aphids viz., *Rhopalosiphum maidis*, and *Macrosiphum* sp showed higher abundance. The grubs and adults of *Coccinella septempunctata*, *C. transversalis* and maggots of *Episyrphus balteatus* and *Ischiodon scutellaris* were observed as the predominant predators of wheat aphids. The predatory bug, *Eocanthocona furcellata* (Pentatomidae) was also found to prey upon the larvae of *Helicoverpa armigera*.

(D) STORED GRAIN PEST MANAGEMENT

Two chemicals viz., Emamectin benzoate (Proclaim @40.0 mg/kg) and spinosad (Tracer 4.4 mg/kg) were found to be effective as seed protectants against *Trogoderma granarium* or *Rhizopertha dominica* infestation in wheat.

Crop health monitoring survey for nematodes

Hisar

Crop health monitoring survey for nematodes was done in Hisar and Fatehabad, districts. Cereal cyst nematode was reported in 32.3 % (21/65) samples. It was reported in samples of Jagaan, Asranwa, Mahalsara, Kohli, Khairampur, Sadalpur, Chuli, Adampur, Siswal & Bhodiya bishnoiyan in Hisar (10/35) ; Mehuwala, Dharnia , Bhattu, Dhabi, Dhingsara, Bhodiya khera, Sulikhera, Kirdhan, Gadli, Fatehabad, Kumhariyan in Fatehabad (11/30) . Number of cysts ranged from 2-28 per 200 cc soil. Other plant parasitic nematodes present in 200 cc soil samples were *Pratylenchus* sp. 38.4% (5-40); *Tylenchorhynchus* sp. 53.8% (15-300); *Hoplolaimus* sp. 18.4% (2-35), *Helicotylenchus* sp. 16.9% (2-20) and root knot nematode 3.0 % (5-20). Wheat seed gall nematode (*Anguina tritici*) was not recorded from the state.

Durgapura

Survey was conducted in the different cultivator's fields of four districts of Rajasthan for studying the incidence and intensity of Cereal Cyst Nematode (CCN). Diseased fields were randomly selected on the basis of above ground symptoms of the crops. Symptoms of stunting, yellowing, patchy and poor growth were recorded during survey of each field. Roots samples were collected from the rhizospere of wheat and barley crops looking above ground symptoms alongwith composite soil sample. Root & soil sample were processed with standard technique of nematode identification. Presence of cereal cyst nematode was further confirmed by seeing the bushy roots with white cyst on it. Cereal cyst nematode infestation was recorded in all four districts e.i. Alwar, Dausa, Jaipur and Sikar districts. A large number of infested fields were observed in Amber, Bassi, Chomu, Jamwa Ramgarh, Kotputli, Sahapura and Viratnagar tehsil of Jaipur district.

Ear Cockle nematode (*Anguina tritici*)

Biotypes of *Heterodera avenae* at Durgapura

The biotypes studies of cereal cyst nematode were carried out during the crop season 20016-17 against Jaipur population of cereal cyst nematode, *Heterodera avenae*. Out of 26 International differentials of wheat, barley and oat, twelve showed resistant reaction i.e. AUS-15854, AUS-7869, AUS-15895, Psathia, KVL-191, Harlan, Dalmitsche, Morocco, P-313221, Martin, Siri, La-estanzuella while rest showed susceptible reaction. Jaipur population of CCN is Pathotype Ha 21.

Host resistance to CCN

The resistant variety was KRL 19 (C) with 1-4 cysts/ plant and moderately resistant varieties and genotypes (5-9 cysts/plant) were HS 490 (C), HD 3171 (I) (C), MP 3288 (C), UAS 304 (C) and VL 3013 at Durgapura. Likewise, at Ludhiana, MR types were HI 1620, PBW 750, DBW 187, HI 8791 (d), UAS 462 (d), DBW 246, PBW 778, VL 4002 and DBW 88 (c).

Evaluation of ecofriendly approaches for the management of cereal cyst nematode, *H. avenae*

Hisar

This experiment was done in screen house in earthen pots. There were seven treatments with three replications each. Castor cake, neem cake, vermi compost and FYM (10 g /kg soil) were mixed in soil at sowing time. Cow urine 25, 50 and 100% was used as seed dip treatment for 4 h. Recommended dose of fertilizers and controlled amount of water were applied in pots. In seed treatment with 50 and 100 % cow urine germination did not take place, so no data was obtained. Castor cake delayed germination and crop growth was poor in the beginning, although at later stage, growth was best in this treatment. None of the organic matter or seed treatment with cow urine was effective in controlling cyst nematode in wheat. On *H. avenae* -resistant wheat variety Raj MR 1, no cyst was formed.

Durgapura

Inoculum level was 11.2 larvae/g soil of cereal cyst nematode. The experiment consisted of seven treatments *viz* Neem cake 10q/ha (soil application), Neem oil 10 ml/kg (seed treatment), NSKP (seed soaking) (10 ml/kg), Neem cake 5 q/ha +half dose of Neem oil, Neem cake 5 q/ha +half dose of NSKP along with treated check (Carbofuran@ 1.5 kg ai/ha) and untreated check (Raj 3765) in a completely randomized block design and replicated thrice. The crop after attaining the age of 75-90 days was examined the development of white cyst/plant in each treatment. The grain yield was taken at the time of harvesting of the crop in each treatment separately. The results revealed that all the treatments gave significantly higher grain yield with reduced number of cysts/plant over control. The maximum grain yield (32.60 q/ha) was recorded in Neem cake 5 q/ha +half dose of Neem oil with 9.22 cyst/ plant) with increase 141.80% in yield followed by Neem cake 5 q/ha +half dose of NSKP (Grain yield – 29.1 q/ha; 10.11 cysts/plant). All the neem based formulations was also found effective in reducing the population of nematodes and increased grain yield over control. Half dose of Neem cake (soil application) with neem oil (seed treatment) showed its overall superiority by keeping larvae entry away from root and better plant growth. Response may be due to the fact that neem oil having nematicidal potential and cake might have increased the tolerance level of plant and potential to resist the nematode attack

Training Programs

The awareness programmes have been organized regarding diseases and insect pest management in wheat with special emphasis on yellow rust. ICAR-IIBWR organized Scientist – Farmers' interaction on 'Seed Day' on 17 October 2016 in which special lecture has been given on 'Disease management in wheat' followed by question answers session. Posters were also displayed to educate farmers aware on identification of stripe rust disease and its management. More than 800 farmers attended the fair. Stripe rust management cards were also distributed among the farmers. Under "Mera Gaon Mera Gaurav" scheme, teams of scientists comprising of Plant Pathologists and Entomologists visited the adopted villages and created awareness among farmers about identification of different diseases and insect pests of wheat and their management practices.

Dr. D. P. Singh, Principal Scientist (Plant Pathology) and Principal Investigator (Crop Protection Programme) delivered a lead lecture on "Yellow rust of wheat: An overview" on 14 December, 2016 at SAMETI, SKUAST Chatha, Jammu in a brain storming workshop on "Yellow rust of wheat and strategy planning for its management" and interacted with state government agriculture and extension officers of Jammu and Kashmir. The diagnostic cards of yellow rust and management were distributed to about 130 participants of workshop.

Training programme on "Disease Surveillance and Healthy Seed Production of Wheat" was organized on 3rd February, 2017 in which 40 participants belonging to west Bengal State agriculture department, seed producers and farmers were present at BCKVV Kalyani.

Training programme of staff of Directorate of Plant Protection, Quarantine and Storage (DAC & FW) were trained at its regional centre, Kolkata on identification of wheat blast and disease survey on 23 Feb. 2017.

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PROGRAMME 1. STATUS OF DISEASE RESISTANCE IN THE ENTRIES OF PRE COORDINATED AND COORINATED YIELD TRIALS AND RELEASED CHECK VARIETIES

1.1 INITIAL PLANT PATHOLOGICAL SCREENING NURSERY (IPPSN)

This nursery contained total 1390 entries of precoordinated yield trials contributed by 42 main wheat breeding centres and was screened at hot spot locations against stem, leaf and stripe rusts as well as leaf blight. The details are as below:

OBJECTIVES

Evaluation of breeding materials generated at various centers against rusts and foliar blights for inclusion in the coordinated multilocational yield evaluation trials.

SIZE AND COMPOSITION

No. of entries: 1390
No. of breeding centers: 42

TEST LOCATIONS

(a) Rusts:

North:

Leaf Rust: Delhi, Hisar, Karnal, Durgapura, Ludhiana (5)

Yellow Rust: Gurdaspur, Dhaulakuan, Malan, Karnal, Durgapura, Ludhiana and Jammu (7)

South:

Stem Rust + Leaf Rust: Mahabaleshwar, Wellington, Powarkheda, Niphad and Indore (5)

(b) **Leaf Blight:** Faizabad, Pusa (Bihar), Varanasi, Kalyani, Sabour, Ranchi and Coochbehar (7)

Data was not considered due to poor/erratic disease development from the following centres:

Leaf rust: Niphad

Evaluation under artificial epiphytotics

Uniform procedure was adopted for evaluation of IPPSN at all the test centers. Rust inoculum represented by a wide spectrum of pathotypes, was used in artificial inoculation of IPPSN materials. Rust inocula were supplied by IIWBR Regional Station Flowerdale and Mahabaleshwar centers. Following pathotypes were supplied for inoculation:

STEM RUST PATHOTYPES

Flowerdale (Shimla)

11(79G31), 40A (62G29), 42 (19G35), 122(7G11), 117-6 (37G19)

Mahabaleshwar

11 (79G31), 40A (62G29), 42 (19G35), 122(7G11), 117-6 (37G19)

LEAF RUST PATHOTYPES

Flowerdale (Shimla)

12-5 (29R45), 77-9 (121R60-1), 77-5 (121R63-1) and 104-2(21R55)

Mahabaleshwar
12-2 (1R5), 77-2(109R31-1), 77-5 (121R63-1) and 104-2(21R55)

STRIPE RUST PATHOTYPES
Flowerdale (Shimla)
46S119, 110S119 and 110S84

The details of the score of three rusts and leaf blight of IPPSN entries are given in annexure Table 1.11. An account of entries exhibiting rust response upto ACI 15 to three rusts is given in Table 1.1. The disease data was sent to the concerned breeders in first week of July, 2017 and was also uploaded on IIWBR website.
The per cent resistant entries against leaf (North) and stripe rust contributed from centres located in NHZ, NWPZ and NEPZ were in the range of 0-100%. Likewise, in case of leaf rust (South) and stem rusts in case of entries of Central and Peninsular zone, the range was 29-100%. The entries which failed miserably (0% resistance to leaf and stripe rusts) in case of North India against rusts were from CSSRI Karnal, GBPUAT (MAB), SKUAS&T Chatha, Jammu in NWPZ and Coochbehar and SHIAT&S, Allahabad. The other centres were BAC, Sabour (5% resistance), CSAUA&T, Kanpur (8%) and BAU, Kanke, Ranchi (10%). In case of Central and Peninsular zones, the entries contributed by BARC, Mumbai (29%) and MAU, Parbhani (40%) were inferior in resistance to leaf and stem rusts.

Table 1.1. Per cent of rust resistant lines (ACI up to 15) in IPPSN slots of different centres

Sr. No.	Name of Centre		Total	PERCENT ENTRIES RESISTANT TO		
		SOUTH		NORTH		
		STEM& LEAF		LEAF & STRIPE		
I. NORTHERN HILLS ZONE						
		Resistant	Total	%	Resistant	Total	%
1	VPKAS, Almora				22	45	49
2	CSK, HPKVV, Malan				16	30	53
3	NABI Mohali				2	2	100
4	Shimla				3	5	60
II. NORTH WESTERN PLAINS ZONE							
5	CCS HAU, Hisar				43	75	57
6	ICAR-CSSRI, Karnal				1	10	10
7	ICAR-CSSRI, Karnal				0	10	0
8	PI CI IIWBR, Karnal				30	123	24
9	PI CI IIWBR, Karnal				6	17	35
10	ICAR-CSSRI, Karnal				11	28	39
11	GBPUA&T, Pantnagar				19	60	32
12	GBPUA&T, Pantnagar				0	4	0
13	IARI, New Delhi.				102	313	33
14	PAU, Ludhiana				99	130	76
15	PAU, Ludhiana				1	2	50
16	PAU, RS, Gurdaspur				21	30	70
17	RAU, ARS, Durgapura				7	60	12
18	SKUAS&T, Chatha, Jammu				0	10	0
III. NORTH EASTERN PLAINS ZONE							
19	Coochbehar (WB)				0	20	0
20	B.H.U., Varanasi				7	30	23

Sr. No.	Name of Centre		Total	PERCENT ENTRIES RESISTANT TO			
		SOUTH			NORTH		
		STEM& LEAF			LEAF & STRIPE		
21	BAC, Sabour				1	20	5
22	BAU, Kanke, Ranchi				1	10	10
23	CSAUA&T, Kanpur				4	50	8
24	Kumarganj, Faizabad				5	25	20
25	SHIAT&S, Allahabad				0	5	0
VI. CENTRAL ZONE							
26	ARS, Ummedganj, Kota	6	10	60			
27	TCB,CA& RS,Bilaspur	17	20	85			
28	College of Agriculture, Gwalior	8	10	80			
29	JNKVV, Jabalpur	11	20	55			
30	JNKVV, ZARS, Powarkheda	25	30	83			
31	RARS, Sagar	6	10	60			
32	SDAU, Vijapur	39	46	85			
33	Bhavnagar (Gujrat)	5	5	100			
V. PENINSULAR ZONE							
34	ARI, Pune	25	35	71			
35	ARI, Pune	3	6	50			
36	BARC, Mumbai	2	7	29			
37	Maharashtra Hybrid Seed Co.Ltd.	2	2	100			
38	MAU, Parbhani	2	5	40			
39	MPKV, ARS, Niphad	14	20	70			
40	UAS, Dharwad	24	30	80			
41	Wheat Research Unit, Akola	9	15	60			
42	ARS Washim (MS)	3	5	60			
		201	276	73	401	1114	36.0

1.2 PLANT PATHOLOGICAL SCREENING NURSERY (PPSN)

OBJECTIVES

Assessment of level of resistance in NIVT and AVT yield trial entries against major diseases and assisting the breeders in promotions of these entries in coordinated yield trials as well as proposing for varietal identification and release.

SIZE AND COMPOSITION

PPSN, 2016-2017 included AVT, NIVT and the special trials (496 entries) including checks. The released / identified varieties as per respective trials, were used as checks and a mixture of susceptible varieties like Agra Local, A-9-30-1, WL-711, PBW 343, Sonalika, C-306, Kharchia 65, VL 804, K 8027, HD 2932, NI 5439, Cow(W) -1, GW 322, HD 2864, NIAW 1415, MACS 2496, MACS 2946, MP 4010 and B. Yellow were used as infectors.

The PPSN was evaluated nationwide under artificially created epiphytotics at respective hot spot locations against three rusts. AVT entries were also evaluated against Karnal bunt, Foliar blight, Powdery mildew, Loose smut, Flag smut, Hill bunt, Head scab and Foot rot under respective disease screening nurseries (Fig. 1.1).

TEST LOCATIONS

Rusts: North:

Stripe Rust: Dhaulakuan, Gurdaspur, Malan, Bajaura, Karnal, Delhi, Ludhiana, Pantnagar, Durgapura, Jammu, Kudwani (Kashmir) (11)

Leaf Rust: Delhi, Hisar, Jammu, Kanpur, Karnal, Ludhiana, Pantnagar, Durgapura(8)

South:

Leaf and Stem Rusts: Wellington, Mahabaleshwar, Niphad, Vijapur, Pune, Junagarh, Powarkheda, Dharwad and Indore (9)

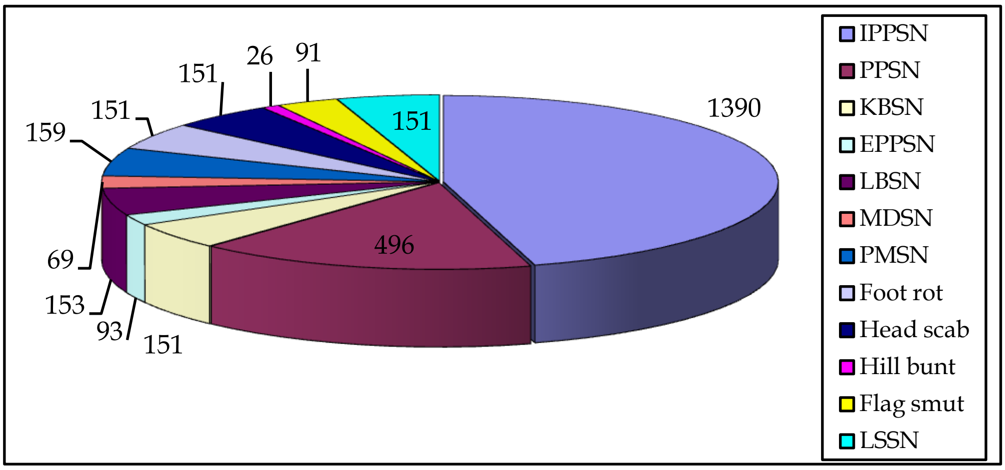

Fig. 1.1. Constitution of different plant pathological nurseries during 2016-17

Evaluation under artificial epiphytotics

Uniform procedure was adopted for scoring of PPSN at all the test centers. Rust inoculum represented by a wide spectrum of pathotypes, was used in artificial inoculation of PPSN materials. Inoculum of yellow, brown and black rusts was supplied by IIWBR Regional Research Station, Flowerdale, Shimla. Mahabaleshwar center also supplied the inoculum to Centres in CZ and PZ. The mixture of pathotypes supplied by Flowerdale and Mahabaleshwar centres are given in IPPSN.

Regional Station Flowerdale has also been given in the respective Tables and also in Tables 1.2a and 1.3. Three years data of AVT final year ebntries are given in Table 1.2b. Disease data of AVT II year entries recorded at the hot spot locations is given in Table 1.2 that of AVT-I and NIVT (three rusts) is presented in Tables 1.3 and 1.4 respectively. Rust resistant genes postulated in AVT entries by IIWBR RS.

Other diseases data of AVT IInd and Ist year entries are presented in Table 1.5.

Rust Resistance entries of AVT (2016-17) with ACI upto 10.0 are given below:

Stem, Leaf and Stripe Rusts

AVT IInd Year: WH 1080 (C), WH 1142 (C), HI 1612, MACS 6222(C), UAS 446 (C), DBW 71(C), TL 2942 (C), TL 2969 (C)

AVT Ist Year: HS 630, UP 2993, VL 1011, VL 1012, VL 3013, VL 3014, HD 3226, HS 611, DBW 187, HI 8791 (d), UAS 462 (d), TL 3011, TL 3012, TL 3013, TL 3014, TL 3015, PBW 777, PBW 778, WH 1232

Stem and Leaf Rusts

AVT IInd Year: HPW 251 (C), HS 375 (C), HS 490 (C), HD 2967 (C) DBW 39 (C), HD 2888 (C), K 1317 (I) (C), DBW 110 (C), HI 8627 (d) (C), MP 3288 (C), DBW 168, UAS 375, NIAW 1415 (C), HW 2044 (C), HW 5216 (C), CoW (W) -1 (C), DDK 1029 (C), HW 1098 (C), PBW 550 (C)

AVT Ist Year: HPW 448, HPW 449, HS 644, HS 646, MP 1318, HD 3219, DDK, 1052, DDK 1053, MACS 5047, MACS 5049, HS 375 (C)

Leaf and Stripe rusts

AVT IInd Year: HS 507 (C), HS 542 (C), VL 829 (C), VL 892 (C), HI 8777 (d), AKDW 2997-16 (d)(C), KRL 210 (C)

AVT Ist Year

HS 648, HD 1620, PBW 750, KRL 370, PBW 780, WH 1316, DBW 251, HD 3271, HD 3272, PBW 757, WH 1233

Seedling resistance test against pathotypes of wheat and rust resistance genes during 2016-17

A. Flowerdale, Shimla

a. Rust resistance

To identify rust resistant lines of wheat and characterize resistance genes, 151 lines of AVT I and II were evaluated at seedling stage using an array of pathotypes of black (*Puccinia graminis tritici*), brown (*P. triticina*) and yellow rust (*P. striiformis*) having varying avirulence/virulence structures. These studies were conducted under controlled conditions of temperature and light. None of the lines was resistant to all the rusts. In addition to all the lines having *Sr31* were resistant to black rust of wheat, whereas lines possessing *Lr24*, some with *Lr26* were resistant to brown rust and few lines with *Yr9* showed resistance to yellow rust of wheat. Details of the wheat rust resistant lines are given below:

Rust resistance in AVT lines

Rust resistance to all the pathotypes of black, brown and yellow rust was not observed in any of entries of AVT II. There was no entry in the AVT II which showed resistance to all the pathotypes of yellow rust. Seven entries *viz.* Cow (W)(C), HW2044(C), HW5216(C), MACS6222(C), MP3288(C), NIAW1415(C) and UAS446 confer resistance to all the pathotypes of brown rust, whereas five entries (VL892(C), HD3043(C), DBW110, TL2942(C) and TL2969(C)) were resistant to all the pathotypes of black rust.

AVT IInd year

Resistant to yellow rust only	:	None
Resistant to brown rust only	:	Cow (W)(C), HW2044(C), HW5216(C), MACS6222(C), MP3288(C), NIAW1415(C), UAS446
Resistant to black rust only	:	VL892(C), HD3043(C), DBW110, TL2942(C), TL2969(C)

All the lines carrying *Sr31* were resistant to black rust. Like AVT II entries, rust resistance to all the pathotypes of black, brown and yellow rust was not observed in any of entries of AVT I. Entries HS630 and VL3013 were found to be resistant to all the pathotypes of black and brown rusts; whereas resistance to black and yellow rusts was conferred by VL1012. Six entries *viz*. DBW246, PBW757, PBW752, PBW777, UP2993 and WH1233 confer resistance to all the pathotypes of yellow rust, whereas nine entries (HS643, VL4002, HD3226, HD3237, MP1318, HD3219, KRL377, TL3012 and TL3015) were resistant to black rust.

AVT I

Resistant to black and brown rusts	:	HS 630, VL3013
Resistant to black and yellow rusts	:	VL1012
Resistant to yellow rust only	:	DBW246, PBW757, PBW752, PBW777, UP2993, WH1233
Resistant to black rust only	:	HS643, VL4002, HD3226, HD3237, MP1318, HD3219, KRL377, TL3012, TL3015

Table 1.2a . Adult plant response of AVT IInd year entries against three rusts under rust epiphytotic conditions at hot spot locations in field during 2016-17

S. No.	Entry	Stem rust		Leaf rust				Stripe rust		Postulated Genes		
				South		North						
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	*Sr*	*Lr*	*Yr*
I. NORTHERN HILLS ZONE												
1	HPW 251 (C)	20MS	5.6	20S	7.8	5S	1.0	60S	43.4	*31+2+*	*26+23+*	*9+*
2	HS 375 (C)	10MS	2.1	20MS	5.0	10S	4.2	60S	31.6	*31+5+2+*	*26+34+*	*9+18+*
3	HS 490 (C)	10S	4.9	20S	7.8	5S	1.1	60S	14.9	*9b+2+*	*23+*	*A+*
4	HS 507 (C)	10MS	2.7	10S	1.5	20S	5.0	40S	15.8	*31+*	*26+1+*	*9+2+*
5	HS 542 (C)	30MS	9.5	10MR	1.0	40S*	8.2	60S	34.6	*8a+5+7b+*	*13+10+*	*2+*
6	VL 829 (C)	40S*	7.0	15MS	2.1	10S	2.2	60S	22.1	*31+5+*	*26+34+*	*9+18+*
7	VL 892 (C)	10MS	4.7	10S	3.3	TS	0.2	80S	35.6	*2+*	*13+10+*	*A+*
8	VL 907 (C)	NS		NS		NS		NS				
II. NORTH WESTERN PLAINS ZONE												
9	DBW 173	80S*	14.3	10MS	2.4	5S	2.0	60MS*	13.8	*31+5+*	*26+10+3+*	*9+A+*
10	DBW 88 (C)	20MR-MS	6.0	20S	5.5	5S	2.8	80S	37.4	*11+2+*	*13+10+3+*	*A+*
11	DBW 90 (C)	60S	33.0	20S	6.5	40S	15.0	5S	1.3	*13+2+*	*13+10+3+*	*2+*
12	HD 3043 (C)	40S	10.9	20S	7.9	60S	16.9	60S	28.2		*23+10+*	*2+*
13	HD 2967 (C)	30MS	5.3	20MR	1.3	10S	4.0	80S	51.0	*80+11+2+*	*23+*	*2+*
14	HD 3059 (C)	30MS	11.0	20S	5.7	20S	6.0	80S	43.6	*11+2+*	*13+*	*2+*
15	HD 3086 (C)	70S	34.7	30S	8.8	20S	11.2	10S	3.3	*7b+2+*	*13+10+3+*	*2+*
16	PBW 644 (C)	40MS	16.0	10S	3.8	10S	2.2	40S	17.6	*11+2+*	*13+1+*	*2+*
17	WH 1021 (C)	20S	7.2	20S	5.5	10S	4.8	60S	43.6	*31+2+*	*26+1+*	*9+*

S. No.	Entry	Stem rust		Leaf rust				Stripe rust		Postulated Genes		
				South		North						
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	*Sr*	*Lr*	*Yr*
18	WH 1080 (C)	15MS	4.5	20S	3.2	20S	8.4	10S	2.3	*9e+2+*	*13+*	*2+*
19	WH 1105 (C)	40S	11.4	40S	9.5	20S	12.0	60S	25.4	*11+2+*	*13+*	*2+*
20	WH 1124 (C)	50S	20.0	30S	10.8	10S	4.2	50S	7.7	*7b+2+*	*13+10+*	*2+*
20. A	INFECTOR	100S	60.0	100S	75.7	80S	60.0	90S	71.0			
21	WH 1142 C)	20MR	2.0	40S	8.1	40S*	8.1	5S	1.4	*31+2+*	*26+23+*	*9+*
III. NORTH EASTERN PLAINS ZONE												
22	HI 1612	40S	9.1	20MS	3.8	5S	1.0	10S	3.2	*7b+2+*	*23+*	*2+*
23	C 306 (C)	40S	25.0	40S	17.9	60S	42.0	80S	44.4		*34+*	*18+*
24	DBW 39 (C)	10MR	0.7	20MR	1.2	5S	1.2	60S	38.6	*31+*	*26+23+10+*	*9+*
25	HD 2733 (C)	10MR	0.8	60S	14.1	5S	2.0	80S	53.6	*31+2+*	*26+34+*	*9+18+*
26	HD 2888 (C)	5MR	0.4	TMR	0.1	5S	2.0	60S	33.2	*24+2+*	*24+*	*2+*
27	HD 3171 (I) (C)	80S	31.4	40S	11.5	20S	5.0	60S	29.6	*11+7b+2+*	*23+13+10+*	*2+*
28	K 8027 (C)	20S	4.7	5S	0.8	60S	18.0	60S	32.6	*11+2+*	*13+1+*	*2+*
29	K 0307 (C)	80S	18.8	40S	7.8	10S	2.8	60S	39.8	*2+*	*23+1+*	*2+*
30	K 1006 (C)	70S	17.7	60S	16.6	10S	3.0	60S	39.7	*8a+9b+11+*	*13+1+*	*2+*
31	K 1317 (I) (C)	30MR	4.9	30S	4.4	10S	2.0	60S	22.9			
IV. CENTRAL ZONE												
32	DBW 110 (C)	30MS	7.0	20S	4.1	20S	5.2	80S	40.4		*13+*	*2+*
33	HI 8627 (d) (C)	10MR	0.8	20S	3.7	0	0.0	20MR	3.5	*9e+2+*		*2+*
34	MP 3288 (C)	20MS	4.1	10S	1.7	5S	1.2	80S	38.0	*24+*	*24+*	*2+*
V. PENINSULAR ZONE												
35	DBW 168	30MS	6.9	20S	3.2	40S	9.0	80S	40.4	*31+2+*	*26+*	*9+*

S. No.	Entry	Stem rust		Leaf rust				Stripe rust		Postulated Genes		
				South		North						
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	*Sr*	*Lr*	*Yr*
36	HI 8777 (d)	60S	15.7	10S	1.6	10S	2.0	15MR	0.9	*7b+*		*2+*
37	MACS 4028 (d)	10MS	1.9	20S	5.8	40S*	8.8	80S	44.1	*7b+*		
38	UAS 375	20MS	3.4	40S	9.6	20S	5.0	80S	46.4	*7b+2+*	*13+1+*	*2+*
39	AKDW 2997-16 (d)(C)	60S	25.7	5MS	2.3	10MR	1.0	10S	2.4	*7b+2+*		
40	GW 322 (C)	60S	22.7	20S	10.3	5S	1.8	80S	42.9	*11+2+*	*13+1+*	*2+*
40. A	INFECTOR	100S	68.3	100S	71.4	80S	46.0	90S	74.0			
41	MACS 6222 (C)	30MS	4.7	30MS	4.6	0	0.0	20S	8.4	*31+2+*	*26+1+*	*9+27+*
42	MACS 6478 (C)	60S	29.7	30S	10.3	10S	2.2	80S	60.6	*28+*	*23+1+*	*2+*
43	NI 5439 (C)	60S	37.3	80S	33.4	40S	13.4	100S	72.4	*11+*	*34+*	*2+18+*
44	NIAW 1415 (C)	30MS	5.4	20S	5.5	10MS	1.8	80S	51.2	*31+2+*	*26+1+*	*9+*
45	UAS 304 (C)	20MS	4.7	40S	9.8	5S	1.2	60S	39.4	*28+8a+*	*23+1+*	*2+*
46	UAS 446 (C)	20MS	4.7	10S	1.6	0	0.0	10MS	2.3	*11+2+*		*2+*
VI. SOUTHERN HILLS ZONE												
47	HW 2044 (C)	20MR	2.9	20MR	1.5	40S	9.0	60S	22.1	*24+*	*24+*	*2+*
48	HW 5216 (C)	20MS	3.4	10MR	0.7	5S	1.2	60S	19.0	*31+*	*26+*	*9+*
49	CoW (W) -1 (C)	20MS	4.1	20MR	1.2	20S	4.2	80S	53.6	*31+*	*26+*	*9+*
VII. SPECIAL TRIAL												
50	DBW 14 (C)	60S	22.7	40S	12.3	10S	3.2	60S	22.6	*28+11+2+*	*23+*	*2+*
51	DBW 71 (C)	20MS	7.0	30S	6.1	5S	1.0	10S	5.0	*31+5+*	*26+*	*9+*
52	DDK 1029 (C)	5MR	0.4	30S	7.2	10MR	1.0	60S	30.6	*11+*	*13+*	
53	HW 1098 (C)	20MR	2.1	20S	4.1	5S	1.4	60S	27.1	*11+2+*		

S. No	Entry	Stem rust		Leaf rust				Stripe rust		Postulated Genes		
				South		North						
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	*Sr*	*Lr*	*Yr*
54	Kharchia 65 (C)	100S	63.3	100S	67.1	80S	48.0	100S	78.0	*7b+*		
55	KRL 19 (C)	80S	32.7	60S	14.9	40S	18.0	100S	62.6	*8b+9b+11+ 2+*	*13+*	*2+*
56	KRL 210 (C)	80S	46.7	20S	3.1	20S	8.8	20S	2.2	*7b+2+*	*13+10+*	*A+*
57	PBW 550 (C)	10MR	3.5	10MR	0.9	10S	2.6	80S	46.0	*31+*	*26+*	*9+*
58	TL 2942 (C)	TR	0.0	TR	0.1	TS	0.2	5S	0.7	*2+*	*13+10+*	
59	TL 2969 (C)	TR	0.0	5MR	0.3	0	0.0	10S	1.1	*2+*	*23+*	
60	WR 544 (C)	80S	25.3	40S	16.2	30S	6.0	100S	58.6	*28+8a+2+*	*13+1+*	*2+*
60. A	INFECTOR	100S	71.7	100S	70.0	80S	62.0	90S	74.0			

TABLE 1.2b. Three years (2014-15, 2015-16 and 2016-17) adult plant disease resistance data of AVT IInd year entries

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
I. NORTHERN HILLS ZONE																								
1	HPW 251 (C)																							
	2014-15	10S	2.8	20MR	2.6	10S	2.4	80S	33.0	89	45	5	2	35.9	11.5	51.4	23.1	5.3	1.3	-	4	-	7	2.3
	2015-16	10MS	2.9	20S	3.7	10S	2.3	80S	37.1	89	46	5	3	16.8	5.5	72.7	22.3	3.1	1.0	5.3	3	-	14.6	4.9
	2016-17	20MS	5.6	20S	7.8	5S	1.0	60S	43.4	99	56	5	3	4.5	3.0	30.0	16.1	25.0	9.9	17.7	5	2	22.6	7.5
	Mean	20MS	3.8	20S	4.7	10S	1.9	80S	37.8	99	46	5	3	35.9	6.7	72.7	20.5	25.0	4.1	17.7	5	2	22.6	4.9
2	HS 375 (C)																							

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
	2014-15	10MS	1.9	30S	10.7	20S	5.1	60S	36.8	69	46	9	4	34.8	11.3	60.0	21.6	8.3	2.1	-	5	-	16	12.2
	2015-16	20MR	2.4	20MS	7.4	30S	5.9	60S	28.1	77	46	5	3	17.2	10.8	39.3	15.8	11.1	3.7	21.1	3	-	36.8	21.5
	2016-17	10MS	2.1	20MS	5.0	10S	4.2	60S	31.6	68	35	7	4	12.5	7.9	19.7	6.5	25.0	12.5	60.0	5	2	54.5	24.8
	Mean	10MS	2.2	30S	7.7	30S	5.1	60S	32.2	77	46	7	4	34.8	10.0	60.0	14.6	25.0	6.1	60.0	5	2	54.5	19.5
3	HS 490 (C)																							
	2014-15	20MS	5.6	10MS	3.1	10S	1.8	60S	18.1	78	35	5	3	17.8	3.8	80.6	31.3	22.2	10.1	-	5	-	3.3	1.1
	2015-16	10S	4.5	20MS	5.9	10S	1.3	60S	12.6	89	57	5	4	12.5	5.1	39.3	25.4	23.5	17.8	22.2	3	-	37	12.9
	2016-17	10S	4.9	20S	7.8	5S	1.1	60S	14.9	57	47	7	3	11.1	3.9	30.0	17.1	7.7	3.9	18.2	5	2	19.9	6.6
	Mean	20MS	5.0	20S	5.6	10S	1.4	60S	15.2	89	46	7	3	17.8	4.3	80.6	24.6	23.5	10.6	22.2	5	2	37.0	6.9
4	HS 507 (C)																							
	2014-15	10MR	0.7	15MR	1.1	10MS	1.0	60S	9.8	79	46	7	3	60.9	16.4	60.4	27.6	5.9	1.6	-	5	-	27.1	10.8
	2015-16	20MS	3.7	30S	4.2	10MS	1.7	20S	6.0	68	46	5	4	21.4	10.2	61.5	33.5	12.5	6.3	23.5	3	-	41.5	24
	2016-17	10MS	2.7	10S	1.5	20S	5.0	40S	15.8	68	35	7	4	11.7	6.2	55.6	19.3	15.8	7.5	20.0	5	2	50.9	32.7
	Mean	20MS	2.4	30S	2.2	20S	2.6	60S	10.5	79	46	7	4	60.9	10.9	61.5	26.8	15.8	5.1	23.5	5	2	50.9	22.5
5	HS 542 (C)																							
	2014-15	20MR	1.3	5S	1.3	10S	1.3	40S	12.0	78	35	9	4	60.7	26.3	55.2	20.1	0.7	0.2	-	5	-	13.5	11.4
	2015-16	5MR	0.7	10S	1.8	5S	0.7	40S	10.4	78	45	6	4	31.3	12.8	49.3	19.4	14.3	5.1	16.7	5	-	46.4	25.8
	2016-17	30MS	9.5	10MR	1.0	40S*	8.2	60S	34.6	68	36	7	4	13.3	9.0	73.3	35.0	14.3	5.4	15.4	5	2	22.2	8.4
	Mean	30MS	3.8	10S	1.4	40S*	3.4	60S	19.0	78	35	9	4	60.7	16.0	73.3	24.8	14.3	3.6	16.7	5	2	46.4	15.2
6	VL 829 (C)																							
	2014-15	10S	2.0	20S	6.4	20MS	5.0	60S	28.6	79	35	9	5	31.8	10.9	23.3	5.9	0.0	0.0	-	5	-	6.8	4.2
	2015-16	5MR	0.4	5MS	1.1	10MS	2.5	60S	18.6	67	35	5	4	30.3	10.9	25.7	5.1	15.4	5.1	16.7	4	-	59.6	23.8
	2016-17	40S*	7.0	15MS	2.1	10S	2.2	60S	22.1	35	13	5	3	10.0	5.1	5.0	1.0	12.5	3.1	0.0	5	3	37.9	31.1

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
	Mean	40S*	3.2	20S	3.2	20MS	3.2	60S	23.1	79	24	9	4	31.8	9.0	25.7	4.0	15.4	2.7	16.7	5	3	59.6	19.7
7	VL 892 (C)																							
	2014-15	20S	6.6	20S	8.1	60S	8.2	80S	25.4	99	57	7	4	92.6	30.7	40.5	24.4	28.6	7.1	-	5	-	35.1	18.6
	2015-16	20S	4.8	20S	4.0	40S*	5.0	60S	15.3	89	57	6	4	34.9	14.7	40.4	14.7	20.0	13.2	21.1	5	-	70.6	41.4
	2016-17	10MS	4.7	10S	3.3	TS	0.2	80S	35.6	99	57	6	4	17.6	11.9	35.6	20.2	13.6	4.5	52.9	5	2	40.8	26.8
	Mean	20S	5.4	20S	5.2	60S	4.5	80S	25.4	99	57	7	4	92.6	19.1	40.5	19.8	28.6	8.3	52.9	5	2	70.6	
8	VL 907 (C)																							
	2014-15	10S	2.9	15MR	2.1	40S	6.5	40S	14.5	69	36	9	5	70.0	13.4	46.1	18.9	40.0	10.0	-	5		55.4	28.2
	2015-16																							
	2016-17	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS		NS	NS
	Mean																							
II. NORTH WESTERN PLAINS ZONE																								
9	DBW 173																							
	2014-15	15S	2.7	20MR	1.2	0	0	60S	15.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2015-16	20MR	1.7	5MR	0.3	10S	1.3	40S	5.6	78	56	5	3	18.3	8.3	-	-	3.1	1.0	15	4	-	-	-
	2016-17	80S*	14.3	10MS	2.4	5S	2.0	60MS*	13.8	99	57	6	3	15.0	5.8	28.6	23.9	5.9	2.9	11.8	5	2	-	-
	Mean	80S*	6.2	10MS	1.3	10S	1.1	60S	11.5	99	56	6	3	18.3	7.1	28.6	23.9	5.9	2.0	15.0	5	2		
10	DBW 88 (C)																							
	2014-15	10S	4.0	20S	6.4	10MS	1.6	60S	20.2	79	45	9	5	43.2	17.7	80.0	41.2	18.8	4.7	-	4	-	-	-
	2015-16	20MS	6.4	10S	2.2	10S	2.3	40S	18.0	78	57	5	4	26.1	13.5	80.0	32.8	10.5	4.7	0.0	3	-	-	-
	2016-17	20MR-MS	6.0	20S	5.5	5S	2.8	80S	37.4	57	45	9	5	17.3	12.9	37.6	22.3	4.0	1.5	35.0	5	2	-	-
	Mean	20MS	5.5	20S	4.7	10S	2.2	80S	25.2	79	46	9	5	43.2	14.7	80.0	32.1	18.8	3.6	35.0	5	2	-	-

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
11	DBW 90 (C)																							
	2014-15	40S	14.3	20S	5.7	20S	4.0	40S	12.7	79	46	9	5	48.7	14.2	60.1	12.0	18.2	5.1	-	5	-	-	-
	2015-16	40S	19.6	20S	4.4	20S	6.2	40S	9.1	89	56	7	4	18.6	15.4	71.3	14.3	15.8	6.8	20.0	5	-	-	-
	2016-17	60S	33.0	20S	6.5	40S	15.0	5S	1.3	57	46	9	4	15.5	11.0	10.8	5.1	14.3	6.1	50.0	5	2	-	-
	Mean	60S	22.3	20S	5.5	40S	8.4	40S	7.7	89	46	9	4	48.7	13.5	71.3	10.5	18.2	6.0	50.0	5	2		
12	HD 3043 (C)																							
	2014-15	10MS	3.1	20S	7.3	20MS	3.5	60S	18.0	68	35	5	2	32.7	18.1	40.2	15.8	0.0	0.0	-	4	-	-	-
	2015-16	10MS	4.8	40S	16.9	40S	8.6	60S	10.5	67	35	6	3	23.5	12.2	56.3	27.2	7.5	2.5	20.0	3	-	-	-
	2016-17	40S	10.9	20S	7.9	60S	16.9	60S	28.2	68	35	5	3	18.3	6.2	62.5	21.5	15.4	6.0	0.0	5	2	-	-
	Mean	40S	6.3	40S	10.7	60S	9.7	60S	18.9	68	35	6	3	32.7	12.2	62.5	21.5	15.4	2.8	20.0	5	2	-	-
13	HD 2967 (C)																							
	2014-15	20MS	6.6	10MS	3.2	10S	1.9	60S	22.7	79	35	9	5	47.4	26.5	86.2	37.8	13.0	4.3	-	5	-	-	-
	2015-16	60S	20.8	20S	4.8	10S	2.6	80S	40.0	67	35	7	5	31.6	20.0	64.3	35.5	15.4	6.9	5.6	5	-	-	-
	2016-17	30MS	5.3	20MR	1.3	10S	4.0	80S	51.0	68	25	9	5	23.3	13.7	60.0	25.2	18.2	6.2	30.0	5	2	-	-
	Mean	60S	10.9	20S	3.1	10S	2.8	80S	37.9	79	35	9	5	47.4	20.1	86.2	32.8	18.2	5.8	30.0	5	2		
14	HD 3059 (C)																							
	2014-15	20MS	3.2	20S	5.9	10MS	1.1	60S	22.3	79	46	7	4	51.0	20.2	43.6	23.3	27.3	10.0	-	5	-	-	-
	2015-16	20S	6.8	10S	3.3	10MS	1.2	60S	20.0	79	57	7	6	26.2	15.5	45.1	26.1	23.5	10.9	26.7	3	-	-	-
	2016-17	30MS	11.0	20S	5.7	20S	6.0	80S	43.6	79	46	9	5	16.6	11.4	65.9	30.9	8.9	3.5	17.7	5	2	-	-
	Mean	30MS	7.0	20S	4.9	20S	2.8	80S	28.6	79	46	9	5	51.0	15.7	65.9	26.8	27.3	8.1	26.7	5	2	-	-
15	HD 3086 (C)																							
	2014-15	40S	26.6	10S	3.4	20S	4.4	80S	16.0	89	46	9	5	51.8	19.3	37.2	7.4	3.7	0.9	-	5	-	-	-
	2015-16	60S	30.4	30S	5.4	30S	7.2	10S	2.1	89	47	6	4	21.3	14.7	41.3	16.6	5.6	2.0	20.0	5	-	-	-

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
	2016-17	70S	34.7	30S	8.8	20S	11.2	10S	3.3	57	46	9	4	16.3	8.4	14.6	5.0	23.5	10.1	50.0	5	2	-	-
	Mean	70S	30.5	30S	5.9	30S	7.6	80S	7.1	89	46	9	4	51.8	14.1	41.3	9.7	23.5	4.3	50.0	5	2	-	-
16	PBW 644 (C)																							
	2014-15	25S	9.9	20S	6.9	5S	1.3	40S	13.5	78	35	9	6	43.7	14.2	40.9	19.7	14.3	8.1	-	4	-	-	-
	2015-16	10S	6.4	10S	3.3	10S	1.9	40S	10.0	79	46	7	4	36.6	17.7	31.6	19.4	16.7	11.1	20.0	4	-	-	-
	2016-17	40MS	16.0	10S	3.8	10S	2.2	40S	17.6	79	46	7	4	17.5	8.2	55.6	22.6	16.7	10.0	10.0	5	2	-	-
	Mean	40MS	10.8	20S	4.6	10S	1.8	40S	13.7	79	46	9	5	43.7	13.4	55.6	20.6	16.7	9.7	20.0	5	2	-	-
17	WH 1021 (C)																							
	2014-15	15S	5.0	15MR	2.1	10S	1.8	80S	37.4	89	46	9	7	39.3	11.2	60.7	28.3	18.2	8.4	-	5	-	-	-
	2015-16	10S	3.6	10S	2.6	10S	2.4	60S	38.5	78	57	9	6	10.1	4.6	77.5	33.8	13.3	11.0	15.8	5	-	-	-
	2016-17	20S	7.2	20S	5.5	10S	4.8	60S	43.6	79	57	7	5	5.6	2.4	48.8	24.4	5.9	3.4	0.0	5	2	-	-
	Mean	20S	5.3	20S	3.4	10S	3.0	80S	39.8	89	57	9	6	39.3	6.1	77.5	28.8	18.2	7.6	15.8	5	2	-	-
18	WH 1080 (C)																							
	2014-15	10S	3.5	10MS	1.9	10S	1.8	60S	16.5	79	46	9	6	56.7	14.1	50.7	25.0	12.5	3.1	-	3	-	-	-
	2015-16	20S	9.4	40S	7.0	20S	5.9	20S	4.3	89	46	9	5	13.1	6.4	55.5	29.3	3.1	1.0	42.1	5	-	-	-
	2016-17	15MS	4.5	20S	3.2	20S	8.4	10S	2.3	89	46	7	4	14.2	9.2	43.3	21.4	7.4	3.5	21.4	5	2	-	-
	Mean	20S	5.8	40S	4.0	20S	5.4	60S	7.7	89	46	9	5	56.7	9.9	55.5	25.2	12.5	2.5	42.1	5	2	-	-
19	WH 1105 (C)																							
	2014-15	20S	5.2	20S	6.2	5S	0.7	40S	11.8	89	46	9	6	58.8	28.4	87.3	43.3	0.0	0.0	-	5	-	-	-
	2015-16	30S	8.6	40S	7.6	40S	7.0	80S	18.0	78	57	7	5	32.4	15.1	82.7	39.7	0.0	0.0	21.1	5	-	-	-
	2016-17	40S	11.4	40S	9.5	20S	12.0	60S	25.4	89	56	9	5	33.3	18.5	67.3	31.8	3.2	0.8	7.1	5	2	-	-
	Mean	40S	8.4	40S	7.8	40S	6.6	80S	18.4	89	56	9	5	58.8	20.7	87.3	38.3	3.2	0.3	21.1	5	2	-	-
20	WH 1124 (C)																						-	-

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
	2014-15	30S	15.7	20S	6.9	30S	5.0	60S	21.1	79	46	9	6	84.5	24.5	60.3	12.1	12.5	3.3	-	5	-	-	-
	2015-16	60S	26.8	20S	4.6	30S	7.2	60S	7.5	89	46	8	5	21.1	8.0	30.7	8.9	6.7	3.6	0.0	4	-	-	-
	2016-17	50S	20.0	30S	10.8	10S	4.2	50S	7.7	89	46	9	4	15.8	6.6	11.1	2.8	9.1	3.8	7.7	5	2	-	-
	Mean	60S	20.8	30S	7.4	30S	5.5	60S	12.1	89	46	9	5	84.5	13.0	60.3	7.9	12.5	3.6	7.7	5	2	-	-
21	WH 1142 (I) C)																						-	-
	2014-15	20MS	6.5	30MS	13.3	20S	6.0	30S	12.6	69	35	9	6	32.6	16.6	50.2	23.9	10.5	4.0	-	5	-	-	-
	2015-16	40S	17.2	60S	25.6	20S	4.6	30S	4.7	79	56	8	5	12.1	6.2	60.0	33.2	8.3	4.4	31.6	5	-	-	-
	2016-17	20MR	2.0	40S	8.1	40S*	8.1	5S	1.4	68	46	9	5	22.2	10.9	19.9	11.2	21.3	11.0	75.0	5	2	-	-
	Mean	40S	8.5	60S	15.6	40S*	6.2	30S	6.2	79	46	9	5	32.6	11.2	60.0	22.8	21.3	6.5	75.0	5	2	-	-
III. NORTH EASTERN PLAINS ZONE																							-	-
22	HI 1612																						-	-
	2014-15	60S	24.7	10MS	3.3	20S	2.6	40S	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2015-16	40S	27.4	30S	7.3	5MS	1	10S	2.2	69	36	6	5	31.8	14.9	-	-	100.0	45.7	17.65	5	-	-	-
	2016-17	40S	9.1	20MS	3.8	5S	1.0	10S	3.2	57	34	9	5	14.5	9.5	29.7	15.1	15.0	9.5	41.2	5	2	-	-
	Mean	60S	20.4	30S	4.8	20S	1.5	40S	4.5	69	35	9	5	31.8	12.2	29.7	15.1	100.0	27.6	41.2	5	2	-	-
23	C 306 (C)																						-	-
	2014-15	20MS	9.3	40MS	9.6	40S	25.6	60S	25.1	78	35	7	5	100.0	40.8	56.2	27.8	38.5	15.9	-	-	-	-	-
	2015-16	40S	38.0	60S	31.5	80S	33.8	60S	23.5	68	46	7	5	35.6	14.5	82.4	37.3	100.0	49.9	64.3	4	-	-	-
	2016-17	40S	25.0	40S	17.9	60S	42.0	80S	44.4	57	35	9	5	16.6	8.1	91.3	26.2	41.7	16.9	6.3	5	3	-	-
	Mean	40S	24.1	60S	19.6	80S	33.8	80S	31.0	78	35	9	5	100.0	21.1	91.3	30.4	100.0	27.6	64.3	5	3	-	-
24	DBW39(C)																						-	-
	2013-14	5S	2.0	20S	2.9	15S	4.7	60S	30.6	79	46	9	6	47.7	15.9	40.0	19.2	0.0	0.0	25	4	-	-	-
	2015-16	10MS	4.2	10MS	3.2	10S	1.9	80S	31.5	47	35	7	5	13.9	11.4	-	-	16.7	5.6	21.1	5	-	-	-

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
	2016-17	10MR	0.7	20MR	1.2	5S	1.2	60S	38.6	67	46	9	5	20.7	14.1	31.3	11.8	23.1	8.9	0.0	5	2	-	-
	Mean	10MS	2.3	20S	2.4	15S	2.6	80S	33.6	79	46	9	5	47.7	13.8	40.0	15.5	23.1	4.8	25.0	5	2	-	-
25	HD 2733 (C)																						-	-
	2013-14	20MS	5.1	20S	7.0	20S	6.0	100S	67.8	99	46	9	6	18.6	7.4	70.2	42.8	1.7	0.6	30	4	-	-	-
	2015-16	20MS	6.1	40S	18.3	10S	2.2	80S	64.0	59	36	6	6	11.2	6.9	-	-	17.6	7.1	20.0	5	-	-	-
	2016-17	10MR	0.8	60S	14.1	5S	2.0	80S	53.6	67	46	9	5	11.1	4.8	15.0	8.3	32.6	13.4	63.2	5	2	-	-
	Mean	20MS	4.0	60S	13.1	20S	3.4	100S	61.8	99	46	9	6	18.6	6.4	70.2	25.6	32.6	7.0	63.2	5	2	-	-
26	HD 2888 (C)																						-	-
	2014-15	10MS	3.2	15MS	2.3	5S	0.8	80S	26.9	78	45	9	6	71.2	25.9	50.0	25.2	20.0	10.7	-	5	-	-	-
	2015-16	10S	4.4	20MR	1.3	5S	0.8	60S	21.1	47	36	7	5	28.0	16.9	65.0	43.4	100.0	45.7	5.3	5	-	-	-
	2016-17	5MR	0.4	TMR	0.1	5S	2.0	60S	33.2	79	46	9	5	17.5	10.5	76.0	24.2	22.2	13.4	6.3	5	2	-	-
	Mean	10S	2.7	15MS	1.2	5S	1.2	80S	27.1	79	46	9	5	71.2	17.8	76.0	30.9	100.0	23.3	6.3	5	2	-	-
27	HD 3171 (I) (C)																						-	-
	2014-15	20S	6.0	10S	5.3	20S	3.6	40S	12.4														-	-
	2015-16	30MS	8.6	40S	7.4	10S	1.3	40S	14.8	78	46	9	6	18.2	10.4	90.3	30.7	23.8	9.3	25.0	5	-	-	-
	2016-17	80S	31.4	40S	11.5	20S	5.0	60S	29.6	89	46	9	4	25.3	14.8	27.3	15.8	6.3	1.8	6.7	5	2	-	-
	Mean	80S	15.3	40S	8.1	20S	3.3	60S	18.9	89	46	9	5	25.3	12.6	90.3	23.3	23.8	5.6	25.0	5	2	-	-
28	K 8027 (C)																						-	-
	2014-15	60S	23.1	40S	20.0	60S	25.0	80S	34.0	78	35	9	7	54.3	21.4	45.9	24.2	0.0	0.0	-	4	-	-	-
	2015-16	40S	28.8	60S	23.8	40S	20.0	60S	28.0	67	35	9	6	26.7	14.5	75.3	32.6	8.3	4.1	5.0	4	-	-	-
	2016-17	20S	4.7	5S	0.8	60S	18.0	60S	32.6	68	46	9	5	17.0	14.2	45.0	12.2	14.3	6.3	23.1	5	2	-	-
	Mean	60S	18.9	60S	14.9	60S	21.0	80S	31.5	78	35	9	6	54.3	16.7	75.3	23.0	14.3	3.5	23.1	5	2	-	-
29	K 0307 (C)																						-	-

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
	2014-15	15S	4.8	60S	16.4	30S	6.3	60S	22.1	89	46	9	5	39.5	13.7	70.3	26.2	0.0	0.0	-	5	-	-	-
	2015-16	40S	20.0	40S	23.0	40S	6.5	80S	26.4	68	36	6	3	26.3	8.4	-	-	0.0	0.0	0.0	5	-	-	-
	2016-17	80S	18.8	40S	7.8	10S	2.8	60S	39.8	68	46	6	4	34.8	13.0	85.0	31.5	5.9	1.5	7.1	5	2	-	-
	Mean	80S	14.6	60S	15.7	40S	5.2	80S	29.4	89	46	9	4	39.5	11.7	85.0	28.9	5.9	0.5	7.1	5	2	-	-
30	K 1006 (C)																						-	-
	2013-14	30S	8.2	60S	13.3	40S	12.0	80S	36.1	99	46	9	5	22.8	7.0	5.2	1.7	0.0	0.0	10	4	-	-	-
	2015-16	20S	13.0	40S	25.5	5S	1.2	60S	22.5	68	46	6	4	11.1	4.4	-	-	0.0	0.0	15.8	5	-	-	-
	2016-17	70S	17.7	60S	16.6	10S	3.0	60S	39.7	79	57	7	5	10.4	4.2	75.0	22.3	13.3	3.6	0.0	5	2	-	-
	Mean	70S	13.0	60S	18.5	40S	5.4	80S	32.8	99	46	9	5	22.8	5.2	75.0	12.0	13.3	1.2	15.8	5	2	-	-
31	K1317 (I) (C)																						-	-
	2014-15	10MS	1.7	20S	7.7	40S	6.3	60S	19.9													-	-	-
	2015-16	10S	4.2	20MS	3.8	5S	0.9	40S	14.0	89	57	7	4	13.2	7.3	71.8	40.8	1.5	0.5	5.3	5	-	-	-
	2016-17	30MR	4.9	30S	4.4	10S	2.0	60S	22.9	89	56	9	5	13.2	9.1	81.1	42.0	3.1	1.3	0.0	5	2	-	-
	Mean	30MR	3.6	30S	5.3	40S	3.1	60S	18.9	89	56	9	5	13.2	8.2	81.1	41.4	3.1	0.9	5.3	5	2	-	-
IV. CENTRAL ZONE																							-	-
32	DBW 110 (C)																						-	-
	2014-15																						-	-
	2015-16	10MS	2.2	10S	1.8	10S	1.5	60S	15.6														-	-
	2016-17	30MS	7.0	20S	4.1	20S	5.2	80S	40.4	79	57	9	4	5.8	3.5	-	-	6.2	1.6	5.0	5	2	-	-
	Mean																						-	-
33	HI 8627 (d) (C)																						-	-
	2014-15	20S	5.7	10MS	1.1	0	0.0	20S	**3.3**														-	-
	2015-16	5MR	0.5	10MS	1.3	20MR	1.3	40S	4.7														-	-

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
	2016-17	10MR	0.8	20S	3.7	0	0.0	20MR	3.5	89	57	9	5	9.3	4.6	-	-	8.8	2.2	0.0	5	2	-	-
	Mean	20S	2.3	20S	2.0	20MR	0.4	40S	3.8	89	57	9	5	9.3	4.6	-	-	8.8	2.2	0.0	5	2	-	-
34	MP 3288 (C)																						-	-
	2014-15	10S	4.9	30MS	2.9	TS	0.2	60S	22.0														-	-
	2015-16																						-	-
	2016-17	20MS	4.1	10S	1.7	5S	1.2	80S	38.0	89	57	7	4	7.5	5.1	-	-	7.7	3.5	5.0	5	2	-	-
	Mean																						-	-
V. PENINSULAR ZONE																							-	-
35	DBW 168																						-	-
	2014-15	20MR	2.1	20S	5.8	40S*	5	80S	29.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2015-16	10MS	2	5S	1.8	TS	0.2	80S	29.7	79	46	8	7	28.5	12.2	-	-	50.0	18.4	29.41	4	-	-	-
	2016-17	30MS	6.9	20S	3.2	40S	9.0	80S	40.4	89	57	9	5	26.7	11.9	22.3	11.8	22.2	7.9	10.0	4	2	-	-
	Mean	30MS	3.7	20S	3.6	40S	4.7	80S	33.2	89	46	9	6	28.5	12.1	22.3	11.8	50.0	13.2	29.4	4	2	-	-
36	HI 8777 (d)																						-	-
	2014-15	20S	5.3	10MS	3.2	10MS	1.5	40S	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2015-16	20S	12	TR	0	30S	4.7	40S	12.5	89	67	6	5	3.0	1.1	-	-	0.0	0.0	31.25	4	-	-	-
	2016-17	60S	15.7	10S	1.6	10S	2.0	15MR	0.9	89	57	9	4	8.3	2.9	28.6	5.7	0.0	0.0	0.0	5	2	-	-
	Mean	60S	11.0	10S	1.6	30S	2.7	40S	7.3	89	67	9	5	8.3	2.0	28.6	5.7	0.0	0.0	31.3	5	2	-	-
37	MACS 4028 (d)																						-	-
	2014-15	20S	9.3	20S	5.3	10S	1.9	80S	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2015-16	40S	12.8	40S	14	20S	5.1	80S	30.5	79	57	6	4	20.7	6.0	-	-	0.0	0.0	14.29	5	-	-	-
	2016-17	10MS	1.9	20S	5.8	40S*	8.8	80S	44.1	89	57	9	4	16.1	5.2	15.0	3.0	17.7	4.4	12.5	5	2	-	-

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
	Mean	40S	8.0	40S	8.4	40S*	5.3	80S	36.2	89	57	9	4	20.7	5.6	15.0	3.0	17.7	2.2	14.3	5	2	-	-
38	UAS 375																						-	-
	2014-15	20S	12.1	40S	15	40S*	5.6	80S	40.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2015-16	40S	10.6	40S	15.5	10S	1.8	60S	28.7	79	57	7	5	15.1	8.6	-	-	21.7	9.5	40	5	-	-	-
	2016-17	20MS	3.4	40S	9.6	20S	5.0	80S	46.4	89	58	7	4	14.2	7.5	80.0	38.2	1.9	0.5	44.4	5	2	-	-
	Mean	40S	8.7	40S	13.4	40S	4.1	80S	38.6	89	57	7	5	15.1	8.1	80.0	38.2	21.7	5.0	44.4	5	2	-	-
39	AKDW 2997-16(d) (C)																						-	-
	2014-15	30S	10.3	40S	8.1	20MS	2.6	60S	13.9	89	57	9	6	5.6	1.4	9.9	2.5	0.0	0.0	-	5	-	-	-
	2015-16	40MS	14.0	20S	5.4	40S	8.6	60S	11.8	89	57	6	5	11.3	3.1	10.1	3.5	0.0	0.0	30.0	5	-	-	-
	2016-17	60S	25.7	5MS	2.3	10MR	1.0	10S	2.4	99	78	9	5	11.7	5.0	65.0	13.7	12.8	3.2	5.3	5	3	-	-
	Mean	60S	16.7	40S	5.3	40S	4.1	60S	9.4	99	67	9	5	11.7	3.2	65.0	6.6	12.8	1.1	30.0	5	3	-	-
40	GW 322 (C)																						-	-
	2014-15	15S	5.7	20S	9.2	40S	8.8	70S	52.0	89	57	9	6	42.4	17.3	62.0	31.2	27.3	7.0	-	5	-	-	-
	2015-16	20S	7.4	40S	14.6	20S	4.3	80S	50.0	89	56	7	4	18.6	8.1	81.8	40.6	15.4	8.3	10.5	5	-	-	-
	2016-17	60S	22.7	20S	10.3	5S	1.8	80S	42.9	89	57	7	4	26.7	11.1	65.0	20.7	6.3	3.2	26.3	5	2	-	-
	Mean	60S	11.9	40S	11.3	40S	4.9	80S	48.3	89	57	9	5	42.4	12.2	81.8	30.8	27.3	6.2	26.3	5	2	-	-
41	MACS 6222 (C)																						-	-
	2014-15	10S	2.5	20S	4.0	40S	6.3	60S	36.4	67	35	9	6	42.4	16.4	51.1	18.6	14.3	7.4	-	5		-	-
	2015-16	30MS	5.8	5S	0.7	10S	1.5	60S	15.3	79	57	8	6	66.7	23.6	33.3	16.0	11.1	5.9	25.0	5		-	-
	2016-17	30MS	4.7	30MS	4.6	0	0.0	20S	8.4	89	57	7	4	26.6	13.9	26.8	13.1	38.5	14.9	16.7	5	3	-	-
	Mean	30MS	4.3	30MS	3.1	40S	2.6	60S	20.0	89	46	9	5	66.7	18.0	51.1	15.9	38.5	9.4	25.0	5	3	-	-
42	MACS 6478 (C)																						-	-
	2014-15	40MS	11.9	40S	8.6	20S	3.5	80S	31.3	68	36	9	5	45.4	15.6	35.2	20.3	10.5	4.3	-	5	-	-	-

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
	2015-16	60S	16.8	30S	7.3	5S	0.8	80S	48.0	79	57	6	6	21.7	10.4	76.2	34.5	66.7	28.9	0.0	5	-	-	-
	2016-17	60S	29.7	30S	10.3	10S	2.2	80S	60.6	68	46	9	5	18.3	10.5	45.1	24.2	37.5	15.0	7.1	5	2	-	-
	Mean	60S	19.5	40S	8.7	20S	2.2	80S	46.6	79	46	9	5	45.4	12.2	76.2	26.3	66.7	16.1	7.1	5	2	-	-
43	NI 5439 (C)																						-	-
	2014-15	40S	17.1	60S	37.1	80S	15.0	100S	75.0	78	46	9	5	96.0	38.8	81.2	27.9	20.0	8.1	-	5	-	-	-
	2015-16	80S	33.6	80S	47.0	80S	25.0	90S	71.0	89	56	7	4	28.6	17.0	89.8	46.4	91.7	40.4	0.0	5	-	-	-
	2016-17	60S	37.3	80S	33.4	40S	13.4	100S	72.4	99	67	9	4	24.0	13.9	52.4	27.3	12.5	7.5	31.6	5	2	-	-
	Mean	80S	29.4	80S	39.2	80S	17.8	100S	72.8	99	56	9	4	96.0	23.2	89.8	33.9	91.7	18.7	31.6	5	2	-	-
44	NIAW 1415 (C)																						-	-
	2014-15	10S	3.3	10S	2.2	80S	10.3	100S	65.0	79	46	9	5	78.3	18.8	60.2	36.1	14.3	3.6	-	5	-	-	-
	2015-16	20MR	1.7	5MS	1.1	20S	2.6	80S	68.0	79	57	6	4	21.2	11.4	80.5	40.0	7.1	3.5	15.8	-	-	-	-
	2016-17	30MS	5.4	20S	5.5	10MS	1.8	80S	51.2	89	67	9	5	28.3	13.6	41.3	24.2	3.2	0.8	47.4	5	3	-	-
	Mean	30MS	3.5	20S	2.9	80S	4.9	100S	61.4	89	57	9	5	78.3	14.6	80.5	33.4	14.3	2.6	47.4	5	3	-	-
45	UAS 304(C)																						-	-
	2016-17	20MS	4.7	40S	9.8	5S	1.2	60S	39.4	99	67	9	5	24.5	8.8	-	-	0.0	0.0	35.0	5	3	-	-
46	UAS 446 (d) (C)																						-	-
	2014-15	40S	10.7	10S	3	5MS	0.6	40S	6	89	38	9	5	9.4	4.2	60.2	7.6	0	0	-	4	-	-	-
	2015-16	30S	11.7	20MR	1.0	5S	0.7	5S	1.3	78	46	7	5	8.2	5.0	4.7	2.2	0.0	0.0	23.5	5	-	-	-
	2016-17	20MS	4.7	10S	1.6	0	0.0	10MS	2.3	99	67	9	4	4.2	2.7	0.0	0.0	26.9	6.7	14.3	4	2	-	-
	Mean	40S	9.0	10S	1.9	0.0	0.4	40S	3.2	99	47	9	5	9.4	4.0	60.2	3.3	26.9	2.2	23.5	5	2	-	-
VI. SOUTHERN HILLS ZONE																							-	-
47	HW 2044 (C)																						-	-

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
	2013-14	20MS	2.2	10S	2.9	10MR	1.4	100S	50.6	99	56	8	5	44.4	34.9	19.5	8.9	37.5	16.5	65	-	-	-	-
	2015-16	20S	6.0	30S	4.4	0	0.0	60S	22.6	NS	NS	NS	NS	7.0	7.0	NS	NS	NS	NS	NS	NS	-	-	-
	2016-17	20MR	2.9	20MR	1.5	40S	9.0	60S	22.1	89	56	7	4	13.9	5.3	-	-	0.0	0.0	18.8	5	2	-	-
	Mean	20S	3.7	30S	2.9	0.0	3.5	100S	31.8	99	56	8	5	44.4	15.7	19.5	8.9	37.5	8.3	65.0	5	2	-	-
48	HW 5216 (C)																						-	-
	2013-14	10S	2.3	5S	1.3	20S	12.2	100S	56.1	99	57	8	5	20.3	10.9	44.8	13.4	61.1	27.9	25	-	-	-	-
	2015-16	20MR	2.5	TMR	0.1	10S	2.4	80S	41.6	NS	NS	NS	NS	8.0	8.0	NS	NS	NS	NS	NS	NS	-	-	-
	2016-17	20MS	3.4	10MR	0.7	5S	1.2	60S	19.0	99	67	7	4	14.9	6.4	-	-	33.3	10.5	27.3	5	2	-	-
	Mean	20MS	2.7	10MR	0.7	20S	5.3	100S	38.9	99	57	8	5	20.3	8.4	44.8	13.4	61.1	19.2	27.3	5	2	-	-
49	CoW (W) -1 (C)																						-	-
	2013-14	40S	5.2	5MS	0.6	30S	8.0	80S	62.9	89	46	8	5	34.7	34.3	29.3	9.0	0.0	0.0	35			-	-
	2015-16	5MR	0.5	20S	10.3	40S	10.5	60S	10.1	NS	NS	NS	NS	0.0	0.0	NS	NS	NS	NS	NS	NS		-	-
	2016-17	20MS	4.1	20MR	1.2	20S	4.2	80S	53.6	99	78	9	4	5.1	1.3	-	-	0.0	0.0	25.0	5	3	-	-
	Mean	40S	3.3	20S	4.0	40S	7.6	80S	42.2	99	57	9	5	34.7	11.9	29.3	9.0	0.0	0.0	35.0	5	3	-	-
VII. SPECIAL TRIAL																							-	-
50	DBW 14 (C)																						-	-
	2014-15	20S	5.4	30S	9.6	60S	8.8	60S	25.4	89	46	9	5	21.2	7.4	70.3	31.6	8.7	5.9	-	5	-	-	-
	2015-16	30S	12.0	40S	7.7	20S	5.3	80S	22.0	79	57	6	3	9.7	4.4	55.9	32.8	6.3	2.1	0.0	5	-	-	-
	2016-17	60S	22.7	40S	12.3	10S	3.2	60S	22.6	89	68	4	3	5.0	1.9	40.0	15.9	3.6	1.6	40.0	5	2	-	-
	Mean	60S	13.4	40S	9.9	60S	5.7	80S	23.3	89	57	9	4	21.2	4.6	70.3	26.8	8.7	3.2	40.0	5	2	-	-
51	DBW 71 (C)																						-	-
	2012-13	20S	8.8	20S	8.0	20S	6.8	40S	19.0	79	34	6	4	45.6	10.3	73.3	38.0	16.7	7.4	10	4	-	-	-
	2015-16	10S	4.2	60S	11.3	TR	0.0	20S	7.0	78	56	7	6	13.4	8.1	-	-	50.0	30.4	27.8	5	-	-	-

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
	2016-17	20MS	7.0	30S	6.1	5S	1.0	10S	5.0	89	56	9	5	8.8	6.7	54.4	37.1	19.1	11.4	60.0	5	2	-	-
	Mean	20S	6.7	60S	8.5	20S	2.6	40S	10.3	89	46	9	5	45.6	8.4	73.3	37.6	50.0	16.4	60.0	5	2	-	-
52	DDK 1029 (C)																						-	-
	2014-15	20S	4.1	20MR	1.4	80S	10.3	80S	40.0	89	46	6	2	50.0	17.6	2.3	0.8	0.0	0.0	-	5	-	-	-
	2015-16	10S	4.8	5S	1.2	20S	5.5	80S	49.0	68	56	4	2	47.0	16.9	21.5	4.3	8.3	2.8	11.1	4	-	-	-
	2016-17	5MR	0.4	30S	7.2	10MR	1.0	60S	30.6	79	57	4	2	12.6	7.6	5.0	1.9	0.0	0.0	76.5	5	2	-	-
	Mean	20S	3.1	30S	3.3	80S	5.6	80S	39.9	89	56	6	2	50.0	14.0	21.5	2.3	8.3	0.9	76.5	5	2	-	-
53	HW 1098 (C)																						-	-
	2014-15	20MR	2.0	10MS	2.3	60S	8.1	60S	38.0	79	46	6	3	43.5	11.2	-	-	0.0	0.0	-	5	-	-	-
	2015-16	5S	2.7	20MR	1.1	30S	7.6	80S	50.0	78	57	6	4	19.6	12.5	60.0	12.8	9.1	3.0	25.0	5	-	-	-
	2016-17	20MR	2.1	20S	4.1	5S	1.4	60S	27.1	99	68	6	3	15.3	8.0	22.2	4.4	0.0	0.0	90.9	5	2	-	-
	Mean	20MR	2.3	20S	2.5	60S	5.7	80S	38.4	99	57	6	3	43.5	10.6	60.0	8.6	9.1	1.0	90.9	5	2	-	-
54	Kharchia 65 (C)																						-	-
	2014-15	70S	37.4	80S	46.5	90S	60.0	100S	74.0	79	46	9	5	86.6	32.2	60.3	29.0	51.9	13.4	-	5	-	-	-
	2015-16	80S	46.0	80S	53.8	100S	56.3	100S	74.0	89	57	8	6	15.2	6.9	73.2	42.9	50.0	28.4	10.0	5	-	-	-
	2016-17	100S	63.3	100S	67.1	80S	48.0	100S	78.0	99	78	9	4	16.6	5.3	62.8	20.2	50.0	17.4	35.3	5	2	-	-
	Mean	100S	48.9	100S	55.8	100S	54.8	100S	75.3	99	57	9	5	86.6	14.8	73.2	30.7	51.9	19.7	35.3	5	2	-	-
55	KRL 19 (C)																						-	-
	2014-15	30S	9.9	40S	11.5	80S	22.5	100S	57.0	99	56	9	5	45.5	15.2	50.4	20.9	15.4	5.0	-	4	-	-	-
	2015-16	40S	14.0	40S	22.0	40S	10.6	80S	46.0	89	57	9	5	20.5	11.5	82.3	33.7	1.4	0.5	0.0	5	-	-	-
	2016-17	80S	32.7	60S	14.9	40S	18.0	100S	62.6	99	78	7	4	13.2	6.1	42.3	16.8	26.7	7.6	23.5	5	3	-	-
	Mean	80S	18.9	60S	16.1	80S	17.0	100S	55.2	99	67	9	5	45.5	10.9	82.3	23.8	26.7	4.4	23.5	5	3	-	-
56	KRL 210 (C)																						-	-

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB		HB	
		South				North				DD		0-9		%		%		%		%	0-5		%	
		Stem rust		Leaf rust		Leaf rust		Stripe																
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS	AV.	HS	AV.
	2014-15	40S	23.1	20S	9.6	50S	13.8	40S	14.5	99	46	6	4	40.6	10.7	60.2	23.3	9.1	2.3	-	5	-	-	-
	2015-16	60S	27.4	40S	13.1	20S	5.7	10S	2.9	89	57	7	4	13.7	6.9	60.0	17.4	2.2	0.7	35.0	5	-	-	-
	2016-17	80S	46.7	20S	3.1	20S	8.8	20S	2.2	99	57	9	4	12.5	4.4	12.8	4.6	3.6	0.9	5.0	5	2	-	-
	Mean	80S	32.4	40S	8.6	50S	9.4	40S	6.5	99	57	9	4	40.6	7.3	60.2	15.1	9.1	1.3	35.0	5	2	-	-
57	PBW 550(C)																						-	-
	2016-17	10MR	3.5	10MR	0.9	10S	2.6	80S	46.0	99	68	7	4	13.3	8.2	-	-	4.6	1.9	0.0	5	3	-	-
58	TL 2942 (C)																						-	-
	2014-15	5S	1.1	TMR	0.1	5MR	0.4	10S	2.3	99	35	1	0	21.7	3.1	9.6	1.9	0.0	0.0	-	4	-	-	-
	2015-16	20MR	1.8	20S	3.8	5MR	0.4	TMS	0.1	68	35	3	1	0.7	0.1	31.8	12.6	0.0	0.0	11.1	5	-	-	-
	2016-17	TR	0.0	TR	0.1	TS	0.2	5S	0.7	99	67	1	1	9.0	3.2	10.0	2.7	0.0	0.0	12.5	5	2	-	-
	Mean	20MR	1.0	20S	1.3	5MR	0.3	10S	1.0	99	45	3	1	21.7	2.1	31.8	5.7	0.0	0.0	12.5	5	2	-	-
59	TL 2969 (C)																						-	-
	2014-15	5S	1.2	5S	0.7	TMS	0.1	20S	2.5	79	35	1	0	15.5	5.8	9.6	1.9	0.0	0.0	-	5	-	-	-
	2015-16	10MR	1.2	TR	0.0	TMS	0.1	0	0.0	78	46	3	1	7.2	2.5	10.1	3.9	0.0	0.0	0.0	4	-	-	-
	2016-17	TR	0.0	5MR	0.3	0	0.0	10S	1.1	99	67	2	1	3.0	0.7	8.3	1.7	0.0	0.0	31.3	5	2	-	-
	Mean	5S	0.8	5S	0.4	TMS	0.1	20S	1.2	99	46	3	1	15.5	3.0	10.1	2.5	0.0	0.0	31.3	5	2	-	-
60	WR544(C)																						-	-
	2015-16	40S	23.2	50S	9.6	5S	0.8	80S	39.8	78	46	7	6	6.0	3.2	-	-	0.0	0.0	6.3	5	-	-	-
	2016-17	80S	25.3	40S	16.2	30S	6.0	100S	58.6	99	68	9	6	2.5	0.9	75.0	30.6	0.0	0.0	31.6	5	3	-	-
	Mean	80S	24.3	50S	12.9	30S	3.4	100S	49.2	99	57	9	6	6.0	2.1	75.0	30.6	0.0	0.0	31.6	5	3	-	-

Table 1.3. Adult plant response of AVT Ist year entries against three rusts under rust epiphytotic conditions at hot spot locations in field during 2016-17

S. No.	Entry	Stem rust		Leaf rust				Stripe rust		Postulated Genes		
				South		North				*Sr*	*Lr*	*Yr*
		HS	ACI	HS	ACI	HS	ACI	HS	ACI			
I. NORTHERN HILLS ZONE												
1	DBW 179	40S	13.0	10S	2.7	0	0.0	50S	13.0	*8a+5+2+*	*13+10+1+*	*A+*
2	DBW 204	NS		NS		NS		NS				
3	HPW 434	NS		NS		NS		NS				
4	HPW 438	NS		NS		NS		NS				
5	HPW 439	80S	35.1	40S	7.1	20S	4.0	5MR	0.6	*7b+*	*23+10+*	*A+*
6	HPW 440	60S*	25.8	40S	19.0	20S	9.0	10MS	2.2	*9e+7b+2+*	*23+13+*	*A+*
7	HPW 448	20MS	4.8	20S	3.2	5S	1.0	60S	14.8	*31+2+*	*26+23*	*9+*
8	HPW 449	20MS	4.2	30S	4.3	TMS	0.3	60S	21.6	*31+*	*26+10+1+*	*9+*
9	HS 629	20MS	4.7	40S	12.9	5S	1.8	60S	17.9	*28+, 5+2+*	*13+*	*2+*
10	HS 630	30MS	7.4	30S	7.5	0	0.0	10S	2.6	*2+*		*2+*
11	HS 643	20MS	4.8	30S	11.5	TS	0.2	40S	12.8	*2+*	*23+13+*	*2+*
12	HS 644	20MS	4.4	30S	7.2	5S	1.0	40S	13.4	*31+5+*	*26+1+*	*9+A+*
13	HS 645	60S	10.9	20S	6.3	0	0.0	TMS	0.1	*8a+5+11+*	*23+13+1+*	*2+*
14	HS 646	20MS	4.1	20MS	5.3	TMR	0.1	40S	13.5	*31+5+2+*	*26+23+1*	*9+A+*
15	HS 647	40S	12.2	20S	2.9	5S	1.0	30S	10.7	*31+5+*	*26+10+*	*9+*
16	HS 648	80S	30.4	20S	4.1	5MS	0.8	10 MR	0.5	*28+2+*	*23+1+*	*2+*
17	UP 2992	40S	11.1	15MS	5.7	20S	5.4	60S	28.2	*5+11+2+*	*23+1+*	*A+*
18	UP 2993	30MS	7.0	20S	3.5	TMS	0.2	TS	0.2	*5+2+*	*13+*	

S. No.	Entry	Stem rust		Leaf rust				Stripe rust		Postulated Genes		
				South		North				*Sr*	*Lr*	*Yr*
		HS	ACI	HS	ACI	HS	ACI	HS	ACI			
19	VL 1011	20MS	4.8	20S	7.2	20S	4.0	10MR	0.6	*11+7b+*	*13+*	*A+*
20	VL 1012	30MS	5.9	30S	4.3	0	0.0	TS	1.2	*2+*	*13+10+1+*	
20. A	INFECTOR	100S	80.0	100S	68.6	80S	56.0	90S	72.0			
21	VL 1013	80S	25.1	10MS	1.3	0	0.0	15 MR	1.7	*5+11+*	*13+*	*A+*
22	VL 3013	10MR	0.8	TR	0.1	0	0.0	60S*	9.4	*2+*		*A+*
23	VL 3014	30MS	5.2	10MS	2.0	0	0.0	10MS	2.2	*25+*	*19+*	*2+*
24	VL 3015	30MS	12.0	10MS	2.9	TMR	0.1	60S	16.7	*7b+*	*13+10+1+*	*A+*
25	VL 4002	40MS	12.7	10S	4.1	5MS	0.8	60S	17.6		*13+1+*	*A+*
26	VL 4003	40S	20.0	60S	24.8	40S	10.0	60S	20.1	*30+*	*13+10+, 13+2a+*	
27	BRW 3773	80S	35.3	30S	9.5	40S*	8.0	20S	5.6	*13+11+*	*13+*	*2+*
28	CG 1023	30MS	12.1	40S	7.5	20S	5.0	40S	12.7	*28+*	*13+10+*	*2+*
29	DBW 189	80S	30.0	20S	4.8	TR	0.0	60S	33.8	*9b+11+2+*	*13+10+*	*2+*
30	DBW 196	30MS	10.7	30S	4.4	5S	1.0	60S	65.1	*9b+11+5+2+*	*13+10+1+*	*2+*
31	HD 3226	20MS	5.4	30S	7.1	30S	10.0	TR	0.6		*23+10+*	*2+*
32	HD 3237	40S	15.6	40S	16.3	5S	1.4	5MR	0.6		*13+3+*	*2+*
33	HI 1617	60S	20.2	20S	4.0	20S	4.0	80S	29.3	*28+5+2+*	*23+10+1*	*A+*
34	HI 1619	80S	40.1	40S*	6.1	TMR	2.1	15S	1.8		*13+10+3+*	*2+*
35	HI 1620	40MS	14.4	30S	8.1	20S	5.0	10S	5.1	*11+7b+*	*13+10+3+*	*A+*
36	HP 1963	30MS	10.3	60S	19.0	40S	20.0	5MS	2.6	*5+11+*	*13+10+*	*A+*
37	HS 611	20MS	3.5	20S	4.4	TS	0.2	10S	3.3	*2+*	*13+*	*2+*

S. No.	Entry	Stem rust		Leaf rust				Stripe rust		Postulated Genes		
				South		North				*Sr*	*Lr*	*Yr*
		HS	ACI	HS	ACI	HS	ACI	HS	ACI			
38	MACS 6677	20MS	6.1	30S	8.4	5S	3.0	40S	19.2		*10+3+*	*A+*
39	MP 1318	20MS	6.1	20S	3.0	10S	3.0	40S	14.4		*13+1+*	*A+*
40	PBW 750	60S	26.7	20S	2.9	20S	4.1	10MS	3.2	*5+11+*	*23+10+*	*A+*
40. A	INFECTOR	100S	66.7	100S	81.4	80S	60.0	90S	72.0			
41	PBW 752	100S	45.0	40S	18.3	20S	6.6	10MS	0.8	*13+11+*	*13+*	
42	UP 2942	60S	23.5	20S	5.8	TS	0.2	40S	19.4	*28+5+*	*13+1+*	*A+*
43	WH 1202	60S	29.7	40S	12.8	10S	8.0	5S	1.3		*13+10+*	*2+*
III. NORTH EASTERN PLAINS ZONE												
44	DBW 187	20MS	9.0	10MS	1.8	TS	0.3	10MS	4.4	*30+*	*23+10+2a+*	*2+*
45	HD 3219	30MS	8.4	20S	5.8	5S	2.0	60S	37.6		*13+1+*	*2+*
46	UAS 384	40MS	11.0	40S	12.3	10S	2.2	80S	40.6	*9b+11+2+*	*23+3+1+*	*2+*
IV. CENTRAL ZONE												
47	BRW 3775	60S	21.7	40S	16.1	10MS	1.8	40S	19.0	*28+*	*23+3+1+*	*2+*
48	HI 8791 (d)	10MR	1.0	20MR	1.5	TMR	0.1	20MR	4.6	*11+*		*2+*
49	UAS 385	20MS	8.3	40S	11.5	20MR	1.0	80S	43.4	*9b+11+*	*13+1+*	*2+*
50	UAS 462 (d)	5MS	2.2	30S	6.6	10MS	1.6	20S	3.9	*7b+*	*13+3+*	*2+*
V. SOUTHERN HILLS ZONE												
51	UAS 387	30MS	10.4	40S	12.6	20S	4.0	80S	51.6	*31+*	*26+*	
VI. SPECIAL TRIAL (Dicoccum, MABB, Salinity and Alkalinity)												
52	DBW 246	60S	15.0	10MS	2.6	10S	2.2	TR	0.6	*9b+11+2+*	*23+10+*	*2+*
53	DBW 247	20MS	4.3	30S	10.6	40S	10.0	5MS	0.7	*7b+2+*	*13+3+*	

S. No.	Entry	Stem rust		Leaf rust				Stripe rust		Postulated Genes		
				South		North				*Sr*	*Lr*	*Yr*
		HS	ACI	HS	ACI	HS	ACI	HS	ACI			
54	DBW 248	80S	34.0	40S	7.8	40S	17.0	40MS	8.6	*7b+*	*13+*	2+
55	DDK 1052	5MR	0.4	5MR	0.4	10S	2.0	100S	34.4	*7b+*		2+
56	DDK 1053	5MR	0.5	10S	1.5	5S	1.0	100S	50.6	*11+7b+*		
57	KRL 370	80S	31.4	10S	1.5	0	0.0	20S	7.0	*30+5+2+*	*23+1+2a+*	2+
58	KRL 377	60S	25.4	20S	4.1	20S	4.2	80S	37.8		*13+1+*	2+
59	KRL 384	60S	26.7	20S	8.4	20S	4.3	40S	12.7	*30+*	*13+10+2a*	2+
60	KRL 386	60S	26.2	20S	5.2	5S	1.2	60S	12.7	*30+2+*	*23+3+2a*	2+
60. A	INFECTOR	100S	66.7	100S	81.4	80S	60.0	90S	72.0			2+
61	MACS 5047	5MS	1.1	5MR	0.4	20S	4.2	80S	34.2	*13+11+*		2+
62	MACS 5049	5MR	0.4	TMR	0.1	0	0.0	70S	28.2	*11+7b+*		
63	PBW 779	30S	14.0	5S	0.8	5S	1.0	40MS	6.7	*31+5+*	*26+23+10+*	*9+A+*
64	PBW 780	60S	16.8	20S	3.1	10S	2.0	10MS	1.3		*23+*	
65	WH 1316	60S	19.3	20S	8.7	10S	4.0	40S	8.3	*28+2+*	*13+10+3+*	2+
VII. SPECIAL TRIAL (TRITICALE)												
66	TL 3011	TR	0.1	30S	4.3	0	0.0	10R	0.4	*31+2+*	*26+23+1*	*9+*
67	TL 3012	TR	0.1	TR	0.1	0	0.0	10R	0.5		*13+*	
68	TL 3013	TR	0.1	20MR	1.2	0	0.0	5R	0.8	*31+*	*26+10+3+*	*9+*
69	TL 3014	20MR	1.4	TR	0.0	0	0.0	5R	0.2	*31+2+*	*26+23*	*9+*
70	TL 3015	20MR	1.4	20MS	3.7	0	0.0	5R	1.4			
VIII. SPECIAL TRIAL (Very Late Sown)												

S. No.	Entry	Stem rust		Leaf rust				Stripe rust		Postulated Genes		
				South		North				*Sr*	*Lr*	*Yr*
		HS	ACI	HS	ACI	HS	ACI	HS	ACI			
71	DBW 249	80S	38.4	30S	4.9	5S	1.0	40S	22.8	*5+11+*	*13+10+3+1+*	2+
72	DBW 250	40S	16.8	10S	2.9	0	0.0	40S	10.6	*28+2+*	*13+*	2+
73	DBW 251	20MS	5.4	20MR	1.2	TMR	0.1	5MS	2.0	*25+*	*19+*	2+
74	HD 3271	30MS	15.2	20S	3.5	0	0.0	10S	5.3	*2+*	*13+10+*	
75	HD 3272	40S	19.8	40S*	5.9	0	0.0	30S	9.3	*7b+*	*13+3+*	2+
76	HI 1621	30S	15.0	30S	12.9	20S	4.2	5MS	1.3	*28+*	*13+*	2+
77	PBW 757	80S	33.2	20S	5.8	10S	2.2	5MS	0.5	*8a+5+2+*	*13+10+1+*	
78	PBW 777	30MS	7.8	10S	2.1	0	0.0	TMS	0.1	*31+*	*26+23+1*	
79	PBW 778	30MS	4.8	10MR	0.6	0	0.0	20S	7.1	*9e+7b+*	*23+1+*	*A+*
80	WH 1232	30S	7.7	40S	5.8	5S	1.0	20S	6.1	*28+*	*23+10+3+*	*A+*
80. A	INFECTOR	100S	73.3	100S	77.1	80S	60.0	90S	72.0			
81	WH 1233	40S	15.4	10S	1.5	0	0.0	5MS	1.2	*30+5+2+*	*13+3+2a+*	
IX. SPECIAL TRIAL (Very High Altitude)												
82	HS 375 (C)	30MS	4.7	20S	9.2	5S	1.0	60S	33.7	*31+5+*	*26+1+*	*9+A+*
83	HS 490(C)	40S	10.7	20S	3.1	10S	2.2	60S	29.2	*28+*	*23+13+,23+3+*	2+
84	DBW 204	40S	12.9	30S	5.6	5S	1.0	80S	39.0	2+	23+13+	2+
85	HPW 434	80S	30.4	30S	6.3	TMR	0.1	20S	3.7	7b+	23+13+	*A+*
86	HPW 438	10MR	1.4	20S	4.4	20S	5.2	10MS	3.3	*31+*	26+23+	*9+A+*
86. A	INFECTOR	100S	60.8	100S	74.3	80S	60.0	90S	71.0			

NS-No Seed

Table 1.4. Adult plant response of NIVT entries against three rusts under rust epiphytotic conditions at hot spot locations in field during 2016-17

S. No.	Entry	Decoded Name	Stem rust		Leaf rust				Stripe rust	
			South		South		North		North	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI
NIVT 1A										
1	N-1A-101	WH1221	40MS	13.7	10MS	1.3	10S	2.2	10MS	3.6
2	N-1A-102	HUW812	20MS	3.9	40S	8.9	40S	9.2	10S	1.4
3	N-1A-103	NW7015	40S	22.3	30S	7.3	20S	4.4	5MS	0.9
4	N-1A-104	K1603	60S	15.4	40S	11.9	10S	4.0	60S	23.0
5	N-1A-105	HD3253	60S	22.0	20S	7.2	TS	0.2	30MS	12.6
6	N-1A-106	DBW223	20MS	7.5	20S	7.5	5S	1.2	20S	14.3
7	N-1A-107	HD3251	30MS	16.3	40S	9.1	40S	12.2	40S	9.7
8	N-1A-108	DBW228	80S	38.4	20S	6.0	TS	0.4	60S	30.8
9	N-1A-109	K0307(C)	30MS	12.7	40S	7.8	5MS	1.0	60S	33.5
10	N-1A-110	WH1222	60S	35.3	40S	10.2	20S	6.3	10S	1.8
11	N-1A-111	UP2978	20MS	9.2	20S	6.6	5S	1.2	60S	17.7
12	N-1A-112	K1601	20MS	6.1	20S	5.6	5S	1.4	20S	6.4
13	N-1A-113	DBW221	80S	46.3	80S	18.9	20S	7.0	40S	11.7
14	N-1A-114	BRW3793	60S	42.5	20S	5.1	30S	10.1	80S	23.6
15	N-1A-115	PBW764	20MS	5.2	40S	7.9	10S	3.2	15MS	4.0
16	N-1A-116	RAJ4493	10MS	2.1	20S	5.8	10MS	2.6	80S	39.4
17	N-1A-117	WH1220	20MS	3.4	20MR	1.9	5S	1.2	40MS	11.7
18	N-1A-118	RAJ4497	40S	17.8	20MS	6.7	20S	6.4	60S	20.6
19	N-1A-119	DBW225	40S	10.7	10S	3.7	TS	0.2	40S	15.9
20	N-1A-120	PBW766	40S	14.3	20S	4.1	10MS	2.6	20MS	7.3
20. A	INFECTOR		100S	66.7	100S	72.9	80S	58.0	100S	75.0
21	N-1A-121	DBW222	60S	27.3	20S	4.2	10S	2.1	40S	12.8
22	N-1A-122	DBW88(C)	30MS	8.7	20S	7.1	10S	2.2	80S	43.4
23	N-1A-123	RAJ4496	20MS	4.1	20MS	4.6	TS	0.2	60S	23.8
24	N-1A-124	PBW762	60S	22.0	30S	10.5	10MR	0.9	TR	0.0
25	N-1A-125	HD3250	60S	35.1	20S	7.2	20S	5.0	60S	22.2
26	N-1A-126	RAJ4495	20S	5.4	10S	2.1	10S	2.0	60S	26.3

S. No.	Entry	Decoded Name	Stem rust		Leaf rust				Stripe rust	
			South		South		North		North	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI
27	N-1A-127	UP2979	20MS	9.5	10S	4.2	10S	2.2	80S	47.2
28	N-1A-128	NW7001	10MS	2.8	10MS	1.8	TS	0.2	40S	19.6
29	N-1A-129	DBW226	10MS	2.1	10MS	1.2	20S	8.2	40S	13.4
30	N-1A-130	Wh1105(C)	40S	20.2	20S	4.4	10S	2.2	80S	33.2
31	N-1A-131	HD3252	60S	30.2	20S	4.1	5S	1.2	10MS	4.5
32	N-1A-132	K1602	40S	14.2	20S	7.1	5S	2.2	10MS	3.6
33	N-1A-133	PBW763	30S	11.8	10S	2.6	10S	2.6	5S	0.6
34	N-1A-134	HD3248	30MS	8.9	TR	0.1	TS	0.2	40S	10.8
35	N-1A-135	HD3249	30MS	10.5	20S	3.3	TMR	0.1	20MS	5.5
36	N-1A-136	DBW227	60S	27.5	20S	3.0	20S	4.0	60S	25.9
37	N-1A-137	UP2977	40S	23.3	10S	2.9	20S	4.0	60S	26.1
38	N-1A-138	JAUW649	20MS	7.9	20S	8.2	40S	10.0	60S	28.3
39	N-1A-139	UP2976	30MS	11.7	20S	7.3	20MS	4.0	40S	5.4
40	N-1A-140	HD3254	20MS	7.4	20S	4.1	10S	2.0	40S	12.2
40. A	INFECTOR		100S	70.0	100S	72.9	80S	50.0	90S	73.0
41	N-1A-141	UP2975	50S	15.4	20S	9.8	20S	6.2	20MS	5.2
42	N-1A-142	HP1966	60S	23.3	10MS	2.6	5MR	0.4	40S	22.1
43	N-1A-143	HUW813	30S	17.6	20S	7.1	10S	2.2	40S	21.3
44	N-1A-144	WH1219	30S	19.3	40S	12.6	40S	14.2	20MS	8.0
45	N-1A-145	DBW224	60S	23.5	20S	4.1	5S	1.0	40S	13.0
46	N-1A-146	WH1218	60S	23.7	20S	4.3	20MR	1.7	5MS	1.0
47	N-1A-147	RAJ4494	30S	14.0	20S	5.8	60S	21.6	20MS	3.8
48	N-1A-148	HD2967(C)	20MS	3.1	5MR	0.4	5S	2.0	80S	35.3
49	N-1A-149	PBW765	60S	23.5	20MR	1.8	10MR	0.8	TR	0.0
NIVT 1B										
50	N-1B-201	WH1224	30S	17.0	20S	6.9	10S	2.2	10S	2.7
51	N-1B-202	HD3257	20MS	5.7	10S	3.7	10S	3.0	80S	37.4
52	N-1B-203	NW7002	10MS	3.4	20MR	1.7	10MS	1.8	60S	23.6
53	N-1B-204	JKW237	20S3	11.7	20S	2.9	5S	1.2	40S	28.5
54	N-1B-205	HD3260	30MS	14.0	40S	8.9	40S	11.4	60S	18.7

S. No.	Entry	Decoded Name	Stem rust		Leaf rust				Stripe rust	
			South		South		North		North	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI
55	N-1B-206	UP2981	30MS	8.0	20S	8.3	40MS	9.4	20S	3.9
56	N-1B-207	DBW232	40S	10.7	20MR	1.3	5S	1.4	60S	39.2
57	N-1B-208	K1607	30S	10.0	40S	11.8	5S	1.0	80S	29.8
58	N-1B-209	Wh1105(C)	40S	19.4	20S	5.0	10S	2.4	60S	31.5
59	N-1B-210	PBW768	40S	10.7	20MS	3.7	20S	6.0	10MS	1.9
60	N-1B-211	K1604	20S	5.2	40S	5.8	10S	3.8	20S	4.7
60. A	INFECTOR		100S	66.7	100S	71.4	80S	52.0	100S	76.0
61	N-1B-212	HD3258	30MS	5.4	10MS	1.2	TR	0.0	60S	28.3
62	N-1B-213	HD3261	20MS	4.9	30S	6.5	10MS	1.7	5MS	0.5
63	N-1B-214	K1608	10MS	4.1	40S	16.6	20S	7.2	80S	32.4
64	N-1B-215	K0307(C)	30MS	9.5	60S	14.5	10S	3.0	80S	29.7
65	N-1B-216	UP2982	30MS	6.5	20S	4.1	20S	7.0	60S	26.5
66	N-1B-217	RAJ4498	10MS	3.0	10MS	2.3	5S	1.0	20MS	10.7
67	N-1B-218	RAJ4500	10MS	2.5	20S	3.6	5S	1.0	100S*	17.4
68	N-1B-219	HUW817	30MS	8.4	20S	6.3	40S	14.0	60S	23.7
69	N-1B-220	BRW3796	80S	37.6	20S	7.4	10S	5.8	40S	8.9
70	N-1B-221	HUW815	60S	34.3	20MS	6.5	20S	9.0	80S	27.2
71	N-1B-222	DBW229	60S	30.0	15MS	4.0	5S	1.2	60S	27.0
72	N-1B-223	DBW233	40S	26.7	20S	4.1	10S	2.0	40S	12.3
73	N-1B-224	NW6098	80S	38.3	20S	5.2	10S	2.1	60S	19.2
74	N-1B-225	PBW767	10MS	3.1	TMR	0.1	0	0.0	40MS	10.9
75	N-1B-226	NW7004	80S	40.3	20S	5.7	TMS	0.2	60S	23.2
76	N-1B-227	WH1223	30MS	10.5	20S	3.3	20MS	4.2	10S	2.8
77	N-1B-228	K1605	40MS	14.7	20S	6.4	10S	4.6	20S	10.0
78	N-1B-229	BRW3799	40S	9.0	20S	2.9	0	0.0	40S	10.9
79	N-1B-230	HD3255	40S	13.3	20S	5.3	10MR	0.9	40S	12.4
80	N-1B-231	DBW230	80S	23.9	20MS	3.9	TR	0.0	60S	22.2
80. A	INFECTOR		100S	70.0	100S	75.7	80S	48.0	100S	75.0
81	N-1B-232	HD3262	60S	23.3	20S	6.3	10S	3.6	40S	24.2
82	N-1B-233	HUW816	60S	19.4	30S	10.3	0	0.0	80S	41.9
83	N-1B-234	DBW234	40S	9.5	40S	10.9	20S	7.0	40S	24.2

S. No.	Entry	Decoded Name	Stem rust		Leaf rust				Stripe rust	
			South		South		North		North	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI
84	N-1B-235	DBW88(C)	30MS	10.2	20S	3.0	5S	1.0	80S	31.7
85	N-1B-236	PBW769	30S	10.0	60S	14.6	40S	15.0	20S	6.3
86	N-1B-237	HUW818	30MS	8.7	30S	9.0	40S	18.0	80S	40.4
87	N-1B-238	RAJ4499	80S	29.0	40S	14.9	20S	6.0	60S	15.9
88	N-1B-239	DBW231	20S	7.7	20S	4.7	10S	2.8	20MS	6.8
89	N-1B-240	UBW5	60S	14.2	20S	3.2	20S	4.0	80S	42.6
90	N-1B-241	K1606	80S	33.7	40S	13.8	5S	1.0	60S	40.6
91	N-1B-242	HUW814	80S	33.3	20S	4.2	10S	2.0	80S	37.0
92	N-1B-243	UP2980	40MS	12.7	30S	4.9	20S	5.0	60S	22.7
93	N-1B-244	HD2967(C)	40S	11.8	20S	2.9	5S	1.0	60S	33.6
94	N-1B-245	BRW3792	60S	27.2	20S	6.9	20S	4.1	30S	8.0
95	N-1B-246	NW7000	60S	27.4	10S	1.5	5S	2.0	60S	22.7
96	N-1B-247	HD3256	80S	35.0	20S	4.2	10S	4.0	60S	20.7
97	N-1B-248	NW7003	60S	23.5	10S	2.2	TS	0.2	60S	33.6
98	N-1B-249	HD3259	40MS	10.7	30S	6.3	40S	9.2	20S	9.0
NIVT 2										
99	N-2-301	HI1622	30MS	13.3	20S	5.6	10S	2.2	80S	41.2
100	N-2-302	MACS6703	40S	11.5	20S	6.5	10S	2.2	60S	38.6
100. A	INFECTOR		100S	70.0	100S	75.7	80S	50.0	100S	76.0
101	N-2-303	MP1339	20MS	5.0	20S	5.5	10S	6.2	80S	48.6
102	N-2-304	PBW770	10MS	3.4	10MR	0.6	10MR	1.0	30MS	9.7
103	N-2-305	GW498	40S	23.3	80S	16.9	20MR	2.8	100S	46.6
104	N-2-306	K1610	40MS	11.7	40S	13.3	10S	4.2	80S	41.4
105	N-2-307	AKAW4924	30MS	7.7	20S	6.4	10S	2.2	100S	49.6
106	N-2-308	UAS391	20MS	5.5	20S	7.5	20S	5.0	80S	40.6
107	N-2-309	GW493	20S	7.4	20S	3.0	20S	6.1	100S	53.0
108	N-2-310	MACS6709	60MS	18.8	20S	5.7	5S	1.2	100S	59.6
109	N-2-311	DBW235	20MS	6.8	20S	6.3	5S	1.2	60MS	13.0
110	N-2-312	NIAW3161	20MS	4.2	5S	1.4	10S	2.2	10S	5.2
111	N-2-313	MACS6222 (C)	20MS	4.6	5S	0.9	10S	2.1	40S	12.1

S. No.	Entry	Decoded Name	Stem rust		Leaf rust				Stripe rust	
			South		South		North		North	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI
112	N-2-314	MP1337	20S	9.2	30S	6.0	60S	13.2	80S	41.4
113	N-2-315	MP3471	20MS	6.0	20MS	2.5	60S	13.8	80S	40.6
114	N-2-316	GW492	10MS	5.0	10MS	2.6	10S	2.2	100S	42.2
115	N-2-317	HI1623	80S	35.3	20S	7.1	40S	8.4	50S	7.1
116	N-2-318	GW495	20MS	4.2	10MS	1.8	10S	2.2	100S	56.6
117	N-2-319	UAS389	30S	9.2	20S	12.7	40S	14.2	80S	45.7
118	N-2-320	WH1234	80S	39.2	20MS	4.8	TS	0.2	10MS	1.7
119	N-2-321	JWS152	30MS	10.7	30S	5.5	20S	4.2	60S	34.6
120	N-2-322	NIAW3173	30S	12.7	20S	9.4	40S	12.2	40MS	9.2
120. A	INFECTOR		100S	71.7	100S	70.0	80S	52.0	100S	75.0
121	N-2-323	UAS390	40MS	12.2	20S	6.6	5S	2.1	10S	4.2
122	N-2-324	UP2983	70MS	24.7	20S	4.1	10S	3.8	60S	34.9
123	N-2-325	HD3263	30S	15.3	10MS	3.0	10S	2.2	10MS	2.0
124	N-2-326	HI1624	20MS	5.4	20MS	2.9	10S	2.2	100S	39.9
125	N-2-327	DBW236	30S	10.0	20S	7.1	5S	2.0	60S	24.3
126	N-2-328	MACS6708	20S	6.9	10S	1.7	40S	13.0	40S	25.9
127	N-2-329	RAJ4501	20MR	1.4	TR	0.0	5S	1.0	60S	32.7
128	N-2-330	CG1024	20MS	6.1	5MS	0.7	10S	3.2	80S	44.6
129	N-2-331	GW491	20MS	4.7	20S	4.2	5S	2.0	100S	70.0
130	N-2-332	HI1625	20MS	3.1	TR	0.1	5MR	1.0	100S	59.2
131	N-2-333	UAS388	40MS	22.0	10MS	2.5	TS	0.3	100S	56.0
132	N-2-334	MP1338	30S	15.7	20S	6.3	40S	11.0	100S	49.4
133	N-2-335	HI1544(C)	10MS	3.1	20MR	2.3	10S	2.2	80S	55.0
134	N-2-336	RAJ4502	10MS	3.8	TR	0.0	20S	4.2	80S	43.0
NIVT - 3A										
135	N-3A-401	JKW234	20MS	7.5	10S	4.3	10MR	1.0	40S	25.6
136	N-3A-402	DBW238	30S	16.7	20S	4.9	TS	0.2	20S	12.6
137	N-3A-403	BRW3791	30S	14.0	20S	3.5	20S	5.2	100S	32.7
138	N-3A-404	HI1563(C)	30S	9.4	10MR	0.7	TS	0.4	80S	48.4
139	N-3A-405	DBW240	40S	23.0	15MS	3.1	20S	6.6	40S	22.7
140	N-3A-406	K1614	40S	9.5	20S	6.3	20S	4.2	100S	28.9

S. No.	Entry	Decoded Name	Stem rust		Leaf rust				Stripe rust	
			South		South		North		North	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI
140. A	INFECTOR		100S	68.3	100S	78.6	80S	56.0	100S	74.0
141	N-3A-407	PBW773	40S	17.0	20MS	3.0	20S	6.2	5MS	0.9
142	N-3A-408	K1612	40S	14.8	30MS	5.7	10S	3.3	10S	3.4
143	N-3A-409	UP2984	40S	22.4	20MS	2.4	5MS	1.0	60S	37.6
144	N-3A-410	UBW14	30S	11.1	20S	4.7	5S	1.2	40MS	11.5
145	N-3A-411	HUW821	30MS	6.9	20MR	1.8	40S	8.3	100S	44.7
146	N-3A-412	WH1226	20S	11.2	10S	2.7	TS	0.2	20S	3.4
147	N-3A-413	NW7010	30MS	13.3	30MS	9.3	TR	0.0	5S	1.9
148	N-3A-414	K1613	30MS	14.7	30S	5.7	20S	6.8	15MS	5.1
149	N-3A-415	PBW772	20MS	7.8	10MS	2.3	10S	3.6	10MS	3.1
150	N-3A-416	HD3269	10MS	2.5	30S	11.6	20S	5.2	80S	44.4
151	N-3A-417	DBW14(C)	30MS	10.5	20S	7.2	10S	3.2	60S	28.8
152	N-3A-418	DBW90(C)	50S	30.0	20S	7.5	20S	8.0	5S	1.9
153	N-3A-419	RAJ4503	30MR	4.7	15MS	1.8	10S	2.0	40MS	11.9
154	N-3A-420	RAJ4504	20MS	3.2	10S	4.1	10S	3.0	20MS	6.3
155	N-3A-421	DBW237	40MS	9.0	5S	1.9	10S	2.2	30S	10.3
156	N-3A-422	HD3267	20MS	7.2	20MR	1.7	20S	6.0	100S	46.2
157	N-3A-423	HD3266	30MS	10.4	20S	5.0	5S	1.4	20S	6.3
158	N-3A-424	HD3268	20S	6.8	20S	5.5	5S	1.0	40S	15.5
159	N-3A-425	HD3265	30MS	10.4	20S	7.2	40S	12.6	40S	27.3
160	N-3A-426	HD3059(C)	30MS	8.2	10MS	2.5	5S	1.1	80S	41.6
160. A	INFECTOR		100S	65.0	100S	74.3	80S	48.0	100S	75.0
161	N-3A-427	WH1228	40S	19.0	30S	7.2	10S	3.0	10MS	2.6
162	N-3A-428	PBW771	20S	8.3	30MS	5.2	5S	1.2	5MS	0.7
163	N-3A-429	HUW819	30MS	14.5	10S	2.6	40S	8.2	80S	36.4
164	N-3A-430	UP2985	30MS	9.7	20MR	2.1	5S	1.2	60MS	27.9
165	N-3A-431	WH1227	40S	16.0	10S	4.3	10S	2.0	20S	5.3
166	N-3A-432	HUW820	30MS	9.7	20S	4.1	40S	9.2	100S	50.4
167	N-3A-433	HD3264	40S	18.0	20S	3.8	10S	3.2	60S	27.8
168	N-3A-434	DBW239	20MS	5.1	10MS	1.2	TS	0.2	60S	27.4
169	N-3A-435	UP2987	30MS	8.2	20S	2.9	10S	2.2	80S	40.2

S. No.	Entry	Decoded Name	Stem rust		Leaf rust				Stripe rust	
			South		South		North		North	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI
170	N-3A-436	NW7007	40S	21.7	20S	5.3	TS	0.3	60S	42.4
NIVT 3B										
171	N-3B-501	DBW243	20MS	6.9	20S	5.2	20S	6.0	60S	30.2
172	N-3B-502	RAJ4083(C)	20S	5.8	20S	4.1	10S	2.0	40S	18.7
173	N-3B-503	HI1627	10S	3.7	5MS	1.3	5S	1.2	100S	70.0
174	N-3B-504	WH1230	20MS	5.4	20MR	1.3	TS	0.2	20S	5.0
175	N-3B-505	AKAW5017	10MS	4.3	50S	7.4	10S	2.6	80S	62.0
176	N-3B-506	MP1340	30MS	8.5	10S	2.1	TS	0.2	10S	3.2
177	N-3B-507	RAJ4238(C)	40S	11.1	20S	2.9	20S	4.2	100S	59.7
178	N-3B-508	WH1229	60S	27.2	20S	6.0	40S	9.0	10S	2.3
179	N-3B-509	HD2864(C)	20MS	3.7	30S	5.5	10MR	1.0	100S	59.6
180	N-3B-510	GW500	20MS	5.7	20MS	2.4	10S	3.6	80S	35.4
180. A	INFECTOR		100S	66.7	100S	81.4	80S	50.0	100S	76.0
181	N-3B-511	LOK73	80S	24.8	10S	1.5	5S	1.2	80S	55.6
182	N-3B-512	NIAW3033	10MS	2.2	5MR	0.3	10S	2.2	80S	55.6
183	N-3B-513	MP1342	40S	11.7	10MS	2.6	0	0.0	5S	2.1
184	N-3B-514	MACS6715	20MS	4.1	10MS	1.2	0	0.0	60S	30.0
185	N-3B-515	HI1626	80S	29.7	20S	4.6	20S	4.4	40S	8.2
186	N-3B-516	GW501	30S	15.0	60S	16.9	40S	9.2	80S	54.0
187	N-3B-517	UAS393	20MS	4.1	20S	9.9	10S	5.0	80S	48.0
188	N-3B-518	NIAW3212	30S	11.7	20S	5.4	5S	1.0	80S	48.0
189	N-3B-519	MP3469	40S	16.3	20S	4.8	40MR	3.2	60S	39.2
190	N-3B-520	HI8794	80S	40.2	20S	6.7	TMR	0.1	30MS	9.1
191	N-3B-521	UAS392	30MS	9.2	20S	5.5	10S	5.0	80S	48.2
192	N-3B-522	CG1025	20MS	3.1	20S	3.3	10S	2.2	100S	56.2
193	N-3B-523	HD3270	30MS	8.7	30S	5.0	TS	0.2	80S	40.2
194	N-3B-524	LOK74	20S	7.2	30S	7.3	5S	1.2	80S	50.0
195	N-3B-525	NIAW3074	30MS	7.4	20S	3.5	TS	0.2	60S	34.7

S. No.	Entry	Decoded Name	Stem rust		Leaf rust				Stripe rust	
			South		South		North		North	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI
196	N-3B-526	CG1026	40S	17.4	60S	17.3	40S	11.0	80S	54.6
197	N-3B-527	DBW241	5MR	1.0	20S	8.7	60S	13.4	20MS-MR	4.7
198	N-3B-528	PBW774	80S	21.5	10S	2.9	10S	2.2	10MS	3.3
199	N-3B-529	MP3470	80S	43.0	20S	4.9	10S	3.8	5S	1.4
200	N-3B-530	GW499	20MS	7.2	20S	3.6	5S	1.2	60S	35.0
200. A	INFECTOR		100S	66.7	100S	72.9	80S	48.0	100S	74.0
201	N-3B-531	DBW242	20MS	6.8	40S	7.8	TMS	0.4	80S	44.6
202	N-3B-532	GW504	20MS	5.7	20MR	1.2	5MS	1.1	100S	54.2
203	N-3B-533	MP1341	40S	18.3	20S	4.3	10S	2.0	40S	32.0
204	N-3B-534	HD2932(C)	30MS	14.2	20S	6.3	60S	14.2	100S	52.6
205	N-3B-535	MACS6714	20MS	3.5	20S	3.0	5S	1.2	100S	58.6
206	N-3B-536	GW502	20MS	4.5	10R	0.3	TS	0.2	100S	61.2
NIVT - 4										
207	N-4-601	HI8801	10MS	3.2	10MR	0.8	5S	1.2	5MS	1.4
208	N-4-602	GW1341	20MS	4.9	10MR	0.7	5S	1.8	80S	15.5
209	N-4-603	NIAW1101	40MR	4.5	10MR	0.7	0	0.0	10S	1.1
210	N-4-604	AKDW5012	40MR	4.5	5R	0.3	0	0.0	5S	0.6
211	N-4-605	DDW44	20MS	6.4	5R	0.3	0	0.0	20MS	3.3
212	N-4-606	GW1339	20MS	5.0	5R	0.3	TS	0.2	40MS	5.7
213	N-4-607	MACS4064	80S	30.5	10S	2.1	10MS	2.6	60S	24.9
214	N-4-608	MACS4067	20S	3.7	5R	0.2	TS	0.2	20MS	4.8
215	N-4-609	UPD99	30S	9.8	10MR	1.2	10S	2.0	30S	8.0
216	N-4-610	AKDW5013	10MS	2.7	TMR	0.1	0	0.0	5MS	0.6
217	N-4-611	PBND5128	10S	2.4	TMR	0.1	TMR	0.1	20MS-MR	2.6
218	N-4-612	HI8800	10MS	1.8	TR	0.1	5MS	0.8	20MS	4.0
219	N-4-613	PDW351	40MS	10.9	TMR	0.2	0	0.0	5MS	1.4
220	N-4-614	MPO1344	10MS	3.4	10MS	1.5	TS	0.3	40S	11.9
220. A	INFECTOR		100S	70.0	100S	81.4	80S	52.0	90S	72.0
221	N-4-615	PDW354	20MS	5.7	10MS	1.3	0	0.0	5R	0.3
222	N-4-616	MACS4071	20MR	4.5	5MR	0.8	5MR	0.4	TR	0.1
223	N-4-617	HI8799	20MR	1.5	5MR	0.3	0	0.0	5MS	0.6

S. No.	Entry	Decoded Name	Stem rust		Leaf rust				Stripe rust	
			South		South		North		North	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI
224	N-4-618	PDW353	30MS	6.0	10MR	0.7	0	0.0	10MS	2.1
225	N-4-619	GW1338	10MS	3.0	TMR	0.2	0	0.0	10S	4.5
226	N-4-620	UAS465	10S	5.0	15MR	1.1	0	0.0	30MS	4.7
227	N-4-621	MPO1343	10MS	4.3	10MR	0.7	0	0.0	10MS	2.0
228	N-4-622	WHD961	10MS	2.6	5MR	0.4	0	0.0	30MS	4.3
229	N-4-623	RKD320	10MS	3.1	5MR	0.8	0	0.0	30MS	4.6
230	N-4-624	PDW352	10MS	3.3	10MR	0.8	0	0.0	10MS	1.1
231	N-4-625	GW1340	20MR	2.4	TR	0.1	0	0.0	TS	0.2
232	N-4-626	HI8797	10S	3.0	10MR	0.7	0	0.0	5MS	1.7
233	N-4-627	UAS464	20S	6.0	10MR	0.9	0	0.0	10MS	2.3
234	N-4-628	HI8795	10MS	2.9	10MR	0.7	TMS	0.2	5MS	1.5
235	N-4-629	NIAW1100	10S	3.7	TMS	0.3	0	0.0	10MS	1.8
236	N-4-630	RKD318	10MS	1.9	5MR	0.7	0	0.0	5S	1.5
237	N-4-631	WHD962	10MR	0.8	TR	0.1	0	0.0	5MS	1.4
238	N-4-632	HI8798	10MS	1.6	10MR	0.7	0	0.0	20MS	6.7
239	N-4-633	UAS428(c)	20MR	4.4	10S	1.5	TMR	0.1	5MS	2.4
240	N-4-634	DDW43	20S	5.5	10MS	1.3	0	0.0	5S	1.9
240. A	INFECTOR		100S	71.7	100S	81.4	80S	50.0	90S	73.0
241	N-4-635	HI8737(c)	30S	15.7	10MS	1.4	TR	0.0	5MS	1.6
242	N-4-636	HI8796	30S	12.2	10MS	1.8	0	0.0	10MS	2.0
NIVT - 5A										
243	N-5A-701	WH1142(c)	40MS	8.7	40S	8.4	TS	0.2	20S	5.0
244	N-5A-702	JWS151	20MS	3.4	15MR	0.9	5MS	1.0	80S	20.5
245	N-5A-703	NIAW3170	20MS	4.3	10MR	1.1	5S	1.0	30S	11.7
246	N-5A-704	DBW252	30S	14.2	TR	0.1	0	0.0	40S	13.9
247	N-5A-705	UP2989	20MR	2.7	30MS	7.4	0	0.0	80S	33.4
248	N-5A-706	BRW3798	80S	31.3	20S	9.8	60S	14.4	80S	55.8
249	N-5A-707	WH1236	60S	30.3	30S	11.5	20S	6.0	80S*	11.1
250	N-5A-708	DBW245	80S	46.7	20MS	2.9	TS	0.2	60S	14.3
251	N-5A-709	NIAW3217	40MS	18.5	5R	0.2	10S	2.2	80S	30.8
252	N-5A-710	HI1628	30MS	14.7	20S	4.9	TS	0.2	60S	18.4

S. No.	Entry	Decoded Name	Stem rust		Leaf rust				Stripe rust	
			South		South		North		North	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI
253	N-5A-711	DBW93(c)	30MS	6.4	30S	7.2	20S	5.0	80S	35.7
NIVT - 5A										
254	N-5A-712	CG1027	30MS	15.8	10MS	1.3	10S	3.2	60S	40.6
255	N-5A-713	MP1334	40S	11.8	10MS	2.3	10S	2.2	60S	51.6
256	N-5A-714	DBW110(c)	30MS	10.0	20S	4.1	5S	1.2	80S	44.6
257	N-5A-715	MP3475	40S	21.3	60S	12.9	10S	4.2	60S	34.2
258	N-5A-716	MP1331	40S	14.2	10MS	1.9	10S	3.2	40MS	13.7
259	N-5A-717	K1616	20MS	5.4	15MR	0.9	TS	0.2	40S	22.6
260	N-5A-718	DBW244	40S	23.3	20MS	5.7	60S	13.2	60S	21.4
260. A	INFECTOR		100S	70.0	100S	78.6	80S	54.0	90S	74.0
261	N-5A-719	PBW775	30MS	8.0	5S	1.3	TS	0.2	15S	5.8
262	N-5A-720	HD3273	60S	20.4	20MS	3.1	5S	1.2	80S	44.2
263	N-5A-721	UP2988	40S	11.6	10MS	1.3	0	0.0	60S	31.3
264	N-5A-722	HD3274	30MS	8.3	5MS	0.6	TS	0.2	60S	37.4
265	N-5A-723	MACS6696	30MS	12.0	20S	5.1	60S	12.1	80S	46.7
266	N-5A-724	MP1332	40S	18.3	10MS	2.2	TS	0.2	20MS	2.6
267	N-5A-725	K1615	40S	14.0	20S	4.6	10S	2.6	60S	42.6
268	N-5A-726	HD3275	80S	34.0	20S	6.7	20S	6.6	80S	48.2
269	N-5A-727	HP1967	30MS	9.4	20S	4.6	5S	2.0	60S	48.8
270	N-5A-728	MP1333	30S	11.7	20S	6.1	10MR	0.8	10S	3.5
271	N-5A-729	HD2888(c)	30S	7.7	TR	0.1	20S	4.1	80S	23.6
272	N-5A-730	MACS6695	30MS	11.3	10R	0.5	60S	12.2	80S	50.2
273	N-5A-731	BRW3806	60S	24.3	40S	8.2	10MR	1.2	40S	20.0
274	N-5A-732	NW7008	50S	24.2	30S	9.0	5S	2.8	60S	33.4
275	N-5A-733	UAS395	20MS	6.2	40S	14.4	20S	4.0	60S	51.2
276	N-5A-734	UAS394	30MS	8.1	20S	6.6	10S	2.0	60S	42.2
277	N-5A-735	PBW776	50S	12.9	20MS	2.3	TR	0.0	20MS	4.9
278	N-5A-736	WH1235	40S	16.7	10S	3.8	TS	0.2	20MS	3.7
NIVT - 5B										
279	N-5B-801	MACS4058	40S	12.7	5S	0.9	0	0.0	60S	24.1

S. No.	Entry	Decoded Name	Stem rust		Leaf rust				Stripe rust	
			South		South		North		North	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI
280	N-5B-802	MPO1336	20S	4.8	20S	3.7	5MR	0.6	5S	2.5
280. A	INFECTOR		100S	70.0	100S	81.4	80S	52.0	90S	77.0
281	N-5B-803	HI8804	30MS	8.0	10MR	0.7	5S	1.0	40S	13.5
282	N-5B-804	GW1343	100S	60.0	80S	30.3	10S	3.6	100S	73.0
283	N-5B-805	UAS466	40S	11.4	10MS	1.3	5MR	0.4	5MS	1.9
284	N-5B-806	NIDW1099	40S	11.0	10MS	1.2	0	0.0	10MR	0.8
285	N-5B-807	DDW45	10MS	3.8	TR	0.1	5S	1.1	30S	5.9
286	N-5B-808	MPO1335	20S	7.7	5MS	0.7	0	0.0	30MS	5.7
287	N-5B-809	HI8805	10S	3.7	TR	0.1	0	0.0	20S	6.8
288	N-5B-810	MACS4059	20MR	2.9	TMR	0.1	0	0.0	40S	14.4
289	N-5B-811	UAS467	10MS	2.3	10MR	0.7	0	0.0	5MS	1.2
290	N-5B-812	GW1346	20MS-S	4.4	40S	5.8	TR	0.0	80S	39.9
291	N-5B-813	MACS4063	20MS	12.8	10MR	1.3	10S	2.0	60S	34.9
292	N-5B-814	NIDW1113	20MS	4.7	10MR	0.7	0	0.0	30MS	3.9
293	N-5B-815	GW1347	20S	3.9	40S	7.8	20S	4.0	100S	61.2
294	N-5B-816	AKDW2997-16(C)	40S	16.2	10MR	0.8	0	0.0	40MS	5.5
295	N-5B-817	DDW46	20MR	1.4	TR	0.1	TS	0.2	20MS	3.9
296	N-5B-818	HI8806	10MR	1.7	TMR	0.2	5S	1.0	20MS	3.6
297	N-5B-819	HI8803	40MS	8.1	20MS	2.7	10S	2.0	20MS	3.2
298	N-5B-820	HI8627(C)	20MS	4.4	10MR	0.9	TMS	0.2	30MS	5.6
299	N-5B-821	HI8802	20MS	4.3	10MS	1.5	5MS	0.8	20MS	3.3
300	N-5B-822	MACS4062	20MS	6.3	20MR	1.7	5S	1.0	TS	0.2
300. A	INFECTOR		100S	80.0	100S	78.6	80S	48.0	100S	76.0
301	N-5B-823	DDW47	60S*	13.4	10MR	0.6	0	0.0	TR	0.1
302	N-5B-824	AKDW4896	40MS-S	10.4	20MS	3.5	0	0.0	30S	3.1
303	N-5B-825	GW1344	80S	40.0	60MS-S	16.1	20S	4.2	100S	70.0
IVT										
I. NORTHERN HILLS ZONE										
304	NHIVT 1601	HS631	60S	29.4	10MS	3.1	0	0.0	10MS	1.4
305	NHIVT 1602	HS632	40S	17.5	20S	4.2	5MR	0.6	30MS	3.7
306	NHIVT 1603	HS633	30S	13.1	40S	7.6	0	0.0	20MS	5.5

S. No.	Entry	Decoded Name	Stem rust		Leaf rust				Stripe rust	
			South		South		North		North	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI
307	NHIVT 1604	HS634	30S	12.8	20MR-MS	3.6	0	0.0	10MS	2.4
308	NHIVT 1605	HS635	80MR	11.3	20S	6.1	10S	4.0	5S	2.1
309	NHIVT 1606	HS636	30MS	8.1	30S	4.4	5S	1.0	30MS	8.6
310	NHIVT 1607	HS637	30MS	11.4	30MS	11.6	20S	8.2	30MS	4.8
311	NHIVT 1608	HPW441	40S	19.1	10MS	1.9	0	0.0	5MS	1.3
312	NHIVT 1609	HPW442	40MR	4.9	TR	0.1	TMR	0.1	20S	9.7
313	NHIVT 1610	HPW443	20MR	1.7	TR	0.1	5MS	0.8	20MS	3.6
314	NHIVT 1611	HPW444	40S	12.5	10MS	1.9	TR	0.0	40MS	9.0
315	NHIVT 1612	HPW445	20MS	4.1	15MS	1.8	5MR	0.4	10MS	1.8
316	NHIVT 1613	HPW446	30S	8.4	TR	0.1	0	0.0	10MS	2.6
317	NHIVT 1614	HPW447	50MS	14.7	20S	4.8	5S	1.0	10MS	4.5
318	NHIVT 1615	VL2025	50MS	16.4	10MS	3.9	TS	0.2	5MS	1.6
319	NHIVT 1616	VL2026	20MR	1.4	TR	0.0	10S	3.0	40S	21.3
320	NHIVT 1617	VL2027	30S	8.0	TR	0.0	5S	1.2	10MS	3.9
320. A	INFECTOR		100S	76.7	100S	78.6	80S	56.0	100S	77.0
321	NHIVT 1618	VL 2028	30MS	9.0	10MS	1.4	0	0.0	20MS	5.6
322	NHIVT 1619	VL2029	30MS	7.4	10S	1.5	5S	1.0	40S	9.6
323	NHIVT 1620	VL2030	30S	10.7	20S	5.8	20S	5.0	5S	2.1
324	NHIVT 1621	UP2990	20MS	4.7	10MR	0.7	0	0.0	5S	2.3
325	NHIVT 1622	UP2991	15S	3.9	10MS	1.2	TR	0.0	10MS	4.2
326	NHIVT 1623	VL907 C)	5MR	0.7	TR	0.1	5MR	0.4	20S	10.1
327	NHIVT 1624	HS507 C)	5MR	1.4	TR	0.0	0	0.0	30S	9.8
II. SOUTHERN HILLS ZONE										
328	SHIVT 101	UAS397	60S	22.2	40S	7.5	5MR	0.8	80S	51.8
329	SHIVT 102	HW5261	20MS	4.1	TR	0.1	30S	6.8	100S	68.0
330	SHIVT 103	HW5265	TMR	0.1	TR	0.1	10MS	1.8	100S	61.2
331	SHIVT 104	HW5254	5MR	0.5	20S	3.0	20S	4.2	100S	44.2
332	SHIVT 105	UAS396	30MS	15.0	20MS	2.4	5S	1.2	80S	42.2
333	SHIVT 106	HS641	20MS	4.0	5S	0.8	TS	0.3	60S	8.1
334	SHIVT 107	HW2044(C)	20S	9.0	10MS	1.5	5MS	1.0	60S	23.3
335	SHIVT 108	CoW(W)1(C)	40S	9.7	TR	0.1	TS	0.2	70S	53.0

S. No.	Entry	Decoded Name	Stem rust		Leaf rust				Stripe rust	
			South		South		North		North	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI
336	SHIVT 109	HW5053	20MS	4.1	10MR	0.6	TS	0.2	60S	42.0
337	SHIVT 110	HW5216(C)	30S	5.1	10MS	1.2	TS	0.2	80S	43.3
338	SHIVT 111	HS639	30MS	6.1	5MR	0.3	TS	0.2	40S	18.7
339	SHIVT 112	HS638	30MS	6.3	10MS	1.2	TS	0.2	60S*	9.3
340	SHIVT 113	MACS6706	30MS	5.7	10MS	1.2	10MS	1.8	100S	61.6
341	SHIVT 114	HS642	90S	18.2	15MS	3.3	5S	1.0	15MS	5.8
342	SHIVT 115	HS640	60S	11.7	20MS	2.6	10S	2.0	60S	31.2
343	SHIVT 116	HW5054	20MS	3.1	TR	0.1	0	0.0	60S	38.6
344	SHIVT 117	HW5255	20MS	4.1	5MR	0.3	0	0.0	60S	35.7
345	SHIVT 118	HW5052	30S	5.1	10MR	0.7	5S	1.0	90S	54.6
345. A	INFECTOR		100S	66.7	100S	75.7	80S	50.0	90S	61.0

Table 1.5: Performance of AVT entries against different diseases under multilocation testing during 2016-17

S. No.	Entry	LB(dd)		PM(0-9)		KB%		LS %		FS%		FR %	FHB		HB %	
		HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	HS	Av.	HS	AV.
AVT IInd year																
I. NORTHERN HILLS ZONE																
1	HPW 251 (C)	99	56	5	3	4.5	3.0	30.0	16.1	25.0	9.9	17.7	5	2	22.6	7.5
2	HS 375 (C)	68	35	7	4	12.5	7.9	19.7	6.5	25.0	12.5	60.0	5	2	54.5	24.8
3	HS 490 (C)	57	47	7	3	11.1	3.9	30.0	17.1	7.7	3.9	18.2	5	2	19.9	6.6
4	HS 507 (C)	68	35	7	4	11.7	6.2	55.6	19.3	15.8	7.5	20.0	5	2	50.9	32.7
5	HS 542 (C)	68	36	7	4	13.3	9.0	73.3	35.0	14.3	5.4	15.4	5	2	22.2	8.4
6	VL 829 (C)	35	13	5	3	10.0	5.1	5.0	1.0	12.5	3.1	0.0	5	3	37.9	31.1
7	VL 892 (C)	99	57	6	4	17.6	11.9	35.6	20.2	13.6	4.5	52.9	5	2	40.8	26.8
8	VL 907 (C)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
II. NORTH WESTERN PLAINS ZONE																
9	DBW 173	99	57	6	3	15.0	5.8	28.6	23.9	5.9	2.9	11.8	5	2	-	-
10	DBW 88 (C)	57	45	9	5	17.3	12.9	37.6	22.3	4.0	1.5	35.0	5	2	-	-
11	DBW 90 (C)	57	46	9	4	15.5	11.0	10.8	5.1	14.3	6.1	50.0	5	2	-	-
12	HD 3043 (C)	68	35	5	3	18.3	6.2	62.5	21.5	15.4	6.0	0.0	5	2	-	-
13	HD 2967 (C)	68	25	9	5	23.3	13.7	60.0	25.2	18.2	6.2	30.0	5	2	-	-
14	HD 3059 (C)	79	46	9	5	16.6	11.4	65.9	30.9	8.9	3.5	17.7	5	2	-	-
15	HD 3086 (C)	57	46	9	4	16.3	8.4	14.6	5.0	23.5	10.1	50.0	5	2	-	-
16	PBW 644 (C)	79	46	7	4	17.5	8.2	55.6	22.6	16.7	10.0	10.0	5	2	-	-
17	WH 1021 (C)	79	57	7	5	5.6	2.4	48.8	24.4	5.9	3.4	0.0	5	2	-	-
18	WH 1080 (C)	89	46	7	4	14.2	9.2	43.3	21.4	7.4	3.5	21.4	5	2	-	-
19	WH 1105 (C)	89	56	9	5	33.3	18.5	67.3	31.8	3.2	0.8	7.1	5	2	-	-
20	WH 1124 (C)	89	46	9	4	15.8	6.6	11.1	2.8	9.1	3.8	7.7	5	2	-	-
21	WH 1142 C)	68	46	9	5	22.2	10.9	19.9	11.2	21.3	11.0	75.0	5	2	-	-
III. NORTH EASTERN PLAINS ZONE																
22	HI 1612	57	34	9	5	14.5	9.5	29.7	15.1	15.0	9.5	41.2	5	2	-	-
23	C 306 (C)	57	35	9	5	16.6	8.1	91.3	26.2	41.7	16.9	6.3	5	3	-	-
24	DBW 39 (C)	67	46	9	5	20.7	14.1	31.3	11.8	23.1	8.9	0.0	5	2	-	-
25	HD 2733 (C)	67	46	9	5	11.1	4.8	15.0	8.3	32.6	13.4	63.2	5	2	-	-
26	HD 2888 (C)	79	46	9	5	17.5	10.5	76.0	24.2	22.2	13.4	6.3	5	2	-	-
27	HD 3171 (I) (C)	89	46	9	4	25.3	14.8	27.3	15.8	6.3	1.8	6.7	5	2	-	-
28	K 8027 (C)	68	46	9	5	17.0	14.2	45.0	12.2	14.3	6.3	23.1	5	2	-	-
29	K 0307 (C)	68	46	6	4	34.8	13.0	85.0	31.5	5.9	1.5	7.1	5	2	-	-
30	K 1006 (C)	79	57	7	5	10.4	4.2	75.0	22.3	13.3	3.6	0.0	5	2	-	-
31	K 1317 (I) (C)	89	56	9	5	13.2	9.1	81.1	42.0	3.1	1.3	0.0	5	2	-	-
IV. CENTRAL ZONE																
32	DBW 110 (C)	79	57	9	4	5.8	3.5	-	-	6.2	1.6	5.0	5	2	-	-
33	HI 8627 (d) (C)	89	57	9	5	9.3	4.6	-	-	8.8	2.2	0.0	5	2	-	-

S. No.	Entry	LB(dd)		PM(0-9)		KB%		LS %		FS%		FR %	FHB		HB %	
		HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	HS	Av.	HS	AV.
34	MP 3288 (C)	89	57	7	4	7.5	5.1	-	-	7.7	3.5	5.0	5	2	-	-
V. PENINSULAR ZONE																
35	DBW 168	89	57	9	5	26.7	11.9	22.3	11.8	22.2	7.9	10.0	4	2	-	-
36	HI 8777 (d)	89	57	9	4	8.3	2.9	28.6	5.7	0.0	0.0	0.0	5	2	-	-
37	MACS 4028 (d)	89	57	9	4	16.1	5.2	15.0	3.0	17.7	4.4	12.5	5	2	-	-
38	UAS 375	89	58	7	4	14.2	7.5	80.0	38.2	1.9	0.5	44.4	5	2	-	-
39	AKDW 2997-16 (d) (C)	99	78	9	5	11.7	5.0	65.0	13.7	12.8	3.2	5.3	5	3	-	-
40	GW 322 (C)	89	57	7	4	26.7	11.1	65.0	20.7	6.3	3.2	26.3	5	2	-	-
41	MACS 6222 (C)	89	57	7	4	26.6	13.9	26.8	13.1	38.5	14.9	16.7	5	3	-	-
42	MACS 6478 (C)	68	46	9	5	18.3	10.5	45.1	24.2	37.5	15.0	7.1	5	2	-	-
43	NI 5439 (C)	99	67	9	4	24.0	13.9	52.4	27.3	12.5	7.5	31.6	5	2	-	-
44	NIAW 1415 (C)	89	67	9	5	28.3	13.6	41.3	24.2	3.2	0.8	47.4	5	3	-	-
45	UAS 304 (C)	99	67	9	5	24.5	8.8	-	-	0.0	0.0	35.0	5	3	-	-
46	UAS 446 (C)	99	67	9	4	4.2	2.7	0.0	0.0	26.9	6.7	14.3	4	2	-	-
VI. SOUTHERN HILLS ZONE																
47	HW 2044 (C)	89	56	7	4	13.9	5.3	-	-	0.0	0.0	18.8	5	2	-	-
48	HW 5216 (C)	99	67	7	4	14.9	6.4	-	-	33.3	10.5	27.3	5	2	-	-
49	CoW (W) -1 (C)	99	78	9	4	5.1	1.3	-	-	0.0	0.0	25.0	5	3	-	-
VII. SPECIAL TRIAL																
50	DBW 14 (C)	89	68	4	3	5.0	1.9	40.0	15.9	3.6	1.6	40.0	5	2	-	-
51	DBW 71 (C)	89	56	9	5	8.8	6.7	54.4	37.1	19.1	11.4	60.0	5	2	-	-
52	DDK 1029 (C)	79	57	4	2	12.6	7.6	5.0	1.9	0.0	0.0	76.5	5	2	-	-
53	HW 1098 (C)	99	68	6	3	15.3	8.0	22.2	4.4	0.0	0.0	90.9	5	2	-	-
54	Kharchia 65 (C)	99	78	9	4	16.6	5.3	62.8	20.2	50.0	17.4	35.3	5	2	-	-
55	KRL 19 (C)	99	78	7	4	13.2	6.1	42.3	16.8	26.7	7.6	23.5	5	3	-	-
56	KRL 210 (C)	99	57	9	4	12.5	4.4	12.8	4.6	3.6	0.9	5.0	5	2	-	-
57	PBW 550 (C)	99	68	7	4	13.3	8.2	-	-	4.6	1.9	0.0	5	3	-	-
58	TL 2942 (C)	99	67	1	1	9.0	3.2	10.0	2.7	0.0	0.0	12.5	5	2	-	-
59	TL 2969 (C)	99	67	2	1	3.0	0.7	8.3	1.7	0.0	0.0	31.3	5	2	-	-
60	WR 544 (C)	99	68	9	6	2.5	0.9	75.0	30.6	0.0	0.0	31.6	5	3	-	-
AVT Ist Year																
I. NORTHERN HILLS ZONE																
1	DBW 179	89	56	5	3	15.7	8.8			36.8	17.8	20.0	5	2	43.4	41.2
2	DBW 204	NS	NS	NS	NS	NS	NS			NS	NS	NS	NS	NS	NS	NS
3	HPW 434	NS	NS	NS	NS	NS	NS			NS	NS	NS	NS	NS	NS	NS
4	HPW 438	NS	NS	NS	NS	NS	NS			NS	NS	NS	NS	NS	NS	NS
5	HPW 439	89	46	5	4	4.6	1.7			8.3	2.6	50.0	5	2	38.1	29.5
6	HPW 440	89	57	7	4	5.5	2.7			10.5	3.1	38.5	5	2	57.9	30.3
7	HPW 448	99	56	5	3	5.6	1.6			3.5	1.1	14.3	5	2	12.7	9.8

S. No.	Entry	LB(dd)		PM(0-9)		KB%		LS %		FS%		FR %	FHB		HB %	
		HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	HS	Av.	HS	AV.
8	HPW 449	99	56	5	3	6.3	3.1			17.6	5.9	0.0	5	2	48.9	30.9
9	HS 629	89	45	7	4	6.1	2.6			4.2	1.7	25.0	5	2	37.6	25.9
10	HS 630	57	35	5	2	5.6	2.0			7.7	2.5	20.0	5	2	32.5	20.4
11	HS 643	68	35	7	3	4.5	2.0			15.8	4.6	0.0	4	2	51.11	31.3
12	HS 644	89	57	4	3	4.6	1.2			5.9	1.5	6.3	5	2	11.9	7.2
13	HS 645	36	24	5	3	5.0	2.4			16.7	5.3	7.7	5	2	44.6	30.7
14	HS 646	99	35	5	3	6.1	2.6			4.2	1.6	0.0	2	1	37.5	24
15	HS 647	57	36	7	4	4.3	1.3			40.0	20.4	30.8	5	2	55.4	30.5
16	HS 648	99	56	7	4	5.3	2.7			14.3	4.2	36.8	5	2	82	63
17	UP 2992	79	35	7	4	23.1	9.4			16.7	5.1	0.0	5	2	48.7	25.8
18	UP 2993	57	34	9	4	9.1	4.6			13.3	4.6	0.0	4	1	0	0
19	VL 1011	79	45	7	4	6.1	2.5			4.4	1.1	8.3	5	2	30.2	23.1
20	VL 1012	99	46	9	5	27.5	7.4			15.4	5.0	7.7	5	3	0	0
21	VL 1013	46	24	7	4	2.5	1.0			54.5	31.5	0.0	2	1	18.3	13.6
22	VL 3013	89	57	5	3	1.4	0.6			37.0	13.3	30.0	5	2	30.8	10.3
23	VL 3014	89	45	5	3	4.1	1.1			8.8	2.2	10.0	5	3	19.6	16.9
24	VL 3015	79	46	7	4	5.0	1.3			21.1	7.2	11.1	5	3	51.35	42.9
25	VL 4002	46	35	5	4	1.7	0.7			18.2	5.6	0.0	5	2	44.2	27.2
26	VL 4003	99	45	9	4	7.9	3.0			7.1	2.8	23.1	5	2	49.1	26.7
III. NORTH EASTERN PLAINS ZONE																
27	BRW 3773	99	57	9	4	6.6	3.6			3.9	1.0	0.0	5	2		
28	CG 1023	79	57	9	5	2.5	1.7			2.0	0.5	13.3	5	2		
29	DBW 189	99	35	7	3	6.1	3.9			2.1	0.5	5.6	4	2		
30	DBW 196	79	46	9	4	8.0	3.4			2.1	0.5	5.6	5	2		
31	HD 3226	99	56	7	4	7.2	3.2			11.1	3.3	5.6	5	2		
32	HD 3237	99	46	5	4	5.0	1.9			11.8	3.9	11.8	5	2		
33	HI 1617	99	56	7	4	9.1	3.9			7.7	1.9	10.5	5	2		
34	HI 1619	89	57	5	3	1.0	0.3			10.5	3.7	7.1	5	2		
35	HI 1620	99	57	7	4	8.2	3.5			6.7	2.4	60.0	5	2		
36	HP 1963	77	46	5	4	6.2	3.0			20.0	5.7	0.0	5	2		
37	HS 611	99	56	4	3	7.2	3.3			17.7	7.0	11.8	5	2		
38	MACS 6677	89	45	9	4	10.3	4.9			12.5	3.1	5.3	5	2		
39	MP 1318	79	35	9	4	2.5	1.6			6.7	2.8	5.6	5	2		
40	PBW 750	99	56	9	4	18.3	8.7			15.8	4.7	0.0	5	3		
41	PBW 752	99	56	9	6	5.3	3.6			10.5	3.3	27.8	5	3		
42	UP 2942	56	34	7	4	5.0	2.4			12.5	3.9	30.0	5	2		
43	WH 1202	99	56	7	4	3.0	1.4			10.5	6.0	100.0	5	2		
III. NORTH EASTERN PLAINS ZONE																
44	DBW 187	99	56	7	4	3.3	1.4			25.0	9.3	58.8	5	2		
45	HD 3219	68	56	9	4	2.5	1.2			5.6	1.4	6.3	5	2		
46	UAS 384	79	57	7	4	9.3	6.1			2.1	0.7	94.1	5	3		
IV. CENTRAL ZONE																
47	BRW 3775	99	57	7	5	6.5	2.7			2.7	0.7	76.9	5	2		
48	HI 8791 (d)	79	47	9	5	19.5	8.1			0.0	0.0	25.0	5	2		

S. No.	Entry	LB(dd)		PM(0-9)		KB%		LS %		FS%		FR %	FHB		HB %	
		HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	HS	Av.	HS	AV.
49	UAS 385	99	56	7	4	5.0	2.8			9.1	5.2	36.8	4	2		
50	UAS 462 (d)	68	35	9	5	20.2	5.6			0.0	0.0	17.7	5	2		
V. SOUTHERN HILLS ZONE																
51	UAS 387	99	57	7	4	6.5	2.7			12.5	6.6	47.4	5	2		
VI. SPECIAL TRIAL (Dicoccum, MABB, Sailinity and Alkalinity)																
52	DBW 246	68	45	7	4	8.3	4.4			3.5	0.9	95.0	5	2		
53	DBW 247	68	35	5	3	4.6	2.7			10.0	7.0	5.6	4	2		
54	DBW 248	89	56	7	5	8.6	4.2			3.8	1.0	0.0	5	2		
55	DDK 1052	99	67	5	3	6.6	2.3			0.0	0.0	0.0	5	2		
56	DDK 1053	99	67	5	2	7.1	5.0			2.3	0.6	25.0	5	2		
57	KRL 370	89	57	7	4	8.2	3.4			6.7	2.4	0.0	5	2		
58	KRL 377	89	57	7	4	4.5	1.7			14.3	3.6	0.0	5	2		
59	KRL 384	99	57	9	4	6.1	3.1			0.0	0.0	0.0	4	2		
60	KRL 386	89	57	9	4	8.4	3.5			20.0	6.1	13.3	5	2		
61	MACS 5047	79	68	4	1	13.6	5.3			0.0	0.0	36.4	5	2		
62	MACS 5049	78	58	3	1	10.0	3.6			2.7	0.7	7.1	5	2		
63	PBW 779	99	67	5	4	6.6	2.8			16.7	9.8	12.5	5	2		
64	PBW 780	89	46	9	5	4.8	2.0			11.1	6.3	30.0	4	2		
65	WH 1316	79	46	9	4	4.3	1.6			4.8	1.8	0.0	5	2		
VII. SPECIAL TRIAL (TRITICALE)																
66	TL 3011	99	57	1	0	5.0	1.3			0.0	0.0	11.8	5	2		
67	TL 3012	99	46	1	0	2.1	0.8			0.0	0.0	46.7	5	2		
68	TL 3013	99	46	1	0	9.8	3.4			0.0	0.0	15.4	5	2		
69	TL 3014	99	67	1	0	1.3	0.3			0.0	0.0	6.7	5	2		
70	TL 3015	99	57	3	1	4.5	1.3			0.0	0.0	21.4	5	2		
VIII. SPECIAL TRIAL (Very Late Sown)																
71	DBW 249	99	56	7	4	9.1	3.5			0.0	0.0	5.3	4	1		
72	DBW 250	89	46	9	4	5.3	1.9			0.0	0.0	5.3	5	2		
73	DBW 251	99	56	7	4	6.6	1.7			8.0	2.5	5.3	5	2		
74	HD 3271	99	46	9	4	5.0	1.7			7.7	5.1	5.9	5	2		
75	HD 3272	79	35	5	3	6.3	3.7			4.3	1.6	5.0	5	2		
76	HI 1621	89	57	9	5	9.1	4.0			1.3	0.3	10.5	5	2		
77	PBW 757	99	67	5	4	5.3	3.0			16.7	4.7	5.6	5	2		
78	PBW 777	99	56	6	4	5.5	2.6			10.0	3.2	31.6	5	2		
79	PBW 778	89	35	7	4	6.6	4.2			10.0	7.1	5.6	5	2		
80	WH 1232	99	57	6	4	5.3	3.0			5.9	2.7	10.5	5	3		
81	WH 1233	79	35	7	5	6.3	2.7			2.7	0.7	0.0	5	2		
IX. SPECIAL TRIAL (Very High Altitude)																
82	HS 375 (C)	79	46	6	4	4.4	1.7			30.8	12.8	11.1	5	3		
83	HS 490 (C)	79	56	7	4	6.1	3.4			20.0	9.7	53.9	5	3		

LB-Leaf blight, dd-Double digit, KB-Karnal bunt, PM-Powdery Mildew, FS-Flag smut, LS-Loose smut, FHB-Fusarium head blight, HB-Hill bunt, FR-Foot rot, HS-Highest score, Av. Average score

AUDPC based identification of slow rusters:

Stripe rust

A total of 60 entries of AVT IInd year and 83 of AVT Ist year were evaluated for slow rusting character based on AUDPC against stripe rust at Ludhiana. Results revealed that only HS 645, UP 2993, VL 1011, VL 1012, DBW246, DBW251, PBW777, TL 2942 (C), and TL 2969 (C) were found immune to stripe rust while a number of genotypes were slow ruster (0-100 AUDPC value) Table 1.6.

Table 1.6. AUDPC based identification of stripe rust slow rusters varieties at Ludhiana during 2016-17

AVT IInd Year 2016-17 Ludhiana	
AUDPC	Varieties/entries
0	TL 2942 (C),TL 2969 (C)
1-100	DBW 173, DBW 90 (C),HD 3086 (C),PBW 644 (C) ,WH 1080 (C), WH 1124 (C), WH 1142 C), HI 1612, HI 8627 (d) (C), HI 8777 (d), AKDW 2997-16 (d)(C), MACS 6222 (C), UAS 446 (C), HW 5216 (C), DBW 71 (C), DDK 1029 (C), HW 1098 (C)
100-500	HPW 251 (C), HS375(C), HS 490 (C), HS 507 (C), HS 542 (C), VL 829 (C), VL 892 (C), VL 907 (C), DBW 88 (C), HD 3043 (C), HD 2967 (C), HD 3059 (C), WH 1021 (C), WH 1105 (C), C 306 (C), DBW 39 (C), DBW 39 (C), HD 2733 (C), HD 2888 (C), HD 3171 (I) (C), K 8027 (C), K 0307 (C), K 1317 (I) (C), DBW 110 (C), MP 3288 (C), DBW 168, HI 8777 (d), MACS 4028 (d) UAS 375, GW 322 (C), MACS 6478 (C), NI 5439 (C), NIAW 1415 (C), UAS 304 (C), HW 2044 (C) HW 5216 (C), CoW (W) -1 (C), DBW 14 (C), Kharchia 65 (C), KRL 19 (C), PBW 550 (C), WR 544 (C)
AVT Ist Year 2016-17	
0	HS 645, UP 2993, VL 1011, VL 1012, DBW246, DBW251, PBW777
1-100	DBW179, HPW 439, HPW 440, HPW 448, HPW 449, HS 630, HS 643, HS 644, HS 646, HS 647, HS 648, VL 1013, VL 3013, VL 3014, BRW 3773, CG 1023, DBW 196, HD 3226, HD 3237, WH 1202, DBW 187, HI 8791 (d), UAS 462 (d), DBW 247, DDK 1052, KRL 370, KRL 384, MACS 5047, PBW 779, PBW 780, TL 3011, TL 3012, TL 3013, TL 3014, TL 3015, DBW 249, HD 3271, HD 3272, HI 1621, PBW 757, PBW 778, WH 1232, WH 1233
100-500	HS 629, UP 2992, VL 3015, VL 4002, VL 4003, DBW 189, HI 1617, HI 1619, HI 1620, HP 1963, HS 611, MACS 6677, MP 1318, PBW 750, PBW 752, UP 2942, HD 3219, UAS 384 ,BRW 3775

Leaf and stem rusts

MAHABALESHWAR

The AUDPC values of different entries of AVT trials tested against stem and leaf rusts are given in Table 1.7-1.8.

Table1.7. Adult plant resistance of AVT entries against stem and leaf rusts of wheat

Sr. No.	Category	Stem rust			Leaf rust		
		AVT II	AVT I	Total	AVT II	AVT I	Total
1.	0 : Immune	00	00	00	00	00	00
2.	Less than 100	52	74	126	38	55	93
3.	101 to 200	03	12	15	08	11	63
4.	201 to 500	02	02	04	09	17	26
5.	501 to 1000	02	00	02	04	05	09
6.	More than 1000	00	00	00	00	00	00
7.	Not Received /Not germinated	01	03	04	01	03	04
Total		**60**	**91**	**151**	60	91	**151**

Table 1.8. AUDPC values (up to 200) of AVT entries against leaf and stem rust at Mahabaleshwar

AUDPC value	Genotypes
Stem Rust, AVT - I year, 2016 - 17	
0	**Nil**
01 – 100	HS 630, HD 3219, USA 384, KRL 377, TL 3012, TL 3014, HS 490 (c), DBW 179, HPW 448, HPW 449, HS 643, HS 644, HS 645, HS 648, UP 2992, VL 1012, VL 3014, VL 4003, HD 3226, HI 1620, MP 1318, PBW 750, PBW 752, DBW 187, BRW 3775, DBW 246, DDK 1052, KRL 370, PBW 780,TL 3011, TL 3013, TL 3015, DBW 249, DBW 251, WH 1233, HS 629, HS 646, HS 647, VL 3013, DBW 189, DBW 196, DBW 248, MACS 5049, HS 375 (c), PBW 778, HPW 439, HPW 440, HD 3237, HS 611, MACS 6677, HI 8791 (d), UAS 462 (d), DBW 250, HD 3272, HI 1619, DDK 1053, HI 1617, UP 2942, MACS 5047, VL 3015, VL 4002, PBW 779, PBW 777, WH 1202, UP 2993 and UAS 385
101 – 200	VL 1011, HP 1963, WH 1316, BRW 3773, DBW 247, WH 1232, PBW 757, HI 1621, VI 1013, UAS 387, HD 3271 and KRL 386
Leaf Rust, AVT – I year, 2016-17	
0	**Nil.**
01-100	HPW439, HPW448, HPW449, HS630 , HS645 , HS647 , HS648 , UP 2992, UP 2993, VL1012, VL1013, VL3013, VL3014, DBW189, DBW 196, HD3226, HI1617, HI1619 , HS 611, MACS 6677, MP1318, PBW 750, UP 2942 , DBW 187, HD 3219 , HI 8791(d), DBW 246, DDK 1052, DDK 1053, KRL 370, KRL 377, MACS 5047, MACS 5049, PBW 779, PBW 780, TL3011, TL3012, TL3013, TL3014, DBW 249, DBW250, DBW251, HD 3271, HD3272, PBW777, PBW778, WH1232, WH1233, HS 490 (c)
101 – 200	DBW179, HS646, VL3015, VL4002, BRW3773, HI1620, UAS385, UAS462(d), UAS387, DBW247 and KRL386
Stem Rust, AVT – II year, 2016-17	
0	**Nil**
01 – 100	VL 829 (C), HI 8627 (d) (C), USA 304 (C), CoW (W) -1 (C), TL 2969 (C), HS 375 (C), HS 490 (C), HS 542 (C), DBW 173, DBW 88 (C), HD 3043 (C), PBW 644 (C), WH 1105 (C), HI 1612, DBW 39 (C), HD 2733 (C), HD 2888 (C), K 1006 (C), DBW 110 (C), MP 3288 (C), DBW 168, USA 375, MACS 6222 (C), NIAW 1415 (C), HW 5216 (C), HPW 251(C), HS 507 (C), HD 3171 (I) (C), K 1317 (I) (C), HI 8777 (d), TL 2942 (C), PBW 550 (C), HD

AUDPC value	Genotypes
	2967 (C), WH 1080 (C), WH 1142 (C), DDK 1029 (C), HW 1098 (C), WH 1021 (C), K 0307 (C), KRL 19 (C), K 8027(C), VL 892 (C), AKDW 2997-16 (d) (C), HW 2044 (C), DBW 90 (C), MACS 4028 (d), GW 322 (C), WH 1124 (C), UAS 446 (C), DBW 14 (C), MACS 6478 (C) and HD 3086 (C) (52)
101 – 200	DBW 71 (C), KRL 210 (C) and HD 3059 (C)
Leaf Rust, AVT – II year, 2016-17	
0	**Nil**
01 – 100	HS490(C), HS 507(C), HS 542(C), VL 829(C), VL 892(C), VL 907(C), DBW173, DBW90(C), HD2967(C), WH1021(C), WH1080(C), WH1105(C), WH1142(C), HI1612, DBW39(C), HD2888(C), HD3171(I) (C), K8027(C), K1317(I) (C), HI8627(d) (C), MP3288(C), DBW168, HI8777(d), MACS4028(d), AKDW2997-16(d) (C), MACS6222(C), NIAW1415(C), UAS304(C), UAS446(C), HW2044(C), HW 5216(C), CoW(W-1) (C), DBW71(C), KRL19(C), KRL210(C),PBW550(C), TL2942(C) and TL2969(C)
101 – 200	HS375(C), DBW88(C), HD3086(C), PBW644(C), K0307(C), K1006(C), DBW110(C) and UAS375

Rust resistance genes in AVT lines (Gene postulation)

To identify rust resistant lines of wheat and characterize resistance genes, 151 lines of AVT I and II were screened at seedling stage using an array of pathotypes of black (*Puccinia graminis tritici*), brown (*P. triticina*) and yellow rust (*P. striiformis*) having varying avirulence/virulence structures. These studies were conducted under controlled conditions of temperature and light. None of the lines was resistant to all the rusts. In addition to all the lines having *Sr31* were resistant to black rust of wheat, whereas lines possessing *Lr24*, some with *Lr26* were resistant to brown rust and few lines with *Yr9* showed resistance to yellow rust of wheat. Details of the wheat rust resistant lines are given below:

***Yr* genes**

AVT II

Five *Yr* genes/patterns (*Yr2, 9, 18, 27* and *A*) were characterized in 52 lines of AVT II entries either alone or in combinations. *Yr2* was found to confer resistance in maximum number of lines (29). However, this gene is susceptible to many of the virulent pathotypes. *Yr9* which is linked to *Lr26* and *Sr31* was postulated in 10 lines. Other resistance genes like *Yr*A, *Yr18*, *Yr27* were postulated in few lines only (Table 1.9).

AVT I

Three patterns of *Yr* genes in different combinations or alone were inferred in 73 lines of AVT I. Among these, *Yr2* was characterized in 42 lines. *Yr9* which is linked to *Lr26* and *Sr31* was identified in 7 lines. *Yr*A was characterized in 18 lines and *Yr9+A+* in 6 lines (Table 1.10).

***Lr* genes**

AVT II

Lr genes characterized in 83% of the AVT II lines. Eight *Lr* genes *Lr1, 3, 10,13, 23, 24, 26* and *34* were identified either alone or in different combinations in 50 lines. Among these *Lr* genes *Lr13* was postulated in 20 lines followed by *Lr26* in 16, *Lr13* and *Lr 1* in 13 lines each. Except for *Lr10* which was observed in 11 lines, other *Lr* genes like *Lr34*, *Lr24* and *Lr3* were inferred in 3-5 lines (Table 1.11).

AVT I

Eight *Lr* genes (*Lr1,2a,3,10,13,19,23* and *26*) were postulated in 84 of the 91 AVT I lines. It is quite interesting that *Lr26* was postulated in 17.7 % of the AVT I lines, which is the lowest proportion ever. *Lr13* was characterized in maximum number of lines i.e. nearly half of the entries followed by *Lr23* in 33, *Lr10* in 30, *Lr1* in 28 lines. *Lr3* was inferred in 19 lines whereas *Lr2a* which is based on linkage to *Sr30* was postulated in 8 lines only (Table 1.12).

***Sr* genes**

AVT II

Twelve *Sr* genes (*Sr2, 5, 7b, 8a, 8b, 9b, 9e, 11, 13, 24, 28* and *31*) were characterized in 56 AVT II lines. *Sr2*, a known APR gene whose postulation is based on characteristic micro-flecking, was postulated in 37 lines followed by *Sr31* in 17, *Sr11* in 15 and *Sr7b* in 11 lines. *Sr24* and *Sr9b* were identified in 3 lines each, whereas *Sr8b* and *Sr13* were conferred in one line each. *Sr5* and *Sr28* were postulated in five and four lines, respectively (Table 1.13).

AVT I

Twelve *Sr* genes (*Sr2, 5, 7b, 8a, 9b, 9e, 11, 13, 25, 28, 30* and *31*) were characterized in 75 lines of AVT I . *Sr2* was highly frequent in AVT I material and postulated in 31 lines followed by *Sr*5 and *Sr11*, which were postulated in 22 and 20 lines, respectively. Most of the durum wheat varieties had resistance based on *Sr7b* and *Sr11*. *Sr31*, which confer resistance to all the known pathotypes from India including SAARC countries, was conferred in 14 lines. *Sr25* and *Sr9e* were characterized in two lines each, whereas *Sr8a* and *Sr13* were postulated in three lines each. *Sr30*, *Sr28* and *Sr7b* were postulated in seven, eleven and fifteen lines, respectively (Table 1.14).

Table 1. 9. *Yr* genes in AVT II of wheat postulated at Flowerdale, Shimla during 2016-17

Yr genes	Nos.	Entries and check varieties (c)
2+	29	DBW110 (C), DBW14 (C), DBW90 (C), GW322 (C), HD2888 (C), HD2967 (C), HD3043 (C), HD3059 (C), HD3086 (C), HD3171 (C), HI1612, HI8627 (D) (C), HI8777 (D), HS542 (C), HW2044 (C), K0307 (C), K1006 (C), K8027 (C), KRL19 (C), MACS6478 (C), MP3288 (C), PBW644 (C), UAS304 (C), UAS375, UAS446 (C), WH1080 (C), WH1105 (C), WH1124 (C), WR544 (C)
9+	10	COW(W)-1 (C), DBW168, DBW39 (C), DBW71 (C), HPW251 (C), HW5216 (C), NIAW1415 (C), PBW550 (C), WH1021 (C), WH1142 (C)
9+18+	03	HD2733 (C), HS375 (C), VL829 (C)
9+27+	01	MACS6222 (C)
9+2+	01	HS507 (C)
9+A+	02	DBW173, K1317 (C)
18+2+	01	NI5439 (C)
18+	01	C306 (C)
A+	04	DBW88 (C), HS490 (C), KRL210 (C), VL892 (C)
Total	52	

Table 1.10. ***Yr genes*** **in AVT I of wheat postulated at Flowerdale, Shimla during 2016-17**

Yr genes	Nos.	Entries and check varieties (c)
2+	42	BRW3773, BRW3775, CG1023, DBW187, DBW189, DBW196, DBW246, DBW248, DBW249, DBW250, DBW251, DDK1052, HD3219, HD3226, HD3237, HD3272, HI1619, HI1621, HI8791 (D), HPW179, HS611, HS629, HS630, HS643, HS645, HS648, KRL370, KRL377, KRL384, KRL386, MACS5047, MACS5049, UAS384, DBW204, HPW434,HS490©, HS629, UAS385, UAS462, VL3014, WH1202, WH1316
9+	07	HPW448, HPW449, HS647, UAS387, TL3011, TL3013, TL3014
9+A+	06	HPW438, HS644, HS646, PBW779, VL 4002 , HS375©
A+	18	DBW179, HPW439, HPW440, HS630,UP2992, VL1011, VL1013, VL3013, VL3015, HI1617, HI1620, MACS6677, MP1318, PBW750, UP2942, HP1963, PBW778, WH1232
Total	73	

Table 1.11. ***Lr*** **gene/s in AVT II of wheat postulated at Flowerdale, Shimla during 2016-17**

***Lr* gene/s**	**Nos.**	**Entries and check varieties (c)**
26+23+10+	1	DBW39 (C)
26+23+	2	HPW251 (C), WH1142 (C)
26+10+3+	1	DBW173
26+1+	4	HS507 (C) MACS 6222 (C), NIAW 1415 (C), WH1021 (C)
26+34+	3	HD2733 (C), HS375 (C), VL892 (C)
26+	5	COW (W)-1 (C), DBW 71 (C), DBW168, HW5216 (C) PWB550 (C)
24+	3	HD2888 (C), MP3288 (C), HW2044 (C)
23+13+10+	1	HD3171 (C)
23+10+	1	HD3043 (C)
23+1+	3	K 0307 (C), MACS 6478 (C),UAS 304 (C)
23+	5	DBW14 (C), HD2967 (C), HI1612, HS490 (C), TL2969 (C)
13+10+3+	3	DBW88 (C), DBW90 (C), HD3086 (C)
13+10+	4	HS542 (C), KRL210(C), TL2942 (C), WH1124(C)
13+1+	6	GW322(C), PBW644(C), K1006(C), K8027, UAS375, WR544 (C)
13+	6	DDK1029(C), DBW110(C), HD3059(C), KRL19(C), WH1080(C), WH1105(C)
34+	2	C306, NI549(C)
Total	50	

Table 1.12. ***Lr*** **gene/s in AVT I of wheat postulated at Flowerdale, Shimla during 2016-17**

***Lr* gene/s**	**Nos.**	**Entries and check varieties (c)**
26+23+1	4	HS646, PBW777, TL3011, VL 4002
26+23	3	HPW438,HPW448, TL3014
26+23+10+	1	PBW779
26+10+3+	1	TL3013
26+10+1+	1	HPW449
26+10+	1	HS647
26+1+	2	HS644, HS375©
26+	1	UAS 387

Lr gene/s	Nos.	Entries and check varieties (c)
23+13+1+	1	HS645
23+13+	5	DBW204, HPW440, HS490©,HS630, HS643
23+1+2a+	1	KRL370
23+10+2a+	2	DBW179, DBW187
23+10+3+	1	WH1232
23+10+1+	1	HI1617
23+10+	4	DBW246, HD3226, HPW439, PBW 750
23+3+2a	1	KRL386
23+3+1+	2	BRW3775, UAS 384
23+3+	2	HS490©, HS630
23+1+2a+	1	KRL370
23+1+	3	HS648, PBW778, UP2992
23+	1	PBW780
19+	2	DBW251, VL3014
13+10+3+1+	1	DBW 249
13+10+3+	3	HI1619, HI1620,WH1316
13+10+2a+	1	KRL384
13+10+1+	5	DBW179, DBW 196, PBW757, VL1012,VL3015
13+10+	7	CG1023, DBW189, HD3271, HP1963, PBW672,VL4003, WH1202
13+3+2a+	1	HW1233
13+3+	6	DBW247, HD3237, HD3272, HI1879(d) , HPW434,UAS462(d)
13+2a+	1	VL4003
13+1+	6	HD3219, KRL377, MP1318, UAS385, UP2942,VL4002
13+	11	BRW3773,DBW248, DBW250,HI1621,HS611, HS629, PBW752,TL3012, UP2993, VL1011, VL1013
10+3+	1	MACS 6677
Total	84	

Table 1.13. ***Sr*** **gene/s in AVT II of wheat postulated at Flowerdale, Shimla during 2016-17**

Sr gene/s	Nos.	Entries and check varieties (c)
31+5+2+	01	HS375 (C)
31+5+	03	VL829 (C), DBW173, DBW71 (C)
31+2+	08	DBW168, HD2733 (C), HPW251 (C), K1317 (I) (C), MACS6222 (C), NIAW1415 (C), WH1021 (C), WH1142 C)
31+	05	CoW (W) -1 (C), DBW39 (C), HS507 (C), HW5216 (C), PBW550 (C)
24+2+	01	HD2888 (C)
24+	02	HW2044 (C), MP3288 (C)
28+8a+2+	01	WR544 (C)
28+8a+	01	UAS304 (C)
28+11+2+	01	DBW14 (C)
28+	01	MACS6478 (C)
8a+5+7b+	01	HS542 (C)
8a+11+2+	01	HD2967 (C)
8a+9b+11+	01	K1006 (C)
9e+2+	02	HI8627 (d) (C), WH1080 (C),
9b+2+	01	HS490 (C)

Sr gene/s	Nos.	Entries and check varieties (c)
8b+9b+11+2+	01	KRL19 (C)
13+2+	01	DBW90 (C)
11+7b+2+	01	HD3171 (I) (C)
11+2+	08	DBW88 (C), GW322 (C), HD3059 (C), HW1098 (C), K8027 (C), PBW644 (C), UAS446 (C), WH1105 (C)
11+	02	DDK1029 (C), NI5439 (C)
7b+2+	06	AKDW2997-16 (d)(C), HD3086 (C), HI1612, KRL210 (C), UAS375,WH1124 (C)
7b+	03	HI8777 (d), Kharchia 65 (C), MACS 4028 (d)
2+	04	K0307 (C), TL2942 (C), TL2969 (C), VL892 (C)
Total	**56**	

Table 1.14. *Sr* gene/s in AVT I of wheat postulated at Flowerdale, Shimla during 2016-17

Postulated genes	Nos.	Entries and check varieties (c)
31+5+2+	01	HS646
31+5+	05	HS644, HS647, PBW779, VL4002, HS375 (C)
31+2+	03	HPW448, TL3011, TL3014
31+	05	HPW449, PBW777, TL3013, UAS387, HP438
25+	02	DBW251, VL3014
30+5+2+	03	KRL370, WH1233, DBW179
30+2+	01	KRL386
30+	03	DBW187, KRL384, VL4003
28+5+2	01	HI1617
28+5+	01	UP2942
28+2+	03	DBW250, HS648, WH1316
28+	06	BRW3775, CG1023, HI1621, HS490(C),HS629, WH1232
8a+5+11+	01	HS645
8a+5+2+	02	DBW179, PBW757
9b+11+5+2+	01	DBW196
9b+11+2+	03	DBW189, DBW246, UAS384
9b+11+	01	UAS385
9e+7b+2+	01	HPW440
9e+7b+	01	PBW778
5+11+2+	01	UP2992
5+11+	04	DBW249, HP1963, PBW750, VL1013
5+2+	02	HS629,UP2993
13+11+	03	BRW3773, MACS5047, PBW752
11+7b+2+	01	HS630
11+7b+	04	DDK1053, HI1620, MACS5049, VL1011
11+	01	HI8791 (d)
7b+2+	01	DBW247
7b+	07	DBW248, DDK1052, HD3272,HPW434, HPW439, UAS462 (d), VL3015
2+	07	DBW204, HD3271, HS611, HS630, HS643, VL1012, VL3013
Total	**75**	

MAHABALESHWAR

55 wheat genotypes from AVT and NIVT were received from the Indian Institute of Wheat and Barley Research, Karnal (Haryana) during *Rabi* 2016-17 for testing against selective pathotypes of stem and leaf rusts under glass house condition. These were tested at seedling stage against 10 pathotypes of stem rust and 16 pathotypes of leaf rust.

Pathotypes used :

Stem Rust (10) : 11, 24-A, 34,40A, 42, 117-3, 117-4, 117-6, 122 and 295.

Leaf Rust (16): 77-1, 77-2, 77-3, 77-4, 77-5, 77-6, 77-8, 77-9, 104-1, 104B, 104-2, 12-2, 12-3, 12-5, 162-1 and 162-2.

The testing of wheat genotypes revealed that out of fifty five genotypes, fourteen genotypes were found to be resistant to stem rust and fifteen genotypes to leaf rust whereas five genotypes were resistant to both rusts under glasshouse condition (Table 1.15).

Table 1.15. Resistant genotypes of wheat against selective pathotypes at seedling stage at Mahabaleshwar

Resistant genotypes		
Stem rust	**Leaf rust**	**Both the rusts**
AVT		
BRW 3775, DBW 110 (C), DBW 168, UAS 375 and NIAW 1415 (C)	HI 8791 (d), MP 3288 (C), DBW 168, MACS-6222 (C) UAS 304 (C) and NIAW 1415 (C)	DBW-168, and NIAW 1415 (C)(d),

The details of SRT carried out against different rust races are given in Annexure Tables1.1-1.10.

RACE SPECIFIC APR

i. Leaf rust: AVT entries of NWPZ, NHZ and NEPZ, along with the check entries of the respective zones.

Centres: New Delhi and Ludhiana under field conditions and Flowerdale, Shimla (under glass house conditions)

ii. Stem rust: AVT of CZ and PZ, along with the check varieties of the respective zone.

Centres: Indore, Pune, Powarkheda and Mahabaleshwar

iii. Stripe rust: AVT entries of NWPZ and NHZ alongwith the checks of the respective zones.

Centres: Ludhiana and N. Delhi under field conditions and Flowerdale (under controlled condition),

Race inoculum was supplied by Flowerdale. It was as follows:

(i) Leaf rust: 77-5 and 77-9

(ii) Yellow rust: 46S119 and 110S119

(iii) Stem rust: 40A and 117-6

Race specific Adult Plant Resistance (APR) in AVT material to rusts under controlled conditions at Flowerdale, Shimla

Race specific Adult Plant Resistance (APR) in AVT material to rusts

Entries of AVT Ist and AVT IInd year were evaluated for identifying adult plant resistance. Pathotypes 110S119 and 110S84 of stripe rust, 77-9 and 104-2 of leaf rust and 40A and 117-6 of stem rust were used in the study. Optimum conditions for infection of rust and growth of wheat material were provided.
Six entries of AVT Ist were resistant to both the pathotypes of stripe rust (110S119 and 110S84), whereas twenty one entries were resistant to pathotype 110S119 and two entries conferred APR to 110S84. Of the AVT IInd lines, four were resistant to both the stripe rust pathotypes (110S119 and 110S84). APR to 110S119 and 110S84 was observed in eleven and one entries of AVT IInd material, respectively (Table 1.16).

Table 1.16. Adult plant resistance in AVT material to stripe rust at Flowerdale, Shimla

APR to pathotypes	AVT	Number of entries	Detail of entries
110S119	Ist	21	BRW3775, DBW187, DBW247, HD3226, HD3271, HI1619, HI1620, HP1963, HPW 438, HPW439, HS611, HS630, HS648, KRL370, PBW750, PBW778, TL3011, TL3012, TL3013, VL3014, WH1202
110S84		2	HPW434, MACS5049
110S119 and 110S84		6	DBW248, DBW251, HI1621, TL3014, TL3015, UAS462 (d)
110S119	IInd	11	AKDW2997-16 (d) (C), DBW71 (C), HD3086 (C), HI8777 (d), HS490 (C), KRL210 (C), MP3288 (C), TL2942 (T) (C), TL2969 (T) (C), VL829 (C), WH1142 (C)
110S84		1	MACS4028 (d)
110S119 and 110S84		4	DBW90 (C), MACS6222 (C), UAS446 (C), WH1124 (C)

Ten entries of AVT Ist and sixteen entries of AVT IInd were resistant to both the leaf rust pathotypes (77-9 and 104-2) at adult plant stage (Table 2). APR to pathotype 77-9 was conferred by thirteen entries of AVT Ist and three entries of AVT IInd. Similarly nine entries of AVT Ist and seven entries of AVT IInd showed APR to pathotype 104-2 (Table 1.8). AVT Ist entry TL3015 confer APR to both brown (77-9 and 104-2) and yellow rust (110S119 and 110S84) pathotypes (Table 1.17 and 1.18).

Table 1.17: Adult plant resistance in AVT material to leaf rust at Flowerdale, Shimla

APR to pathotypes	AVT	Number of entries	Detail of entries
77-9	Ist	13	BRW3775, CG1023, DBW189, DBW196, DBW204, DBW 249, HS440, HS629, HS645, PBW757, UAS384, UAS385, UAS387
104-2		9	DBW250, DDK1052, HI8791 (D), HP1963, HS490, KRL386, MP1318, UAS462 (D), VL1011
77-9 and 104-2		10	DBW179, HD3226, HI1619, HI1620, HPW440, HPW448, HS611, MACS6677, TL3015, UP2993
77-9	IInd	3	HD2967 (C), HS375 (C), WH1147 (C)
104-2		7	DBW14(C), DDK1098 (C), HD3086 (C), HD3171 (C), HS 490 (C), K0307 (C), PBW644 (C)
77-9 and 104-2		16	DBW39 (C), DBW 88 (C), DBW168, DBW173, HD2733, HD3043 (C), HD3059 (C), HPW251 (C), HI1612, HI8627, K1317 (C), KRL 19 (C), NIAW1415 (C), TL2969 (C), WH1080 (C), WH1105 (C)

WH 1202 was the only entry in AVT Ist showing APR against both the pathotypes (40A and 117-6) of stem rust. APR to 40A was recorded in HPW440, UAS462, DBW248 whereas MACS5047 confirmed APR to 117-6 pathotype in AVT Ist entries. AVT IInd entries HD2967(C), HI8627(C), HI8777(D) and AKDW2997-16(d)(C) were resistant to pathotype 40A at adult plant stage and K8027(C) was the only entry conferring APR to pathotype 117-6 in AVT IInd. None of the entries of AVT IInd were resistant to both the pathotypes of stem rust at adult plant stage (Table 1.19).

Table 1.18: Adult plant resistance in AVT material to stem rust at Flowerdale, Shimla

APR to pathotypes	AVT	Number of entries	Detail of entries
40A	Ist	03	HPW440, UAS462, DBW248
117-6		01	MACS5047
40A and 117-6		01	WH1202
40A	IInd	05	HD2967(C), HI8627(C), HI8777(D), AKDW2997-16(d)(C)
117-6		01	K8027(C)
40A and 117-6		None	-

The results of APR of AVT entri1s against stripe rust of Ludhiana and New Delhi are presented in Tables 1.19 and 1.21.

Table 1.19. APR in AVT IInd year material against major races of stripe and leaf rust races during 2016-17 at PAU, Ludhiana

S. No.	Entry	Stripe rust		Leaf rust	
		46S119	110S119	77-5	77-9
I. NORTHERN HILLS ZONE					
1	HPW 251 (C)	60S	60S	0	0
2	HS 375 (C)	0	60S	20S	10S
3	HS 490 (C)	40S	60S	0	0
4	HS 507 (C)	40S	40S	0	0
5	HS 542 (C)	80S	60S	10S	20S
6	VL 829 (C)	60S	60S	0	0
7	VL 892 (C)	80S	60S	0	0
8	VL 907 (C)	No seed	no seed	no seed	no seed
II. NORTH WESTERN PLAINS ZONE					
9	DBW 173	60S	60S	5S	0
10	DBW 88 (C)	80S	80S	5S	0
11	DBW 90 (C)	0	5S	20S	40S
12	HD 3043 (C)	60S	60S	60S	60S
13	HD 2967 (C)	80S	60S	0	0
14	HD 3059 (C)	80S	60S	20S	0
15	HD 3086 (C)	0	TS	20S	20S
16	PBW 644 (C)	80S	60S	0	0
17	WH 1021 (C)	80S	60S	10S	0
18	WH 1080 (C)	5S	10S	0	10S
19	WH 1105 (C)	60S	60S	20S	40S
20	WH 1124 (C)	5S	5S	20S	20S
20. A	INFECTOR	80S	80S	60S	60S

S. No.	Entry	Stripe rust		Leaf rust	
		46S119	110S119	77-5	77-9
21	WH 1142 C)	5MS	10MS	0	0
III. NORTH EASTERN PLAINS ZONE					
22	HI 1612	10MS	40S	0	0
23	C 306 (C)	80S	60S	20S	0
24	DBW 39 (C)	80S	60S	0	0
25	HD 2733 (C)	80S	60S	20S	0
26	HD 2888 (C)	60S	60S	0	0
27	HD 3171 (I) (C)	80S	40S	5S	10S
28	K 8027 (C)	80S	60S	0	0
29	K 0307 (C)	60S	60S	0	5S
30	K 1006 (C)	60S	60S	0	0
31	K 1317 (I) (C)	60S	40S	10S	0
IV. CENTRAL ZONE					
32	DBW 110 (C)	60S	60S	0	5S
33	HI 8627 (d) (C)	10MS	5MS	0	0
34	MP 3288 (C)	60S	60S	0	0
V. PENINSULAR ZONE					
35	DBW 168	60S	610S	10S	20S
36	HI 8777 (d)	10MS	5MS	0	0
37	MACS 4028 (d)	60S	60S	0	0
38	UAS 375	80S	60S	10S	10S
39	AKDW 2997-16 (d))C)	40S	10MS	0	0
40	GW 322 (C)	80S	60S	0	0
40. A	INFECTOR	80S	80S	60S	60S
41	MACS 6222 (C)	40S	40S	0	0
42	MACS 6478 (C)	80S	60S	0	0
43	NI 5439 (C)	80S	60S	40S	40S
44	NIAW 1415 (C)	80S	60S	0	0
45	UAS 304 (C)	80S	40S	0	0
46	UAS 446 (C)	5MS	5S	0	0
VI. SOUTHERN HILLS ZONE					
47	HW 2044 (C)	60S	40S	0	0
48	HW 5216 (C)	60S	40S	0	0
49	CoW (W) -1 (C)	60S	60S	0	0
VII. SPECIAL TRIAL (MABB-IR-LS-CZ/PZ/WB)					
50	DBW 14 (C)	60S	60S	0	0
51	DBW 71 (C)	20MS	20S	0	0
52	DDK 1029 (C)	40S	40S	0	0
53	HW 1098 (C)	40S	40S	0	0
54	Kharchia 65 (C)	80S	60S	60S	40S
55	KRL 19 (C)	80S	60S	40S	0
56	KRL 210 (C)	5S	5S	20S	20S
57	PBW 550 (C)	80S	60S	0	0
58	TL 2942 (C)	10MR	5MS	0	0
59	TL 2969 (C)	10MS	10MR	0	0
60	WR 544 (C)	80S	80S	5S	0
60. A	INFECTOR	80S	80S	60S	60S

Table 1.20. APR in AVT Ist year material against major races of stripe and leaf rust races during 2016-17 at PAU, Ludhiana

S. No.	Entry	Stripe rust		Leaf rust	
		46S119	110S119	77-5	77-9
I. NORTHERN HILLS ZONE					
1	DBW 179	60S	60S	0	0
2	DBW 204	No Seed	No Seed	No Seed	No Seed
3	HPW 434	No Seed	No Seed	No Seed	No Seed
4	HPW 438	No Seed	No Seed	No Seed	No Seed
5	HPW 439	5S	5S	0	0
6	HPW 440	40S	10S	40S	40-60S
7	HPW 448	80S	60S	20S	20S
8	HPW 449	60S	60S	0	10S
9	HS 629	40S	40S	10S	0
10	HS 630	5MS	5MS	0	0
11	HS 643	40S	20S	10S	0
12	HS 644	60S	40S	0	0
13	HS 645	5S	5S	0	0
14	HS 646	60S	40S	0	0
15	HS 647	60S	60S	0	5S
16	HS 648	5MS	5MS	0	0
17	UP 2992	60S	60S	0	0
18	UP 2993	0	0	0	0
19	VL 1011	10MS	0	0	0
20	VL 1012	5S	0	0	10S
20. A	INFECTOR	80S	80S	60S	60S
21	VL 1013	10S	10S	20S	0
22	VL 3013	40S(mixture)	5S	0	0
23	VL 3014	20-40S	5MS	0	0
24	VL 3015	60S	40S	0	0
25	VL 4002	60S	40S	0	10S
26	VL 4003	60S	40S	40S	40S
II. NORTH WESTERN PLAINS ZONE					
27	BRW 3773	20MS	20MS	40S	20S
28	CG 1023	60S	60S	10S	60S
29	DBW 189	60S	60S	0	0
30	DBW 196	60S	60S	0	0
31	HD 3226	TS	5S	0	5MS
32	HD 3237	20MS	10MS	40S	40S
33	HI 1617	80S	60S	0	5S
34	HI 1619	5S	10MS	0	0
35	HI 1620	60S	40S	0	0
36	HP 1963	10MS	20S	40S	20S
37	HS 611	TS	5MS	0	0
38	MACS 6677	20MS	40S	0	10S
39	MP 1318	60S	40S	5S	0
40	PBW 750	20S	20S	0	0
40. A	INFECTOR	80S	80S	60S	60S
41	PBW 752	5S	5MS	10S	0
42	UP 2942	60S	60S	0	0
43	WH 1202	5S	10S	0	10S
III. NORTH EASTERN PLAINS ZONE					
44	DBW 187	20-40S	40S	0	0

S. No.	Entry	Stripe rust		Leaf rust	
		46S119	110S119	77-5	77-9
45	HD 3219	60S	60S	0	10S
46	UAS 384	80S	60S	0	0
IV. CENTRAL ZONE					
47	BRW 3775	60S	60S	0	20S
48	HI 8791 (d)	10MS	10S	0	0
49	UAS 385	80S	60S	0	0
50	UAS 462 (d)	10MS	20MS	0	0
V. SOUTHERN HILLS ZONE					
51	UAS 387	80S	60S	10S	0
VI. SPECIAL TRIAL (Dicoccum, MABB, Salinity and Alkalinity)					
52	DBW 246	5MS	0	10S	10S
53	DBW 247	5MS	10MS	0	0
54	DBW 248	5MS	40S	20S	40S
55	DDK 1052	40S	20S	0	0
56	DDK 1053	40S	40S	0	0
57	KRL 370	40S	40S	0	0
58	KRL 377	80S	60S	20S	40S
59	KRL 384	20S	40S	20S	40S
60	KRL 386	40S	40S	0	10S
60. A	INFECTOR	80S	80S	60S	60S
61	MACS 5047	40S	40S	0	0
62	MACS 5049	40S	40S	0	0
63	PBW 779	10-20S	10S	0	0
64	PBW 780	TS	5MS	0	0
65	WH 1316	20MS	20MS	0	0
VII. SPECIAL TRIAL (TRITICALE)					
66	TL 3011	10MR	10MR	0	0
67	TL 3012	10MS	10MR	0	0
68	TL 3013	10MR	10MR-MS	0	0
69	TL 3014	10MR	10MR	0	0
70	TL 3015	10MR	10MR	0	0
VIII. SPECIAL TRIAL (Very Late Sown)					
71	DBW 249	60S	40S	0	0
72	DBW 250	20MS-40S	40S	0	20S
73	DBW 251	5MS	5MS	0	0
74	HD 3271	40S	20S	0	0
75	HD 3272	5MS	10S, 60S(MIXTURE)	0	5S
76	HI 1621	5MS	10MS	10S	5S
77	PBW 757	5MS	5MS	0	10S
78	PBW 777	5MS	0	0	0
79	PBW 778	40S	20S	0	20S
80	WH 1232	40S	40S	0	0
80. A	INFECTOR	80S	80S	60S	60S
81	WH 1233	10MS	10MS	0	10S
IX. SPECIAL TRIAL (Very High Altitude)					
83	HS 375 (C)	60S	60S	10S	20S
84	HS 490 (C)	60S	60S	0	0

Table 1.21 APR in AVT material against major races of stripe rust during 2016-17 at IARI, New Delhi

Sr. No.	Variety		
		YELLOW RUST	
		46S119	110S119
AVT IInd Year 2016-17			
I. NORTHERN HILL ZONE			
1	HPW 251 (C)	20S	40S
2	HS 375 (C)	20S	40S
3	HS 490 (C)	5MR	TR
4	HS 507 (C)	TR	10MR
5	HS 542 (C)	40S	60S
6	VL 829 (C)	10S	20S
7	VL 892 (C)	TMR	5MS
8	VL 907 (C)	No Seed	No Seed
II. NORTH WESTERN PLAIN ZONE			
9	DBW 173	TMR	10MR
10	DBW 88 (C)	40S	50S
11	DBW 90 (C)	5S	0
12	HD 3043 (C)	10S	20S
13	HD 2967 (C)	40S	60S
14	HD 3059 (C)	40S	60S
15	HD 3086 (C)	0	TR
16	PBW 644 (C)	10MS	20MS
17	WH 1021 (C)	20S	40S
18	WH 1080 (C)	5S	TR
19	WH 1105 (C)	10S	30S
20	WH 1124 (C)	TR	10MR
20. A	INFECTOR	80S	90S
21	WH 1142 C)	0	TR
III. NORTH EASTERN PLAIN ZONE			
22	HI 1612	0	TR
23	C 306 (C)	40S	50S
24	DBW 39 (C)	20S	40S
25	HD 2733 (C)	60S	80S
26	HD 2888 (C)	40S	60S
27	HD 3171 (I) (C)	0	20S
28	K 8027 (C)	20S	40S
29	K 0307 (C)	30S	60S
30	K 1006 (C)	40S	60S
31	K 1317 (I) (C)	10S	20S
IV. CENTRAL ZONE			
32	DBW 110 (C)	40S	60S
33	HI 8627 (d) (C)	TR	5R
34	MP 3288 (C)	40S	60S
V. PENINSULAR ZONE			
35	DBW 168	40S	60S
36	HI 8777 (d)	TR	5MR
37	MACS 4028 (d)	60S	80S
38	UAS 375	60S	80S
39	AKDW 2997-16 (d))C)	0	TR
40	GW 322 (C)	40S	60S
40. A	INFECTOR	90S	90S
41	MACS 6222 (C)	10MS	20MS
42	MACS 6478 (C)	60S	80S
43	NI 5439 (C)	80S	80S
44	NIAW 1415 (C)	80S	80S
45	UAS 304 (C)	40S	40S
46	UAS 446 (C)	0	5MR
VI. SOUTHERN HILLS ZONE			
47	HW 2044 (C)	5MR	5MR
48	HW 5216 (C)	5MR	5MR
49	CoW (W) -1 (C)	60S	80S
VII. SPECIAL TRIAL (MABB-IR-LS-CZ/PZ/WB)			
50	DBW 14 (C)	20S	40S
51	DBW 71 (C)	5MR	TR
52	DDK 1029 (C)	40S	60S
53	HW 1098 (C)	40S	60S
54	Kharchia 65 (C)	80S	90S
55	KRL 19 (C)	80S	80S
56	KRL 210 (C)	0	10MS
57	PBW 550 (C)	60S	60S
58	TL 2942 (C)	0	0
59	TL 2969 (C)	0	0
60	WR 544 (C)	60S	80S
60. A	INFECTOR	90S	90S
AVT Ist Year 2016-17			
I. NORTHERN HILL ZONE			
1	DBW 179	10S	20S
2	DBW 204	No Seed	No Seed
3	HPW 434	No	No

Sr. No.	Variety		
		YELLOW RUST	
		46S119	110S119
		Seed	Seed
4	HPW 438	No Seed	No Seed
5	HPW 439	TR	5MR
6	HPW 440	TR	10MR
7	HPW 448	5MR	10MR
8	HPW 449	20MS	30MS
9	HS 629	TR	5MR
10	HS 630	0	TR
11	HS 643	0	10MR
12	HS 644	TR	10MR
13	HS 645	0	0
14	HS 646	5MR	5MR
15	HS 647	10MR	20MR
16	HS 648	0	0
17	UP 2992	10MR	20S
18	UP 2993	0	0
19	VL 1011	0	0
20	VL 1012	0	0
20. A	INFECTOR	80S	90S
21	VL 1013	0	5MR
22	VL 3013	5MR	0
23	VL 3014	TR	0
24	VL 3015	TMR	5MS
25	VL 4002	TR	5MR
26	VL 4003	TR	20S
II. NORTH WESTERN PLAIN ZONE			
27	BRW 3773	0	TR
28	CG 1023	5MR	10MR
29	DBW 189	60S	60S
30	DBW 196	60S	60S
31	HD 3226	0	5R
32	HD 3237	0	0
33	HI 1617	10MS	10MS
34	HI 1619	0	0
35	HI 1620	TR	5MR
36	HP 1963	5MR	TR
37	HS 611	0	0
38	MACS 6677	5MR	TR
39	MP 1318	0	5MR
40	PBW 750	0	5MR
40. A	INFECTOR	80S	90S
41	PBW 752	0	0
42	UP 2942	10MS	30MS
43	WH 1202	0	0
III. NORTH EASTERN PLAIN ZONE			
44	DBW 187	TR	TR
45	HD 3219	40S	60S
46	UAS 384	40S	60S
IV. CENTRAL ZONE			
47	BRW 3775	5MS	10MS
48	HI 8791 (d)	0	5MR
49	UAS 385	40S	60S
50	UAS 462 (d)	TR	5R
V. SOUTHERN HILLS ZONE			
51	UAS 387	40S	80S
VI. SPECIAL TRIAL (Dicoccum, MABB, Sailinity and Alkalinity)			
52	DBW 246	0	0
53	DBW 247	0	0
54	DBW 248	0	TR
55	DDK 1052	20S	60S
56	DDK 1053	60S	80S
57	KRL 370	5MR	10MR
58	KRL 377	20S	40S
59	KRL 384	TMR	5MR
60	KRL 386	5MR	5MR
60. A	INFECTOR	80S	90S
61	MACS 5047	40S	40S
62	MACS 5049	5MS	10MS
63	PBW 779	0	TR
64	PBW 780	0	TR
65	WH 1316	0	TR
VII. SPECIAL TRIAL (TRITICALE)			
66	TL 3011	0	5R
67	TL 3012	0	0
68	TL 3013	0	0
69	TL 3014	0	TR
70	TL 3015	5MR	10MR
VIII. SPECIAL TRIAL (Very Late Sown)			
71	DBW 249	10MR	0
72	DBW 250	TR	0
73	DBW 251	0	0
74	HD 3271	0	TR

Sr. No.	Variety		
		YELLOW RUST	
		46S119	110S119
75	HD 3272	0	0
76	HI 1621	0	0
77	PBW 757	0	0
78	PBW 777	0	0
79	PBW 778	TR	0
80	WH 1232	0	5MR
80. A	INFECTOR	90S	90S
81	WH 1233	5MR	TR
IX. SPECIAL TRIAL (Very High Altitude)			
82	HS 375 (C)	0	TR
83	HS 490 (C)	10S	20S

Stem rust

The APR was tested against stem rust in case of AVT entries at Indore, Powarkheda and Pune and results are given in Tables 1.23-1.26.

Table 1.22. APR of AVT material against major races of stem rust during 2016-17 at IARI Indore

		PATHOTYPES	
S.NO.	VARIETY	STEM RUST	
		40A	117-6
AVT IInd Year 2016-17			
I. NORTHERN HILL ZONE			
1	HPW 251 (C)	10R	5R
2	HS 375 (C)	0	TR
3	HS 490 (C)	TR	0
4	HS 507 (C)	0	0
5	HS 542 (C)	TS	TS
6	VL 829 (C)	TR	0
7	VL 892 (C)	TS	TMS
8	VL 907 (C)	No Seed	
II. NORTH WESTERN PLAIN ZONE			
9	DBW 173	0	TR
10	DBW 88 (C)	TMS	TR
11	DBW 90 (C)	30S	40S
12	HD 3043 (C)	0	TMR
13	HD 2967 (C)	5MSS	20S
14	HD 3059 (C)	TR	TMR
15	HD 3086 (C)	40S	40S
16	PBW 644 (C)	5MR-MS	10S
17	WH 1021 (C)	10MR-MS	10MR
18	WH 1080 (C)	5MR-MS	5MR-MS
19	WH 1105 (C)	TMS	5MS
20	WH 1124 (C)	40S	40S
20. A	IN0ECTOR	100S	100S
21	WH 1142 C)	20RMR	TS
III. NORTH EASTERN PLAIN ZONE			
22	HI 1612	10S	20S
23	C 306 (C)	50S	30S
24	DBW 39 (C)	0	0
25	HD 2733 (C)	5R	TMR
26	HD 2888 (C)	5RMR	0
27	HD 3171 (I) (C)	TMR	0
28	K 8027 (C)	30S	10S
29	K 0307 (C)	10MR	10MR-MS
30	K 1006 (C)	10MR	5MR-MS
31	K 1317 (I) (C)	10MR	TMR
IV. CENTRAL ZONE			
32	DBW 110 (C)	5RMR	0
33	HI 8627 (d) (C)	TMS	TMR
34	MP 3288 (C)	20R	TMR
V. PENINSULAR ZONE			
35	DBW 168	TMR	0
36	HI 8777 (d)	0	TMR
37	MACS 4028 (d)	TMR	5MR-MS
38	UAS 375	5MR-	5MS

		PATHOTYPES	
S.NO.	VARIETY	STEM RUST	
		40A	117-6
		MS	
39	AKDW 2997-16 (d))C)	TS	10MSS
40	GW 322 (C)	TS	5MR
40. A	IN0ECTOR	100S	100S
41	MACS 6222 (C)	5R	TMR
42	MACS 6478 (C)	TMR	5S
43	NI 5439 (C)	50S	TS
44	NIAW 1415 (C)	TR	0
45	UAS 304 (C)	5R	TMR
46	UAS 446 (C)	5MR	10S
VI. SOUTHERN HILLS ZONE			
47	HW 2044 (C)	5S	10S
48	HW 5216 (C)	TR	TR
49	CoW (W) -1 (C)	TR	0
VII. SPECIAL TRIAL (MABB-IR-LS-CZ/PZ/WB)			
50	DBW 14 (C)	5MR	0
51	DBW 71 (C)	5RMR	5MR
52	DDK 1029 (C)	TR	0
53	HW 1098 (C)	5R	5S
54	Kharchia 65 (C)	60S	40S
55	KRL 19 (C)	5R	TR
56	KRL 210 (C)	10MSS	30S
57	PBW 550 (C)	10MR	0
58	TL 2942 (C)	0	0
59	TL 2969 (C)	0	0
60	WR 544 (C)	60MSS	5MSS
60. A	IN0ECTOR	100S	100S
AVT Ist Year 2016-17			
I. NORTHERN HILL ZONE			
1	DBW 179	5MSS	TS
2	DBW 204	NS	
3	HPW 434	NS	
4	HPW 438	NS	
5	HPW 439	30S	10MSS
6	HPW 440	5S	5MSS
7	HPW 448	TMR	0
8	HPW 449	TMR	0
9	HS 629	TMR	0
10	HS 630	5MR-	TMS

		PATHOTYPES	
S.NO.	VARIETY	STEM RUST	
		40A	117-6
		MS	
11	HS 643	TMR	TS
12	HS 644	TMR	TS
13	HS 645	10S	5S
14	HS 646	0	5S
15	HS 647	TMR	TS
16	HS 648	20S	10S
17	UP 2992	20S	TS
18	UP 2993	5MR	TR
19	VL 1011	10MSS	TS
20	VL 1012	TMR	TS
20. A	IN0ECTOR	100S	100S
21	VL 1013	40S	5S
22	VL 3013	5MR	TS
23	VL 3014	TS	TMS
24	VL 3015	20S	5S
25	VL 4002	30S	10S
26	VL 4003	20S	5S
II. NORTH WESTERN PLAIN ZONE			
27	BRW 3773	10MR-MS	5MR-MS
28	CG 1023	10S	TS
29	DBW 189	TS	0
30	DBW 196	TS	TMR
31	HD 3226	10MR-MS	TMR
32	HD 3237	5MR-MS	5MR-MS
33	HI 1617	10MSS	10S
34	HI 1619	40S	20S
35	HI 1620	TMR	5MR-MS
36	HP 1963	20MR	10MSS
37	HS 611	10MSS	10S
38	MACS 6677	20MR-MS	5S
39	MP 1318	30MR-MS	TMR
40	PBW 750	5S	10MSS
40. A	IN0ECTOR	100S	100S
41	PBW 752	10S	TS
42	UP 2942	5S	TMR

		PATHOTYPES	
S.NO.	VARIETY	STEM RUST	
		40A	117-6
43	WH 1202	40MSS	10MSS
III. NORTH EASTERN PLAIN ZONE			
44	DBW 187	TMR	TS
45	HD 3219	10MSS	TS
46	UAS 384	5MSS	5MSS
IV. CENTRAL ZONE			
47	BRW 3775	5S	5MR-MS
48	HI 8791 (d)	TMR	TMR
49	UAS 385	5MR	5S
50	UAS 462 (d)	TMS	TMS
V. SOUTHERN HILLS ZONE			
51	UAS 387	10R	5MR-MS
VI. SPECIAL TRIAL (Dicoccum, MABB, Sailinity and Alkalinity)			
52	DBW 246	5MSS	5MR
53	DBW 247	10MR-MS	5MS
54	DBW 248	20MR-MS	10MS
55	DDK 1052	5MR	TMS
56	DDK 1053	5MR	5MSS
57	KRL 370	10S	5MS
58	KRL 377	5S	5S
59	KRL 384	40MSS	5MSS
60	KRL 386	40MSS	5S
60. A	IN0ECTOR	100S	100S
61	MACS 5047	5MR	5MR-MS
62	MACS 5049	TMR	0

		PATHOTYPES	
S.NO.	VARIETY	STEM RUST	
		40A	117-6
63	PBW 779	10MR-MS	0
64	PBW 780	5S	5S
65	WH 1316	20MSS	5MR-MS
VII. SPECIAL TRIAL (TRITICALE)			
66	TL 3011	0	TMR
67	TL 3012	TMR	0
68	TL 3013	TMR	TMR
69	TL 3014	0	0
70	TL 3015	0	TMR
VIII. SPECIAL TRIAL (Very Late Sown)			
71	DBW 249	TMR	5S
72	DBW 250	10MR-MS	5MSS
73	DBW 251	20S	30S
74	HD 3271	20MSS	40S
75	HD 3272	10MSS	10MSS
76	HI 1621	30MSS	30S
77	PBW 757	20MSS	5MS
78	PBW 777	20MSS	10MR-MS
79	PBW 778	5S	5S
80	WH 1232	10MSS	40S
80. A	IN0ECTOR	100S	100S
81	WH 1233	20S	10MSS
IX. SPECIAL TRIAL (Very High Altitude)			
82	HS 375 (c)	10S	10S
83	HS 490 (c)	TMR	5MR

Table 1.23. APR of AVT material against major races of stem rust during 2016-17 at ARI Pune

Sr. No.	Variety	PATHOTYPES	
		STEM RUST	
		40A	117-6
AVT IInd Year 2016-17		30/3/2017	30/3/2017
I. NORTHERN HILL ZONE			
1	HPW 251 (C)	10MS	10MR
2	HS 375 (C)	TR	5MR

Sr. No.	Variety	PATHOTYPES	
		STEM RUST	
		40A	117-6
3	HS 490 (C)	TR	5MR
4	HS 507 (C)	TR	5 MR
5	HS 542 (C)	TR	TR
6	VL 829 (C)	10 MR	5 MR
7	VL 892 (C)	5 MR	10 MR

Sr. No.	Variety	PATHOTYPES	
		STEM RUST	
		40A	117-6
8	VL 907 (C)	No Seed	
II. NORTH WESTERN PLAIN ZONE			
9	DBW 173	10 MS	10 MR
10	DBW 88 (C)	TR	50 MR
11	DBW 90 (C)	20 S	30 S
12	HD 3043 (C)	30 MR	20 MR
13	HD 2967 (C)	20 MS	20 MS
14	HD 3059 (C)	TR	5 MR
15	HD 3086 (C)	10 MS	10 MR
16	PBW 644 (C)	20 S	5 MR
17	WH 1021 (C)	30 S	10 MR
18	WH 1080 (C)	20 MR MS	10 MR
19	WH 1105 (C)	20 MS	5 MR
20	WH 1124 (C)	40 MS	20 MS
20. A	INFECTOR	80 S	80 S
21	WH 1142 C)	20 MR	10 MR
III. NORTH EASTERN PLAIN ZONE			
22	HI 1612	10 MR	10 MR
23	C 306 (C)	40 S	40 S
24	DBW 39 (C)	20 MR	20 MR
25	HD 2733 (C)	5 MR	10 MR
26	HD 2888 (C)	20 MS	20 MR
27	HD 3171 (I) (C)	40 MS	20 MR
28	K 8027 (C)	40 S	40 MS
29	K 0307 (C)	20 S	20 MR
30	K 1006 (C)	40 MR	10 MR
31	K 1317 (I) (C)	20 MR	5 MR
IV. CENTRAL ZONE			
32	DBW 110 (C)	10 MR	10 MR
33	HI 8627 (d) (C)	40 MS	30 S
34	MP 3288 (C)	20 MR	20 MS
V. PENINSULAR ZONE			
35	DBW 168	10 MR	20 MR
36	HI 8777 (d)	10 MR	20 MR
37	MACS 4028 (d)	20 MR	30 MS

Sr. No.	Variety	PATHOTYPES	
		STEM RUST	
		40A	117-6
38	UAS 375	10 MR	20 MR
39	AKDW 2997-16 (d))C)	20 MR	40 MS
40	GW 322 (C)	20 MR	20 MS
40. A	INFECTOR	80 S	80 S
41	MACS 6222 (C)	5 MR	5 MR
42	MACS 6478 (C)	40 S	20 MR
43	NI 5439 (C)	40 S	40 MS
44	NIAW 1415 (C)	20 MR	10 MR
45	UAS 304 (C)	20 MS	40 MR
46	UAS 446 (C)	20 MR	20 S
VI. SOUTHERN HILLS ZONE			
47	HW 2044 (C)	40 MR	20 MR
48	HW 5216 (C)	20 MR	10 MR
49	CoW (W) -1 (C)	10 MR	5 MR
VII. SPECIAL TRIAL (MABB-IR-LS-CZ/PZ/WB)			
50	DBW 14 (C)	20 MR MS	5 MR
51	DBW 71 (C)	40 MR MS	20 MR
52	DDK 1029 (C)	5 MR	20 MR
53	HW 1098 (C)	20 MR	20 MR
54	Kharchia 65 (C)	60 S	60 S
55	KRL 19 (C)	5 MR	20 MR
56	KRL 210 (C)	20 S	40 MS
57	PBW 550 (C)	20 MS	20 MR
58	TL 2942 (C)	10 MR	10 MR
59	TL 2969 (C)	20 MR	5 MR
60	WR 544 (C)	20 S	20 MR
60. A	INFECTOR	80 S	80 S
AVT Ist Year 2016-17			
I. NORTHERN HILL ZONE			
1	DBW 179	10 MR	20 MR
2	DBW 204	No Seed	--
3	HPW 434	NS	--
4	HPW 438	NS	--
5	HPW 439	30 S	20 MR
6	HPW 440	20 MS	20 MR
7	HPW 448	5 MR	10 MR
8	HPW 449	10 MR	20 MR

Sr. No.	Variety	PATHOTYPES	
		STEM RUST	
		40A	117-6
9	HS 629	20 MR	5 MR
10	HS 630	30 MR	5 MR
11	HS 643	10 MR	5 MR
12	HS 644	20 MR MS	10 MR
13	HS 645	20 MS	20 MR
14	HS 646	10 MR	10 MR
15	HS 647	30 S	10 MR
16	HS 648	40 S	20 MR
17	UP 2992	20 S	5 MR
18	UP 2993	10 MR	20 MR
19	VL 1011	20 MR	5 MR
20	VL 1012	20 MR	10 MR
20. A	INFECTOR	80 S	80 S
21	VL 1013	60 S	40 MS
22	VL 3013	10 MR	10 MR
23	VL 3014	5 MR	10 MR
24	VL 3015	10 MR	5 MR
25	VL 4002	40 MS	10 MR
26	VL 4003	TR	10 MR
II. NORTH WESTERN PLAIN ZONE			
27	BRW 3773	5 MR	5 MR
28	CG 1023	10 MR	40 MS
29	DBW 189	20 MS S	5 MR
30	DBW 196	5 MR	5 MR
31	HD 3226	5 MR	20 MR
32	HD 3237	5 MR	10 MR
33	HI 1617	20 MR	20 MS
34	HI 1619	40 S	10 MR
35	HI 1620	20 MR MS	5 MR
36	HP 1963	20 MS S	10 MR
37	HS 611	10 MR	10 MR
38	MACS 6677	10 MR	20 MR
39	MP 1318	20 MR	10 MR
40	PBW 750	20 MR MS	20 MR
40. A	INFECTOR	80 S	80 S
41	PBW 752	30 S	20 MS S
42	UP 2942	20 S	10 MR
43	WH 1202	30 S	40 MS S
III. NORTH EASTERN PLAIN ZONE			
44	DBW 187	10 MR	5 MR
45	HD 3219	5 MR	10 MR
46	UAS 384	20 MR MS	10 MR
IV. CENTRAL ZONE			
47	BRW 3775	20 MR	20 MS

Sr. No.	Variety	PATHOTYPES	
		STEM RUST	
		40A	117-6
48	HI 8791 (d)	10 MR	10 MR
49	UAS 385	5 MR	10 MR
50	UAS 462 (d)	20 MR	40 MS
V. SOUTHERN HILLS ZONE			
51	UAS 387	40 MS	5 MR
52	DBW 246	40 MR	10 MR
53	DBW 247	20 MR	5 MR
54	DBW 248	30 S	10 MR
55	DDK 1052	40 MR	10 MR
56	DDK 1053	20 MS	20 MR
57	KRL 370	10 MR MS	5 MR
58	KRL 377	20 MR MS	10 MR
59	KRL 384	20 MR	40 MS
60	KRL 386	40 MS	10 MR
60. A	INFECTOR	80 S	80 S
61	MACS 5047	20 MR	10 MR
62	MACS 5049	20 MR	10 MR
63	PBW 779	20 MR	20 MR
64	PBW 780	20 MR	20 MR
65	WH 1316	40 MS	20 MS
VII. SPECIAL TRIAL (TRITICALE)			
66	TL 3011	10 MR	10 MR
67	TL 3012	10 MR	5 MR
68	TL 3013	10 MR	10 MR
69	TL 3014	20 MR	10 MR
70	TL 3015	10 MR	20 MR
VIII. SPECIAL TRIAL (Very Late Sown)			
71	DBW 249	20 S	10 MR
72	DBW 250	40 MR	20 MS
73	DBW 251	20 MR	40 S
74	HD 3271	40 MS	40 MS
75	HD 3272	10 MR	40 MS
76	HI 1621	40 MR	10 MR
77	PBW 757	40 S	20 MR
78	PBW 777	20 MR	10 MR
79	PBW 778	20 MR	40 MR
80	WH 1232	40 MR	20 MS
80. A	INFECTOR	80 S	80 S
81	WH 1233	40 S	40 MS
IX. SPECIAL TRIAL (Very High Altitude)			
82	HS 375 (c)	40 MS	40 MS
83	HS 490 (c)	10 MR	5 MR

Table 1.24. Adult Plant Resistance Test of wheat genotypes from AVT I & II year (CZ and PZ) against selective pathotypes of stem rust at Mahabaleshwar during 2016-17

S No.	Genotype	40A	117-6	SNo.	Genotype	40A	117-6
AVT – I :CENTRAL ZONE				36	HI-8777 (d)	TR	10S
47	BRW-3775	5MR	TMR	37	MACS-4028 (d)	TR	TMR
48	HI-8791(d)	10S	10S	38	UAS-375	TMR	10MR
49	UAS-385	TR	TMR	39	AKDW-2997-16 (d) (C)	TMR	10S
50	UAS-462 (d)	TR	TMS	40	GW-322 (C)	5MR	TR
AVT – II :CENTRAL ZONE				40A	INFECTOR	40S	30S
32	DBW-110 (C)	TR	TMS	41	**MACS-6222 (C)**	TR	TR
33	HI-8627 (d) (C)	10S	TR	42	MACS-6478 (C)	10S	TR
34	MP-3288 (C)	TR	TMR	43	NI-5441 (C)	TS	TR
AVT – II :PENINSULAR ZONE				44	**NIAW-1415 (C)**	TR	TR
35	DBW-168	TR	TR	45	UAS-304 (C)	TR	10MR
				46	UAS-446 (C)	TMR	TR

Table 1.25. APR of AVT I & II year (CZ and PZ) entries against selective pathotypes of stem rust at Powarkheda during 2016-17

Sr. No.	Variety	Stem rust pathotye	Leaf rust pathotye
		40A	**77-5**
AVT IInd Year 2016-17			
I. NORTHERN HILL ZONE			
1	HPW 251 (C)	20MS	15MS
2	HS 375 (C)	10MS	TR
3	HS 490 (C)	10MS	20MS
4	HS 507 (C)	10MS	TR
5	HS 542 (C)	30MS	10MR
6	VL 829 (C)	40S	15MS
7	VL 892 (C)	10MS	0
8	VL 907 (C)	No seed	No seed
II. NORTH WESTERN PLAIN ZONE			
9	DBW 173	80S	10MS
10	DBW 88 (C)	20MR	20S
11	DBW 90 (C)	40S	15MS
12	HD 3043 (C)	40S	TR
13	HD 2967 (C)	30MS	TR
14	HD 3059 (C)	30MS	TR
15	HD 3086 (C)	70S	10MS
16	PBW 644 (C)	40MS	10MR
17	WH 1021 (C)	20MS	20MS
18	WH 1080 (C)	10MR	TR

Sr. No.	Variety	Stem rust pathotye	Leaf rust pathotye
		40A	**77-5**
19	WH 1105 (C)	40S	10MS
20	WH 1124 (C)	20S	30S
20. A	INFECTOR	100S	100S
21	WH 1142 C)	TR	TR
III. NORTH EASTERN PLAIN ZONE			
22	HI 1612	TR	0
23	C 306 (C)	30S	20MS
24	DBW 39 (C)	0	0
25	HD 2733 (C)	0	0
26	HD 2888 (C)	0	0
27	HD 3171 (I) (C)	80S	40S
28	K 8027 (C)	5MR	TR
29	K 0307 (C)	80S	TR
30	K 1006 (C)	70S	10MR
31	K 1317 (I) (C)	30MR	TR
IV. CENTRAL ZONE			
32	DBW 110 (C)	30MS	0
33	HI 8627 (d) (C)	TR	TR
34	MP 3288 (C)	20MS	TR
V. PENINSULAR ZONE			
35	DBW 168	30MS	TR
36	HI 8777 (d)	30MS	TR

Sr. No.	Variety	Stem rust pathotye	Leaf rust pathotye
		40A	77-5
37	MACS 4028 (d)	TR	TR
38	UAS 375	20MS	TR
39	AKDW 2997-16 (d))C)	40S	10MR
40	GW 322 (C)	40S	10MS
40. A	INFECTOR	100S	100S
41	MACS 6222 (C)	30MS	30MS
42	MACS 6478 (C)	40S	10MS
43	NI 5439 (C)	30MS	20MS
44	NIAW 1415 (C)	30MS	10MS
45	UAS 304 (C)	10MR	TR
46	UAS 446 (C)	20MS	TR
VI. SOUTHERN HILLS ZONE			
47	HW 2044 (C)	TR	0
48	HW 5216 (C)	20MS	TR
49	CoW (W) -1 (C)	20MS	0
50	DBW 14 (C)	40MS	20MS
51	DBW 71 (C)	20MS	TR
52	DDK 1029 (C)	0	0
53	HW 1098 (C)	TR	0
54	Kharchia 65 (C)	100S	70S
55	KRL 19 (C)	60S	20MS
56	KRL 210 (C)	60S	TR
57	PBW 550 (C)	20MS	10MR
58	TL 2942 (C)	0	0
59	TL 2969 (C)	0	0
60	WR 544 (C)	40S	10MS
60. A	INFECTOR	100S	100S
AVT Ist Year 2016-17			
I. NORTHERN HILL ZONE			
1	DBW 179	40S	TR
2	DBW 204	No Seed	No Seed
3	HPW 434	No Seed	No Seed
4	HPW 438	No Seed	No Seed
5	HPW 439	80S	TR
6	HPW 440	60S	10MS
7	HPW 448	20MS	5MR
8	HPW 449	20MS	TR
9	HS 629	20MS	0
10	HS 630	30MS	15MS
11	HS 643	20MS	TR
12	HS 644	20MS	TR
13	HS 645	60S	20MS

Sr. No.	Variety	Stem rust pathotye	Leaf rust pathotye
		40A	77-5
14	HS 646	20MS	5MR
15	HS 647	30MS	TR
16	HS 648	80S	10MS
17	UP 2992	40S	15MS
18	UP 2993	30MS	TR
19	VL 1011	20MS	TR
20	VL 1012	30MS	0
20. A	INFECTOR	100S	100S
21	VL 1013	80S	10MS
22	VL 3013	10MR	TR
23	VL 3014	30MS	10MS
24	VL 3015	30MS	5MR
25	VL 4002	40MS	TR
26	VL 4003	40S	TR
II. NORTH WESTERN PLAIN ZONE			
27	BRW 3773	50S	TR
28	CG 1023	30MS	TR
29	DBW 189	80S	10MS
30	DBW 196	30MS	TR
31	HD 3226	20MS	0
32	HD 3237	30MS	0
33	HI 1617	40S	10MS
34	HI 1619	50S	TR
35	HI 1620	30S	0
36	HP 1963	30MS	TR
37	HS 611	20MS	TR
38	MACS 6677	20MS	0
39	MP 1318	20MS	0
40	PBW 750	60S	0
40. A	INFECTOR	100S	100S
41	PBW 752	100S	40S
42	UP 2942	60S	TR
43	WH 1202	40S	10MS
III. NORTH EASTERN PLAIN ZONE			
44	DBW 187	20MS	10MS
45	HD 3219	30MS	TR
46	UAS 384	30MS	TR
IV. CENTRAL ZONE			
47	BRW 3775	60S	40MS
48	HI 8791 (d)	TR	TR
49	UAS 385	20MS	TR
50	UAS 462 (d)	TR	TR
V. SOUTHERN HILLS ZONE			
51	UAS 387	30MS	TR
52	DBW 246	60S	0

Sr. No.	Variety	Stem rust pathotye	Leaf rust pathotye
		40A	**77-5**
53	DBW 247	TR	TR
54	DBW 248	60S	TR
55	DDK 1052	TR	TR
56	DDK 1053	TR	TR
57	KRL 370	60S	TR
58	KRL 377	60S	10MS
59	KRL 384	60S	10MS
60	KRL 386	60S	TR
60. A	INFECTOR	100S	100S
61	MACS 5047	TR	TR
62	MACS 5049	TR	TR
63	PBW 779	30S	TR
64	PBW 780	60S	0
65	WH 1316	60S	TR
66	TL 3011	TR	0
67	TL 3012	TR	0
68	TL 3013	TR	0
69	TL 3014	TR	0

Sr. No.	Variety	Stem rust pathotye	Leaf rust pathotye
		40A	**77-5**
70	TL 3015	TR	0
VIII. SPECIAL TRIAL (Very Late Sown)			
71	DBW 249	80S	TR
72	DBW 250	40S	0
73	DBW 251	20MS	0
74	HD 3271	20MS	10MR
75	HD 3272	40S	TR
76	HI 1621	30S	0
77	PBW 757	50S	TR
78	PBW 777	30MS	0
79	PBW 778	30MS	10MR
80	WH 1232	30S	0
80. A	INFECTOR	100S	70S
81	WH 1233	40S	0
IX. SPECIAL TRIAL (Very High Altitude)			
82	HS 375 (c)	40S	TR
83	HS 490 (c)	30MS	10MR

COOPERATORS:				
NAME	**CENTRES**		**NAME**	**CENTRES**
RAKESH DEVLASH	BAJAURA		S.G. SAWASHE, N. V. SAVANT, M. A. GUD	MAHABALESHWAR
A.K. BASANDRAI, SACHIN UPMANYU	MALAN		B.C. GAME, P. E. More	NIPHAD
V.K. SINGH	NEW DELHI		P. NALLATHAMBI, C.UMAMAHESHWARI	WELLINGTON
V.K. RATHEE	DHAULAKUAN		JAVED BAHAR KHAN	KANPUR
JASPAL KAUR, RITU BALA	LUDHIANA		S.P. SINGH, J. VERMA	FAIZABAD
DEEP SHIKHA, KANAK SRIVASTAVA	PANTNAGAR		S.S. VAISH	VARANASI
S.S. KARWASARA, R. S. BENIWAL	HISAR		SUNITA MAHAPATRA, DHIMAN MUKHERJEE	KALYANI
M. K. PANDEY	JAMMU		C.S.AZAD	SABOUR
P.S. SEKHAWAT	DURGAPURA		SATYAJIT HEMBRAM	COOCHBEHAR
K. K. MISHRA	POWARKHEDA		H.C. LAL	RANCHI
I.B. KAPADIA	JUNAGARH		ASHISH KUMAR GUPTA	PUSA, BIHAR
PRAKASHA, T.L.	INDORE		S.C.BHARDWAJ, PRAMOD PRASAD, OP GANGWAR	FLOWERDALE, SHIMLA
S.I. PATEL	VIJAPUR		R.S.BAL	GURDASPUR
P.V. PATIL	DHARWAD		D.P. SINGH, SUDHEER KUMAR, P.L. KASHYAP	KARNAL (COORDINATING UNIT
B.K. HONRAO	PUNE			

PROGRAMME 2: RESISTANT SOURCES TO DIFFERENT DISEASES AND THEIR UTILIZATION

The AVT entries and entries from other national and international nurseries were tested against major diseases at hot spot locations under artificially inoculated and disease epiphytotic conditions using standard rating scales and procedure for their resistance. The details are given in the programme of work and location wise data in Annexure Tables. The entries found resistance against three or two rusts in PPSN were again tested in EPPSN for their resistance against three rusts as well as in MDSN against other diseases. The resistant sources identified are given as below along with those sent for utilization at different wheat breeding centres in NGSN (Table 2.1):

Confirmed sources of resistant
Rusts (ACI 0-10.0 only)
Source: EPPSN, 2016-17
A. Resistant to all three rusts: HI 8759 (d), PBW 723 (Source: AVT IInd year 2015-16), HI 8774 (d), HPPAU 05, HPW 423, HPW 433, HS 622, HS 623, HS 626, HS 628, PBW 725, PBW 756, PBW 760, RKD 283 (d), TL 3006 (T), TL 3007 (T), TL 3008 (T), TL 3009 (T), VL 3002, VL 3012, WH 1181, WH 1216, WH 1310, HS 627, WH 1184, (Source: AVT Ist year 2015-16)
B. Resistant to Stem and Leaf rusts: HD 3171, HD 3209, WB 2 (Source: AVT IInd year 2015-16), AKAW 4842, DBW 179, DBW 216, DBW 217, DBW 219, DDK 1051 (dic.), MACS 5044 (dic.), MACS 5046 (dic.), NW 6094, PBW 621, RKD 292 (d), VL 4001, WH 1215, UP 2955, VL 3011 (Source: AVT Ist year 2015-16)
C. Resistant to Leaf and Stripe rusts: DBW 220, PBW 757, HPPAU 10, HPW 424, NW 6046, PDW 344 (d), UAS 459 (d), UP 2954 (Source: AVT Ist year 2015-16)
D. Resistant to Stem and Stripe rusts: HS 580 (Source: AVT Ist year 2015-16).
The detailed data on three rusts of EPPSN entries are given in Annexure Table 2.1.

MDSN (2016-17)
A. Resistant to all three rust
PBW 723, HS 580,
+ Loose smut (Highest score 5%): HI 8737 (d) (Source: AVT IInd year, 2013-14), HD 4730 (d), HI 8750 (d), HI 8751 (d), TL 2995 (T), TL 2996 (T), TL 3000 (T) (Source: AVT I YEAR 2013-14)
+ KB+FS: MACS 3970 (d), MACS 3972 (d), HI8765 (d)
+KB+PM+FS: HS 599, TL 3002(T)
+ PM+FS: TL 3001 (T), TL 3003 (T), TL 3004 (T), TL 3005 (T), K 1314, PBW 709
+LB+FS: HS 596, HS 597
+KB: HI 8765 (d)
+FS: VL 3007, WB5, HPW 422, MACS 4024.
B. Resistant to Stem and leaf rust: DBW 182, HD 3164, HPBW 01, HUW 712, K 1313, VL 3008, HI 1604.
+LB+KB: K 1315
+LB+PM: BW- 1
+PM: PBW 719
+FS: HPBW 02, HUW 695, HPBW 08, WH 1309, HS 600,
+KB+FS: DDK 1048 (dic), MACS 5041, MACS 5043, K 1312, GW 463, UP 2383
+KB+PM+FS: DDK 1049 (dic.), GW 1315 (d), MACS 4020 (d),DDW31
+LB: DBW 150,KRL 350,KRL 351,PBW 716,VL 4001,HPBW 09
C. Resistant to leaf and stripe rust: HD 3165, PBW 721

+KB+FS: UAS 453 (d), UAS 455 (d)
+PM+FS: PBW 718
+FS: DDW 32, DBW 147
D. Resistant to stem and stripe: PBW 707, HD 3159
+KB+FS: UAS 428 (d)
+FS: DBW 184, HPBW 07
+KB: HS 583
The detailed data on three rusts and other diseases of MDSN entries are given in Annexure Tables 2.2 and 2.3.

MPSN (2016-17)

Out of 87 multiple rust resistant entries tested against insect pests at hot spot locations followings were found promising:

Shoot fly (SF): IWP 72 (C) (with 6.52% SF).

Brown wheat mite (BWM): WB1 (6.00 mites/ 10 cm^2).

Foliar aphid: At Karnal location, four entries namely PBW -723, MACS 4020 (d), MACS 5041 and MACS 5043 were rated as moderately resistant (grade 3).

Root aphid: At Ludhiana the entry WB1 was found to be resistant (grade 2) to root aphid. Sixteen entries were also found to be moderately resistant (grade 3) to root aphid.

The details are given in Table 2.

(Abbreviations: EPPSN: Elite Plant Pathological Screening Nursery, MDSN: Multiple Disease Screening Nursery, KB: Karnal bunt, LB: leaf Blight, PM: Powdery Mildew, FS: Flag Smut, LS: Loose Smut, FHB: Fusarium Head Blight, HB: Hill Bunt, FR: Foot Rot, d: *T. durum*. dic. *T. dicoccum*, C: released check variety, T: Triticale)

Resistant entries found in PPSN (2016-17):
Rust Resistance materials in AVT IInd and Ist Year (2015-16) with ACI upto 10.0 are given below:

Stem, Leaf and Stripe Rusts
WH 1080 (C), WH 1142 (C), HI 1612, MACS 6222(C), UAS 446 (C), DBW 71(C), TL 2942 (C), TL 2969 (C) (Source: AVT IInd Year, 2016-17)
HS 630, UP 2993, VL 1011, VL 1012, VL 3013, VL 3014, HD 3226, HS 611, DBW 187, HI 8791 (d), UAS 462 (d), TL 3011, TL 3012, TL 3013, TL 3014, TL 3015, PBW 777, PBW 778, WH 1232(Source: AVT Ist Year, 2016-17)

A. Stem and Leaf Rusts
HPW 251 (C), HS 375 (C), HS 490 (C), HD 2967 (C) DBW 39 (C), HD 2888 (C), K 1317 (I) (C), DBW 110 (C), HI 8627 (d) (C), MP 3288 (C), DBW 168, UAS 375, NIAW 1415 (C), HW 2044 (C), HW 5216 (C), CoW (W) -1 (C), DDK 1029 (C), HW 1098 (C), PBW 550 (C) (Source: AVT IInd Year, 2016-17)
HPW 448, HPW 449, HS 644, HS 646, MP 1318, HD 3219, DDK, 1052, DDK 1053, MACS 5047, MACS 5049, HS 375 (C) (Source: AVT Ist Year, 2016-17)

B. Leaf and Stripe rusts

HS 507 (C), HS 542 (C), VL 829 (C), VL 892 (C), HI 8777 (d), AKDW 2997-16 (d)(C), KRL 210 (C) (Source: AVT IInd Year, 2016-17)

HS 648, HD 1620, PBW 750, KRL 370, PBW 780, WH 1316, DBW 251, HD 3271, HD 3272, PBW 757, WH 1233(Source: AVT Ist Year, 2016-17) (Details are given in Tables 1.2-1.3 of programme 1)

RESISTANT TO OTHER DISEASES

LEAF BLIGHT

Moderately resistance (average leaf blight score below 35 and the HS of 57 in 0-9 dd scale)

HI 1612, VL 829 (C), C 306 (C) (Source: AVT II year, 2016-17),

VL 4001, UP2955, HD 3184, VL 4001 (Source: AVT I 2016-17year)

Moderately resistant except that HS at one location was higher than 57

HD 2967 (C), HS 375 (C), HS 507 (C) and HD 3043 (C) (Source: AVT II year, 2016-17),

HS 645, VL 1013, UP 2942, UP 2993, VL 4002 and HS 630, HS 643, UAS 462 (d), DBW 247, UP 2992, MP 1318, HD 3272, WH 1233, PBW 778, HS 646 and DBW 189 (Source: AVT I year, 2016-17). The details of leaf blight score of different entries at three growth stages and at different hot spot locations are given in Annexure Tables 2.5-2.6).

KARNAL BUNT

Resistant (Av. KB incidence upto 5%):

HI 8777 (d), TL 2969 (C), WR 544 (C), CoW (W) -1 (C), DBW 14 (C), WH 1021 (C), UAS 446 (C), HPW 251 (C), TL 2942 (C), DBW 110 (C), HS 490 (C), K 1006 (C), KRL 210 (C), HI 8627 (d) (C), HD 2733 (C) and AKDW 2997-16 (d) (C) (Source: AVT IInd Year 2016-17).

HI 1619, TL 3014, VL 3013, VL 4002, TL 3012, VL 1013, VL 3014, HS 644, HD 3219, HS 647, VL 3015, TL 3011, TL 3015, WH 1202, DBW 187, HPW 448, MP 1318, WH 1316, HPW 439, CG 1023, RL 377, DBW 251, HD 3271, HD 3237, DBW 250, HS 630, HS 643, PBW 780, DDK 1052, HS 645, UP 2942, VL 1011, HS 629, HS 646, PBW 777, HPW 440, HS 648, BRW 3775, UAS 387, DBW 247, WH 1233, UAS 385, PBW 779, VL 4003, HP 1963, PBW 757, WH 1232, HPW 449, KRL 384, HD 3226, HS 611, DBW 196, KRL 370, TL 3013, HI 1620, KRL 386, DBW 249, BRW 3773, PBW 752, MACS 5049, HD 3272, DBW 189, HI 1617, HI 1621, DBW 248, PBW 778, DBW 246, UP 2993, MACS 6677, DDK 1053, HS 375 (C) and HS 490(C) (Source: AVT Ist Year 2016-17) The details of Karnal bunt (% infection) of different entries at hot spot locations are given in Annexure Table 2.7).

POWDERY MILDEW

Resistant (Av. PM score 0-3, highest score upto 5):

DBW 173, TL 2942 (C), TL 2969 (C), DDK 1029 (C), HPW 251 (C), VL 829 (C), HD 3043 (C) and DBW 14 (C) (Source: AVT II[nd] Year 2016-17)

TL 3011, TL 3012, TL 3013, TL 3014, TL 3007, MACS 5047, MACS 5049, TL 3015, DDK 1050, TL 3008, HS 630, DDK 1053, WB 2 , MACS 5044, DBW 179, HPW 448, HPW 449, HS 644, HS 645, HS 646, VL 3013, VL 3014, HI 1619, HS 611, DBW 247, DDK 1052, HD 3272, PBW 737 and KA 1427 (Source: AVT Ist Year 2016-17)

The details of powdery mildew scores of different entries at hot spot locations are given in Annexure Table 2.9).

LOOSE SMUT

Highly resistant (Free from LS) (No infection at any location):

HI 8759 (D), HD 4728 (D) (I) (C), HI 8498 (D) (C) and UAS 446 (d) (C)

Resistant (Average score: 0.1-5.0 % LS infection):

UAS 428 (d) (C), VL 829 (C), HI 8737 (D) (C), TL 2969 (C), DDK 1029 (C), TL 2942 (C), WH 1124 (C), HW 1098 (C), KRL 210 (C) and HD 3086 (C) (Source: AVT II[nd] year, 2015-16)
TL 3009, TL 3010, UP 2955, TL 3007, VL 3002, DDK 1051, PDW 344 (D), RKD 283 (D), MACS 5046, HPW 433, MACS 4028 (D), HPW 432, VL 3011, UAS 459 (D) and MACS 5044 (AVT I[st] Year, 2015-16
The details of loose smut (% infection) of different entries of AVT Ist year, 2015-16 at hot spot locations are given in Annexure Table 2.8).

FUSARIUM HEAD BLIGHT (FHB) OR HEAD SCAB
Resistant entries: Nil (details are given in Annexure Table 2.10).

FLAG SMUT
Highly resistant (Free FS infection): HI 8777 (d), UAS 304 (C), HW 2044 (C), CoW (W) -1 (C), DDK 1029 (C), HW 1098 (C), TL 2942 (C), TL 2969 (C) and WR 544 (C) (Source: AVT II[nd] Year 2016-17).
HI 8791 (d), UAS 462 (d), DDK 1052, KRL 384, MACS 5047, TL 3011, TL 3012, TL 3013, TL 3014, TL 3015, DBW 249 and DBW 250 (Source: AVT Ist Year 2016-17).

Resistant (upto 10% FS infection):
UAS 375, HI 1612, PBW 550, DBW 173, MACS 4028 (d), DBW 168, WH 1105 (C), NIAW 1415 (C), KRL 210 (C), K 1317 (I) (C), DBW 88 (C), K 0307 (C), DBW 110 (C), DBW 14 (C), HD 3171 (I) (C), HD 8627 (d) (C), VL 829 (C), AKDW 2997-16(d) (C), GW 322 (C), WH 1021 (C), HD 3059 (C), WH 1080 (C), MP 3288 (C), K 1006 (C), WH 1124 (C), HS 490 (C), VL 892 (C), HS 542 (C), HD 3043 (C), DBW 90 (C), HD 2967 (C), K 8027 (C), UAS 446 (d) (C), HS 507 (C), NI 5439 (C), KRL 19 (C), DBW 39 (C), HPW 251 (C) and PBW 644 (C) (Source: AVT II[nd] Year 2016-17).

HI 1621, CG 1023, DBW 189, DBW 196, DDK 1053, UAS 384, BRW 3775, MACS 5049, WH 1233, DBW 246, BRW 3773, DBW 248, HPW 448, VL 1011, HD 3219, HS 644, HS 646, HD 3272, HS 629, WH 1316, HI 1617, VL 3014, HI 1620, KRL 370, HS 630, DBW 251, HPW 439, WH 1232, VL 4003, MP 1318, HPW 440, MACS 6677, PBW 777, HD 3226, PBW 752, KRL 377, HI 1619, HD 3237, UP 2942, HS 648, HS 643, UP 2993, PBW 750, PBW 757, VL 1012, UP 2992, HD 3271, UAS 385, HS 645, VL 4002, HP1963, HPW 449, WH 1202, KRL 386, PBW 780, UAS 387, HS 611, DBW 247, PBW 778, VL 3015, DBW 187, PBW 779 and HS 490(C) (Source: AVT Ist Year 2016-17).
The details of flag smut (% infection) of different entries at hot spot locations are given in Annexure Table 2.11.

FOOT ROT (Based on only one location: Dharwad)
Highly resistant (upto 5 % disease):
HI 8777 (d), VL 829 (C), HD 3043 (C), WH 1021 (C), DBW 39 (C), K 1006 (C), K 1317 (I) (C), HI 8627 (d) (C), PBW 550 (C), DBW 110 (C), MP 3288 (C) and KRL 210 (C) (Source: AVT II[nd] Year 2016-17)
HPW 449, HS 643, HS 646, UP 2992, UP 2993, VL 1013, VL 4002, BRW 3773, HP 1963, PBW 750, DBW 248, DDK 1052, KRL 370, KRL 377, KRL 384, WH 1316, WH 1233 and HD 3272 (Source: AVT Ist Year 2016-17)
Resistant (5-10 % disease):
DBW 168, AKDW 2997-16 (d) (C), C 306 (C), HD 2888 (C), HD 3171 (I) (C), WH 1105 (C), K 0307 (C), MACS 6478 (C), WH 1124 (C), and PBW 644 (C) (Source: AVT II[nd] Year 2016-

17), MACS 6677, DBW 249, DBW 250, DBW 251, DBW 189, DBW 196, HD 3226, MP 1318, DBW 247, PBW 757, PBW 778, HD 3271, HS 644, HD 3219, TL 3014, HI 1619, MACS 5049, HS 645, VL 1012, VL 1011 and VL 301 (Source: AVT Ist Year 2016-17)
The details of foot rot (% infection) of different entries at hot spot locations are given in Table 1.5 of programme 1.

HILL BUNT
Resistant (1-10 % HB disease): HS 490 (C), HPW 251 (C) and HS 542 (C) **(**Source: AVT IInd Year 2016-17)
UP 2993, VL 1012, HS 644 and HPW 448 (Source: AVT Ist Year 2015-16)
The details of hill bunt (% infection) of different entries at hot spot locations are given in Annexure Table 2.12.

Utilization of resistant source in breeding for resistance
A total of 41 multiple disease resistant entries were contributed in NGSN for utilization in breeding programme at 23 main breeding centres. Out of these 40 entries were utilized in the range of 4.2-58.3% centres. (Table 2.1).

Table 2.1. Utilization of multiple disease resistant entries at different wheat breeding centre in NGSN During 2016-17 crop season

S. No.	Entry	Utilization (Nos. of centres)																									
		Almora	Indore	Udaipur	Sabour	Bilaspur	Vijapur	Junagadh	Malan	Ranchi	Dharwad	Jabalpur	Powerkheda	Sagar	Akola	Pune	Ludhiana	Durgapura	Faizabad	Kanpur	Hisar	Karnal,DWR	Burdawn	Wellington	Total	%
1	DBW129			1	1		1	1			1	1	1	1	1	1	1		1		1	1			14	58.3
2	VL1003			1							1		1					1							4	16.7
3	HPW373				1	1	2		1			1	1	1					1						9	37.5
4	HS593			1			1					1	1	1	1										6	25.0
5	TL2992(T)				1		1	1						1											4	16.7
6	TL2999(T)																						1		1	4.2
7	TL2996(T)				1																				1	4.2
8	PBW677	1		1	1						1	1		1				1		1					8	33.3
9	PBW723											1		1			1	1							4	16.7
10	PBW681		1	1			1	1		1	1	1	1	1			1		1						11	45.8
11	HPW411										1		1	1				1					1		5	20.8
12	HUW666												1	1				1							3	12.5
13	V967						1	1								1			1				1		5	20.8
14	DBW154					1	1							1				1							4	16.7
15	HD2932-Lr/Sr25		1				1	1				1		1										1	6	25.0
16	HD3133		1		1		1				1			1											5	20.8
17	HUW675			1	1		1				1							1			1				6	25.0
18	VL1004	1					1	1			1	1				1		1					1		8	33.3
19	VL3004	1		1							1														3	12.5
20	DBW110	1	1										1	1				1	1			1	1		8	33.3
21	VL977				1		1	1	1	1				1											6	25.0
22	HD3132				1							1	1	1				1					1		6	25.0
23	HS547			1			1				1			1									1		5	20.8
24	HS595			1			2				1			1					1				1		7	29.2
25	GW455		1					1		1				1											4	16.7
26	HD3146			1			2	1																	4	16.7
27	HUW677			1			1						1					1							4	16.7
28	PBW701			2																					2	8.3
29	UP2864				1	1	1						1	1											5	20.8

S. No.	Entry	Utilization (Nos. of centres)																								
		Almora	Indore	Udaipur	Sabour	Bilaspur	Vijapur	Junagadh	Malan	Ranchi	Dharwad	Jabalpur	Powerkheda	Sagar	Akola	Pune	Ludhiana	Durgapura	Faizabad	Kanpur	Hisar	Karnal,DWR	Burdawn	Wellington	Total	%
30	**UP2891**							1		1	1	1			1			1							6	25.0
31	**HS592**			1	1			1						1					1						5	20.8
32	**HUW661**	1									1			1			1								4	16.7
33	**K1204**				1		1		1			1						1					1		6	25.0
34	**PBW695**	1					1										1						1		4	16.7
35	**PBW698**								1					1			1				1		1		5	20.8
36	**DDW30(d)**																						2		2	8.3
37	**HD4728(d)**				1						1				1										3	12.5
38	**HD4730(d)**		1					1							1										3	12.5
39	**HD8750 (d)**														1										1	4.2
40	**UAS446(d)**				1																				1	4.2
41	**HI8755(d)**																								0	0.0
	Total	6	6	14	14	3	22	12	4	4	14	11	11	22	6	3	6	13	7	1	3	2	13	1	198	

PROGRAMME 3. CROP HEALTH

PRE- HARVEST CROP HEALTH MONITORING

Crop health was rigorously monitored during the crop season. Major focus was on the occurrence of yellow rust and surveillance for wheat blast. Status of other diseases, including leaf rust was also monitored during these survey trips. The extensive surveys were also conducted by the wheat crop protection scientists of different cooperating centers including ICAR-IIWBR Karnal. Special teams of scientists were also constituted during the 55th All India Wheat & Barley Workers' Meet held at CCS HAU Hisar during 21-24 August, 2016. Advisory for stripe rust management was issued during December-March regularly. Information on wheat crop health was disseminated through the "*Wheat Crop Health Newsletter*", Vol. 22 which was issued during the crop season. This was also put on ICAR-IIWBR website (http://dwr.res.in) now known as http://iiwbr.icar.gov.in All the issues of the Newsletter brought out during the crop season, are given as an annexure at the end of this report.

The overall crop health status was excellent in the country. The yellow rust could not make any dent on wheat production and was very well controlled at initiation in adjoining districts in Punjab close to foot hills of H.P. The exotic diseases and pathotypes like Ug99 race of stem rust and wheat blast were not reported from any part of the country. Details are given in issues of Wheat Crop Health Newsletter as Annexure.

Strategy Meetings: A strategy planning meeting was held at Kolkata on "Occurrence of blast disease on wheat" on 28th September, 2016 organised by DAC &FW and Govt. of West Bengal and was attended by ICAR and IIWBR scientists and Director. A meeting on "Evolving strategies for enhancing wheat production with special reference to management of wheat rusts and Karnal bunt" was organized by DAC &FW on 5.10.2016 at Krishi Bhavan, New Delhi. Dr. G. P. Singh, Director, presented a talk entitled "Evolving strategies for enhancing wheat production with special reference to manage wheat rust and Karnal bunt". Dr. D. P. Singh along with Hon. DDG (CS) and ADG (PP&B) participated in a meeting called by Hon. Secretary, DAC & FW on the topic occurrence of wheat blast in Bangladesh in Krishi Bhavan New Delhi on 4.3.2017 and given IPM and latest update on wheat blast survey report. Dr. D. P. Singh also participated in the meeting with hon. AS (Ad), DAC & FW, Krishi Bhavan, New Delhi on label claim of fungicides for wheat blast control on 27.3.2017 and given technical inputs. On 1.8.2017, another wheat blast planning meeting was attended by Dr. D. P. Singh at DAC & FW Krishi Bhavan, New Delhi under chairmanship of Hon. Secretary, DAC & FW.

Advisory for stripe rust management: Advisory for stripe rust management was issued three times i.e. in December, January and February for northern states. Awareness among farmers for stripe rust management was created through mobile, internet, toll free number, newspapers, discussions and delivering lectures in farmers training programmes. The details of survey and surveillance done are presented in wheat crop health newsletter vol. 22 issues 1-5 in annexure.

Preparedness for wheat blast disease

Wheat blast present in the primary wheat production areas of Brazil, Bolivia, and Paraguay, and recently identified in a small area in northeast Argentina, wheat blast is a potential threat to wheat production worldwide. The disease was first reported from Brazil in 1985. Wheat blast pathogen is a distinct population of *M. oryzae* (referred as *M. oryzae* Triticum population).

- The first report of wheat blast in South Asia came from Bangladesh in last week of March, 2016, ICAR took note of the disease. Since then ICAR worked hand in hand with DAC&FW and Govt. of West Bengal.
- So far wheat blast is not found in India during 2015-15 and 2016-17 crop seasons.
- During 2016-17, vigorous survey and surveillance programme as per the guidance of ICAR authorities, a team of scientists (Dr. D. P. Singh, Dr. Raj Kumar, Dr. A. K. Sharma of IIWBR and Dr. Dhiman Mukherjee of BCKVV Kalyani conducted extensive survey in West Bengal on 4th Feb. 2017 and found spike blight like symptoms on spikes of two local wheat varieties, Prodip and Satabdi in Murshidabad and Nadia districts close to Bangladesh borders. It was followed by other visits of UVKVV and BCKVV Scientists, PI (CP) and higher officials of DAC & FW and Directorate of Plant Quarantine and Storage as well as State Agric. Department officials of Govt. of West Bengal.
- The samples collected were however negative to wheat blast.
- The affected crop in these districts was sprayed with foliar sprays of tebuconazole+ trifloxystrobin @ 0.4g/lit of water. The crop was also sanitized. The farmers were compensated for their damaged crop.
- The surveys conducted from other parts of West Bengal revealed no such symptoms except one field in Malda district. No such symptoms were found from crop grown in other Eastern states as well as other agro ecological zones of India.
- The high yielding variety HD 2967 was found resistant to spike blight like symptoms in Murshidabad district of West Bengal during 2016-17 crop season.
- The farmers in Murshidabad and Nadia districts were told not to use seeds of any exotic variety of wheat in near future as well as their own produced wheat seed for at least three years.
- The state government was asked to keep no wheat corridor of up to 5 km from Bangladesh borders, not to allow any wheat seed or grain to enter in state from Bangladesh and diversify cropping system by replacing wheat with oilseeds and pulses during next crop season in Nadia and Malda districts.
- The seed of wheat will be supplied from north in West Bengal during 2017-18 crop season.
- As an immediate step, in collaboration with CIMMYT, Mexico, evaluation of Indian released varieties / advance wheat lines in Latin America (Bolivia) – the hot spot for this disease has been approved by DARE, Ministry of Agriculture and Farmers Welfare on May 19, 2016. For this, a set of 40 Indian popular varieties and advance lines has been sent immediately to CIMMYT for evaluation against blast disease. These were being evaluated under field conditions in Bolivia and under grass house conditions in USA.
- The varieties with 2NS translocation are showing promise against wheat blast in Bolivia and USA.
- During 2017, 100 more varieties of wheat will be sent to CIMMYT for evaluation against wheat blast.

ADHOC INTEGRATED PEST MANAGEMENT FOR WHEAT BLAST DISEASE (2016-17 crop season)

Wheat blast caused by a fungus *Mangaporthe oryzae* pathotype *Triticum* is an exotic disease in India and was reported from Bangladesh in 2016. It is a seed, soil and airborne disease and humid and warmer climate favours the disease. Keeping in view of possible threat of entry and establishment of wheat in India following adhoc IPM is suggested by D. P. Singh, PI (CP), ICAR-IIWBR Karnal

1. Strict quarantine of seed or grain of wheat from Bangladesh and South American countries where disease occurs.
2. Prevention of smuggling and entry of wheat grains of Bangladesh origin in India through borders. BSF posts at borders may be informed and sensitization of Ministry of Home Affairs, New Delhi may be done regarding it.
3. Prevention and destruction of wheat seed and grains entered in India by any mean.
4. Seed health testing of uncertified seed and farmers' grown self seed of wheat before sowing during 2016-17 crop season in West Bengal and Assam.
5. Use of certified and treated seed for sowing. Compulsory seed treatment of seed with recommended fungicides like carboxin+thiram @2.5 g/kg of seed or tebuconazole @ 1.25 g /kg of seed or carbendazim @2.5 g /kg of seed to eliminate any possible seedborne infection.
6. The wheat leaves and spikes may be monitored for wheat blast like symptoms. The samples of such plants may be sent for proper diagnosis to designated Plant Pathological laboratories in the states and SAUs.
7. The standing crop may be sprayed with recommended fungicides like tebuconazole+ trifloxystrobin @ 0.4g/lit of water or tricyclazole @ 0.6 g /lit of water on initiation of disease and may be repeated after 20 days. A combination of fungicides is preferred since wheat blast pathogen develops resistance to fungicides fast.
8. The burning of crop may also be practiced wherever seed of exotic and susceptible wheat varieties are sown.

POST HARVEST SURVEYS

KARNAL BUNT (KB)

A total of **7144** grain samples collected from various mandies in different zones, and were analyzed at cooperating centers (Table 3.1). Among different states samples taken from M.P., Maharashtra and Gujarat were found free from Karnal bunt infection. The overall infection was 17.7%. The samples from Haryana showed maximum infection (57.4%) followed by Rajasthan (42.8%) and U.P. (36.5%)

Table 3.1. Karnal bunt situation in the country during 2016-17 crop season

State	Total samples	Infected samples	% infected samples	Range of infection
Punjab	**2138**	**353**	**16.5**	**0.00-1.99**
Haryana	1516	865	57.4	0.05-3.00
Delhi	130	0	0	-
Rajasthan	509	291	42.8	0.1-5.2
Uttarakhand	920	62	6.7	0.25-10.00
Jammu	483	83	17.2	0.25-5.00
U.P.	74	27	36.5	1.0-20.0
M.P.	526	0	0	--
Maharashtra	175	0	0	--
Gujarat	673	0	0	--
Total	**7144**	**1681**	**17.7**	0.1-20.0

Prevalence of Post harvest diseases of wheat in Punjab (2016-17)

A total of 2138 samples were collected from 137 grain markets of Punjab state during the months of April and May 2017. The samples were analyzed for Karnal bunt, Black point and shriveled grains. The data was analyzed and present for all the three parameters in table 3.2 and 3.3.

A total of 353 samples out of 2138 showed Karnal bunt infection (16.51%). District Mohali showed the maximum KB infected samples followed by Pathankot, Ropar and Amritsar. The range of percent KB infected samples was 0.00-78.13.

As far as severity in concerned, the highest KB infection was in the Ropar district followed by Mohali and Hoshiarpur. This year further showed a decrease in the disease from the last year 2015-16 (0.248 %,) due to unfavorable environmental conditions at anthesis stage of the crop

Table 3.2. Spectrum of Karnal Bunt (KB) infection in Punjab (2016-17)

S.No.	District	Total Samples	Infected Samples	% infected samples	% Average infection	Range of Av. infection
1	Amritsar	**111**	**46**	41.44	0.130	0.004-0.34
2	Barnala	**90**	**3**	3.33	0.009	0.01-0.05
3	Bathinda	63	1	1.59	0.005	0.00-0.02
4	Faridkot	85	6	7.06	0.011	0.00-0.02
5	Fatehgarh Sahib	98	25	25.51	0.001	0.00-0.19
6	Fazilka	86	1	1.16	0.015	0.00- 0.01
7	Ferozepur	131	9	6.87	0.040	0.01-0.07
8	Gurdaspur	98	19	19.39	0.127	0.00-0.44
9	Hoshiarpur	104	36	34.62	0.402	0.01-1.99
10	Jallandhar	164	27	16.46	0.054	0.00-0.27
11	Kapurthala	107	10	9.35	0.023	0.00-0.07
12	Ludhiana	248	15	6.05	0.008	0.00-0.02
13	Mansa	33	5	15.15	0.176	0.04-0.17
14	Moga	138	22	15.94	0.024	0.003-0.02
15	Mohali	32	25	78.13	0.447	0.38-0.51
16	Muktsar	83	5	6.02	0.007	0.00-0.04
17	Nawanshar	42	3	7.14	0.040	0.00-0.11
18	Pathankot	26	13	50.00	0.369	0.13-0.52
19	Patiala	120	23	19.17	0.061	0.00-0.25
20	Ropar	104	46	44.23	0.758	0.03-0.47
21	Sangrur	70	3	4.29	0.004	0.00-0.05
22	Tarantarn	105	10	9.52	0.019	0.00-0.06
% Infected samples		**2138**	**353**	**16.51**	**0.100**	**0.00-1.99**

On an average 94.6% grain samples in Punjab were infected with black point infection with an average infection of 0.53% (Table 3.3).

Table 3.3. Black point and Shriveled grains in the Punjab state during 2016-17

S. No	District	Black point		Shriveled grains	
		% infected samples	% Average infection	% infected samples	% Average infection
1	Amritsar	96.40	0.515	95.50	0.491
2	Barnala	100.00	0.678	100.00	0.628
3	Bathinda	100.00	0.683	100.00	0.532
4	Faridkot	85.88	0.479	82.35	0.349
5	Fatehgarh Sahib	89.80	0.581	95.92	0.472
6	Fazilka	100.00	0.530	100.00	0.602
7	Ferozepur	100.00	0.631	88.55	0.576
8	Gurdaspur	100.00	0.460	100.00	0.583
9	Hoshiarpur	96.15	0.419	95.19	0.444
10	Jallandhar	85.37	0.504	81.71	0.459
11	Kapurthala	94.39	0.451	91.59	0.365
12	Ludhiana	95.56	0.473	97.58	0.601
13	Mansa	100.00	0.570	100.00	0.670
14	Moga	95.65	0.488	93.48	0.395
15	Mohali	93.75	0.531	93.75	0.400
16	Muktsar	100.00	0.648	45.78	0.492
17	Nawanshar	88.10	0.448	88.10	0.352
18	Pathankot	100.00	0.623	100.00	0.381
19	Patiala	83.33	0.576	80.83	0.567
20	Ropar	93.27	0.423	84.62	0.374
21	Sangrur	94.29	0.457	90.00	0.327
22	Tarantarn	99.05	0.590	99.05	0.610
% infected samples in the State		**94.57**		**90.79**	
% Avg. Infection in the state			**0.525**		**0.497**

Cooperators: Ritu Bala, Jaspal Kaur

Prevalence of Post harvest diseases of wheat in Haryana (2016-17)

To know the status of Karnal bunt infection in Haryana, a total 1516 seed samples were collected from different mandis and grain markets (Table 3.4). Out of which, 57.41% showed the KB infection and it was ranged from 31.57 (Gurgaon) to 84.61 % (Ambala).

Table 3.4 . Status of Karnal bunt infection during 2016-17 in Haryana

Districts South west zone	Total samples	%Infected samples	Range of infection	Average infection
Hisar	175	61.63	0.05-0.65	0.065
Rohtak	123	43.08	0.05-0.50	0.056
Bhiwani	68	51.47	0.05-0.70	0.063
Mahendergarh	25	68.00	0.05-1.25	0.500

Districts South west zone	Total samples	%Infected samples	Range of infection	Average infection
Rewari	31	70.96	0.05-1.00	0.140
Jhajjar	112	48.21	0.05-0.80	0.107
Gurgaon	76	31.57	0.05-0.55	0.049
Mewat	48	43.75	0.05-0.55	0.059
Jind	129	61.24	0.05-1.40	0.130
Fatehabad	81	41.97	0.05-0.85	0.043
Sirsa	82	39.02	0.05-1.20	0.044
Mean South west zone	950		0.05-1.40	0.114
North East Districts				
Karnal	102	69.6	0.05-2.00	0.164
Ambala	13	84.61	0.05-0.50	0.207
Kurukshetra	177	58.19	0.05-3.00	0.120
Kaithal	11	63.63	0.05-0.30	0.068
Panipat	114	80.43	0.05-3.00	0.138
Palwal	44	56.01	0.05-0.35	0.043
Yamuna Nagar	80	57.51	0.05-1.05	0.160
Panchkula	25	60.00	0.05-0.20	0.032
Mean(North East Zone)	566		0.05-3.00	0.116
State Mean	1516	57.41	0.05-3.00	0.115

Cooperator: R. S. Beniwal

IARI, New Delhi center collected seed samples from Karnal and Sonepat district of Hariyana and from the zero tillage field of IARI, Research farm (Table 3.5). Total 230 samples were analyzed and it is found that the samples collected from zero tillage fields were free from KB infection (Table 3.5).

Table 3.5. Grain samples analysis for KB at IARI New Delhi during 2016-17 crop season

State/ District/ Varieties	Total samples	Infected samples	% infected samples	Range of infection
Haryana				
Karnal	60	10	16.67	**0-0.20**
Sonepat	40	4	10.00	**0-0.20**
IARI Zero tillage field				
HD 2967, HDCSW18, HD 3086, HD 3117, WH 1105	130	0	-	**-**
Total	230	14	6.08	**0-0.02**

Cooperator: IARI New Delhi M. S. Saharan

Prevalence of Post harvest diseases of wheat in Jammu province of J&K (2016-17)

Total 483 seed samples were collected from grain market of Jammu province, out of which 83 were Karnal bunt infected (Table 3.6). The average infection is 17.18% and it ranges from

8.77 to 20.95%. Maximum infection was observed from Jammu district whereas it was minimum in Rajori district.

Table 3.6 Karnal bunt status in Jammu province during 2016-17 crop season

Districts	Total Samples	No. of infected samples	% infected samples	Number of samples showing different level of Karnal bunt incidence (%)			
				<0.25%	0.26-1%	1.1-5%	>5%
Rajauri	57	05	08.77	3	2	0	0
Jammu	167	35	20.95	15	11	9	0
Samba	109	21	19.26	9	9	3	0
Kathua	89	16	17.97	6	8	2	0
Udhampur	61	06	09.83	2	4	0	0
Total	483	83	17.18	35	34	14	0

Cooperator: M. K. Pandey

Uttarakhand

In Uttarakhand 920 wheat samples were analyzed, out of which 62 samples had Karnal bunt infected grains. These samples were collected from the seed growers of four districts namely Udham Singh Nagar, Nainital, Dehradun and Haridwar. About 87.1% of the total infected samples were in the category of below 0.25%, which is the tolerance limit of Karnal bunt for certified seeds. The rest 12.90% samples had more than 0.25% infected grains. Maximum incidence 19.75% was observed in the district Haridwar followed by Nainital (17.02%), Dehradun (11.11%) & Udham Singh Nagar (3.47%). In Haridwar district the prevalence of Karnal bunt recorded was high (16 samples) out of 81 samples and severity was also high. The maximum Karnal bunt incidence was recorded in variety PBW 550 of Haridwar district followed by variety VL 892.

Table 3.7. Incidence of Karnal bunt in different districts of Uttarakhand 2016-17 crop season

S. N.	Districts	Total samples	No. of infected samples	No. of disease free samples	% infected samples	No. of samples in different range of infection				Per cent rejection
						Below 0.25%	0.26 -1%	1.1-5%	5.1-10%	
1	Udham Singh Nagar									
A	Pantnagar	499	19	480	3.81	18	1	0	0	0.20
B	Khatima	97	1	96	1.03	0	1	0	0	1.03
C	Sitarganj	38	1	37	2.63	0	1	0	0	2.63
D	Kashipur	18	0	18	0.0	0	0	0	0	0.0
E	Bajpur	39	3	36	7.7	2	1	0	0	2.56
	Total	691	24	667	3.47	20	4	0	0	0.58
2	Haridwar	81	16	65	19.75	13	2	1	0	3.70
3	Dehradun	54	6	48	11.11	6	0	0	0	0.0

4	Nainital (Kotabagh)	94	16	78	17.02	15	1	0	0	1.06
	Total	920	62	858	6.74	54	7	1	0	0.87

Cooperator: Kanak Srivastava

Prevalence of Post harvest diseases of wheat in Rajasthan (2016-17)

In post–harvest survey a total of 509 wheat grain samples were collected from 12 grain mandies of Rajasthan (Table 3.8). These samples were analysed in the laboratory for status of Karnal bunt and black point diseases. The data revealed that 42.81 percent samples (218) were found infected with Karnal bunt with incidence ranging from 0.1 to 5.2 per cent maximum being in a sample collected from the Alwar mandi. The black point was noted in 461samples (90.6%) in the range of 0.1 to 13.2 per cent.

Table 3.8. Status of Karnal bunt of wheat in Rajasthan during Rabi, 2016-17

S. No.	Location	No. of samples showing different level of KB infection						Total samples	Infected samples (%)	Incidence range (%)
		0	0.1-0.5	0.5-1.0	1-5	5-10	>10			
1	Jaipur	23	14	1	1	0	0	39	41.03	0.1-1.8
2	Bagru	30	1	2	1	0	0	34	11.76	0.1-1.4
3	Bassi	33	6	0	1	0	0	40	17.5	0.1-1.2
4	Chomu	36	11	0	1	0	0	48	25.0	0.1-2.6
5	Kotputli	10	2	1	3	0	0	16	37.5	0.1-2.5
6	Dausa	24	20	5	1	0	0	50	52.0	0.1-2.4
7	Lalsot	35	15	2	3	0	0	55	36.36	0.1-3.2
8	Mandawari	37	7	0	0	0	0	44	15.9	0.1-0.2
9	Bandikui	6	3	2	0	0	0	11	45.45	0.1-0.8
10	Alwar	18	26	3	3	1	0	51	64.71	0.1-5.2
11	Khertal	26	22	3	2	0	0	53	50.94	0.1-1.8
12	Bansur	13	43	7	5	0	0	68	80.88	0.1-3.2
Total		**291**	**170**	**26**	**21**	**1**	**0**	**509**	**42.81**	**0.1-5.2**

Prevalence of Post harvest diseases of wheat in Uttar Pradesh (2016-17)

The seed samples were collected from grain market of district Etah, Kasganj, Kanpur, Kannauj and Faizabad (Table 3.9). A total 293 samples were collected, out of which 44 found infected with Karnal bunt with an average infestation of 15.02% and range from 0 to 40%. The samples (219) collected from Faizabad were also analyzed for black point and discolouration. Out of 219 samples, 53 and 71 were found black point infected and discoloured, respectively.

Table 3.9. Karnal bunt, black point and grain discoloration incidence in the wheat cultivars in U. P. (2016-17)

S. No.	District	Varieties	Total samples	KB sample	% infected samples	KB range (%)
1	Etah	PBW 343, Halna, HD 2967, Unknown	19	5	26.3	1-5
2	Kasganj	PBW 343	10	4	40.0	1-5
3	Kanpur	PBW 343, HD 2967, Halna, WH 711, DBW 38, HD 2733, DBW 17,	40	16	40.0	1-20
4	Kannauj	K0307, PBW 502,HD 2967	5	0	0.0	0
5	Faizabad		219	19	8.67	0 – 0.2
		Total	293	44	15.02	

Cooperator: Javed Bahar Khan, Kanpur, S. P. Singh, Faizabad

Prevalence of Post harvest diseases of wheat in Madhya Pradesh (2016-17)

Grain samples were collected from Indore, Dewas, Uijain, Dhar, Shajapur, Khargone and Burhanpur. A total 526 grain samples were collected and analyzed for Karnal bunt infection. All were found free from KB infection (Table 3.10).

Table 3.10. Karnal incidence in the wheat in Madhya Pradesh (2016-17)

S. No.	District	No. of samples	KB (%)
1	Indore	299	Nil
2	Dewas	181	Nil
3	Uijain	36	Nil
4	Dhar	4	Nil
5	Shajapur	3	Nil
6	Khargone	2	Nil
7	Burhanpur	1	Nil
	Total	526	

Cooperator: T. L. Prakasha

Prevalence of Post harvest diseases of wheat in Maharashtra (2016-17)

A total 175 grain samples were collected and analyzed for Karnal bunt as well as black point disease. All the 175 samples were free from KB infection (Table 3.11). Out of 175 samples, 42 were found infested with black point disease (Table 3.12).

Table 3.11. Karnal bunt spectrum in Maharashtra in wheat cultivars during 2016-17 crop season (Niphad centre)

S. No.	Tahasil	Total samples	Infected	Per cent infected samples	Range of infection
1	Nandurbar	15	0	0	--
2	Satana	09	0	0	--
3	Sakari	34	0	0	--
4	Dhule	17	0	0	--
5	Kopargaon	19	0	0	--
6	Chalisgaon	20	0	0	--
7	Rahuri	10	0	0	--
8	Niphad	30	0	0	--
9	Sinnar	06	0	0	--
10	Shahada	15	0	0	--
	Total	**175**	**0**	**0**	**--**

Table 3.12 . Analysis of grain samples for black point in Maharashtra during 2016-17 crop season (Niphad centre)

Sr. No.	Tahasil	Total samples	Infected	Per cent infected samples	Range of infection
1	Nandurbar	15	15	100.00	0.1-4.7
2	Satana	09	01	11.11	0.0-6.0
3	Sakari	34	06	17.65	0.0-6.3
4	Dhule	17	03	17.65	0.0-4.8
5	Kopargaon	19	03	15.79	0.0-3.2
6	Chalisgaon	20	02	10.00	0.0-3.4
7	Rahuri	10	03	30.00	0.0-3.0
8	Niphad	30	02	6.67	0.0-12.2
9	Sinnar	06	01	16.67	0.0-5.3
10	Shahada	15	6	40.00	0.0-3.7
	Total	**175**	**42**	**24.00**	**0.0-12.2**

Cooperators: B.C.Game, A.P.Padhye, V.S.Pawar, P.E. More, C.B.Beldar

Prevalence of Post harvest diseases of wheat in Gujarat (2016-17)

Twelve different marketing yards and various farmers' fields located in different wheat growing areas of North Gujarat were surveyed for wheat seed health status. A total 673 grain samples out of which 568 seed samples from marketing yards and 105 samples from farmers' fields were examined. All the samples were free from Karnal bunt infection (Table 3.13). However, black point infection was ranged from 13.3 (Prantij) to 30.0 (Dehgam) in different marketing yards. The data further indicated that 19 samples (18.1 %) from farmers' field examined were found black point infected. In all, 22.6 per cent samples showed black point infection in the range of 0.0 to 6.2 %.

Table 3.13 Status of Black point (BP) and Karnal bunt (KB) of wheat in North Gujarat during 2016-17

Sr. No.	Market yard/Farmers' fields	Total samples examined	Black point infection			Karnal bunt incidence
			No.	Per cent	Range of infection	
[A] Market Yards :						
1	Dehgam	40	12	30.0	0.0 – 6.2	0.0
2	Idar	51	11	21.6	0.0 – 4.2	0.0
3	Kalol	55	12	21.8	0.0 – 4.2	0.0
4	Khedbrahma	38	10	26.3	0.0 – 4.4	0.0
5	Mansa	39	09	23.1	0.0 – 5.0	0.0
6	Mehsana	58	14	24.1	0.0 – 5.2	0.0
7	Prantij	45	10	22.2	0.0 – 4.7	0.0
8	Talod	60	08	13.3	0.0 – 3.4	0.0
9	Vadali	30	07	23.3	0.0 – 3.4	0.0
10	Vijapur	75	18	24.0	0.0 – 4.0	0.0
11	Visnagar	47	12	25.5	0.0 – 3.8	0.0
12	Dhansura	30	06	20.0	0.0 – 3.2	0.0
	SUB TOTAL	**568**	**133**	**23.4**	**0.0 – 6.2**	**0.0**
[B]	**Farmers' fields**	105	19	18.1	0.0 – 6.0	0.0
	TOTAL	**673**	**152**	**22.6**	**0.0 – 6.2**	**0.0**

Cooperator: S. I. Patel

RUST PATHOTYPE DISTRIBUTION

IIWBR RS, Shimla

Pathotype Distribution of wheat and barley rusts during 2016-17

It was practically a rust free year. With the help of cooperators, different wheat growing areas were monitored regularly to keep an eye on the occurrence of India and neighbouring countries. Of the odd 1302 wheat and barley rust samples received during the year from 12 states of India and two adjoining countries, 854 have been analyzed so far. The pathotype situation is presented below:

Yellow (Stripe) rust of wheat and Barley (*Puccinia striiformis*)

During 2016-17, 400 samples of yellow rust of wheat and barley were analyzed from seven North Indian states of India. Total 11 pathotypes were identified based on Indian wheat differentials. The maximum number of samples were collected and analyzed from Punjab followed by Himachal Pradesh . The frequency of pt. 46S119 (virulent to *Yr2, Yr3, Yr4, Yr6, Yr7, Yr8, Yr9, Yr17, Yr18, Yr19, Yr21, Yr22, Yr23, Yr25* and *YrA*) was maximum (54.5%) followed by pt. 110S119 (33.0%). Barring 238S119, which was identified in 6% of the samples, remaining 6 pathotypes were observed in few samples only. It was also true for pt. 78S84 which was predominant up to 2010-11, occurred in one yellow rust sample only. *Puccinia* *striiformis* f. sp. *tritici* (*Pst*) population was found avirulent on *Yr*5, *Yr*10, *Yr*15, *Yr*Sp and *Yr*Sk. In barley, frequency of pt. 57 and M was nearly same as was evident from the 13 samples of barley yellow rust analyzed during the year (Table 3.14).

Black (Stem) rust of wheat (*Puccinia graminis tritici*)

Five pathotypes of black rust of wheat were observed on 72 samples received/collected from five Indian states. Population analyzed during the year has avirulence to *Sr26, 27, 31, 32, 35, 39, 40, 43, Tt3* and *Tmp*. Most of the samples were received from Tamil Nadu followed by Gujarat and Maharashtra. 40A (62G29) was recorded in more than 50% samples.

Table 3.14. Pathotype distribution of Yellow rust (*Puccinia striiformis*) up to 30.06.2017

S. No.	State /country	No. of Samples	Pathotypes identified										
			P. striiformis tritici									*P. striiformis hordei*	
			46S119	110S119	238S119	78S84	79S68	111S68	46S103(P)	6S0	7S0	1S0(M)*	0S0(57)*
1	Jammu & Kashmir	11	10	-	01	-	-	-	-	-	-	-	-
2	Himachal Pradesh	78	39	26	06	01	01	01	-	-	02	01	01
3	Punjab	210	127	68	10	-	-	-	01	-	04	-	-
4	Haryana	17	09	03	04	-	-	-	-	-	01	-	-
5	Uttarakhand	19	08	05	03	-	-	-	01	01	-	01	-
6	Rajasthan	64	24	30	-	-	-	-	-	-	-	04	06
7	Uttar Pradesh	01	01	-	-	-	-	-	-	-	-	-	-
	Total	**400**	**218**	**132**	**24**	**01**	**01**	**01**	**02**	**01**	**07**	**06**	**07**

Table 3.14. Pathotype distribution of black rust (*Puccinia graminis tritici*) in India during 2016-17

S. No.	States	Samples Analyzed	Pathotypes* identified				
			11	21-1	40A	40-3	122
1	Gujarat	22	22	-	-	-	-
2	Karnataka	01	-	-	01	-	-
3	Madhya Pradesh	02	-	-	-	-	02
4	Maharashtra	06	06	-	-	-	-
5	Tamil Nadu	41	03	01	34	02	01
Total		**72**	**31**	**01**	**35**	**02**	**03**
* 11(79G31), 21-1(24G5), 40A(62G29), 40-3(127G29), 122(7G11)							

Table 3.15 Prevalence of pathotypes of stem and leaf rusts of wheat (*Kharif*, 2016 & *Rabi*-2016-17)

Season / State	Samples Nos.)	Prevalent Pathotypes				
Stem Rust Pathotype		40A			117-6	
Off-season (*Kharif*, 2016) (Tamil Nadu)	19	13			06	
Rabi – 2016-17						
Maharashtra	00	00			00	
Leaf Rust Pathotypes		77-2	77-3	77-5	77-8	162-2
Off-season (*Kharif*, 2016)(Tamil Nadu)	28	05	09	07	03	04
Rabi – 2016-17						
Maharashtra	03	01	01	01	00	00

Brown rust of wheat (*P. triticina*)

Analyses of 382 samples of wheat brown rust was accomplished during 2016-17 from 12 states of India and neighboring countries Nepal and Bhutan. Twenty four pathotyes belonging to 4 major groups of pathotypes 12, 77, 104 & 162 were identified. There was increase in the proportion of pathotype 77-9 which was identified in about 45.8 % of the samples analyzed. Contrarily pt. 77-5, predominant pathotype of yester years was identified in 24.8 % of the samples. However, pt. 77-5 was more widely distributed than any other pathotype. Likewise there was reduction in the frequency of pathotype 104-2, 104-3. In addition a new pathotype designated as 162-4 was also observed in 3.9% of the samples. Remaining pathotypes were observed just in few samples only (Table 3.15). Indian population of wheat brown rust was avirulent to *Lr9*, *Lr19*, *Lr*24, *Lr*25, *Lr*29, *Lr*32, *Lr*39, *Lr*45 and *Lr*47.

A) Wheat rust situation in Peninsular India:

During *Rabi*, 2016-17, wheat rust trap nurseries were established at 24 locations *viz*, Maharashtra (18), Madhya Pradesh (2), Karnataka (2), Gujarat (1) and Tamil Nadu (1). Reports on incidence of stem and leaf rusts of wheat were received.

Out of 24 Co-operating centers of wheat rust trap nurseries, incidence of stem rust and leaf rust of wheat was not reported by any centre.

Survey and surveillance was undertaken in different regions of Maharashtra state during *Rabi*-2016-17 for recording stem and leaf rust intensity. Survey was conducted in Satara, Sangli, Kolhapur districts on 3/3/2017 and 4/3/2017, Pune, Ahmednagar, Nashik, Dhule, Jalgaon districts on 16/3/2017 to 18/3/2017 and Solapur, Osmanabad, Latur, Beed, Parbhani, Hingoli, Washim, Buldhana, Aurangabad, Jalgaon on 22/3/2017 to 24/3/2017 in Maharashtra states. Wheat crop was found healthy and free from rust disease. However, leaf rust was observed on off-type wheat plant in trace at few locations. The stem rust was not observed at any location.

B) Virulence monitoring:

The survey of off season wheat crop grown at Wellington in Tamil Nadu state was undertaken during *Kharif*, 2016. A total of 19 samples of stem rust and 28 samples of leaf rust were analyzed for pathotype detection. From these samples pathotype 40A, 117-6 of stem rust whereas 77-2, 77-3, 77-5, 77-8, 162-2 of leaf rust were detected.

The survey during *Rabi* season (2016-2017) for wheat rusts on the crop grown in Maharashtra state was undertaken and 04 leaf rust affected samples were collected from different localities for pathotype analysis whereas no stem rust was observed during survey. None of the sample was received for pathotype analysis of stem rust from any location whereas no sample was received for pathotype analysis of leaf rust from any centre. From the three samples, the pathotypes of leaf rust *viz*., 77-2, 77-3 and 77-5 were found prevalent in Maharashtra. (Table 3.15).

49th wheat disease monitoring nursery (WDMN) 2016-17

Over the years wheat disease monitoring nursery (earlier trap plot nursery/TPN) is working as a logistic and effective tool for monitoring the occurrence of rusts, blights, powdery mildew and other wheat diseases across different wheat growing zones of India. Additionally, it has helped in knowing the seasonal progress of these diseases over different wheat growing zones. Wheat and barley rust samples collected from WDMN gives an overview of area wise distribution and load of rust pathotypes. The effectiveness of different wheat lines or resistance genes has been assessed through the WDMNs. The 49th wheat disease monitoring nursery was planted at 35 locations (Table 1) covering all the major wheat growing areas in the country, especially those situated near the bordering areas to the neighboring countries. Pathotype 11 (79G31), virulent on *Sr2, Sr5, Sr6, Sr7b Sr9a, Sr9b,Sr9c, Sr9d, Sr9f, Sr9g, Sr10, Sr13, Sr14, Sr15, Sr16, Sr17, Sr18, Sr19, Sr20, Sr21, Sr28, Sr29, Sr30, Sr34, Sr36, Sr38, SrMcN* was the second most frequent pathotype and observed in 31 samples received from Gujarat, Maharashtra and Tamil Nadu. Other pathotypes such as 21-1 (24G5), 40-3 (127G29) and 122 (7G11) were observed in few samples only. Diversity of black rust pathotypes was maximum in Tamil Nadu (Table 3.16).

Co-operators and locations where WDMN was planted during 2016-17

Northern Hills and High Altitude Zone		
Himachal Pradesh	V.K. Rathee R. Devlash Head, ICAR-IIWBR, RS, Shimla Sachin Upmanyu	Dhaulakuan Bajaura **Shimla** Malan (Kangra)
Jammu & Kashmir	M.K. Pandey Deepak Kumar and M.K. Pandey Najeeb Mughal	Udhaywalla (Jammu), Kathua Rajouri Khudwani
Uttarakhand	Deep Shikha and Kanak Srivastava K.K. Mishra	Pantnagar Hawalbagh (Almora)

North Western Plains Zone		
Punjab	Jaspal Kaur	Abohar Deenanagar Gurdaspur Langroya Ludhiana Ropar
Haryana	Rajender Singh Beniwal	Hisar
North Eastern Plains Zone		
Bihar	**C. S. Azad** Ashish Kumar Gupta	Sabour Pusa
Jharkhand	H.C. Lal	Kanke , Ranchi
Uttar Pradesh	S.P. Singh and J. Verma J.B. Khan and C. Kanchan Shyam Saran Vaish	Faizabad Araul (Kanpur) B.H.U. Varanasi
Rajasthan	P.S. Shekhawat and Nitin Chawla	**RARI, Durgapura, Jaipur**
West Bengal	S.K. Mukhopadhyay, D. Mukherjee and S. Mahapatra	Kalyani
Central Zone		
Gujarat	S.I. Patel and Premabati Devi I.B. Kapadiya	**Ladol (Vijapur)** Mangrol (Junagadh)
Madhya Pradesh	Prakasha T.L. K. K. Mishra	**Indore** **Khojanpur (Powarkheda)**
Peninsular and Southern Hills Zone		
Maharashtra	B. K. Honrao, Yashwant Kumar, V. S. Baviskar, V. D. Surve, V. M. Khade and D. N. Bankar B.C. Game, V.S.Pawar, P.E. More, R.B. Sonawane, C.B.Beldar S.G. Bharad, N. R. Potdukhe and H.S. Gaukar S. G. Sawashe	**A.R.S. Baner, (Pune)** **ARS, Niphad** **Akola** **Mahabaleshwar**
Karnataka	P. V. Patil and Mr. S. V. Kulkarni	**Ugar Khurd (Dharwad)**
Tamil Nadu	P. Nallathambi	**Wellington**

There were 20 (21 for High Altitude Zone and North Hills Zone) entries in the nursery during 2016-17. Of these, first 15 entries were common to all zones, rest of the five (six for High Altitude Zone and North Hills Zone) entries were zone specific varieties. The detailed updated constituent of WDMN for 2016-17 crop season was as given below:

Common set of varieties for all zones

WL711, HD2329, Agra Local, HD2160, Lal Bahadur, WL1562, HW2021 (Lr24/Sr26), HD2204, C306, WH147, HW2008 (*Lr*24/*Sr*26), Kharchia Mutant, HP1633, DL 784-3 and RNB1001

Zone specific varieties

i) North Western Plains Zone
WH1105, WH542, PBW343, DPBW621-50 and WH896

ii) North Eastern Plains Zone
K8804, HD2402, HP1102, HUW468 and NW1014

iii) Central Zone
HI8663, HI1544, LOK-1, GW366 and GW322

iv) Peninsular and Southern Hills Zone
MACS2496, Bijaga Yellow, HW971, HD2501 and HW2022 (*Sr*24/*Lr*24)

v) Northern Hills and High Altitude Zone
HPW349, VL892, HS420, Sonalika, HS507 and Barley Local

Each entry of the nursery was planted in two consecutive rows with two rows of Agra local as spreader row covering the periphery of nursery area. Observations on diseases were generally recorded five times during the crop season. The co-operators were advised to plant wheat disease monitoring nursery in time, in isolation and away from the rust inoculated fields. The disease situation was monitored at regular intervals and the rust disease samples from these nurseries were analyzed at ICAR-IIWBR, RS, Flowerdale, Shimla.

Table 3.16a. Pathotype distribution of brown rust (*Puccinia triticina*) in India and neighboring countries during 2016-17

S. No.	State/Country	No. of isolates Analyzed	Pathotypes identified*																						
			12-1(5R37)	12-3(49R37)	12-5 (29R45)	12-7(93R45)	12-8(49R45)	20-1*	77-1 (109R63)	77-3 (125R55)	77-5 (121R63-1)	77-6 (121R55-1)	77-9 (121R60-1)	77-12*	77A (109R31)	104-1 (21R31-1)	104-2 (21R55)	104-3 (21R63)	104-4(93r57)	104A(21R31)	106 (0R9)	162-1 (93R47)	162-2 (93R39)	162-4 *	162A (93R15)
1	Himachal Pradesh	25	1		2	3					5		6	1			2	2			1		1	1	
2	Jammu & Kashmir	13									4		8	1											
3	Uttarakhand	34	1			1			1		3		16				2			1		1		2	6
4	Haryana	10									2		5		1		1		1						
5	Punjab	8											8												
6	Uttar Pradesh	8									2		5												1
7	West Bengal	6						1			1						1	1			1		1		
8	Assam	31							3		7					1	6	2	4	1				5	
9	Madhya Pradesh#	8							2		3						3								
10	Maharashtra	13									6		7												
11	Karnataka	32			1						15		8		1	2	1	2				1		1	
12	Tamil Nadu	145					1		1		32	1	10 7					1						1	1
Other Countries																									
1	Bhutan	7							1		2		1		1		1					1			
2	Nepal	42		5	1				2	2	13		4				5	2					3	5	
Total		**382**	**2**	**5**	**4**	**4**	**1**	**1**	**10**	**2**	**95**	**1**	**17 5**	**2**	**3**	**5**	**22**	**10**	**5**	**2**	**2**	**3**	**5**	**15**	**8**

one sample of 77A,* New pathotypes under detailed studies for confirmation.

Disease incidence in WDMN

Information on wheat disease situation was received from Dhaulakuan, Bajaura, Malan & Shimla in Himachal Pradesh, Udhaywalla (Jammu), Kathua, Rajouri, & Khudwani in Jammu & Kashmir, Pantnagar & Almora in Uttarakhand, Abohar, Deenanagar, Gurdaspur, Langroya, Ludhiana & Ropar in Punjab, Hisar (Haryana), Sabour & Pusa in Bihar, Ranchi (Jharkhand), Faizabad, Kanpur and Varanasi in Uttar Pradesh, Kalyani (West Bengal), Vijapur & Junagadh in Gujarat, Indore & Powarkheda in Madhya Pradesh, Jaipur (Rajasthan), Pune, Niphad, Mahabaleshwar & Akola in Maharashtra, Dharwad (Karnataka) and Wellington (Tamil Nadu)

Disease incidence in WDMN

Wheat blast was not reported from India. Likewise there was no occurrence of black rust on *Sr31* type of resistance (Ug99 type of pathotypes). Yellow rust was noticed at all the locations of NHZ and NWPZ. It was also observed at Sabour in NEPZ. All the entries of WDMN in other locations including SHZ, where yellow rust appears regularly, were free from yellow rust. Yellow rust was very severe at many locations at NWPZ and NHZ. 100S severity of yellow rust was observed on Kharchia Mutant at Bajaura. Eleven entries had more than 30S severity of yellow rust at Malan (Kangra). Brown rust was reported from few locations of NHZ and NWPZ *viz*. Shimla in HP, Kathua, Rajauri & Jammu in J. & K., Pantnagar in Uttarakhand, Langroya & Abohar in Punjab. It was reported from all the locations of NEPZ except Ranchi and Kalyani. In central zone brown rust appeared at Vijapur, Indore and Powerkheda only. There was no brown rust on WDMN entries in PZ. At Wellington (SHZ) brown rust appeared on 18 entries of WDMN. Of the 34 locations of WDMNs black rust was observed only at Wellington in SHZ, Vijapur, Indore & Powerkheda in CZ. NHZ, NWPZ, NEPZ and PZ were free from black rust. Leaf blight is reported from WDMNs planted at Almora, Kathua, Rajouri, Jammu (Udhaywalla), Sabour, Pusa, Ranchi, Faizabad, Kanpur, Kalyani, Mahabaleshwar, Pune, Niphad, Dharwad and Wellington. Almora, Kathua, Rajauri, Jammu and Wellington were the only locations of WDMNs where powdery mildew was observed.

Appearance of Wheat rusts in WDMN

The data on first appearance of the wheat diseases on WDMN was not available for most of the locations. As per the data available, yellow rust was first observed at Pantnagar (17.01.17) followed by Udhaywalla and Kathua (24.01.17), Durgapura (02.02.17), Hisar (05.02.17), Dhaulakuan (11.02.17) and Almora (13.02.17). Brown rust was first observed at Pusa (04.01.17) followed by Pantnagar (25.01.17), Jammu and Kathua (10.02.17), Powerkheda (15.02.17), Sabour (04.03.17), Faizabad (05.03.17) and Kanpur (09.03.17). Black rust was first observed at Vijapur (20.02.17) and then at Powerkheda (25.02.17).

Varietal Performance against wheat rusts

High Altitude and Northern Hills Zone

Maximum severity of yellow rust was observed at Bajaura, where eleven entries of WDMN were showing more than 30S severity of yellow rust. However; WL711, HW2021, HD2204, C306, WH147, HPW349, VL892 and HS 507 were yellow rust free at Bajaura. Shimla was the only center in NHZ where yellow rust was not observed on WDMN entries during offseason. Two entries *viz*. HW2021 and VL892 were yellow rust free at all the locations of NHZ. Kharchia mutant was the most susceptible entry for yellow rust in NHZ as more than 60S yellow rust severity was reported on it from all the locations of NHZ.

WDMN entry WL1562 was yellow rust free at all the locations of NHZ except at Bajaura, where yellow rust severity of 80S was reported on it. Brown rust appeared at Shimla on Agra Local (5S) only, Kathua and Rajauri. At Kathua thirteen entries showed brown rust infection between 5S to 40S. Seven entries *viz.* WL711, Agra local, WL1562, HD2204, C-306, RNB1001 and WH1105 were showing brown rust infection (TMS to 10S) at Rajauri. Black rust did not appear on WDMN entries in this zone.

North Western Plain Zone

Yellow rust was highly severe at Dhaulakuan, Ludhiana, Gurdaspur and Pantnagar in NWPZ. Twelve, seventeen, sixteen and eleven entries of WDMN had more than 40S severity of yellow rust at Dhaulakuan, Ludhiana, Gurdaspur and Pantnagar, respectively. All the entries except Kharchia Mutant (TS) were free from yellow rust at Abohar. Similarly at Deenanagar twelve entries (HD2329, HD2160, WL1562, HW2021, HD2204, WH147, HW2008, HP1633, DL784-3, RNB1001, DPBW621-50 and WH896) were yellow rust free. WDMN entry WH896 was yellow rust free at all the locations of NWPZ. Brown rust appeared at Hisar, Jammu, Langroya, Abohar and Pantnagar in NWPZ. Two entries viz. HW2021 and DL784-3 were free from brown rust infection at all the locations of NWPZ. At Pantnagar all the entries except HW2021, HP1633 and DL 784-3 were showing brown rust infection. Brown rust appeared only on WDMN entries HD2329, Lal Bahadur, HD2204 and WH542 at Langroya others were infection free**.** Black was not reported from this zone.

North Eastern Plains Zone

Yellow rust was observed only at Sabour in NEPZ, where 10S to 20S yellow rust severity was observed on HD2329, Agra Local, Lal Bahdur, Kharchia Mutant and RNB1001. Brown rust appeared at all the locations of NEPZ except at Ranchi and Kalyani. At Varanasi it was reported only on entries WL711 (20S) and Kharchia Mutant (10S). Maximum brown rust severity was observed at Pusa as ten WDMN entries were showing more than 30S severity of brown rust. WDMN entries HW2021, HW2008 and HD2402 were free from brown rust infection at all the locations of NEPZ. Black rust did not appear on any of the entries of WDMN in this zone.

Central Zone

Brown rust was observed at all the locations of CZ except at Junagarh (Gujarat). At Indore Lal Bahadur showed score of 10S. WDMN entries HD2160, HI8663, HI1544 and GW366 were free from brown rust infection at all the locations of CZ**.** Black rust was observed at Indore, Vijapur and Powerkheda only. WL711 (30MSS), Agra Local (20S) and Lal Bahadur (60MSS) were the only entries showing black rust infection at Indore. Four entries WL1562, MACS2496, Bijaga Yellow and HD2501 were black rust free at all the locations of CZ.

Peninsular Zone and Southern Hill Zone

Yellow rust did not appear on any of the locations in these zones. Brown rust appeared only at Dharwad and Wellington. At Dharwad all the WDMN entries except Lal Bahadur (5S) were brown rust free. At Wellington seven entries (WL711, HD2329, Agra Local, HD2160, Lal Bahadur, Kharchia Mutant and MACS2496) showed more than 40S severity of brown rust. Black rust appeared on all the entries of WDMN except HD2160 and RNB1001 in SHZ (Wellington). WDMN planted at Peninsular Zone was black rust free. Four entries Agra Local, Kharchia Mutant, HP1633 and Bijaga Yellow showed 100S severity of black rust at Wellington whereas 80S black rust severity was recorded on Lal Bahadur, HD2204 and

C306. The results of occuurence of different diseases in different entries in HP are given in Table 3.16b.

Blights

Earliest record of blight was from Pune (17.12.16) followed by Pusa (28.12.16), Ranchi (07.01.17), Faizabad (28.01.17), Niphad (04.02.17), Varanasi (08.02.17) and Sabour (25.02.17). Blight was reported from Almora, Kathua and Rajauri in Northern hills zone, where up to 46 severity was reported on WDMN entries. Leaf blight severity was minimum on WDMN entries from Almora. Jammu was the only location in NWPZ where up to 36 severity of leaf blight was observed. All the entries at other locations in NWPZ were free from wheat blight. Maximum severity of leaf blight (Up to 78) was recorded at Faizabad. In PZ blight was reported from Pune, Niphad and Dharwad locations. At Niphad all the entries except WL1562 (03), HW2021 (14), HP1633 (02) and HD2501 (02) were blight free. Leaf blight was not found at Wellington (SHZ) and CZ.

Powdery mildew

Powdery mildew appeared Almora, Kathua, Rajauri, Jammu, Akrot, Malan (Kangra, HP) and Wellington only. It was first seen on 01.02.17 at Almora followed by 10.02.17 at Jammu & Kathua and on 04.03.17 at Rajauri. All the entries of WDMN were susceptible to powdery mildew at all these locations except at Wellington. Maximum incidence was at Akrot (9).

Table3.16 b. Reaction to various diseases on entries of wheat trap nursery 2016-17 at various locations in Himachal Pradesh.

Entry	Stripe rust score at different locations						Leaf rust	Powdery mildew	
	Akrot	Malan		Bert hin	Kan gra	Sunder nagar	Kan-gra	Ak-rot	Malan
		7/3/2017	17-4-2017						
WL 711	40S	0	40S	10	80 S	40S	10S	9	4
HD 2329	80S	0	40S	10	80 S	40S	-	9	3
Agra Local	80S	10S	40S	0	60 S	40-60S	-	9	4
HD 2160	60S	0	20S	5	20 S	40S	-	9	5
Lal Bahadur	80S	0	60S	10	90 S	60S	60S	9	5
WL 1562	10S	0	20S	0	R	40S	-	9	4
HW 2021	10MS	0	20S	5	10 S	40-60S	-	7	3
HD 2204	20MS	0	30S	0	10 S	20-40S	5 S	7	5
C-306	0	10S	10S	0	R	20-40S	-	5	5
WH 147	20S	5S	40S	12	80 S	60-80S	10 S	9	4
HW 2008	20S	5S	40S	0	40 S	40-60S	20 S	7	5
Kharchia M	80S	5S	60S	15	90 S	60-80S	-	8	4
HP 1633	10MS	0	30S	8	60 S	40S	-	5	5
DL 784-3	20S	0	20S	6	40 S	20-40S	5 S	7	5
RNB 1001	10MS	TS	20S	0	20 S	20-40S	-	9	4
HPW 349	0	0	10S	0	10 S	20-40S	-	7	2
VL 892	10MS	TS	20S	0	10 S	20S	-	5	4
HS 420	40S	0	40S	2	50 S	40-60S	-	9	4
Sonalika	80S	0	40S	5	80 S	20-40S	-	9	3
HS 507	5MS	0	10S	0	10S	Free	-	7	3
Barley Local	F	0	40S	2	20S	20S	10 S	3	3

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SAARC Wheat Disease Monitoring Nursery (2016-17)

Under the umbrella of Regional Station, ICAR-IIWBR, Shimla and CIMMYT, Delhi, SAARC wheat disease monitoring nursery is being conducted in SAARC countries with the objectives similar to the wheat disease monitoring nursery (WDMN) in India. During 2016-17, SAARC wheat disease monitoring nursery was planted at 29 locations across the six SAARC countries (Table 3.17).

Table 3. 17.Detail of SAARC-Wheat disease monitoring nursery locations during 2016-17.

S. No.	Country/ Locations	Contact person
1.	Nepal (3 sets)	CIMMYT, Nepal*
2.	Bangladesh (5 sets)	CIMMYT, Nepal
3.	Pakistan (2 sets)	CIMMYT, Nepal
4.	**Bhutan (1 set)**	CIMMYT, Nepal
5.	**Afghanistan (1 set)**	CIMMYT, Nepal
6.	India (17 sets)	Head, RS, ICAR-IIWBR, Shimla
Total	**29 locations**	
*Coordinator: Dr. A.K. Joshi, CIMMYT, Delhi.		

Information on wheat diseases in SAARC Wheat Disease Monitoring Nursery has been received from all the locations in India. Data from other locations of Nepal, Bangladesh, Pakistan, Bhutan and Afghanistan is awaited. In India SAARC wheat disease nursery was planted at 17 locations as detailed below.

Table 3.18. Locations of SAARC Wheat disease monitoring nursery in India during 2016-17

State	Co-operator	Locations
Delhi	V. K. Singh and Koshal Kishor Sameriya	New Delhi
Himachal Pradesh	V.K. Rathee	Dhaulakuan
Jammu & Kashmir	M.K. Pandey and Deepak Kumar	Jammu (Udhaywalla) Kathua Rajauri
Punjab	Jaspal Kaur	Ludhiana Gurdaspur Deenanagar Ropar Langroya Abohar
Bihar	Ashish Kumar	Pusa, Bihar
Rajasthan	P. S. Shekhawat and Nitin Chawla	Durgapura (Jaipur)
Tamil Nadu	P. Nallathambi	Wellington
Uttar Pradesh	S. P. Singh and J. Verma	Faizabad
Uttarakhand	Deepshikha and Kanak S. K. K. Mishra	Pantnagar Almora

The SAARC wheat disease monitoring nursery comprised of 20 lines contributed by four SAARC countries.

Table 3.19. Composition of SAARC wheat disease monitoring nursery

S. No.	Variety		S. No.	Variety
1.	Annapurna-1		11.	Punjab 85
2.	WL1562		12.	Chakwal 86
3.	HD2204		13.	Faisalabad 85
4.	PBW343		14.	Inquilab 91
5.	HD2687		15.	Faisalabad 83
6.	HD2189		16.	Rawal 87
7.	HP1633		17.	Kohsar
8.	RAJ3765		18.	Bakhtawar 94
9.	PBW660		19.	Gourab
10.	Pak 81		20.	Susceptible Check

Wheat Disease Situation in SAARC countries

Disease situation in India

Rusts

SAARC nursery was planted at 14 locations of NHZ and NWPZ, Faizabad, Pusa and Wellington. Yellow rust was observed at all the SAARC nursery locations in India except at Abohar, Pusa, Faizabad and Wellington. Yellow rust was first observed at Pantnagar (12.01.17), followed by Udhaywalla and Kathua (24.01.17), Durgapura (14.02.17), Dhaulakuan (15.02.17), Delhi (24.02.17) and Rajauri (04.03.17). All the entries of SAARC nursery were infected at Dhaulakuan and 14 entries were showing more than 40S severity of yellow rust. At Delhi only 6 entries *viz*. Annapurna (5S), PBW343 (40S), HD2687 (10S), HP1633 (TR), Kohsar (10S) and Susceptible check (60S) were showing yellow rust infection. During last year crop season there was no yellow rust on SAARC nursery at Durgapura (Jaipur) however during 2016-17 nine entries were infected with yellow rust. Up to 30S severity of yellow rust was observed on susceptible check at Durgapura. PBW343 was showing more than 30S severity of yellow rust at 11 locations (Table 4). Entry HD2189 was yellow rust free at all the locations except at Jammu, Pantnagar, Gurdaspur and Dhaulakuan.

Brown rust was observed at all the SAARC nursery locations except at Dhaulakuan, Ludhiana, Deenanagar and Durgapura. First report of brown rust was from Pusa and Pantnagar on 04.01.17 followed by Jammu and Kathua on 10.02.17, Faizabad (05.03.17) and Delhi (10.03.17). All the entries of SAARC-WDMN were brown rust free at Almora except Kohsar (10S) and susceptible check (TS). Similarly at Ludhiana and Ropar all the entries were brown rust free except Rawal 87 (20S) and susceptible check (10S). Brown rust was observed only on HD2204 (5S) and susceptible check (TS) at Gurdaspur and on Annapurna (TS) and susceptible check (TS) at Abohar; other entries were brown rust free at these two locations. Severity of brown rust was maximum at Wellington, where all the entries except Gourab were showing brown rust infection. Eight entries had more than 40S severity at Wellington (Table 4).

Black rust was observed only at Wellington, where the all the entries of SAARC nursery except Inquilab 91, Rawal 87 and Bakhtawar 94 were infected with black rust. Black rust severity at Wellington was ranging from TR in PBW343 and Chakwal86 to 20S in HP1633 and susceptible check (Table 4).

Leaf Blight

Leaf Blight of wheat was observed only at six locations (Almora, Faizabad, Jammu, Kathua, Pusa and Rajauri) of SAARC nursery. All the entries at Almora, Jammu, Faizabad, Kathua and Pusa were infected with leaf blight. At Rajauri three entries *viz*. HD2687, Chakwal86 and Faisalabad85 were leaf blight free. Highest severity of leaf blight was observed at Pusa followed by Faizabad and Jammu. Leaf blight severity was more than 45 on all the SAARC-WDMN entries at Pusa (Table 3.19).

Powdery mildew

Powdery mildew has been reported from five SAARC-WDMN locations i.e. Almora, Jammu, Kathua, Rajauri and Wellington. It was first reported at Almora (03.02.17) and then at Jammu and Kathua on 10.02.17 and Rajauri (04.03.17). All the entries were infected with powdery mildew at Almora, Jammu, Kathua and Wellington. At Rajauri four entries (HD2687, HP1633, PBW660 and Gourab) were free of powdery mildew infection(Table 3.20).

Loose Smut

There was no report of loose smut from any of the locations of SAARC nursery in India.

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Incidence of Wheat diseases in SAARC WDMN

With the courtesy of Dr. A. K. Joshi, CIMMYT, India, report on SAARC Wheat disease monitoring nursery was received from Bhutan and Nepal. Both wheat yellow and brown rusts were observed in these countries, whereas black rust was not observed.

Bhutan

Nursery was planted at one location only at Agriculture Research and Development Center, Department of Agriculture, Bajo, Wangdue (1250 masl). During 2016-17, incidence of wheat diseases was very less and yellow and brown rusts of wheat were observed. Wheat black rust was not observed anywhere. Most of the wheat lines were free from rusts, however, incidence of brown rust was more than yellow rust (Table 3.23).

Nepal

SAARC nursery was planted at Bhairahawa and Tarahar (Nepal). At both the locations wheat brown and black rusts were not observed. Incidence of yellow rust was also low. Except for 60S brown rust on Annapuna at Bhairahawa, other entries supported little rust

The wheat blast could be recorded only in Bangladesh at Jessore and Rajshahi. However results were not conclusive since check used did not have much blast.

Table 3.20. Incidence of rusts on entries of SAARC Wheat Disease Monitoring Nursery in India during 2016-17

S. No.	Varieties	Stripe rust score													Stem rust
		ALM	DEL	DKN	DNN	DUR	GUR	JAM	KAT	LAN	LUD	PAN	RAJ	ROP	WEL
1	Annapurna	5S	5S	60S	10S	0	60S	40S	5S	0	60S	20S	20S	20S	10MR
2	WL1562	0	0	60S	10S	0	40S	10S	TMS	0	60S	5S	10S	10S	5MR
3	HD2204	0	0	40S	10S	0	40S	10MS	0	0	60S	10S	0	10MS	60MR/10S
4	PBW343	10S	40S	60S	40S	30S	60S	60S	40S	10S	80S	80S	60S	20-40S	TR
5	HD2687	10S	10S	40S	20S	0	60S	40S	5S	10-40S	60S	10S	10S	10S	5MR
6	HD2189	0	0	10S	0	0	5S	5S	0	0	0	20S	0	0	5MR
7	HP1633	10S	TR	60S	20S	15S	60S	40S	20S	10S	40S	50S	20S	10S	20S
8	RAJ3765	30S	0	60S	20S	TMS	60S	20S	5S	40S	60S	80S	5S	40S	5MR
9	PBW660	0	0	10S	0	0	0	5R	0	TS	10S	TMS	0	TS	5MR
10	PAK81	30S	0	40S	20S	20S	60S	40S	5S	10MS	60S	20S	TMS	10MS	10MR
11	Punjab85	0	0	5S	0	0	0 (I P40S)	5S	0	0	5MS	TS	5S	0	5MR
12	Chakwal86	0	0	5S	TS	15MS	5MS	10S		0	20S	TS	0	0	TR
13	Faisalabad85	40S	0	60S	10S	0	60S	60S	20S	10S	60S	60S	20S	10S	10MR
14	Inquilab91	0	0	60S	10S	0	60S	40S	10S	10S	60S	40S	40S	10S	0
15	Faisalabad83	0	0	20S	10S	10S	40S	20S	5S	TS	60S	10S	20S	TS	5MR
16	Rawal87	5S 1P	0	25S	10S	0	20S	5R	0	0	40S	40S	0	0	0
17	Kohsar	0	10S	40S	10S	10S	20S	10S	0	0	60S	30S	5S	0	10MR
18	Bakhtawar94	0	0	40S	10S	0	10S	10S	0	10S	20S	30S	20S	10S	0
19	Gourab	10S	0	60S	20S	10S	40S	40S	10S	20S	60S	60S	10S	20S	5MR
20	Susceptible check	40S	60S	60S	20S	30S	60S	40S	10S	20S	80S	90S	60S	20S	20S
Date of first Appearance		25.03.17	24.02.17	-	-	14.02.17	-	24.01.17	24.01.17	-	-	12.01.17	04.03.17	-	-

Table 3.21. Incidence of rusts on entries of SAARC Wheat Disease Monitoring Nursery in India during 2016-17

S. No.	Varieties	Leaf rust score												
		ABO	ALM	DEL	FAZ	GUR	JAM	KAT	LAN	PAN	PUS	RAJ	ROP	WEL
1	Annapurna	TS	0	TS	30 S	0	20S	40S	0	20S	40 S	5S	0	60S
2	WL1562	0	0	5S	0	0	0	0	0	TS	70 S	0	0	5S
3	HD2204	0	0	TS	20 S	5S	10S	5S	0	20S	50 S	0	0	100S
4	PBW343	0	0	5S	5 S	0	10S	10S	0	5S	0	0	0	60S*
5	HD2687	0	0	0	10 S	0	0	0	0	5S	0	0	0	40S
6	HD2189	0	0	0	5 S	0	0	0	0	10S	20 S	0	0	40S
7	HP1633	0	0	0	0	0	0	0	0	0	0	0	0	5S
8	RAJ3765	0	0	0	0	0	0	10S	0	0	0	0	0	20S
9	PBW660	0	0	0	0	0	10S	10S	0	0	0	0	0	5MR
10	PAK81	0	0	0	0	0	10S	10S	0	10S	0	0	0	40S
11	Punjab85	0	0	0	0	0	20S	20S	0	5S	0	0	0	20S
12	Chakwal86	0	0	0	0	0	0	0	0	TS	0	0	0	10MR
13	Faisalabad85	0	0	10S	20 S	0	40S	20S	0	20S	0	5S	0	60S
14	Inquilab91	0	0	0	40 S	0	5S	10S	0	30S	0	0	0	5S
15	Faisalabad83	0	0	0	0	0	0	0	0	10S	60 S	0	0	10S
16	Rawal87	0	0	0	10 S	0	20S	20S	10-20S	5S	0	0	10-20S	40S
17	Kohsar	0	10S	0	0	0	0	0	0	TS	70 S	0	0	20S
18	Bakhtawar94	0	0	0	10 S	0	20S	20S	0	10S	0	0	0	10S
19	Gourab	0	0	0	0	0	0	0	0	TS	0	0	0	FL
20	Susceptible check	TS	TS	20S	80 S	TS	40S	60S	10S	10S	70 S	20S	10S	20S
Date of first Appearance		-	25.04.17	10.03.17	15.03.17	-	10.02.17	10.02.17	-	04.01.17	04.01.17	02.04.17	-	-

Abvn. : *ALM= Almora, DEL=New Delhi, DKN=Dhaulakuan, DNN=Deenanagar, DUR=Durgapura, GUR=Gurdaspur, JAM=Jammu, KAT=Kathua, LAN=Langroya, LUD=Ludhiana, PAN=Pantnagar, RAJ=Rajauri, ROP=Ropar, ABO=Abohar; FAZ= Faizabad, PUS=Pusa, WEL=Wellington

Table 3.22. Incidence of leaf blight in SAARC Wheat Disease Monitoring Nursery during 2016-17 in India

S. No.	Varieties	Leaf blight severity					
		Almora	Faizabad	Kathua	Pusa	Rajouri	Jammu
1	Annapurna	12	57	24	56	12	24
2	WL1562	12	58	66	57	18	46
3	HD2204	12	58	46	68	21	46
4	PBW343	12	45	12	45	12	12
5	HD2687	12	46	24	68	0	24
6	HD2189	12	46	24	78	06	24
7	HP1633	01	58	35	78	36	35
8	RAJ3765	02	57	56	78	46	36
9	PBW660	12	46	24	78	12	24
10	PAK81	02	58	24	78	12	24
11	Punjab85	12	68	24	47	06	24
12	Chakwal86	11	45	12	78	0	12
13	Faisalabad85	01	45	12	78	0	12
14	Inquilab91	11	58	24	78	26	24
15	Faisalabad83	01	67	24	79	12	24
16	Rawal87	12	47	12	78	18	12
17	Kohsar	12	68	12	89	21	12
18	Bakhtawar94	11	47	12	68	12	12
19	Gourab	02	46	46	68	26	35
20	Susceptible check	23	78	56	89	36	46
Date of first appearance		**05.04.17**	**28.01.17**	**28.02.17**	**28.02.17**	**02.04.17**	**28.02.17**

Table 3.23. SAARC Wheat disease monitoring nursery 2016–2017 (Bhutan)

Sl. No.	Entry	2nd March, 2017			17th March, 2017			1st April, 2017			16th April, 2017		
		YR	LR	SR	YR	LR	SR	YR	LR	SR	YR	LR	SR
1	Annapurna	0	0	0	0	0	0	0	0	0	0	0	0
2	WL 1563	0	0	0	0	0	0	0	0	0	0	0	0
3	HD 2204	0	0	0	0	0	0	0	0	0	0	0	0
4	PBW 660	0	0	0	0	0	0	0	0	0	0	0	0
5	HD 2687	0	0	0	0	0	0	0	0	0	0	0	0
6	HD 2189	0	0	0	0	0	0	0	20S	0	0	30S	0
7	HP 163	0	0	0	10S	0	0	10S	20S	0	10S	30S	0
8	RAJ 3765	0	0	0	0	0	0	0	10S	0	0	10S	0
9	DWB 373	0	0	0	0	0	0	0	0	0	0	10S	0
10	PAK 81	0	0	0	0	0	0	0	0	0	0	10S	0
11	Punjab 85	0	0	0	10S	0	0	10S	10S	0	10S	30S	0
12	Chakwal 86	0	0	0	0	0	0	0	10S	0	0	20S	0
13	Faislabad 85	0	0	0	0	0	0	0	10S	0	0	20S	0
14	Inquilab 85	0	0	0	0	0	0	0	10S	0	0	30S	0
15	Faislabad 83	0	0	0	10S	0	0	10S	0	0	10S	10S	0
16	Rawal 87	0	0	0	10S	0	0	10S	0	0	10S	10S	0
17	Kohsar	0	0	0	0	0	0	0	0	0	0	10S	0
18	Bakhtwar	0	0	0	0	0	0	0	0	0	0	10S	0
19	Gaurab	0	0	0	0	0	0	0	0	0	0	10S	0
20	Morocco	0	0	0	10S	40S	0	20S	60S	0	20S	60S	0

Table 3.24. Incidence of Powdery Mildew in SAARC Wheat Disease Monitoring Nursery during 2016-17 in India

S.No.	Varieties	Powdery Mildew				
		Almora	Jammu	Kathua	Rajauri	Wellington
1	Annapurna	3	3	5	3	3
2	WL1562	3	3	5	3	5
3	HD2204	3	3	3	3	2
4	PBW343	5	3	7	5	3
5	HD2687	3	1	1	0	3
6	HD2189	3	1	1	1	1
7	HP1633	3	1	7	0	1
8	RAJ3765	7	5	3	3	3
9	PBW660	3	1	3	0	2
10	PAK81	3	5	5	5	3
11	Punjab85	5	5	7	3	5
12	Chakwal86	3	5	7	5	2
13	Faisalabad85	3	3	3	1	3
14	Inquilab91	5	3	5	3	8
15	Faisalabad83	3	3	3	3	3
16	Rawal87	3	5	5	5	3
17	Kohsar	5	5	5	5	5
18	Bakhtawar94	3	5	7	5	5
19	Gourab	3	3	3	0	8
20	Susceptible check	5	6	7	5	9
Date of first appearance		03.02.17	10.02.17	10.02.17	04.03.17	-

Table 3.25. Incidence of wheat diseases in SAARC WDMN in Nepal during 2016-17

S. No	Genotypes	Bhairahawa, Altitude: 105 masl		Tarahara (Eastern Nepal)	
		YR	LR	YR	LR
1	Annapurna-1	0	5 MR	0	60 S
2	WL-1563	0	0	0	5 S
3	HD-2204	0	20 MS	0	5 MS
4	PBW-660	0	0	0	R
5	HD-2687	0	0	0	10 S
6	HD-2189	0	0	0	5 S
7	HP-163	0	0	0	0
8	Raj-3765	0	10 MR-MS	0	0
9	PBW-373	0	20 MS	0	0
10	Pak-81	0	10MS	0	0
11	Punjab-85	0	0	0	10 MS
12	Chakwal-86	0	0	0	R
13	Faislabad-85	0	20 S	0	R
14	Inguilab-85	0	5 MR	0	0
15	Faislabad-83	0	0	0	0
16	Rawal-87	0	0	0	20 S
17	Kohsar	0	0	0	10 MS-S
18	Bakhtwar	0	5 MR	0	5 MS
19	Gaurab	0	0	0	5 MS
20	Morocco	0	30 S	0	40 S

Table. 3.26. Incidence of wheat diseases in SAARC WDMN in Afganistan, 2016-17

S. No.	Variety	Stripe rust score		
		Baghlan	Nangarhar	Kabul
1	Annapurna-1	5R	20MR	10R
2	WL 1563	0	TR	0
3	HD 2204	TR	5MR	TR
4	PBW 660	0	0	TR
5	HD 2687	TR	5MR	TR
6	HD 2189	TR	10MR	TR
7	HP 163	5R	10MS	10R
8	Raj 3765	20MS	40S	20MS
9	PBW 373	30MS	20MS	20MS
10	Pak 81	TR	5MR	0
11	Punjab 85	TR	TR	0
12	Chakwal 86	0	10MR	0
13	Faislabad 85	5R	20MS	10R
14	Inquilab 85	30MS	20MR	20MS
15	Faislabad 83	0	20MS	5R
16	Rawal 87	5R	20M	5R
17	Kohsar	10MR	20MS	10MR
18	Bakhtwar	5R	10M	10R
19	Gaurab	5R	20MS	10R
20	Morocco	80S	40MS	30S

Table 3. 27. SAARC Disease Monitoring Nursery 2016-17, RAJSHAHI , Bangladesh

S. No.	Entry	Days to heading	Plant height (cm)	Spot blotch score		Leaf rust resistance	Wheat Blast (%)
				9.03.17	24.03.17		
1	Annapurna-1	70	86.7	43	89	MR	5
2	WL 1567	63	74.7	68	88	MS	0
3	HD 2204	63	73.0	56	88	MS	0
4	PBW 343	72	84.3	43	79	MR	2
5	HD 2687	69	79.3	43	88	R	0
6	HD 2189	63	100.3	43	88	MS	0
7	HP 1633	63	109.3	55	88	MS	0
8	Raj 3765	62	96.7	44	89	MS	0
9	PBW 373	46	91.7	33	79	S	5
10	Pak 81	46	87.3	33	79	0	15
11	Punjab 85	64	91.0	53	88	0	Trace
12	Chakwal 86	65	96.7	45	88	MS	Trace
13	Faisalabad 85	70	84.3	43	88	MS	7
14	Inquilab 91	62	98.0	44	88	MR	0
15	Faisalabad 83	62	92.3	54	89	MR	0
16	Raqal 87	65	105.3	53	88	MS	16
17	Koshar	64	85.0	43	88	MR	20
18	Bakhtwar 94	65	91.7	33	88	0	5
19	Gourab	62	94.7	33	88	MS	0
20	Susceptible check	65	109.7	33	79	MR	Trace

Table 3. 28. SAARC Disease Monitoring Nursery 2016-17Centre: JESSORE , Bangladesh

S.No.	Variety/Line	Days to heading	PHT(cm)	Spot blotch score		Wheat blast	
				06.03.17	20.03.17	%INC.	%SEV.
1	Annapurna-1	71	90	32	62	5	70
2	WL 1567	62	69	42	62	1	30
3	HD 2204	59	84	42	62	2	30
4	PBW 343	76	91	22	62	40	60
5	HD 2687	72	86	22	62	10	50
6	HD 2189	64	99	32	52	1	50
7	HP 1633	60	108	41	52	0	0
8	Raj 3765	63	95	41	62	2	40
9	PBW 373	79	95	22	52	10	40
10	Pak 81	76	95	22	52	20	60
11	Punjab 85	66	84	32	52	2	30
12	Chakwal 86	69	89	32	62	20	60
13	Faisalabad 85	75	92	22	62	10	50
14	Inquilab 91	61	90	32	52	5	40
15	Faisalabad 83	58	90	42	72	5	60
16	Rawal 87	65	98	32	42	0	0
17	Koshar	64	95	32	51	1	50
18	Bakhtwar 94	69	94	31	52	10	60
19	Gourab	60	95	41	51	0	0
20	Susceptible check	68	102	32	51	0	0

Table 3.29. SAARC Disease Monitoring Nursery 2016-17, JOYDEBPUR (Bangladesh)

S. No.	Entry	Days to heading HD	Plant height (cm)	Spot blotch score		
1	Annapurna-1	68	90	33	43	55
2	WL 1567	61	89	32	54	55
3	HD 2204	53	88	33	54	64
4	PBW 343	72	92	32	43	64
5	HD 2687	70	91	32	44	53
6	HD 2189	61	88	32	53	64
7	HP 1633	61	89	43	54	64
8	Raj 3765	61	89	43	53	64
9	PBW 373	77	94	43	53	64
10	Pak 81	72	91	32	43	54
11	Punjab 85	61	90	32	53	64
12	Chakwal 86	66	91	43	53	64
13	Faisalabad 85	72	93	32	43	54
14	Inquilab 91	61	89	43	53	64
15	Faisalabad 83	66	92	43	54	65
16	Rawal 87	61	90	32	43	54
17	Koshar	61	89	43	53	64
18	Bakhtwar 94	66	91	32	43	54
19	Gourab	66	92	32	43	54
20	Susceptible check	66	92	32	43	54

Table 3.30. SAARC Disease Monitoring Nursery 2016-17, JAMALPUR (Bangladesh)

Entry	Variety/ Line	Heading days	PHT (cm)	Spot blotch score (AUDPC)	Leaf rust (Cobb scale)
1	Annapurna-1	70	85	493.83	10R
2	WL 1567	60	60	755.56	0
3	HD 2204	60	69	755.56	0
4	PBW 343	71	83	375.31	0
5	HD 2687	69	72	493.83	10R
6	HD 2189	64	86	346.91	0
7	HP1633	71	88	719.75	10R
8	Raj 3765	65	69	508.64	0
9	PBW 373	71	82	375.31	10R
10	Pak 81	69	72	576.54	10R
11	Punjab 85	65	66	486.42	0
12	Chakwal 86	75	83	346.91	10R
13	Faisalabad 85	78	88	277.78	0
14	Inquilab 91	65	74	551.85	0
15	Faisalabad 83	60	71	576.54	0
16	Rawal 87	72	92	381.48	0
17	Koshar	62	73	479.01	0
18	Bakhtwar 94	69	69	418.52	0
19	Gourab	65	82	346.91	0
20	Susceptible check	71	98	422.22	20MS

Table 3.31. SAARC Disease Monitoring Nursery 2016-17, DINAJPUR (Bangladesh)

S. No.	Entry	HD	PHT (cm)	Spot blotch score			Leaf rust score	
				03-08-2017	19-3-2017	27-3-2017	Score	Reaction
1	Annapurna-1	77	88	32	53	87	20	MS-S
2	WL 1567	65	69	43	65	87	T	MS
3	HD 2204	60	81	43	75	85	5	MS
4	PBW 343	77	90	22	43	76	T	MS
5	HD 2687	75	87	22	43	87	5	MS-S
6	HD 2189	66	100	22	54	75	T	MS
7	HP1633	63	107	43	75	75	T	MS
8	Raj 3765	67	92	32	54	75	T	MR-MS
9	PBW 373	81	98	22	43	86	20	MS-S
10	Pak 81	79	95	32	43	65	T	MS-MR
11	Punjab 85	69	79	22	43	85	5	MS-S
12	Chakwal 86	74	93	33	64	87	5	MS-S
13	Faisalabad 85	76	95	22	43	86	5	MS-S
14	Inquilab 91	64	94	22	43	87	T	MS
15	Faisalabad 83	61	85	33	65	75	5	MS-S
16	Rawal 87	71	103	32	43	85	10	MS-S
17	Koshar	67	98	22	43	86	5	MS-S
18	Bakhtwar 94	71	108	22	33	87	5	MS-S
19	Gourab	64	98	22	43	85	T	MR
20	Susceptible check	71	120	53	64	88	80	S

(Source: Dr. A.K. Joshi, CIMMYT, India)

PROGRAMME 4. INTEGRATED DISEASE MANGEMENT

Integrated disease management is an important alternative strategy in case a ruling variety becomes susceptible to rusts and other diseases due to change in pathotypes, weather and cropping system. It is therefore important to evaluate fungicides which may be used to control disease in such cases. It is achieved through seed treatment and foliar sprays.

Stripe rust

Experiments on chemical control of stripe rust were conducted at Jammu and Ludhiana centres and results are presented in Table 4.1 and 4.2.

Ludhiana

For the evaluation of different chemicals against yellow rust of wheat, a trial was conducted with 9 treatments including control with four replications. Stripe rust was created by artificial inoculation of mixed pathotypes spores. The result revealed that Amistar gave the maximum disease reduction over control followed by Nativo 75WG and Tilt 25EC and however, maximum yield was recorded in Nativo 75WG followed by Amistar.

Table 4.1. Fungicidal control of stripe rust at Ludhiana, 2016-17

S. No.	Treatment	Dose (%)	Stripe rust score (HS)	CI	Grain yield (q/ha)	1000 grain wt.(g)
1	Tilt 25EC (propiconazole)	0.1	TS	0.7	43.33	33.2
2	Markazole 25EC (propiconazole)	0.1	5S	2.0	44.00	34.1
3	Shine (propiconazole)	0.1	5S	3.3	41.23	34.0
4	Bumper (propiconazole 25%)	0.1	5S	2.0	44.53	33.4
5	Compass 50WG (propiconazole)	0.1	10S	3.7	41.70	33.5
6	Stilt 25 EC (propiconazole)	0.1	5S	3.7	46.65	34.3
7	Amistar (azoxystrobin+difeconazole)	0.1	0	0.0	50.10	35.4
8	Nativo 75 WG (trifloxystrobin 25%+ tebuconazole 50%)	120g /acre	TS	0.7	52.89	35.7
9	Control	0	80S	80.0	10.19	27.5
	CD (5%)			16.7	2.55	2.28

Variety PBW 343
Date of sowong :25.11.2016
Date of inoculation:20.12.2016
Date of Ist appearance of rust: 05.1.2017
Date of foliar spray:6.1.2017,22.1.2017,.18.2.2017

Jammu

Variety: PBW 343, **Treatments:** 9, **Plot size:** 3 x 4 meter^2 , **Replications:** 4, **Design:** RBD

Stripe rust susceptible variety, PBW 343 was sown in field in 3 x 4 m^2 plots with 9 treatments including control with four replications. Stripe rust was created by artificial inoculation of mixed pathotypes spores. Fungicidal sprays were given at 15 days interval. The result revealed that all the treatments records significant reduction of disease incidence. Two sprays of Tilt (0.01%) at 15 days interval resulted in minimum disease severity (6.25) followed by two spray of Folicur @ 0.1% (12.5%) and Bayleton @0.1% (17.5%). The highest yield (49.55q/ha) was recovered in the plot treated with two sprays of Tilt @0.1% followed by two spray of Folicur (48.61q/ha) and Bayleton @0.01% (46.05q/ha). The plot treated with two spray of Tilt @ 0.1% was recorded highest yield increased (48.99%) followed by two spray of Folicur (48.00%) and Bayleton @0.01% (45.11%) over control.

Table 4.2. Fungicidal control of stripe rust at Jammu, 2016-17

S. No.	Treatment	Concentration (%)	Mean Rust Severity (%)	Grain Yield (q/ha)	Yield increased (%)
1	One spray of Tilt	0.1 %	25.00	45.22	41.51
2	Two sprays of Tilt	0.1 %	06.25	49.55	48.99
3	Two sprays of Mancozeb	0.25 %	65.00	26.46	04.47
4	Three sprays of Mancozeb	0.25 %	45.00	31.83	20.59
5	One spray of Folicur	0.1 %	35.00	44.44	40.44
6	Two sprays of Folicur	0.1 %	12.50	48.61	48.00
7	One spray of Bayleton	0.1 %	32.50	42.33	37.32
8	Two sprays of Bayleton	0.1 %	17.50	46.05	45.11
9	Control (No spray)		90.00	25.27	00.00
	CD (5%)		**12.1**	**3.9**	

Leaf blight

An experiment was conducted to evaluate the fungicidal efficacy against foliar blight pathogen of wheat at Ranchi center. Experiment was conducted in RBD with ten treatment including control with three replications. The minimum disease severity was recorded on spray of Tilt @ 0.1% (Two sprays) followed by spray of Folicur @ 0.1% (Two sprays). Whereas, maximum yield was recorded on spray of Folicur @ 0.1% (Two sprays) followed by spray of Tilt @ 0.1% (Two sprays).

Chemical control of flag smut of wheat:

The trial was planted at four locations (Karnal, Ludhiana, Hisar and Durgapura) and results are given in Tables 4.5-4.6. This is the first year of trial.

To evaluate the efficacy of different fungicides as seed dresser against flag smut of wheat, an experiment was conducted at four locations. Six different fungicides with untreated control were evaluated with three replications. Among these, Difenoconazole 3% (Dividend) and

Carboxin 75 WP (Vitavax) were at par and most effective in comparison to control. However, maximum yield was recorded when treated with Tebuconazole 5.36% (Raxil easy) followed by Tebuconazole (Raxil 2% DS).

Table 4.3. Management of foliar blight at Ranchi Centre, 2016-17

S. No	Treatment	Seed germination at 20DAS (%)	Leaf blight score			Grain yield	1000 grain weight
			Flowering	Milk	dough	q/ha	(g)
1	Untreated control	83	36	47	68	31.89	36.0
2	Only ST with Captaf@ 3.0g/Kg seed	90	13	25	36	33.35	37.3
3	Only seed treatment with Vitavax @ 2.5g/Kg seed	92	14	25	35	34.95	38.0
4	ST (Vitavax Powder @ 2.5g/Kg Seed) + 1 Spray of Tilt	92	01	12	24	37.66	38.6
5	ST (Vivatax powder @ 2.5g/Kg seed) + 2 sprays of Tilt	96	02	13	24	42.40	41.6
6	Only one foliar spray of Tilt @ 0.1%	90	13	25	35	37.76	38.5
7	Foliar spray of Tilt @ 0.1% (Two sprays)	88	00	02	12	39.04	40.0
8	Only one spray of Folicur @ 0.1%	86	13	24	25	38.88	39.0
9	Foliar spray of Folicur @ 0.1% (Two sprays)	90	02	03	14	40.50	39.6
10	Three foliar spray of Dithane M-45 @0.25%	86	13	25	35	35.68	38.0
	CD (5%)					5.9	1.3

Table 4.4. Effect of fungicidal seed treatment on incidence of flag smut at different locations during 2016-17 crop season

S. No.	Treatments	Doses (%)	Diseases incidence on tiller basis (%)					Disease control over check (%)
			Hisar	Ludhiana	Karnal	Durgapura	Av.	
1	Tebuconazole (Raxil 2% DS) (Powder)	1.5	0.0	4.2	0.0	0.0	1.1	95.7
2	Difenoconazole 3% (Dividend) (Powder)	1.0	0.0	3.5	0.0	0.0	0.9	96.5

S. No.	Treatments	Doses (%)	Diseases incidence on tiller basis (%)					Disease control over check (%)
			Hisar	Ludhiana	Karnal	Durgapura	Av.	
3	Carboxin 75 WP (Vitavax)	2.5	0.0	3.6	0.0	0.0	0.9	96.5
4	Tebuconazole 5.36% (Raxil easy) (Liquid)	1.0	0.0	4.3	2.0	0.0	1.6	93.8
5	Carboxin 17.5% + Thiram 17.5% (Vitavax Ultra) (Liquid)	2.5	0.0	3.5	6.9	2.5	3.2	87.5
6	Carbendazim – 50% WP (Bavistin)	2.5	7.0	3.8	1.0	1.3	3.3	87.2
7	Control		13.0	44.0	12.6	33.1	25.7	-
	CD (5%)		0.3	2.1	2.0	3.3		

Table 4.5. Effect of fungicidal seed treatment for control of flag smut and wheat yields

S. No.	Treatments	Doses	Yield/plot (q/ha)					
			Hisar	Ludhiana	Karnal	Durgapura	Av.	Increase over check (%)
1	Tebuconazole (Raxil 2% DS) (Powder)	1.5	49.0	49.5	49.2	47.5	48.8	44.8
2	Difenoconazole 3% (Dividend) (Powder)	1.0	46.2	48.3	47.3	45.7	46.9	39.2
3	Carboxin 75 WP (Vitavax)	2.5	44.9	49.7	48.2	46.0	47.2	40.1
4	Tebuconazole 5.36% (Raxil easy) (Liquid)	1.0	48.1	48.4	52.8	46.2	48.9	45.1
5	Carboxin 17.5% + Thiram 17.5% (Vitavax Ultra) (Liquid)	2.5	47.4	47.5	51.4	42.2	47.1	39.8
6	Carbendazim – 50% WP (Bavistin)	2.5	39.0	48.9	47.6	42.8	44.6	32.3
7	Control		35.4	27.3	44.0	28.0	33.7	-
	CD (5%)		2.3	6.2	1.7	5.8		

DOS: 22 Nov. 2016, PBW 343 (Karnal) 6 rows, 30 cm distance

Name	centre
P.S. SHEKHAWAT	DURGAPURA
JASPAL KAUR, RITU BALA	LUDHIANA
M.K. PANDEY	JAMMU
D.P.SINGH, SUDHEER KUMAR, P.L.KASHYAP	KARNAL
H.C.LAL	RANCHI
R.S.BENIWAL	HISAR

PROGRAMME 5. WHEAT NEMATOLOGY

Wheat Nematology sub programme under crop protection programme of AICW&BIP action plan for the year 2016-17 considered the aspects like evaluation of host resistance against Cereal Cyst Nematode (*Heterodera avenae* & *H. filipjevi*) and root knot nematode (RKN); survey and surveillance for CCN, ECN and other plant parasitic nematodes found in wheat; population dynamics studies on major parasitic nematodes in wheat based different cropping systems and integrated and eco friendly approaches in management of CCN. The activities dealt in details with resultant outcomes are written hereunder.

HOST RESISTANCE

i) Response of CCNSN (AVT entries) against CCN, *Heterodera avenae* and *H. filipjevi* at multilocations

Hisar

Screening of wheat germplasm against *Heterodera avenae*

Screening of wheat was done in 1 kg capacity earthen pots, using nematode – infested soil, under screen house conditions. Four seeds of each entry were sown and thinned to two plants per pot after one week of germination. Each entry had three replications. Numbers of white females/cysts were recorded in each pot after 120 days of sowing. Varieties/ lines were categorized as resistant (1-4 cysts), moderately resistant (5-9 cysts), susceptible (9 -20 cysts) and highly susceptible (>20cysts).

AVT-1: Under AVT-I, 90 entries were screened against *H. avenae*, under screen house conditions. all the entries were found highly susceptible.

AVT-I1: Out of the 60 entries tested, two (sr no.23 & 53) were susceptible and remaining highly susceptible. On susceptible entries, size of cysts was also smaller.

Ludhiana

Ninety one entries of AVT I and sixty entries of AVT II were screened for resistance against *H. avenae* CCN sick plot conditions. PBW 621, PBW 550 and HD 2967 were used as susceptible checks. Out of these none of the entry was found resistant. Only eight entries namely HI 1620, PBW 750, DBW 187, HI 8791 (d), UAS 462 (d), DBW 246, PBW 778 and NH-01-VHA in AVT I and only one entry DBW 88 (c) in AVT II have shown moderately resistant reaction. Rest of the entries was either susceptible or highly susceptible to CCN.

Durgapura

Ninety one wheat germplasms (AVT-I) were received from IIWBR, Karnal and nursery was planted in naturally infested field condition against cereal cyst nematode, *Heterodera avenae* (Pathotypes Ha 21) of RARI, Durgapura, Jaipur. The inoculums level was 10 L/gm of soil. Out of 91 germplasm none was found the resistant reaction, whereas, one showed moderately resistant reaction i.e. VL 3013, rest were found susceptible (73) and highly susceptible (14). Seed of three germplasm were not received (Table -5.1).

Sixty wheat germplasms (AVT-II) were received from IIWBR, Karnal and nursery was planted in naturally infested field condition against cereal cyst nematode, *Heterodera avenae* of RARI, Durgapura, Jaipur. The inoculums level was 10 L/gm of soil. Out of 68 germplasm, only one was found resistant (KRL 19 (C), whereas, four showed moderately resistant reaction i.e. HS 490 (C), HD 3171 (I) (C), MP 3288 (C), UAS 304 (C), rest were found susceptible (51) and highly susceptible (4) (Table-5.2).

Table 5.1. Screening of wheat germplasm AVT- I against cereal cyst nematode, *Heterodera avenae* (Jaipur Population) at Durgapura during 2016-17

S.N	Category	Entries (91)
1	Resistant	Nil
2	Moderately Resistant (1)	VL 3013
3	Susceptible (73)	DBW 179, HPW 439, HPW 440 HPW 449, HS 629, HS 630, HS 643 HS 644, HS 645, HS 646, HS 647, HS 648, VL 1012, VL 1013, VL 3014, VL 3015, VL 4002, BRW 3773, CG 1023, DBW 189, DBW 196 HD 3226, HD 3237 HI 1617, HP1963, PBW 750, PBW 752, UP 2942, WH 1202, DBW 187, HD 3219, UAS 384, HI 8791 (d), UAS 385, UAS 387, DBW 246, DBW 247, DDK 1052, DDK 1053, KRL 370, KRL 377, KRL 384, KRL 386, MACS 5047, MACS 5049, PBW 779, PBW 780, WH 1316, TL 3011, TL 3012, TL 3013, TL 3014, TL 3015, DBW 249, DBW 250, DBW 251, HD 3271, HD 3272, HI 1621, PBW 757, PBW 777, PBW 778, WH 1232, WH 1233, NH-01-VHA, NH-02-VHA, NH-03-VHA, NH-04-VHA, NH-05-VHA, NH-07-VHA, NH-08-VHA, NH-09-VHA, NH-10-VHA
4	Highly Susceptible (14)	HPW 448, UP 2992, UP 2993, VL 1011, VL 4003, HI 1619, HI 1620, HS 611, MACS 6677, MP 1318, BRW 3775, UAS 462 (d), DBW 248, NH-06-VHA

SEED NOT RECEIVED: DBW 204, HPW 434 and HPW 438

Table 5.2. Screening of wheat germplasm AVT- II against cereal cyst nematode, *Heterodera avenae* (Jaipur Population) at Durgapura during 2016-17

S.No.	Category	Entries (60)
1	Resistant (1)	KRL 19 (C)
2	Moderately Resistant (4)	HS 490 (C), HD 3171 (I) (C), MP 3288 (C), UAS 304 (C)
3	Susceptible (51)	HPW 251 (C), HS 375 (C), HS 507 (C), HS 542 (C), VL 907 (C), DBW 173, DBW 88 (C), DBW 90 (C), HD 3043 (C), HD 2967 (C), HD 3059 (C), HD 3086 (C), PBW 644 (C), WH 1021 (C), WH 1080 (C), WH 1105 (C), WH 1124 (C), WH 1142 (C), HI 1612, C 306 (C), DBW 39 (C), HD 2733 (C), HD 2888 (C), K 8027 (C), K 0307 (C), K 1006 (C), K 1317 (I) (C), DBW 110 (C), HD 8627 (d) (C), DBW 168, HI 8777 (d), MACS 4028 (d), AKDW 2997-16(d) (C), GW 322 (C), MACS 6222 (C), MACS 6478 (C), NI 5439 (C), NIAW 1415 (C), UAS 446 (d) (C), HW 2044 (C), HW 5216 (C), CoW (W) -1 (C), DBW 14 (C), DDK 1029 (C), HW 1098 (C), Kharchia 65 (C), KRL 210 (C), PBW 550, TL 2942 (C), TL 2969 (C), WR 544 (C)
4	Highly Susceptible (4)	VL 829 (C), VL 892 (C), UAS 375, DBW 71 (C)

Table 5.3. Screening of AVT- entries against cereal cyst nematode, *Heterodera avenae* at Delhi during 2016-17

S. No.	Entry	Cysts (Nos.)				
		R1	R2	R3	AVERAGE	GRADING
I. NORTHERN HILLS ZONE,						
1	DBW 179	9	14	10	11	S
2	DBW 204	No Seed	No Seed	NS	No Seed	No Seed
3	HPW 434	No Seed	No Seed	NS	No Seed	No Seed
4	HPW 438	No Seed	No Seed	NS	No Seed	No Seed
5	HPW 439	12	10	14	12	S
6	HPW 440	30	36	40	35	HS
7	HPW 448	19	22	16	19	S
8	HPW 449	48	65	58	57	HS
9	HS 629	11	15	21	16	S
10	HS 630	41	36	40	39	HS
11	HS 643	54	61	48	54	HS
12	HS 644	35	38	26	33	HS
13	HS 645	23	18	29	23	HS
14	HS 646	43	36	29	36	HS
15	HS 647	16	12	20	16	S
16	HS 648	31	35	22	29	HS
17	UP 2992	17	11	20	16	S
18	UP 2993	33	40	38	37	HS
19	VL 1011	22	28	19	23	HS
20	VL 1012	36	29	22	29	HS
20. A	INFECTOR	11	18	10	13	S
21	VL 1013	19	15	23	19	S
22	VL 3013	23	19	30	24	HS
23	VL 3014	9	12	15	12	S
24	VL 3015	16	10	13	13	S
25	VL 4002	14	17	8	13	S
26	VL 4003	20	24	31	25	HS
II. NORTH WESTERN PLAINS ZONE						
27	BRW 3773	45	30	36	37	HS
28	CG 1023	19	23	16	19	S
29	DBW 189	12	16	9	12	S
30	DBW 196	62	48	52	54	HS
31	HD 3226	69	50	46	55	HS
32	HD 3237	33	29	25	29	HS
33	HI 1617	61	53	48	54	HS
34	HI 1619	39	27	21	29	HS
35	HI 1620	59	48	52	53	HS
36	HP 1963	44	30	49	41	HS
37	HS 611	22	29	18	23	HS
38	MACS 6677	47	54	40	47	HS
39	MP 1318	70	68	81	73	HS
40	PBW 750	29	18	32	26	HS
40. A	INFECTOR	54	38	49	47	HS
41	PBW 752	90	105	88	94	HS
42	UP 2942	39	42	36	39	HS
43	WH 1202	62	55	66	61	HS
III. NORTH EASTERN PLAINS ZONE						

44	DBW 187	49	39	52	47	HS
45	HD 3219	32	35	26	31	HS
46	UAS 384	34	37	28	33	HS
IV. CENTRAL ZONE						
47	BRW 3775	43	36	47	42	HS
48	HI 8791 (d)	52	48	38	46	HS
49	UAS 385	22	19	28	23	HS
50	UAS 462 (d)	72	68	64	68	HS
V. SOUTHERN HILLS ZONE						
51	UAS 387	96	82	89	89	HS
VI. SPECIAL TRIAL (Dicoccum, MABB, Salinity and Alkalinity)						
52	DBW 246	70	65	72	69	HS
53	DBW 247	41	37	45	41	HS
54	DBW 248	82	75	71	76	HS
55	DDK 1052	69	62	76	69	HS
56	DDK 1053	42	33	36	37	HS
57	KRL 370	34	45	41	40	HS
58	KRL 377	57	63	48	56	HS
59	KRL 384	95	101	98	98	HS
60	KRL 386	52	44	54	50	HS
60. A	INFECTOR	108	49	102	86	HS
61	MACS 5047	26	28	18	24	HS
62	MACS 5049	51	58	47	52	HS
63	PBW 779	41	39	46	42	HS
64	PBW 780	71	65	68	68	HS
65	WH 1316	21	19	26	22	HS
VII. SPECIAL TRIAL (TRITICALE)						
66	TL 3011	9	13	8	10	S
67	TL 3012	86	73	81	80	HS
68	TL 3013	40	38	45	41	HS
69	TL 3014	16	8	12	12	S
70	TL 3015	40	38	33	37	HS
VIII. SPECIAL TRIAL (Very Late Sown)						
71	DBW 249	33	28	35	32	HS
72	DBW 250	22	18	29	23	HS
73	DBW 251	63	68	52	61	HS
74	HD 3271	21	17	19	19	S
75	HD 3272	55	46	58	53	HS
76	HI 1621	39	43	36	39	HS
77	PBW 757	43	51	56	50	HS
78	PBW 777	59	63	70	64	HS
79	PBW 778	41	35	38	38	HS
80	WH 1232	30	26	34	30	HS
80. A	INFECTOR	44	51	46	47	HS
81	WH 1233	56	47	53	52	HS
IX. SPECIAL TRIAL (Very High Altitude)						
82	VHA-01	33	28	38	33	HS
83	VHA-02	25	19	28	24	HS
84	VHA-03	19	10	13	14	S
85	VHA-04	22	16	13	17	S
86	VHA-05	29	18	16	21	HS
87	VHA-06	20	13	18	17	S
88	VHA-07	19	23	15	19	S
89	VHA-08	35	28	33	32	HS

90	VHA-09	13	9	17	13	S
91	VHA-10	10	8	6	8	MR
91. A	INFECTOR	34	28	31	31	HS

Reactions of entries of MDSN, AVTs (Total 239) against CCN at Wellington, 2017-18

Plot No. B5 of ICAR-IARI, RS, Wellington
Soil type red loam
Date of sowing 01/12/16
Observation revealed that none of the lines responded as the population of *Heterodera avenae* was not was found in this area. However soil quantification reveals the presence of various other cyst nematodes such as *Globodera* spp., Pseudo cysts (*Cactodera* sp. – but not confirmed) and other *Heterodera* spp. Further quantification with 100 and 400 mesh sieves showed the presence of *Pratylenchus* sp. (300 nematode/100cc soil), *Aphelenchus* sp. (150 nematode/100cc soil), *Aphelenchoides* sp. (50 nematode/100cc soil), *Trichodorus* sp. (50 nematode/100cc soil), *Helicotylenchus dihystera* (50 nematode/100cc soil) and Free living nematodes.

MULTIPLE DISEASE/PEST SCREENING NURSERIES: NEMATODES (CCN)

MDSN

Hisar
Under multiple disease screening nursery, 69 entries were screened against *Heterodera avenae*, under screen house conditions. All the entries, except PBW719, gave highly susceptible reaction. PBW719 was re-sown, had poor growth and <5 cysts per plant. It needs further confirmation.

Ludhiana
Sixty nine entries were evaluated for resistance to cereal cyst nematode, *H. avenae* and none were found resistant. Only six entries namely HPBW 08, HS 596, K1314, TL 3004 (T), DBW 183 and WH 1309 were moderately resistant. Remaining entries were susceptible or highly susceptible. Screening against cereal cyst nematode was done under pot culture conditions in the nematode infested soil.

Durgapura
Sixty nine wheat germplasms (MDSN) were received from IIWBR, Karnal and nursery was planted in naturally infested field condition against cereal cyst nematode, *Heterodera avenae* of RARI, Durgapura, Jaipur. The inoculums level was 11.0 L/gm of soil. Out of 69 germplasm, none was found resistant, whereas, one showed moderately resistant reaction i.e. GW 1315 (d), rest were found susceptible (66) and highly susceptible (2) (Table -5.4).

Studies of biotypes of *Heterodera avenae* at Durgapura
The biotypes studies of cereal cyst nematode were carried out during the crop season 20016-17 against Jaipur population of cereal cyst nematode, *Heterodera avenae*. Out of 26 International differentials of wheat, barley and oat, twelve showed resistant reaction i.e. AUS-15854, AUS-7869, AUS-15895, Psathia, KVL-191, Harlan, Dalmitsche, Morocco, P-313221, Martin, Siri, La-estanzuella while rest showed susceptible reaction. Jaipur Population of CCN is Pathotype Ha 21. (Table-5.5).

Table 5.4. Screening of multiple disease screening nursery (MDSN) of wheat against cereal cyst nematode, *Heterodera avenae*

S. No.	Category	Entries (69)
1	Resistant	NIL
2	Moderately Resistant (1)	GW 1315 (d)
3	Susceptible (66)	PBW 723, HI 8765 (d), HPBW 08, HPBW 09, HPW 422, HS 580, HS 596, HS 597, HS 599, K 1312, K 1314, MACS 4024, MACS 3970 (d), MACS 3972 (d), PBW 709, PBW 718, TL 3001 (T), TL 3002 (T), TL 3003 (T), TL 3004 (T), TL 3005, UAS 453 (d), UAS 455 (d), VL 3007, VL 3008, WB5, DBW 147, DBW 150, DBW 181, DBW 182, DBW 183, DDK 1048 (dic.), DDK 1049 (dic.), DDW 31, GW 463, HD 3164, HPBW 01, HPBW 02, HPBW 05, HUW 695, HUW 712, JWS 712, K 1313, K 1315, KRL 350, KRL 351, MACS 4020 (d), MACS 5041, MACS 5043, PBW 716, PBW 719, UP 2883, VL 4001, WB1, WH 1309, DDW 32, HD 3165, HS 600, PBW 721, UAS 428 (d), DBW 184, HPBW 07, HS 583, HS 601, PBW 707, VL 1006
4	Highly Susceptibl (2)	HD 3159, HI 1604

Table 5.5. Reaction of *Heterodera avenae* of Jaipur population on International differentials

S.No.	International Differentials	Reactions
1	AUS-15854	R
2	AUS-15807	S
3	AUS-7869	R
4	AUS-15895	R
5	AUS-4930	S
6	AUS-498	S
7	Loros	S
8	IK2 Light	S
9	Psathia	R
10	Capa	S
11	Ortalan	S
12	KVL-191	R
13	Harlan	R
14	Ogrlitsche	S

S.No.	International Differentials	Reactions
15	Dalmitsche	R
16	Harta	S
17	Emir	S
18	Morocco	R
19	Gelliune	S
20	P-313221	R
21	Martin	R
22	Varda	S
23	Siri	R
24	La-estanzuella	R
26	L-62	S
26	Nidar-2	S
	Pathotype	Ha 21

Rating scale(0 -5%= resistant), (6 -100%= susceptible)

SURVEY AND SURVEILLANCE

Cereal Cyst Nematode and other soil borne Nematode

Hisar

Crop health monitoring survey for nematodes was done in Hisar and Fatehabad, districts. Cereal cyst nematode was reported in 32.3 % (21/65) samples. It was reported in samples of Jagaan, Asranwa, Mahalsara, Kohli, Khairampur, Sadalpur, Chuli, Adampur, Siswal & Bhodiya bishnoiyan in Hisar (10/35) ; Mehuwala, Dharnia , Bhattu, Dhabi, Dhingsara, Bhodiya khera, Sulikhera, Kirdhan, Gadli, Fatehabad, Kumhariyan in Fatehabad (11/30) . Number of cysts ranged from 2-28 per 200 cc soil. Other plant parasitic nematodes present in 200 cc soil samples were *Pratylenchus* sp. 38.4% (5-40); *Tylenchorhynchus* sp. 53.8% (15-300); *Hoplolaimus* sp. 18.4% (2-35), *Helicotylenchus* sp. 16.9% (2-20) and root knot nematode 3.0 % (5-20) (Table 5.6). Wheat seed gall nematode (*Anguina tritici*) was not recorded from the state.

Table 5.6. Community analysis of plant parasitic nematodes associated with wheat in Hisar and Fatehabad districts

Nematode species	Frequency of occurrence (%)
Heterodera avenae	32.3 (2-28)
Tylenchorhynchus sp.	53.8 (15-300)
Pratylenchus sp	38.4 (5-40)
Helicotylenchus sp.	16.9 (2-20)
Hoplolaimus sp.	18.4 (2-35)
Meloidogyne spp	3.0 (5-20)

Total number of samples = 65
Figures in parentheses indicate range in 200 cc soil

Durgapura

Survey was conducted in the different cultivator's fields of four districts of Rajasthan for studying the incidence and intensity of Cereal Cyst Nematode (CCN). Diseased fields were randomly selected on the basis of above ground symptoms of the crops. Symptoms of stunting, yellowing, patchy and poor growth were recorded during survey of each field. Roots samples were collected from the rhizospere of wheat and barley crops looking above ground symptoms alongwith composite soil sample. Root & soil sample were processed with standard technique of nematode identification. Presence of cereal cyst nematode was further confirmed by seeing the bushy roots with white cyst on it. Cereal cyst nematode infestation was recorded in all four districts e.i. Alwar, Dausa, Jaipur and Sikar districts. A large number of infested fields were observed in Amber, Bassi, Chomu, Jamwa Ramgarh, Kotputli, Sahapura and Viratnagar tehsil of Jaipur district.

Integrated and ecofriendly management of *Heterodera avenae*

Evaluation of ecofriendly approaches for the management of cereal cyst nematode, *H. avenae*

Hisar

This experiment was done in screen house in earthen pots. Nematode – infested soil was filled after diluting the soil with dune sand to make the initial inoculum 15 cysts/ 1 kg pot. Sowing of wheat var. WH 1105 was done on 5-12-2016 and two plants were maintained in each pot. In one set, resistant variety Raj MR 1 was sown in infested soil. There were seven treatments with three replications each (Table 5.7). Castor cake, neem cake, vermi compost and FYM (10 g /kg soil) were mixed in soil at sowing time. Cow urine 25, 50 and 100% was used as seed dip treatment for 4 h. Recommended dose of fertilizers and controlled amount of water were applied in pots. Observation on number of cysts was recorded, 110 days after sowing.

In seed treatment with 50 and 100 % cow urine germination did not take place, so no data was obtained. Castor cake delayed germination and crop growth was poor in the beginning, although at later stage, growth was best in this treatment. None of the organic matter or seed treatment with cow urine was effective in controlling cyst nematode in wheat. On *H. avenae* -resistant wheat variety Raj MR 1, no cyst was formed.

Table 5.7. Effect of various treatments on cereal cyst nematode (Hisar)

Treatment	No. of cysts per pot
Raj MR1 (CCN resistant variety)	0 (1.4)
Untreated Control	52.7 (7.4)
Castor cake	67.3 (8.2)
Neem cake	58.7 (7.7)
Vermi compost	60.0 (7.8)
FYM	42.7 (6.7)
Cow urine 25% (seed treatment)	46.0 (6.9)
C D at 5 %	(1.1)

Figures in parentheses are n+1 square root transformations
Date of sowing: 5-12-2016

Evaluation of Eco-friendly approaches in management of Cereal cyst nematode, *Heterodera avenae* in wheat

An experiment was conducted at Rajasthan Agricultural Research Institute, Durgapura, Jaipur in naturally infested soil. Inoculum level was 11.2 larvae/g soil of cereal cyst nematode. The experiment consisted of seven treatments *viz* Neem cake 10q/ha (soil application), Neem oil 10 ml/kg (seed treatment), NSKP (seed soaking) (10 ml/kg), Neem cake 5 q/ha +half dose of Neem oil, Neem cake 5 q/ha +half dose of NSKP along with treated check (Carbofuran@ 1.5 kg ai/ha) and untreated check (Raj 3765) in a completely randomized block design and replicated thrice. The crop after attaining the age of 75-90 days was examined the development of white cyst/plant in each treatment. The grain yield was taken at the time of harvesting of the crop in each treatment separately. The results revealed that all the treatments gave significantly higher grain yield with reduced number of cysts/plant over control. The maximum grain yield (32.60 q/ha) was recorded in Neem cake 5 q/ha +half dose of Neem oil with 9.22 cyst/ plant) with increase 141.80% in yield followed by Neem cake 5 q/ha +half dose of NSKP (Grain yield – 29.1 q/ha; 10.11 cysts/plant). All the neem based formulations was also found effective in reducing the population of nematodes and increased grain yield over control. Half dose of Neem cake (soil application) with neem oil (seed treatment) showed its overall superiority by keeping larvae entry away from root and better plant growth. Response may be due to the fact that neem oil having nematicidal potential and cake might have increased the tolerance level of plant and potential to resist the nematode attack (Tables 5.7-5.8).

Table 5.8. Evaluation of Eco-friendly approaches in management of Cereal cyst nematode, *Heterodera avenae* in Wheat

S.NO.	Treatments	Grain Yield of Wheat		Cysts/ Plant
		Yield q/ha	% Increase over control	
1	Neem cake 10 q/ha	28.0	104.91	13.26
2	Neem oil 10 ml /kg seed	25.0	88.52	12.84
3	NSKP 10 % (seed soaking)	23.6	75.40	11.82

4	Neem cake 5 q/ha +half dose of Neem oil	32.6	141.80	9.22
5	Neem cake 5 q/ha +half dose of NSKP	29.1	122.31	10.14
6	Treated check (Carbofuran 1.5 kg ai/ha)	42.2	190.98	6.28
7	Untreated check (Raj-3765)	14.8	---	20.40
	CD5% **CV%**	**1.42** **2.78**		**0.32** **3.34**

Diversification in existing wheat based systems for CCN management

Durgapura

An experiment was conducted at Rajasthan Agricultural Research Institute, Durgapura, Jaipur in naturally infested soil. Inoculum level was 10.00 to 11.00 larvae/g soil of cereal cyst nematode. The experiment consisted of eight treatments *viz* Mustard, Pea, Gram, Fenugreek, Cabbage, Raj MR 1 (Resistant variety) along with treated check (Carbofuran @ 1.5 kg ai/ha) and untreated check (Raj 3765) in a completely randomized block design. Soil samples were taken from each plot before the sowing to record initial population of cyst. Each treatment was replicated thrice. After the harvest of each treatment, soil samples were collected from each treatment and recorded the number of cyst for final population. All the treatments significantly reduced the cyst in the soil as compared the control (Higher cyst). Carbofuran @ 1.5 kg ai/ha reduces the cereal cyst nematode population followed by cabbage, resistant variety, mustard, fenugreek, gram and pea. Population were recorded in Carbofuran (Initial 4.16cyst in 100ml soil and final 2.90 cyst in 100ml soil) followed by cabbage (Initial 4.12 cyst in 100ml soil and final 2.40 cyst in 100ml soil) and mustard (Initial 3.96 cyst in 100ml soil and final 2.90 cyst in 100ml soil), fenugreek (Initial 3.70 cyst in 100ml soil and final 2.66 cyst in 100ml soil). Final population was recorded in control (Initial 3.90 cyst in 100ml soil and final 5.80 cysts in 100ml soil) with 48.71 increase population of Cereal Cyst Nematode. (Table 5.9).

Table 5.9. Diversification in existing wheat based system for cereal cyst nematode, *Heterodera avenae* (Durgapura centre)

S.No.	Treatments	Pi (100 ml soil)	Pf (100ml soil)	Difference	% age	Increase/ Decrease
1	Mustard	3.96	2.90	1.06	26.76	Decrease
2	Pea	3.84	3.22	0.62	16.14	Decrease
3	Gram	3.74	3.22	0.52	13.90	Decrease
4	Fenugreek	3.70	2.66	1.04	28.10	Decrease
5	Cabbage	4.12	2.40	1.72	41.74	Decrease
6	Raj MR-1	4.24	2.92	1.32	31.13	Decrease
7	Carbofuran @ 1.5 kg ai/ha	4.16	2.90	1.26	30.28	Decrease
8	Control (Raj-3765)	3.90	5.80	1.90	48.71	Increase
	CD5%	0.66	1.22			

No. of cyst in soil
Pi = Population at the time of sowing/100 ml soil (Initial Population)
Pf = Population at the time of harvesting (Final Population)

Population dynamics of plant parasitic nematodes in cotton –wheat system (Hisar)

Population dynamics of plant parasitic nematodes was studied in cotton- wheat system (2005-2015). For this study fields were selected in cotton season, in Hisar and Fatehabad districts. Soil samples taken from cotton in Aug/ Sept and wheat Feb/ March were analyzed for nematode populations. In most of the fields studied, plant parasitic nematodes were- *Tylenchorynchus* spp, *Pratylenchus* sp, *Hoplolaimus indicus*, *Heterodera avenae* (Pathotype *Ha21*), *Helicotylenchus* sp. *Meloidogyne incognita*, (*Rotylenchulus reniformis*) and *Longidorus pisi*. Nematode species identified were *Tylenchorynchus goffarti, T. vulgaris, Pratylenchus thornei, P. mulchandi* and *P. zeae.*

Populations of *H. avenae* , *Tylenchorynchus* spp. and *Pratylenchus* spp. increased in wheat season to varying levels in different fields. Multiplication of these nematodes depended on Pi, crop condition and crop husbandry practices like use of nematicides and nutrients. *Tylenchorynchus* sp and *Pratylenchus* spp feed on both the crops while *H. avenae* remains dormant during Kharif (April- October). Populations of *Hoplolaimus, Helicotylenchus*, were more on cotton than wheat. *Meloidogyne incognita* , *Rotylenchulus reniformis* and *Longidorus pisi* were found in some fields occasionally on cotton but not recorded in wheat crop. High populations of *Rotylenchulus reniformis*, *Hoplolaimus* and *Longidorus pisi* on cotton and *Tylenchorynchus* spp., *Pratylenchus* spp. needs attention on both crops.

Effect of crop diversification on CCN (Hisar)

Effect of crop rotation with cabbage, mustard, methi, onion garlic and resistant wheat was studied in 5 kg pots using *H. avenae* - infested soil. In 2015-16, nematode population decreased on all crops except susceptible wheat. Nematode penetration and development occurred in resistant and susceptible wheat only but not in other crops. In 2016-17, susceptible wheat WH 1105 was sown in all pots. All the crops reduced cyst population significantly as compared to susceptible wheat, although mustard, and garlic proved the most effective crops in maintaining lowest population of cereal cyst nematode (3.3/200 cc soil)

Table 4. Effect of some **rabi** crops on population development of *Heterodera avenae* in crop rotations

Rotation	No. of cysts /200 cc soil
Mustard -wheat	3.3
Methi-wheat	9.7
Onion-wheat	14.3
Garlic –wheat	3.3
Cabbage –wheat	4.7
Resistant wheat -wheat	14.3
wheat -wheat	57.0
CD 5%	11.0

Crop varieties used: Mustard -RH30, Methi- Hisar Sonali, Onion-Hisar-3, Garlic-local, Cabbage -Golden arc, Resistant wheat -Raj MR1, Susceptible wheat -WH 1105

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PROGRAMME 6. ENTOMOLOGY

Wheat Entomology programme covers four aspects viz. host plant resistance (A), chemical control (B), integrated pest management (IPM)(C) and stored grain pest management (D). During 2016-17 crop season, the experiments were conducted on all above mentioned aspects of entomology. The host plant resistance included studies on pest screening nurseries against foliar and root aphids, shoot fly and brown wheat mite, preliminary screening of elite lines for different pests and multiple pest screening nursery. The chemical control experiments were conducted against foliar aphids including an experiment on bio rational products also. Insect pest management trials were also conducted on termites and brown wheat mite with additional trials on need based sporadic pests at specific locations. A trial on incidence and population build of major insect pest in different dates of sowing was also conducted. IPM studies included basic work on pest management issues and regular surveys activities in the jurisdiction of each centre. The summary containing highlights of this report is given here:

(A) HOST PLANT RESISTANCE

Breeding plants for resistance to insects is really just another form of biological pest control. Rather than finding insects to attack the pests, scientists look for genetic traits that reduce an organism's susceptibility to attack or injury by its insect pests. Present day cultivated cereal crops originated from genetically diverse plant types and these are now grown in large, genetically homogeneous stands, a practice that decreases genetic and species diversity and increase the likelihood of economically significant insect pest infestations. Defense mechanisms of plants can be re-created in resistant plants. These defense mechanisms include escape in space and time, incompatible biological associations, physically and chemically derived barriers and accommodation by replacement or repair of damaged plant parts. Keeping these things in mind the wheat entomological work formulates pest specific hot spot screening of advanced wheat lines in the pursuit of identifying resistant sources. The summary of the result are described here in the following paragraphs.

6.1: Entomological Screening Nurseries

6.1a: Shoot fly screening nursery

A total of 60 AVT II year and 91 AVT I year wheat genotypes were screened against shoot fly, at five hotspot locations *viz*. Ludhiana, Niphad, Dharwad, Kanpur and Kharibari. The average infestation levels of AVT II year genotypes ranged from 6.51 % (HD 2967 (C)) to 23.57 % (Sonalika) (Table 6.1a). Among AVT II year genotypes, based on the average incidence of all locations, 46 entries showed higher level of resistance (infestation > 10%) to shoot fly and remaining showed less than 10% infesation (Table 6.1a).

Among AVT I year genotypes, based on the average incidence of shootfly at all the locations, 75 entries had showed more than 10% shootfly infestation while the remaining entries had less than 10% shootfly infestation (Table 6.1b).The lowest infestation of shootfly i.e 5.70% was recorded in entry TL 3013, while highest infestation of 29.66% was recorded in entry HI 1620 (Table 6.1b).

6.2: Brown wheat mite screening nursery

A total of 151 lines were screened against brown wheat mite at two locations *viz.*, Durgapura and Ludhiana. Due to low incidence of mite, screening was not carried out at Durgapura location. At Ludhiana, among AVT II screening nursery, the maximum mite population was observed in DBW 90 & HD 2733 (42/10 cm^2 area) while K 1006 (9/10cm2 area) recorded the minimum mite population (Table 6.2a). Amongst AVT I entries, the maximum mite infestation was recorded in DBW 204 (60/m^2 area) and minimum in VL 1011 (10/10 m2 area) (Table 6.2b).

6.3: Screening nursery for foliar wheat aphids and root aphids

Foliar aphid: The foliar wheat aphid screenings nursery consisting of 60 AVT II and 91AVT I year genotypes were screened at six locations *viz.* Niphad, Ludhiana, Karnal, Shillongani, Pantnagar and Kharibari. Aphid count/shoots were recorded at weekly interval from all these genotypes and grades were given according to 5 point system described below.

Table 6.3a: Grading and rating of foliar aphid and root aphid on the basis of population in wheat.

Grade	Approx. numbers of aphids/shoot	Rating
1	0	Immune
2	1-5	Resistant
3	6-10	Moderately resistant
4	11-20	Susceptible
5	21 and above	Highly susceptible

Though the material was screened at Shillongani and Pantnagar the pest population was recorded very low and check entries scored immune or resistant response. Therefore, the data from these two locations was not considered. On the basis of average grading of the foliar aphid infestation, all entries were categorized as susceptible (grade 4) or highly susceptible (grade 5) to wheat foliar aphid (Table 6.3a).

Among AVT II year genotypes, three entries at location Kharibari showed moderately resistance response to foliar aphid. These were HS-375 (c), TL-2969 and WR-544 (Table 6.3b). However, amongst AVT-I year genotypes, one entry viz. HS-647 and twelve entries viz. UP 2992, VL 1011, VL 3013, VL 3014,HI 1617,HI 1620,MP 1318,HS 611,DBW 246 PBW 757, VHA-01 and VHA-03 were found to be moderately resistant to foliar aphid (grade 3) (Table 6.3c).

Root aphid:

The screening nursery for root aphid was consisted of 60 AVT II and 91AVT I year entries. The data was collected at Ludhiana and Karnal centres for each entry by uprooting the seedling when the crop was 3-4 weeks old at weekly interval from all these genotypes and grades were given according to 5 point system described below. Though the material was screened at Karnal, the pest did not appear and the data was not considered.

Out of total 60 AVT II year three entries *viz.* HD 2967 (C), K 8027 (C) and UAS 375 showed the moderately resistant reaction at Ludhiana (Table 6.3b). However, among 90 AVT I year, 14 entries *viz.* HS 646,HS 647,VL 3015,CG 1023,DBW 189,HD 3226,HI 1620,PBW 750,TL

3011, TL 3012,TL 3013,TL 3015,WH 1232,VHA-09 showed the moderately resistant reaction at Ludhiana and rest of them were susceptible (grade 4) or highly susceptible (grade 5) to wheat root aphid (Table 6.3b).

6.4: Screening of multiple pest nursery against insect-pests

Evaluation for insect resistance

Shoot fly: Eighty seven MPSN lines were screened against shoot fly at six locations *viz.* Dharwad, Durgapura, Ludhiana, Niphad, Kanpur and Kharibari. Due to low incidence of shoot fly, screening was not carried out at Durgapura location. Out of tested entries, the average maximum score was observed in entry HS -597 and it was 28.35%. However the minimum score of 6.52% was recorded for IWP 72 (C) (Table 6.4a).

Brown wheat mite: Amongst tested entries, the highest population of 47.00 mites/ 10 cm^2 area was recorded for UAS 446 and lowest population of 6.00 mites/ 10 $cm^2$was observed in entry WB1.Brown wheat mite was not observed on any genotype at Durgapura (Table 6.4a).

Foliar aphid: Eighty seven MPSN lines were screened against foliar aphid at six locations *viz.* Niphad Ludhiana, Kharibari (W.B.), Karnal, Pantnagar and Shillongani. The screened entries fall into either moderately resistant (grade 3) or susceptible (grade 4) or highly susceptible (grade 5) categories.At Karnal location, four entries namely PBW -723, MACS 4020 (d), MACS 5041 and MACS 5043 were rated as moderately resistant (grade 3). Low infestation of foliar aphid was at Shillongani and Pantanagar, therefore screening against aphids cannot be carried out (Table 6.4b).

Root aphid: The data on root aphid infestation was collected from Ludhiana and Karnal locations by uprooting few seedling of each entry when the crop was 3-4 weeks old. At Ludhiana the entry WB1 was found to be resistant (grade 2) to root aphid. Sixteen entries were also found to be moderately resistant (grade 3) to root aphid. Root aphid infestation was not observed on any genotype at Karnal (Table 6.4b).

Table 6.1a: Screening against Shoot fly: AVT II year genotypes (Year-2016-17)

Sr. No.	Entry	Shoot fly Incidence (%)					Average
		Ludhiana	Niphad	Dharwad	Kanpur	Kharibari	
I. NORTHERN HILL ZONE							
1	HPW 251 (C)	9.78	3.33	16.67	10.00	2.00	9.95
2	HS 375 (C)	6.25	3.33	28.57	13.33	3.00	12.87
3	HS 490 (C)	7.41	3.33	16.07	9.09	3.00	8.98
4	HS 507 (C)	18.75	5.00	14.81	7.14	2.00	11.43
5	HS 542 (C)	11.76	5.00	18.33	6.25	2.00	10.34
6	VL 829 (C)	13.56	6.66	37.04	6.66	3.00	15.98
7	VL 892 (C)	7.46	5.00	12.00	5.00	2.00	7.37
8	VL 907 (C)	-	-	-	-	-	
II. NORTH WESTERN PLAIN ZONE							
9	DBW 173	5.34	6.66	43.24	7.69	2.00	15.73
10	DBW 88 (C)	9.88	5.00	38.00	6.66	3.00	14.89
11	DBW 90 (C)	8.33	6.66	13.33	10.00	3.00	9.58
12	HD 3043 (C)	8.00	5.00	10.34	3.33	2.00	6.67
13	HD 2967 (C)	5.38	6.66	9.46	4.54	2.00	6.51
14	HD 3059 (C)	6.38	6.66	12.90	13.33	2.00	9.82
15	HD 3086 (C)	16.46	6.66	15.19	5.00	3.00	10.83
16	PBW 644 (C)	9.47	5.00	26.32	4.54	2.00	11.33
17	WH 1021 (C)	9.80	6.66	16.13	5.55	3.00	9.54

Sr. No.	Entry	Shoot fly Incidence (%)					Average
		Ludhiana	Niphad	Dharwad	Kanpur	Kharibari	
18	WH 1080 (C)	7.14	3.33	10.45	7.69	2.00	7.15
19	WH 1105 (C)	11.63	6.66	26.42	5.00	2.00	12.43
20	WH 1124 (C)	7.50	6.66	15.69	5.55	2.00	8.85
20A	SONALIKA	23.68	13.33	30.00	9.52	2.00	19.13
21	WH 1142 C)	9.86	6.66	32.43	10.00	3.00	12.39
III. NORTH EASTERN PLAIN ZONE							
22	HI 1612	25.00	3.33	20.37	5.26	2.00	13.49
23	C 306 (C)	22.78	8.33	14.44	4.54	2.00	12.52
24	DBW 39 (C)	16.44	6.66	10.42	11.53	3.00	11.26
25	HD 2733 (C)	15.38	8.33	53.33	9.09	2.00	21.53
26	HD 2888 (C)	21.90	3.33	12.82	4.54	2.00	10.65
27	HD 3171 (I) (C)	13.33	3.33	36.11	3.84	2.00	14.15
28	K 8027 (C)	26.19	3.33	33.33	3.84	3.00	16.67
29	K 0307 (C)	8.62	6.66	26.19	7.69	2.00	12.29
30	K 1006 (C)	20.63	3.33	31.25	4.54	3.00	14.94
31	K 1317 (I) (C)	17.28	1.66	29.73	3.33	2.00	13.00
IV. CENTRAL ZONE							
32	DBW 110 (C)	9.38	5.00	22.22	7.14	2.00	10.94
33	HI 8627 (d) (C)	5.88	3.33	38.24	21.05	3.00	17.13
34	MP 3288 (C)	15.91	8.33	37.78	8.00	2.00	17.51
V. PENINSULAR ZONE							
35	DBW 168	24.00	8.33	23.08	4.54	3.00	14.99
36	HI 8777 (d)	25.49	6.66	19.44	7.14	2.00	14.68
37	MACS 4028 (d)	10.94	6.66	16.36	11.11	2.00	9.41
38	UAS 375	12.28	8.33	32.08	4.54	3.00	14.31
39	AKDW 2997-16 (d)(C)	6.94	6.66	20.34	5.88	3.00	9.96
40	GW 322 (C)	15.15	6.66	26.32	3.57	3.00	12.93
40 A	SONALIKA	28.99	13.33	42.86	9.09	2.00	23.57
41	MACS 6222 (C)	12.00	6.66	25.71	5.55	3.00	12.48
42	MACS 6478 (C)	12.16	6.66	14.77	7.14	2.00	10.18
43	NI 5439 (C)	12.90	8.33	25.71	13.33	3.00	15.07
44	NIAW 1415 (C)	16.67	5.00	9.57	8.00	3.00	9.81
45	UAS 304 (C)	20.91	10.00	14.29	9.09	3.00	13.57
46	UAS 446 (C)	25.58	6.66	11.90	10.71	2.00	13.71
VI. SOUTHERN HILLS ZONE							
47	HW 2044 (C)	-	-	-	-	-	-
48	HW 5216 (C)	-	3.33	37.04	6.25	2.00	15.54
49	CoW (W) -1 (C)	16.92	5.00	62.50	3.7	3.00	22.03
VII. SPECIAL TRIAL (MABB-IR-LS-CZ/PZ/WB)							
50	DBW 14 (C)	19.05	6.66	40.00	3.12	2.00	17.21
51	DBW 71 (C)	21.88	8.33	56.00	4.54	3.00	22.69
52	DDK 1029 (C)	14.81	5.00	42.31	3.12	2.00	16.31
53	HW 1098 (C)	12.61	6.66	25.00	3.84	3.00	12.03
54	Kharchia 65 (C)	24.47	6.66	42.42	4.00	2 .00	19.39
55	KRL 19 (C)	10.40	3.33	61.11	7.14	2.00	20.50
56	KRL 210 (C)	16.90	1.66	7.14	5.00	2.00	7.68
57	PBW 550 (C)	13.49	3.33	25.00	5.55	3.00	11.84
58	TL 2942 (C)	12.96	3.33	30.00	4.54	3.00	12.71
59	TL 2969 (C)	13.79	3.33	7.69	8.33	3.00	8.29
60	WR 544 (C)	22.64	6.66	30.56	7.14	3.00	16.75
60 A	SONALIKA	24.73	13.33	24.29	10.52	3.00	15.17

Table 6.1b: Screening against Shoot fly: AVT I year genotypes (Year-2016-17)

Sr. No.	Entry	Shoot fly Incidence (%)					Average
		Ludhiana	Niphad	Dharwad	Kanpur	Kharibari	
I. NORTHERN HILL ZONE							
1	DBW 179	12.37	1.66	21.43	12.50	2.00	9.99
2	DBW 204	-	-	-	-	-	-
3	HPW 434	-	-	-	-	-	-
4	HPW 438	-	-	-	-	-	-
5	HPW 439	16.19	1.66	12.-86	17.14	3.00	9.50
6	HPW 440	12.86	6.66	9.09	9.09	2.00	9.43
7	HPW 448	4.88	8.33	15.00	14.28	2.00	10.62
8	HPW 449	16.67	5.00	26.67	9.52	2.00	14.47
9	HS 629	9.09	8.33	34.48	11.11	1.00	15.75
10	HS 630	14.04	10.00	27.42	14.28	3.00	16.44
11	HS 643	23.08	6.66	45.71	12.00	2.00	21.86
12	HS 644	26.00	5.00	48.72	14.28	2.00	23.50
13	HS 645	17.39	8.33	20.51	13.63	2.00	14.97
14	HS 646	9.38	6.66	21.57	16.00	1.00	13.40
15	HS 647	11.11	5.00	24.59	9.09	2.00	12.45
16	HS 648	3.85	6.66	17.86	12.00	2.00	10.09
17	UP 2992	15.58	10.00	31.17	10.52	2.00	16.82
18	UP 2993	27.03	6.66	34.85	9.09	2.00	19.41
19	VL 1011	16.67	8.33	42.00	9.52	2.00	19.13
20	VL 1012	21.21	6.66	25.35	11.53	2.00	16.19
20 A	SONALIKA	27.91	11.66	21.43	13.63	2.00	18.66
21	VL 1013	18.37	10.00	62.96	12.00	3.00	25.83
22	VL 3013	15.22	8.33	25.00	14.28	2.00	15.71
23	VL 3014	18.37	10.00	34.25	10.71	3.00	18.33
24	VL 3015	8.89	8.33	36.36	14.28	3.00	16.97
25	VL 4002	13.16	8.33	42.22	5.55	3.00	17.32
26	VL 4003	12.70	11.66	34.29	9.09	2.00	
II. NORTH WESTERN PLAIN ZONE							
27	BRW 3773	13.33	10.00	22.50	5.71	2.00	12.74
28	CG 1023	19.61	6.66	18.92	13.33	3.00	12.97
29	DBW 189	10.59	10.00	36.96	7.69	1.00	18.22
30	DBW 196	17.89	6.66	21.28	7.14	4.00	11.69
31	HD 3226	17.19	8.33	20.27	7.69	2.00	12.10
32	HD 3237	27.08	5.00	27.03	4.54	3.00	12.19
33	HI 1617	26.56	5.00	26.79	9.09	1.00	13.63
34	HI 1619	20.56	8.33	32.84	4.54	2.00	15.24
35	HI 1620	20.93	8.33	65.85	14.81	3.00	29.66
36	HP 1963	6.25	6.66	41.10	16.66	1.00	21.47
37	HS 611	5.71	10.00	33.33	14.28	2.00	19.20
38	MACS 6677	10.53	6.66	26.47	12.50	3.00	15.21
39	MP 1318	19.44	8.33	25.71	13.33	3.00	15.79
40	PBW 750	18.10	5.00	24.24	12.50	2.00	13.91
40 A	SONALIKA	29.03	13.33	27.27	14.28	3 .00	18.29
41	PBW 752	9.59	11.66	21.00	9.09	2.00	13.92
42	UP 2942	7.69	8.33	22.58	7.69	3.00	12.87
43	WH 1202	8.60	6.66	22.12	14.28	2.00	14.35
III. NORTH EASTERN PLAIN ZONE							
44	DBW 187	19.78	5.00	28.75	11.11	3.00	14.95
45	HD 3219	16.67	8.33	35.56	8.57	2.00	17.49
46	UAS 384	6.25	6.66	41.46	7.14	4.00	18.42
IV. CENTRAL ZONE							
47	BRW 3775	14.00	8.33	35.00	12.5	2 .00	18.61

Sr. No.	Entry	Shoot fly Incidence (%)					Average
		Ludhiana	Niphad	Dharwad	Kanpur	Kharibari	
48	HI 8791 (d)	15.25	8.33	25.49	14.28	3.00	16.03
49	UAS 385	26.15	3.33	27.42	13.33	2.00	14.69
50	UAS 462 (d)	14.29	6.66	26.67	12.5	4.00	15.28
V. SOUTHERN HILLS ZONE							
51	UAS 387	22.77	6.66	20.00	11.42	3.00	10.27
VI. SPECIAL TRIAL (Dicoccum, MABB, Sailinity and Alkalinity)							
52	DBW 246	10.26	5.00	21.65	12.00	3.00	12.88
53	DBW 247	10.37	6.66	43.90	13.33	4.00	21.30
54	DBW 248	12.12	6.66	26.83	12.50	2.00	15.33
55	DDK 1052	8.90	6.66	23.68	11.42	3.00	13.92
56	DDK 1053	16.00	3.33	28.57	8.57	2.00	13.49
57	KRL 370	17.46	5.00	28.36	9.37	3.00	14.24
58	KRL 377	14.77	8.33	18.18	7.14	2.00	11.22
59	KRL 384	14.41	3.33	18.75	8.57	3.00	10.22
60	KRL 386	16.87	6.66	14.08	3.33	3.00	8.02
60 A	SONALIKA	29.47	13.33	14.29	10.71	3 .00	12.78
61	MACS 5047	7.61	5.00	7.89	5.55	4.00	6.15
62	MACS 5049	18.33	6.66	7.27	6.66	2.00	6.86
63	PBW 779	19.34	5.00	7.25	5.26	2.00	5.84
64	PBW 780	28.03	6.66	12.50	13.33	3.00	10.83
65	WH 1316	19.12	5.00	12.50	7.40	2.00	8.30
VII. SPECIAL TRIAL (TRITICALE)							
66	TL 3011	11.76	6.66	13.98	3.84	2.00	8.16
67	TL 3012	16.35	5.00	13.04	6.66	3.00	8.23
68	TL 3013	14.73	5.00	8.54	3.57	2.00	5.70
69	TL 3014	15.65	5.00	15.09	8.00	3.00	9.36
70	TL 3015	13.64	6.66	12.16	4.00	4.00	7.61
VIII. SPECIAL TRIAL (very late sown)							
71	DBW 249	21.74	5.00	17.54	5.55	4.00	9.36
72	DBW 250	20.18	3.33	28.99	6.66	3.00	12.99
73	DBW 251	18.62	5.00	12.14	4.54	2.00	7.23
74	HD 3271	17.77	6.66	23.33	5.55	3.00	11.85
75	HD 3272	13.89	5.00	27.36	4.54	2.00	12.30
76	HI 1621	25.00	6.66	50.00	5.55	3.00	20.74
77	PBW 757	16.67	6.66	44.26	5.26	2.00	18.73
78	PBW 777	11.85	5.00	23.81	4.54	3.00	11.12
79	PBW 778	13.33	5.00	28.57	11.42	4.00	15.00
80	WH 1232	17.57	8.33	26.23	9.09	2.00	14.55
80. A	SONALIKA	27.78	13.33	31.91	11.11	2 .00	18.78
81	WH 1233	8.33	8.33	29.73	5.00	2.00	11.27
IX. SPECIAL TRIAL (Very High Altitude)							
82	VHA-01	5.48	5.00	30.77	4.00	3.00	13.26
83	VHA-02	7.79	5.00	22.86	7.69	3.00	11.85
84	VHA-03	8.89	6.66	21.21	5.55	3.00	11.14
85	VHA-04	8.47	6.66	38.71	7.14	2.00	17.50
86	VHA-05	7.29	6.66	21.43	6.66	3.00	11.58
87	VHA-06	8.82	5.00	13.56	3.70	2.00	7.42
88	VHA-07	7.14	6.66	41.94	7.92	3.00	18.84
89	VHA-08	12.87	5.00	18.33	14.28	3.00	12.54
90	VHA-09	6.12	6.66	15.22	15.38	2.00	12.42
91	VHA-10	16.67	6.66	21.21	12.00	3.00	13.29

Table 6.2a: Brown wheat mite screening nursery: AVT II year lines (Year-2016-17)

Sr. No.	Ludhiana Entry	No. of mites/10 cm sq area
I. NORTHERN HILL ZONE		
1	HPW 251 (C)	11
2	HS 375 (C)	18
3	HS 490 (C)	22
4	HS 507 (C)	18
5	HS 542 (C)	28
6	VL 829 (C)	31
7	VL 892 (C)	24
8	VL 907 (C)	-
II. NORTH WESTERN PLAIN ZONE		
9	DBW 173	14
10	DBW 88 (C)	38
11	DBW 90 (C)	42
12	HD 3043 (C)	41
13	HD 2967 (C)	22
14	HD 3059 (C)	28
15	HD 3086 (C)	34
16	PBW 644 (C)	26
17	WH 1021 (C)	40
18	WH 1080 (C)	33
19	WH 1105 (C)	19
20	WH 1124 (C)	10
20A	IWP (72)	46
21	WH 1142 C)	18
III. NORTH EASTERN PLAIN ZONE		
22	HI 1612	19
23	C 306 (C)	26
24	DBW 39 (C)	33
25	HD 2733 (C)	42
26	HD 2888 (C)	16
27	HD 3171 (I) (C)	17
28	K 8027 (C)	12
29	K 0307 (C)	31
30	K 1006 (C)	9
31	K 1317 (I) (C)	18
IV. CENTRAL ZONE		
32	DBW 110 (C)	26
33	HI 8627 (d) (C)	39
34	MP 3288 (C)	33
V. PENINSULAR ZONE		
35	DBW 168	15
36	HI 8777 (d)	18
37	MACS 4028 (d)	26
38	UAS 375	40
39	AKDW 2997-16 (d))C)	13
40	GW 322 (C)	20
40 A	IWP (72)	50
41	MACS 6222 (C)	18
42	MACS 6478 (C)	31
43	NI 5439 (C)	29
44	NIAW 1415 (C)	24
45	UAS 304 (C)	17
46	UAS 446 (C)	26
VI. SOUTHERN HILLS ZONE		
47	HW 2044 (C)	-
48	HW 5216 (C)	16
49	CoW (W) -1 (C)	27
VII. SPECIAL TRIAL (MABB-IR-LS-CZ/PZ/WB)		
50	DBW 14 (C)	29
51	DBW 71 (C)	35
52	DDK 1029 (C)	28
53	HW 1098 (C)	34
54	Kharchia 65 (C)	38
55	KRL 19 (C)	24
56	KRL 210 (C)	14
57	PBW 550 (C)	29
58	TL 2942 (C)	16
59	TL 2969 (C)	14
60	WR 544 (C)	26
60 A	IWP (72)	39

Table 6.2b: Brown wheat mite screening nursery: AVT I year lines (Year-2016-17)

Sr. No.	Ludhiana Entry	No. of mites /10 cmsq area
I. NORTHERN HILL ZONE		
1	DBW 179	40
2	DBW 204	-
3	HPW 434	-
4	HPW 438	-
5	HPW 439	25
6	HPW 440	18
7	HPW 448	32
8	HPW 449	45
9	HS 629	20

Sr. No.	Ludhiana	
	Entry	No. of mites /10 cmsq area
10	HS 630	34
11	HS 643	38
12	HS 644	30
13	HS 645	10
14	HS 646	25
15	HS 647	13
16	HS 648	30
17	UP 2992	19
18	UP 2993	20
19	VL 1011	10
20	VL 1012	28
20 A	IWP (72)	51
21	VL 1013	16
22	VL 3013	35
23	VL 3014	19
24	VL 3015	12
25	VL 4002	22
26	VL 4003	40
II. NORTH WESTERN PLAIN ZONE		
27	BRW 3773	16
28	CG 1023	24
29	DBW 189	45
30	DBW 196	27
31	HD 3226	37
32	HD 3237	35
33	HI 1617	36
34	HI 1619	40
35	HI 1620	28
36	HP 1963	19
37	HS 611	33
38	MACS 6677	40
39	MP 1318	42
40	PBW 750	37
40 A	IWP (72)	49
41	PBW 752	38
42	UP 2942	36
43	WH 1202	25
III. NORTH EASTERN PLAIN ZONE		
44	DBW 187	18
45	HD 3219	41
46	UAS 384	20
IV. CENTRAL ZONE		
47	BRW 3775	15
48	HI 8791 (d)	35
49	UAS 385	22
50	UAS 462 (d)	45
V. SOUTHERN HILLS ZONE		
51	UAS 387	41
VI. SPECIAL TRIAL (Dicoccum, MABB, Sailinity and Alkalinity)		
52	DBW 246	28
53	DBW 247	29

Sr. No.	Ludhiana	
	Entry	No. of mites /10 cmsq area
54	DBW 248	34
55	DDK 1052	27
56	DDK 1053	14
57	KRL 370	33
58	KRL 377	41
59	KRL 384	28
60	KRL 386	43
60 A	IWP (72)	48
61	MACS 5047	15
62	MACS 5049	12
63	PBW 779	28
64	PBW 780	26
65	WH 1316	31
VII. SPECIAL TRIAL (TRITICALE)		
66	TL 3011	11
67	TL 3012	16
68	TL 3013	19
69	TL 3014	21
70	TL 3015	25
VIII. SPECIAL TRIAL (very late sown)		
71	DBW 249	31
72	DBW 250	15
73	DBW 251	42
74	HD 3271	22
75	HD 3272	19
76	HI 1621	23
77	PBW 757	31
78	PBW 777	20
79	PBW 778	16
80	WH 1232	30
80. A	IWP (72)	45
81	WH 1233	23
IX. SPECIAL TRIAL (Very High Altitude)		
82	VHA-01	26
83	VHA-02	35
84	VHA-03	26
85	VHA-04	28
86	VHA-05	11
87	VHA-06	25
88	VHA-07	24
89	VHA-08	26
90	VHA-09	34
91	VHA-10	33
91. A	IWP (72)	44

Table 6.3b: Screening against foliar wheat aphids- AVT II year lines (Year-2016-17)

Sr. No.	Entry	Aphid score (1-5)						
I. NORTHERN HILLS ZONE								
		Ludhiana	**Niphad**	**Karnal**	**Kharibari**	**Average Score**	**Highest Score**	**Root aphid** (Ludhiana)**
1	HPW 251 (C)	5	4	5	4	4.50	5	5
2	HS 375 (C)	5	4	5	3	4.25	5	4
3	HS 490 (C)	5	4	5	4	4.50	5	5
4	HS 507 (C)	5	5	4	5	4.75	5	4
5	HS 542 (C)	5	5	5	4	4.75	5	4
6	VL 829 (C)	5	5	5	5	5.00	5	5
7	VL 892 (C)	5	5	5	4	4.75	5	4
8	VL 907 (C)	-	-	-	-	-	-	-
II. NORTH WESTERN PLAINS ZONE								
9	DBW 173	5	5	5	5	5.00	5	5
10	DBW 88 (C)	5	5	5	5	5.00	5	5
11	DBW 90 (C)	5	5	5	4	4.75	5	5
12	HD 3043 (C)	5	5	5	5	5.00	5	4
13	HD 2967 (C)	5	5	5	4	4.75	5	3
14	HD 3059 (C)	5	5	5	5	5.00	5	4
15	HD 3086 (C)	5	5	5	5	5.00	5	4
16	PBW 644 (C)	5	5	5	4	4.75	5	3
17	WH 1021 (C)	5	5	5	5	5.00	5	4
18	WH 1080 (C)	5	4	5	4	4.50	5	4
19	WH 1105 (C)	5	5	5	5	5.00	5	3
20	WH 1124 (C)	5	5	5	4	4.75	5	4
20A	A 9-30-1 (C)	5	5	5	5	5.00	5	5
21	WH 1142 C)	5	5	5	5	5.00	5	4
III. NORTH EASTERN PLAINS ZONE								
22	HI 1612	5	4	4	4	4.25	5	4
23	C 306 (C)	5	5	4	5	4.75	5	4
24	DBW 39 (C)	5	5	5	4	4.75	5	5
25	HD 2733 (C)	5	5	5	5	5.00	5	5
26	HD 2888 (C)	5	4	5	4	4.50	5	4
27	HD 3171 (I) (C)	5	4	5	5	4.75	5	4
28	K 8027 (C)	5	4	5	4	4.50	5	3
29	K 0307 (C)	5	5	5	5	5.00	5	4
30	K 1006 (C)	5	4	5	4	4.50	5	5
31	K 1317 (I) (C)	5	4	5	5	4.75	5	4
IV. CENTRAL ZONE								
32	DBW 110 (C)	5	5	5	4	4.75	5	5
33	HI 8627 (d) (C)	5	4	5	5	4.75	5	4
34	MP 3288 (C)	5	5	5	4	4.75	5	5
V. PENINSULAR ZONE								
35	DBW 168	5	5	5	5	5.00	5	5
36	HI 8777 (d)	5	5	5	4	4.75	5	4
37	MACS 4028 (d)	5	5	5	5	5.00	5	4
38	UAS 375	4	5	4	4	4.25	5	3
39	AKDW	5	5	4	5	4.75	5	4

Sr. No.	Entry	Aphid score (1-5)						
I. NORTHERN HILLS ZONE								
		Ludhiana	Niphad	Karnal	Kharibari	Average Score	Highest Score	Root aphid** (Ludhiana)
	2997-16 (d))C)							
40	GW 322 (C)	5	5	5	4	4.75	5	4
40 A	A 9-30-1 (C)	5	5	5	5	5.00	5	5
41	MACS 6222 (C)	4	5	5	5	4.75	5	4
42	MACS 6478 (C)	5	5	5	4	4.75	5	4
43	NI 5439 (C)	5	4	4	4	4.25	5	4
44	NIAW 1415 (C)	5	4	4	5	4.50	5	4
45	UAS 304 (C)	4	5	4	4	4.25	5	4
46	UAS 446 (C)	5	5	5	5	5.00	5	5
VI. SOUTHERN HILLS ZONE								
47	HW 2044 (C)	-	-	-	-	-	-	-
48	HW 5216 (C)	3	4	4	5	4.00	4	
49	CoW (W) -1 (C)	5	5	5	4	4.75	5	
VII. SPECIAL TRIAL (MABB-IR-LS-CZ/PZ/WB)								
50	DBW 14 (C)	5	5	5	5	5.00	5	5
51	DBW 71 (C)	5	5	4	5	4.75	5	4
52	DDK 1029 (C)	5	5	5	5	5.00	5	2
53	HW 1098 (C)	5	5	4	5	4.75	5	5
54	Kharchia 65 (C)	5	5	5	5	5.00	5	4
55	KRL 19 (C)	5	4	4	5	4.50	5	4
56	KRL 210 (C)	5	4	4	4	4.25	5	5
57	PBW 550 (C)	5	4	5	5	4.75	5	4
58	TL 2942 (C)	5	4	5	4	4.50	5	4
59	TL 2969 (C)	5	4	5	3	4.25	5	4
60	WR 544 (C)	5	5	5	3	4.50	5	4
60 A	A 9-30-1 (C)	5	5	5	4	4.75	5	4

*Due to low population of aphids at Shillongani and Pantnagar, screening results for aphid resistance were not included in the comparison table. **Root aphid did not appear at Karnal

Table 6.3c: Screening against foliar wheat aphids: AVT I year lines (Year-2016-17)

Sr. No.	Entry		Aphid score (1-5)					
		Ludhiana	Niphad	Karnal	Kharibari	Average score	Highest Score	Root Aphid** (Ludhiana)
I. NORTHERN HILL ZONE								
1	DBW 179	5	4	5	**5**	4.75	5	5
2	DBW 204	-	-	-	-			-
3	HPW 434	-	-	-	-			-
4	HPW 438	-	-	-	-			-
5	HPW 439	5	4	4	4	4.33	5	4
6	HPW 440	4	5	4	5	4.33	5	5
7	HPW 448	4	5	4	4	4.33	5	5

Sr. No.	Entry		Aphid score (1-5)					
		Ludhiana	Niphad	Karnal	Kharibari	Average score	Highest Score	Root Aphid** (Ludhiana)
8	HPW 449	4	5	5	5	4.67	5	5
9	HS 629	5	5	5	5	5.00	5	4
10	HS 630	4	5	4	5	4.33	5	4
11	HS 643	3	5	4	4	4.00	5	4
12	HS 644	3	5	4	5	4.00	5	4
13	HS 645	4	5	4	3	4.33	5	4
14	HS 646	4	5	4	4	4.33	5	3
15	HS 647	3	4	3	5	3.33	5	3
16	HS 648	5	4	4	5	4.33	5	4
17	UP 2992	4	5	4	3	4.33	5	5
18	UP 2993	5	5	4	2	4.67	5	4
19	VL 1011	4	5	4	3	4.33	5	4
20	VL 1012	5	5	4	4	4.67	5	2
20 A	A 9-30-1 (C)	5	5	5	5	5.00	5	5
21	VL 1013	5	5	4	2	4.67	5	4
22	VL 3013	5	5	5	3	5.00	5	4
23	VL 3014	4	5	4	3	4.33	5	4
24	VL 3015	4	5	4	4	4.33	5	3
25	VL 4002	5	5	5	4	5.00	5	4
26	VL 4003	4	5	4	5	4.33	5	2
II. NORTH WESTERN PLAIN ZONE								
27	BRW 3773	5	5	5	4	5.00	5	4
28	CG 1023	5	5	5	4	5.00	5	3
29	DBW 189	4	5	4	4	4.33	5	3
30	DBW 196	5	5	4	4	4.67	5	5
31	HD 3226	5	5	5	4	5.00	5	3
32	HD 3237	5	5	5	4	5.00	5	4
33	HI 1617	5	5	5	3	5.00	5	4
34	HI 1619	5	5	5	5	5.00	5	4
35	HI 1620	5	5	5	3	5.00	5	3
36	HP 1963	5	5	5	4	5.00	5	4
37	HS 611	4	5	5	3	4.67	5	4
38	MACS 6677	5	4	5	4	4.67	5	4
39	MP 1318	4	5	4	3	4.33	5	4
40	PBW 750	4	4	4	4	4.00	5	3
40 A	A 9-30-1 (C)	5	5	5	5	5.00	5	5
41	PBW 752	5	5	5	5	5.00	5	4
42	UP 2942	5	5	5	5	5.00	5	4
43	WH 1202	5	5	5	5	5.00	5	4
III. NORTH EASTERN PLAIN ZONE								
44	DBW 187	5	5	5	5	5.00	5	4
45	HD 3219	5	5	5	5	5.00	5	4
46	UAS 384	5	5	5	5	5.00	5	5
IV. CENTRAL ZONE								
47	BRW 3775	5	5	5	4	4.50	5	5
48	HI 8791 (d)	5	5	5	4	4.75	5	5
49	UAS 385	5	5	5	4	4.75	5	4
50	UAS 462 (d)	5	5	5	4	4.75	5	5

Sr. No.	Entry	Ludhiana	Aphid score (1-5) Niphad	Karnal	Kharibari	Average score	Highest Score	Root Aphid** (Ludhiana)
V. SOUTHERN HILLS ZONE								
51	UAS 387	5	5	5	5	5.00	5	4
VI. SPECIAL TRIAL (Dicoccum, MABB, Sailinity and Alkalinity)								
52	DBW 246	5	5	5	3	5.00	5	5
53	DBW 247	5	5	5	4	5.00	5	4
54	DBW 248	5	5	5	4	5.00	5	5
55	DDK 1052	5	5	5	4	5.00	5	4
56	DDK 1053	5	5	5	5	5.00	5	5
57	KRL 370	5	5	5	4	5.00	5	4
58	KRL 377	5	5	5	5	5.00	5	5
59	KRL 384	5	5	5	4	5.00	5	4
60	KRL 386	5	5	5	5	5.00	5	4
60 A	A 9-30-1 (C)	5	5	5	4	5.00	5	5
61	MACS 5047	5	5	5	5	5.00	5	4
62	MACS 5049	5	5	5	5	5.00	5	5
63	PBW 779	5	5	5	4	5.00	5	4
64	PBW 780	5	5	5	5	5.00	5	4
65	WH 1316	5	5	5	5	5.00	5	4
VII. SPECIAL TRIAL (TRITICALE)								
66	TL 3011	5	5	5	5	5.00	5	3
67	TL 3012	5	5	5	5	5.00	5	3
68	TL 3013	5	5	5	5	5.00	5	3
69	TL 3014	5	5	5	4	5.00	5	4
70	TL 3015	5	5	5	4	5.00	5	3
VIII. SPECIAL TRIAL (very late sown)								
71	DBW 249	5	5	5	5	5.00	5	4
72	DBW 250	5	4	5	4	4.67	5	4
73	DBW 251	5	5	5	4	5.00	5	4
74	HD 3271	5	5	5	4	5.00	5	5
75	HD 3272	5	5	5	4	5.00	5	5
76	HI 1621	5	5	5	4	5.00	5	4
77	PBW 757	5	5	5	3	5.00	5	4
78	PBW 777	5	5	5	4	5.00	5	4
79	PBW 778	5	5	5	5	5.00	5	4
80	WH 1232	5	5	5	4	5.00	5	3
80. A	A 9-30-1 (C)	5	5	5	5	5.00	5	5
81	WH 1233	5	5	5	5	5.00	5	4
IX. SPECIAL TRIAL (Very High Altitude)								
82	HS 375 (C)	5	5	5	4	5.00	5	4
83	HS 492 (c)	5	5	5	4	5.00	5	5
83 A	A 9-30-1 (C)	5	5	5	5	5.00	5	5

*Due to low population of aphids at Shillongani and Pantnagar, screening results for aphid resistance were not included in the comparison table. **Root aphid did not appear at Karnal

Table **6.4a Screening of MPSN nursery against shoot fly and Brown Wheat mite 2016-17**

Sr. No.	Entry	Shoot fly Incidence (%)					Average incidence (%)	Highest incidence (%)	Brown Wheat mite No. of mites/10^2 area*
		Dharwad	Ludhiana	Niphad	Kharibari	Kanpur			Ludhiana
1	PBW 723	22.22	19.74	5.00	3.00	16.66	13.32	22.22	20
2	HI 8765 (d)	9.43	18.37	6.66	1.00	15	10.09	18.37	15
3	HPBW 08	13.51	11.02	5.00	3.00	13.33	9.17	13.51	30
4	HPBW 09	19.23	11.03	3.33	4.00	14.28	10.37	19.23	20
5	HPW 422	8.62	11.84	5.00	5.00	9.09	7.91	11.84	20
6	HS 580	18.57	6.17	3.33	2.00	13.33	8.68	18.57	12
7	HS 596	40.35	18.82	5.00	3.00	14.28	16.29	40.35	30
8	HS 597	95.24	25.56	3.33	4.00	13.63	28.35	95.24	18
9	HS 599	14.52	26.21	6.66	3.00	20	14.08	26.21	10
10	K 1312	17.74	20.49	5.00	3.00	9.09	11.06	20.49	42
11	K 1314	27.27	16.42	6.66	4.00	5.55	11.98	27.27	25
12	MACS 4024	17.65	11.84	8.33	2.00	6.66	9.30	17.65	19
13	MACS 3970 (d)	15.79	15.2	8.33	3.00	11.11	10.69	15.79	14
14	MACS 3972 (d)	11.11	20.21	6.66	0.00	22.22	12.04	22.22	22
15	PBW 709	24.29	14.62	6.66	0.00	16.66	12.45	24.29	40
16	PBW 718	15.87	20.15	3.33	0.00	7.69	9.41	20.15	35
17	TL 3001 (T)	15	23.08	8.33	0.00	9.09	11.10	23.08	24
18	TL 3002 (T)	9.84	13.71	10.00	3.00	6.25	8.56	13.71	20
19	TL 3003 (T)	8.33	14.63	6.66	2.00	6.25	7.57	14.63	15
20	TL 3004 (T)	14.29	13.59	13.33	3.00	4.54	9.75	14.29	25
20 A	SONALIKA (C) FOR SF	50.75	26.14	5.00	2.00	13.33	19.44	50.75	-
20 B	IWP 72 (C) FOR BWM	40	-	6.66	3.00	16.66	16.58	40	45
20 C	A 9-30-1 (C) FOR FA	11.88	-	5.00	3.00	13.63	8.38	13.63	-
20 D	GW 173 (C) FOR RA	14.93	-	10.00	2.00	12.5	9.86	14.93	-
21	TL 3005 (T)	14.29	27.27	6.66	2.00	14.26	12.90	27.27	19
22	UAS 453 (d)	9.26	20	5.00	2.00	16	10.45	20	13
23	UAS 455 (d)	8.75	11.03	8.33	2.00	19.23	9.87	19.23	34
24	VL 3007	22.86	14.13	6.66	2.00	4	9.93	22.86	18
25	VL 3008	40.45	16	6.66	2.00	13.33	15.69	40.45	10
26	WB5	17.35	16.67	6.66	2.00	10.71	10.68	17.35	10
27	DBW 147	13.16	8.57	5.00	3.00	16.66	9.28	16.66	25
28	DBW 150	18.75	18.8	8.33	3.00	20.83	13.94	20.83	20
29	DBW 181	44.71	25.83	8.33	2.00	20.72	20.32	44.71	14
30	DBW 182	48	9.84	6.66	3.00	11.11	15.72	48.00	9
31	DBW 183	10.81	13.27	8.33	2.00	12	9.28	13.27	12
32	DDK 1048 (dic.)	34.48	18.06	5.00	2.00	10.71	14.05	34.48	20
33	DDK 1049 (dic.)	8.57	11.76	10.00	2.00	11.53	8.77	11.76	16
34	DDW 31	4.55	10.63	8.33	2.00	11.11	7.32	11.11	10
35	GW 1315 (d)	33.33	5.71	3.33	2.00	14.28	11.73	33.33	7
36	GW 463	3.17	23.23	10.00	2.00	8	9.28	23.23	28
37	HD 3164	16.67	11.36	10.00	3.00	10.71	10.35	16.67	18
38	HPBW 01	8.62	10.47	8.33	2.00	7.14	7.31	10.47	10
39	HPBW 02	21.25	9.38	6.66	3.00	4	8.86	21.25	10
40	HPBW 05	30	12.12	6.66	2.00	11.11	12.38	30	8
40 A	SONALIKA (C) FOR SF	24.29	27.52	15.00	3.00	13.33	16.63	27.52	-
40 B	IWP 72 (C) FOR BWM	5.75	-	5.00	2.00	13.33	6.52	13.33	39
40 C	A 9-30-1 (C) FOR FA	10.91	-	6.66	3.00	16.66	9.31	16.66	-
40 D	GW 173 (C) FOR RA	8	-	5.00	2.00	13.33	7.08	13.33	-
41	HUW 695	14.55	20.95	3.33	2.00	8	9.77	20.95	16
42	HUW 712	9.8	17.02	1.66	2.00	9.09	7.91	17.02	9
43	JWS 712	15.07	21.21	3.33	2.00	13.33	10.99	21.21	13
44	K 1313	23.21	18.67	1.66	3.00	9.09	11.13	23.21	10
45	K 1315	12.63	16.67	3.33	2.00	9.37	8.80	16.67	25
46	KRL 350	30.59	7.69	5.00	3.00	4.54	10.16	30.59	18

Sr. No.	Entry	Shoot fly Incidence (%)					Average incidence (%)	Highest incidence (%)	Brown Wheat mite No. of mites/10^2 area*
		Dharwad	Ludhiana	Niphad	Kharibari	Kanpur			Ludhiana
47	KRL 351	29.31	5.45	8.33	2.00	9.09	10.84	29.31	22
48	MACS 4020 (d)	14.93	15	8.33	3.00	9.37	10.13	15.00	15
49	MACS 5041	36.11	11.67	10.00	2.00	9.37	13.83	36.11	35
50	MACS 5043	45.45	6.06	6.66	3.00	5	13.23	45.45	28
51	PBW 716	50	13.33	6.66	2.00	11.11	16.62	50	30
52	PBW 719	72.46	13.43	8.33	3.00	12	21.84	72.46	27
53	UP 2883	81.63	12.07	8.33	2.00	6.66	22.14	81.63	8
54	VL 4001	72	13.08	10.00	3.00	11.11	21.84	72	12
55	WB1	21.67	9.62	6.66	2.00	5.55	9.10	21.67	6
56	WH 1309	66	14.61	8.33	3.00	9.09	20.21	66	10
57	DDW 32	12.99	10.94	8.33	3.00	10.52	9.16	12.99	18
58	HD 3165	16.67	14.74	10.00	3.00	4.54	9.79	16.67	16
59	HS 600	12.5	10.26	6.66	3.00	11.11	8.71	12.50	20
60	PBW 721	37.1	19.69	10.00	2.00	5.55	14.87	37.1	30
60 A	SONALIKA (C) FOR SF	6.94	27.91	13.33	2.00	12.5	12.54	27.91	-
60 B	IWP 72 (C) FOR BWM	8.33	-	6.66	2.00	12	7.25	12	35
60 C	A 9-30-1 (C) FOR FA	4.62	-	6.66	2.00	15	7.07	15	-
60 D	GW 173 (C) FOR RA	12	-	5.00	2.00	10.52	7.38	12	-
61	UAS 428 (d)	20.83	7.06	8.33	2.00	12	10.04	20.83	28
62	DBW 184	18.18	23.08	10.00	0.00	16.66	13.58	23.08	25
63	HD 3159	21.21	18.67	6.66	0.00	6.66	10.64	21.21	15
64	HI 1604	35.9	15.49	8.33	0.00	12.5	14.44	35.9	20
65	HPBW 07	26.79	6.67	6.66	0.00	8.33	9.69	26.79	17
66	HS 583	49.09	18.11	8.33	0.00	12	17.51	49.09	19
67	HS 601	13.33	20.54	6.66	2.00	13.33	11.17	20.54	22
68	PBW 707	38.71	10.37	6.66	2.00	14.28	14.40	38.71	30
69	VL 1006	29.51	11.54	6.66	2.00	5.55	11.05	29.51	46
70	DBW 129	23.26	7.94	6.66	2.00	10.71	10.11	23.26	10
71	HI 8750 (d)	18.6	14.55	5.00	0.00	10.71	9.77	18.6	10
72	GW 451	52.78	11.63	6.66	0.00	13.63	16.94	52.78	22
73	HD 2932-Lr19/Sr25	34.48	12.5	5.00	0.00	8	12.00	34.48	15
74	HD 3132	66.67	13.56	3.33	0.00	10.71	18.85	66.67	14
75	HD 3133	44.23	7.03	5.00	2.00	11.11	13.87	44.23	20
76	WH 1129	59.09	6.73	3.33	2.00	21.05	18.44	59.09	25
77	PBW 704	35	5.66	5.00	2.00	14.28	12.39	35.00	30
78	HD 4728 (d)	30.95	9.38	8.33	2.00	12	12.53	30.95	35
79	HI 8751 (d)	75	10.81	6.66	2.00	10.71	21.04	75	35
80	PBW 723	40.63	10.17	10.00	2.00	12	14.96	40.63	20
80 A	SONALIKA (C) FOR SF	60	28.21	13.33	1.00	13.33	23.17	60	-
80 B	IWP 72 (C) FOR BWM	54.29	-	5.00	1.00	11.11	17.85	54.29	45
80 C	A 9-30-1 (C) FOR FA	18	-	6.66	1.00	14.28	9.99	18	-
80 D	GW 173 (C) FOR RA	54.35	-	5.00	1.00	15	18.84	54.35	-
81	UAS 451 (d)	5.41	8.51	8.33	2.00	21.42	9.13	21.42	22
82	DBW 110	30.77	8.82	6.66	1.00	8	11.05	30.77	18
83	HI 8755 (d)	15	7.81	8.33	2.00	22.72	11.17	22.72	12
84	UAS 446	16.67	-	8.33	1.00	8.57	8.64	16.67	47
85	UP 2891	38.71	15.38	10.00	2.00	8	14.82	38.71	14
86	TL 2995 (T)	26.83	22.22	6.66	2.00	7.14	12.97	26.83	8
87	TL 2999 (T)	6.59	12.77	8.33	1.00	6.25	6.99	12.77	30

* Durgapura : Shoot fly incidence was not observed on any genotype.

Table 6.4b. Screening of MPSN nursery against foliar aphid and root aphid 2016-17

Sr. No.	Entry	Foliar Aphid Score (1-5)*				Average score	Highest Score	Root Aphid Score (1-5)**
		Ludhiana	Niphad	Karnal	Kharibari			Ludhiana
1	PBW 723	5	5	3	4	4.25	5	5
2	HI 8765 (d)	5	5	4	5	4.75	5	5
3	HPBW 08	5	5	4	4	4.50	5	5
4	HPBW 09	5	5	4	5	4.75	5	5
5	HPW 422	5	5	4	5	4.75	5	4
6	HS 580	5	5	4	5	4.75	5	4
7	HS 596	5	4	5	5	4.75	5	4
8	HS 597	5	5	4	5	4.75	5	4
9	HS 599	5	4	4	5	4.50	5	5
10	K 1312	5	5	5	5	5.00	5	5
11	K 1314	4	5	4	5	4.50	5	5
12	MACS 4024	4	5	4	5	4.50	5	5
13	MACS 3970 (d)	4	5	5	4	4.50	5	3
14	MACS 3972 (d)	5	5	5	5	5.00	5	5
15	PBW 709	5	5	5	4	4.75	5	5
16	PBW 718	5	5	4	5	4.75	5	4
17	TL 3001 (T)	5	4	5	4	4.50	5	3
18	TL 3002 (T)	5	5	5	5	5.00	5	4
19	TL 3003 (T)	5	5	5	4	4.75	5	4
20	TL 3004 (T)	5	5	5	5	5.00	5	5
20 A	SONALIKA (C) FOR SF	-	4	-	5	4.50		-
20 B	IWP 72 (C) FOR BWM	-	5	-	5	5.00	5	-
20 C	A 9-30-1 (C) FOR FA	5	5	5	5	5.00	5	-
20 D	GW 173 (C) FOR RA	-	4	-	4	4.00	5	5
21	TL 3005 (T)	5	5	4	5	4.75	5	4
22	UAS 453 (d)	5	5	3	4	4.25	5	4
23	UAS 455 (d)	5	5	4	5	4.75	5	4
24	VL 3007	5	5	4	4	4.50	5	5
25	VL 3008	5	5	4	5	4.75	5	5
26	WB5	5	5	4	5	4.75	5	5
27	DBW 147	5	5	5	5	5.00	5	4
28	DBW 150	5	5	4	5	4.75	5	4
29	DBW 181	5	5	4	4	4.50	5	4
30	DBW 182	5	5	3	5	4.50	5	4
31	DBW 183	4	5	5	4	4.50	5	4
32	DDK 1048 (dic.)	5	5	5	5	5.00	5	5
33	DDK 1049 (dic.)	5	5	5	4	4.75	5	3
34	DDW 31	5	5	5	5	5.00	5	3
35	GW 1315 (d)	5	5	-	3	4.33	5	4
36	GW 463	5	4	4	5	4.50	5	4
37	HD 3164	5	5	4	5	4.75	5	3
38	HPBW 01	5	5	5	5	5.00	5	3
39	HPBW 02	5	5	4	5	4.75	5	4
40	HPBW 05	5	5	4	4	4.50	5	4
40 A	SONALIKA (C) FOR SF	-	4	-	5	4.50	5	-
40 B	IWP 72 (C) FOR BWM	-	5	-	4	4.50	5	-
40 C	A 9-30-1 (C) FOR FA	5	5	5	5	5.00	5	-
40 D	GW 173 (C) FOR RA	-	4	-	4	4.00	4	5
41	HUW 695	4	4	5	5	4.50	5	4
42	HUW 712	4	4	4	4	4.00	5	4
43	JWS 712	4	4	4	5	4.25	5	4
44	K 1313	4	4	4	4	4.00	5	3
45	K 1315	5	5	5	4	4.75	5	4
46	KRL 350	5	5	4	4	4.50	5	4

Sr. No.	Entry	Foliar Aphid Score (1-5)*				Average score	Highest Score	Root Aphid Score (1-5)**
		Ludhiana	Niphad	Karnal	Kharibari			Ludhi ana
47	KRL 351	5	5	4	5	4.75	5	5
48	MACS 4020 (d)	5	5	3	4	4.25	5	4
49	MACS 5041	5	5	3	5	4.50	5	4
50	MACS 5043	5	5	3	4	4.25	5	5
51	PBW 716	5	5	4	5	4.75	5	5
52	PBW 719	5	5	4	5	4.75	5	4
53	UP 2883	5	5	5	5	5.00	5	5
54	VL 4001	5	5	4	5	4.75	5	3
55	WB1	5	5	5	4	4.75	5	2
56	WH 1309	5	5	5	5	5.00	5	5
57	DDW 32	5	5	4	4	4.50	5	4
58	HD 3165	5	5	5	5	5.00	5	4
59	HS 600	5	5	5	4	4.75	5	3
60	PBW 721	5	4	5	5	4.75	5	4
60 A	SONALIKA (C) FOR SF	-	5	-	4	4.50	5	-
60 B	IWP 72 (C) FOR BWM	-	5	-	5	5.00	5	-
60 C	A 9-30-1 (C) FOR FA	5	4	5	4	4.50	5	-
60 D	GW 173 (C) FOR RA	-	5	-	5	5.00	5	5
61	UAS 428 (d)	5	5	4	5	4.75	5	5
62	DBW 184	4	5	5	5	4.75	5	4
63	HD 3159	5	5	4	5	4.75	5	4
64	HI 1604	5	5	4	5	4.75	5	5
65	HPBW 07	5	5	5	5	5.00	5	3
66	HS 583	5	5	4	5	4.75	5	4
67	HS 601	5	5	5	5	5.00	5	3
68	PBW 707	5	5	4	4	4.50	5	4
69	VL 1006	5	5	5	5	5.00	5	4
70	DBW 129	5	5	5	4	4.75	5	4
71	HI 8750 (d)	4	5	4	5	4.50	5	3
72	GW 451	4	5	5	4	4.50	5	4
73	HD 2932-Lr19/Sr25	5	5	4	5	4.75	5	3
74	HD 3132	4	5	5	4	4.50	5	4
75	HD 3133	4	5	5	5	4.75	5	4
76	WH 1129	5	5	5	4	4.75	5	3
77	PBW 704	5	5	4	5	4.75	5	4
78	HD 4728 (d)	5	5	4	4	4.50	5	4
79	HI 8751 (d)	4	5	4	5	4.50	5	5
80	PBW 723	5	5	4	4	4.50	5	4
80 A	SONALIKA (C) FOR SF	-	4	-	5	4.50	5	-
80 B	IWP 72 (C) FOR BWM	-	5	-	4	4.50	5	-
80 C	A 9-30-1 (C) FOR FA	5	5	5	5	5.00	5	-
80 D	GW 173 (C) FOR RA	-	4	-	4	4.00	5	5
81	UAS 451 (d)	4	5	4	4	4.25	5	4
82	DBW 110	5	5	4	5	4.75	5	4
83	HI 8755 (d)	4	5	5	4	4.50	5	5
84	UAS 446	4	5	4	5	4.50	5	5
85	UP 2891	5	5	5	4	4.75	5	4
86	TL 2995 (T)	4	5	4	5	4.50	5	3
87	TL 2999 (T)	5	5	4	5	4.75	5	3

*Due to low infestation of foliar aphid and root aphid screening at Shillongani was not carried out; Karnal: Infestation of Root aphid was not observed

(B) CHEMICAL CONTROL

I: Effect of insecticidal seed treatment on germination, termite damage and yield.

All the treatments were done a day before sowing. The EC formulations equivalent to a.i. amounts, were diluted with 50 ml water and sprayed with hand sprayer over seed uniformly spread in a tray or polythene sheet on *pucca* floor. The seed were turned over frequently to ensure proper application and left over night for drying.

Observations Recorded:

1. Earmarked five spots of 2m-row length in each plot and counted the total number of seedlings three weeks after sowing (for subsequent germination, the observations may be deferred till few days after first irrigation) and data was presented as plant population per meter row in final table.
2. Recorded the total number of affected and healthy tillers in these spots 3, 4 and 5 weeks after sowing. Also recorded total number of effective tillers and those damaged in these spots at crop maturity and given as % damaged effective tillers / m row. For analysis, angular transformations of the percentages were used.
3. When the crop was nearing maturity but still green, then damaged ear heads were counted and removed. The total number of damaged ear heads from net plot (except the two border rows and 25 cm space at each end but inclusive of the damaged ear heads in premarked spots) was expressed as number of effective damaged tillers per hectare.
4. Recorded grain yield (a) from pre marked spots and expressed in g/m row length (b) from net plot (including the pre marked spots) and expressed in q/ha.
5. In the final table, the mean values followed by alphabets indices were given to denote statistical variations based on C.D. values.
6. This trial was not conducted at Bansathali centres
7. The details of results at each experimental site are given below:

Centre: Durgapura

The experiment for the control of termite through seed treatment was carried out at the Rajasthan Agriculture Research Institute, Durgapura under irrigated conditions and the results are summarized in Table 6.5. The plant population / m row that was counted after 3 weeks of sowing revealed non-significant difference among the treatments. In confirmative test on germination, where the counted no. of seeds of different treatments were sown separately in small replicated trial under field conditions also showed non-significant difference. Hence, none of the insecticidal treatments affected the seed germination. The data further revealed that termite damage was observed during 5th week after sowing in all the treatments but more in Chorpyeiphos 20 EC (2.42%) and in untreated was 8.39%. Percent damaged effective tiller / m row was maximum in untreated check (18.57%), whereas it was minimum in the treatment of Imidacloprid 600 FS (0.48%), at par with Fipronil 5 SC (0.64%), Imidacloprid 17.8 SC (0.65%) and Lacenta 40% was 0.67% respectively. On the basis of number of damaged effective tiller / ha, the highest damage was recorded in untreated check (99010). Significantly lowest damage was noticed in Imidacloprid 600 FS (5646). The maximum grain yield (gm / m / row) was recorded in the plot treated with Imidacloprid 600 FS (41.33) as compared to untreated check (22.66). The grain yield data computed on the basis of q / ha from different treatments indicated that maximum yield was observed in Imidacloprid 600 FS (44.70 q / ha) was at par with Imidacloprid 17.8 SL (42.50 q / ha), Fipronil 5 SC (42.10 q / ha)and lowest yield was observed in untreated check (23.90 q / ha).

Centre: Ludhiana

This experiment was conducted in the rainfed fields at New experimental area, Dept. of Plant Breeding and Genetics, PAU Ludhiana. The wheat variety PBW 660 was sown on 5th

Nov 2016. Before sowing, the seeds were treated with seven different insecticides separately by spraying on the spreaded layer of equal quantity of seed on polyethene sheet. The treated seed was dried overnight before sowing. There were seven treatments including untreated check and each was replicated thrice. For recording observations on the plant population and damage plants, five spots of 2 m row lengths each, were ear marked in each plot.

The data presented in Table 6.6 revealed that plant population/m row recorded after 3 weeks of germination was non-significant among all the treatments. Hence, none of treatment used, affected the seed germination. Per cent damaged effective tillers/m row after 3, 4 & 5 weeks of germination indicated that all the insecticidal treatments recorded significantly lower per cent damaged effective tillers/ m row than the untreated check.

At ear head stage, the per cent damaged effective tillers per meter row (in marked spots) were minimum in the plot treated with thiamethoxam 35FS @ 1.5 ml/kg of seed (1.49) and these were on par with all the other treatments except untreated check. The numbers of damaged effective tillers/ha were lowest in plots treated with clothianidin 50 WDG @ 1.5 gm/kg of seed (10333). All these insecticide treated plots recorded significantly lower number of damaged tillers/ha as compare to untreated check.

There were non-significant differences among all the treatment for grain yield (g/m row). However, the grain yield (q/ha) obtained from different treatments revealed that all the insecticide treated plots showed significantly higher yield than the untreated check, however clothianidin @ 1.5 g/kg treated plots recorded maximum yield (45.46).

Centre: Kanpur

The experiment was conducted at Research Farm, Nawabganj, Kanpur under rainfed condition in 23 rows of 4m length in R.B.D. with eight treatments replicated thrice (Table 6.7). The initial plant population counts indicated that seed treatments with different insecticides had no effect on germination per cent. The incidence of termite after 3 weeks of sowing was not seen in any of the treatments accept untreated plot i.e. 2.91 per cent. The incidence of termite after 4 weeks of sowing range from 0.39 to 0.67 per cent, while in untreated plot it was 3.27 per cent. The incidence of termite after 5 weeks of sowing range from 1.57 to 1.73 per cent, while in untreated plot it was 3.46 per cent, significantly less damaged shoot were recorded in treated plot with fipronil 40% + imidacloprid 40 WG and fipronil 5SC, which was at par acephate 50% + imidacloprid 1.8% and imidacloprid 600FS (48%). Minimum damage of effective tiller per meter row was recorded in the treated plots with fipronil 40% + imidacloprid 40WG and fipronil 5SC. Which was at par acephate 50% + imadacloprid 1.8% and imadacloprid 600FS (48%).

All the insecticidal treatments showed, superiority over untreated checks in minimizing the per cent damaged effective tillers. The damaged number of effective tillers/ha in different treatments ranged from 3033.33 to 4966.66 while it was 16833.33 in untreated plots. The minimum damaged number of effective tillers/ha were recorded in fipronil 40% + imidacloprid 40 WG and fipronil 5SC treated plot followed by acephate 50% + imidaclopird 1.8% and imidacloprid 600FS (48%).

All the treatments showed minimum damaged number of effective tillers/ha as compared to untreated check. Grain yield g./m row and q/ha was significantly higher in treated plot with fipronil 40% + imidacloprid 40 WG and fipronil 5SC, followed by acephate 50% + imidacloprid 1.8% and imidacloprid 600 FS (48%).

The result concluded that insecticide fipornil 40% + imidacloprid 40WG @ 3.0gm and fipronil 5SC @ 10ml were superior to acephate 50% + imidacloprid 1.8% @ 4.0gm, imidacloprid 600 FS (48%) @ 4.0ml, thiamethoxam 25WG @ 3.2gm, clothianidin 50WDG @ 1.5gm, clorentranilpride 18.5% SC @ 3.0ml and imidacloprid 17.8 % @ 3.0ml/kg of seed.

Table 6.5: Effect of insecticidal seed treatment on the germination, termite damage and yield during 2016-17 (Location: Durgapura)

S. No	Treatments	Dose (g a.i./ ml/kg seed)	Plant population/m row	Per cent damaged shoots/m row after 5 weeks	Per cent damaged effective tillers/m row at ear head stage	No. of damaged effective tillers/ha	Grain yield	
							g/m row	q/ha
1	Imidacloprid 600 FS Gauchao	1.92 ml (4 ml)	43.00	0.25 (4.05)	0.48 (4.23)	5646 (73.78)	41.33	44.70
2	Clothianidin 50WDG Dantosau	0.75g (1.5 gm)	42.00	0.84 (5.25)	2.02 (8.03)	10150 (100.74)	37.33	40.25
3	Imidacloprid 17.8% (Confidor)	1.92 ml (4.0 ml)	43.00	0.25 (4.05)	0.48 (4.23)	5646 (73.78)	41.33	44.70
4	Thiamethoxam 35 FS	0.6 ml (3.0 ml)	41.66	0.53 (4.23)	0.65 (4.61)	5996 (77.37)	40.66	42.50
5	Chlorpyriphos 20 EC	0.8 ml (4.0 ml)	41.33	2.42 (8.90)	6.31 (14.51)	32540 (180.35)	33.33	30.45
6	Fipronil 5% SC Regent	0.5 ml (10.ml)	42.33	0.54 (4.22)	0.64 (4.58)	6014 (77.53)	40.33	42.10
7	Untreated		41.00	8.39 (16.82)	18.57 (25.51)	99010 (314.62)	22.66	23.90
	S. Em ±	-	0.62	0.32	0.57	1.69	1.08	0.76
	CD at 5%	-	NS	0.97	1.73	5.13	3.29	2.31

* Transformed values, Figures within parenthesis represent actual mean values; Figures with same alphabets are statistically at par

Date of sowing : 28.11.2016 Plot size Gross: 7x 3 m No. of rows/plot : 10
Date of insecticidal application : 02.12.2016 Net : 6.5 x 2.5 m Design : RBD
Date of plant population counts : 19.01.2017 Variety : Raj 4083 Replication : 3
Date of harvest : 28.03. 2017 Condition :Irrigated

Table 6.6 : Effect of insecticidal seed treatment on germination, termite damage and yield during 2016-17 (Location: Ludhiana)

S. No	Treatments	Dose g or ml / Kg seed	Plant population/ m row	Per cent damaged shoots/m row			Per cent damaged tillers/m row at ear head stage	No. of damaged effective tillers/ha	Grain yield	
				3 weeks	4 weeks	5 weeks			g/m row	q/ha
1	Thiamethoxam 25WG	3.2 gm	49.63	1.40 (7.92)	1.52 (8.16)	1.52 (8.15)	1.93 (8.94)	11000 (104.62)	69.33	42.35
2	Imidacloprid 17.8 SL	3.0 ml	48.30	1.53 (8.19)	1.32 (7.75)	1.54 (8.19)	1.80 (8.68)	11583 (107.35)	68.00	42.68
3	Fipronil 5 SC	6.0 ml	48.66	0.82 (6.58)	1.18 (7.43)	1.14 (7.36)	1.55 (8.22)	10916 (104.45)	69.33	44.30
4	Thiamethoxam 35 FS	2.4 ml	49.40	0.85 (6.64)	1.00 (7.03)	1.19 (7.45)	1.49 (8.11)	10583 (102.79)	69.00	44.03
5	Imidacloprid 600FS	4 ml	48.96	0.84 (6.63)	0.96 (6.93)	1.12 (7.30)	1.52 (8.15)	10416 (101.93)	67.66	44.35
6	Clothianidin 50 WDG	1.5 gm	50.03	0.87 (6.71)	0.91 (6.82)	1.10 (7.27)	1.62 (8.36)	10333 (101.60)	65.33	45.46
7	Chlorpyriphos 20%EC	4 ml	48.70	1.03 (7.10)	1.18 (7.44)	1.35 (7.82)	1.66 (8.44)	11416 (106.82)	64.66	43.28
8	Untreated check	-	48.73	3.29 (11.21)	3.49 (11.51)	3.53 (11.57)	3.99 (12.23)	19583 (139.92)	67.33	40.75
CD (p=0.05)			NS	(0.92)	(0.72)	(0.73)	(1.00)	(10.73)	NS	2.40

* Figures in parentheses are transformed means

Date of sowing	:	5-11-2016	Plot size	:	40 m^2
Date of insecticidal application	:	4-11-2016	Variety	:	PBW 660
Date of harvest	:	14-4-2017	Replications	:	Three

Table 6.7: Effect of insecticidal seed treatment on germination termite damage and yield during 2016-17 (Location: Kanpur)

S. No	Treatments	Actual Dose gm/ ml/kg of seed.	Plant population/ m row	Per cent damaged shoots/m row			Per cent damaged effective tillers/m row at crop maturity	No. of damaged effective tillers/ha at harvest	Grain yield	
				3 weeks	4 weeks	5 weeks			g/m row	q/ha
1.	Thiamethoxam 25 WG	3.2g	33.73	0	0.57 (4.33)	1.69 (7.27)	1.57 (7.04)	3583.33 (59.86)	39.83	20.41
2.	Imidacloprid 17.8 %	3.0ml	34.16	0	0.67 (4.69)	1.73 (7.49)	1.78 (7.49)	4966.66 (70.47)	39.10	18.57
3.	Acephate 50% + Imidacloprid 1.8 %	4.0g	34.53	0	0.48 (3.97)	1.64 (7.27)	1.53 (7.04)	3433.33 (58.59)	44.89	20.58
4.	Fipronil 5 SC (regent)	10ml	33.86	0	0.41 (3.67)	1.57 (7.04)	1.50 (7.04)	3166.67 (56.27)	45.94	20.92
5.	Imidacloprid 600 FS (48%)	4.0ml	35.60	0	0.51 (4.09)	1.67 (7.27)	1.56 (7.04)	3533.33 (59.44)	40.84	20.50
6.	Clothianidin 50 WDG	1.5g	34.13	0	0.64 (4.59)	1.70 (7.49)	1.60 (7.27)	4666.66 (68.31)	39.62	20.25
7.	Fipronil 40% + Imidacloprid 40 WG	3.0g	32.36	0	0.39 (4.01)	1.57 (7.04)	1.41 (6.80)	3033.33 (55.07)	47.16	21.00
8.	Chlorantaniliprid (Coragen) 18.5 SC	3.0ml	35.90	0	0.64 (4.59)	1.71 (7.49)	1.70 (7.49)	4916.66 (70.11)	39.65	20.05
9.	Control	-	34.03	2.91	3.27 (11.09)	3.46 (10.63)	3.75 (11.09)	16833.33 (129.74)	31.65	15.42
	SEm±	-	-	-	0.404	0.262	0.233	2.106	1.360	0.245
	CD at 5%	-	-	-	1.220	0.793	0.704	6.369	4.113	0.741

* Transformed values, Figures within parenthesis represent actual mean values; Figures with same alphabets are statistically at par

Date of sowing	: 25.11.2016	Plot size Gross	: 4 x 5m = 20 Sqm.
Date of insecticidal application	: 24.11.2016	Design	: R.B.D.
Date of plant population counts	: 25.12.2016	Variety	: K8027
Date of harvest	: 14.04.2017	No. of rows/plot	: 23
Irrigated/ Unirrigated	: Unirrigated	Replication	: Three

Table 6.8. Effect of insecticidal seed treatment on germination termite damage and yield during 2016-17 (Location: Vijapur)

Sr. No.	Treatment	Dose g a.i./ kg seed	Plant population /m row length	Confirmative test for seed germination	Per cent damaged shoots/m row after sowing (week)			% Damaged effective tillers/m row	No. of damaged effective tillers/ha	Grain yield	
					3rd	4th	5th			g/m	q/ha
1.	Imidacloprid 17.8 SL	0.60	60	88.00	0.00* (0.00)	0.00* (0.00)	0.00* (0.00)	9.83*ab (6.26)	3511**bcd (58113)	47	30.28
2.	Fipronil 5 SC	0.50	63	91.00	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	8.10ab (5.09)	2913ab (41186)	48	30.08
3.	Thiamethoxam 30 FS	0.72	56	91.67	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	11.99ab (10.34)	3760cd (67628)	45	27.71
4.	Imidacloprid 600 FS	1.92	63	87.33	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	9.48ab (6.69)	3167abc (48237)	47	29.35
5.	Clothianidin 50 WDG	0.75	59	89.00	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	11.27ab (8.64)	3968de (75801)	44	27.83
6.	Fipronil+Imidacloprid 40 % WG (Lacenta)	1.20	65	91.33	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	7.39a (4.25)	2644a (35897)	50	31.92
7.	Chlorpyriphos 20% EC	0.80	61	88.67	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	12.49b (10.57)	4664e (112179)	41	27.20
8.	Untreated Check	-	63	84.00	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	36.81c (76.17)	9988f (456571)	39	26.84
	S.Em.±		6.0	3.28	-	-	-	1.53	252	3	1.92
	C.D. at 5%		NS	NS	-	-	-	4.65	764	NS	NS
	C.V.%		-	-	-	-	-	-	-	11.3	11.54

* Figures followed within same column are Arcsin percentage transformation ** Figures followed within same column are square root transformation

Date of sowing	: 24.11.2016	Plot size Gross	: 14 x 2.4m (gross)
Date of insecticidal application	: 23.11.2016	Design	: R.B.D.
Date of plant population counts	: 16.12.2016	Variety	: GW496
Date of harvest	: 22.03.2017	No. of rows/plot	: 12
Irrigated/ Unirrigated	: Irrigated	Replication	: Three

Centre: Vijapur

The experiment for the control of termite through seed treatment was carried out at Wheat Research Station, Vijapur under irrigated conditions and the results are summarized in Table 1. The plant population/m row was counted after 3 weeks of sowing and it revealed that non-significant differences among all the treatments. In confirmative test on germination, where the counted number of seeds of different treatments were sown separately in small replicated trial under field conditions also showed non-significant difference. Hence, none of the insecticidal treatments affected the seed germination. The data further revealed that there was no termite damage observed during 3rd, 4th and 5th weeks after sowing in all treatments including untreated plot. Per cent damaged effective tillers/meter row were maximum in untreated check, whereas it was minimum in the treatment of fipronil + imidacloprid and it was at par with all the treatments except chlorpyriphos and untreated check. On the basis of number of damaged effective tillers/ha, the highest damage was recorded in untreated check. Significantly lowest damage was noticed in fipronil+ imidacloprid. The maximum grain yield (gram/m row) was recorded in the plot treated with fipronil+ imidacloprid as compared to untreated check. The grain yield data computed on the basis of q/ha from different treatments indicated non-significant differences among the treatments. However, the maximum grain yield was obtained from fipronil+ imidacloprid treated plot (Table 6.8).

II: Management of termite damage through broadcasting of newer insecticides in standing wheat crop.

Centre: Ludhiana

This trial was also conducted under rainfed conditions at New Experimental Area, Department of Plant Breeding and Genetics, PAU, Ludhiana. The wheat variety PBW 660 was sown on 5th Nov, 2016 in the replicated trial in 40 sq. m. plots. There were eight treatments including broadcasting of fipronil 5 SC, imidacloprid 600 FS, imidacloprid 17.8 SL, thiamethoxam 35 FS, thiamethoxam 25 WG, clothianidin 50 WDG, chlorpyriphos 20 EC and untreated check. Each treatment was replicated thrice. The different insecticides were broadcasted 3 weeks after emergence of seedling. For recording observations on the plant population and damage plants, five spots of 2 m row lengths each, were ear marked in each plot.

The observations on the termite damage at the seedling stage (Table 6.9) revealed that all broadcasting treatments have lower termite damage as compared to untreated control. At ear head stage, the percent damaged effective tillers/m row were lowest (1.44) in chlorpyriphos 20 EC broadcasted plots. However, all the insecticides recorded significantly less percent damaged effective tiller/m row than untreated check. The number of damaged effective tillers/ha recorded were lowest (9166) clothianidin 50 WDG broadcast plots. All the treatments recorded significantly lower number of damaged effective tillers/ha than untreated check. Among different broadcasting treatments, grain yield (q/ha) obtained was maximum (43.03 q/ha) in clothianidin 50 WDG treated plot. However, all treatments recorded significantly higher grain yield than untreated check and were statistically at par with each other.

Centre: Durgapura

This trial was also conducted under irrigated conditions at RARI, Durgapura farm. The wheat variety Raj 4083 was sown on 28th November 2016 in the replicated plots. There were 8 treatments which were broadcasted after 3 weeks of germination and were compared with untreated check. Each treatment was replicated thrice. For recording observations on the plant population and the damaged plants, fine spots of 2 m row lengths each, were ear marked in each plot. The observations of the plant population / m row and percent damaged shoots / m row at broadcasting stage was non-significant in all the treatments including untreated check.

At ear head stage, the percent damaged effective tiller / m row were lowest (5.50) in Imidacloprid 17.8 SL was at par with Fipronil 5 SC (5.86) and Lacenta 40% (5.90) respectively. However, all the insecticides recorded significantly lower percent of damaged effective tiller / m row than untreated check (19.46). The number of damaged effective tillers / ha recorded were lowest (9670) in Fipronil 5 SC broadcast plot. All the treatments recorded significantly lower number of damaged effective tillers / ha than untreated check. Among different broadcasting treatments, grain yield (gm / m row) obtained was maximum in (35.45) in Imidacloprid 17.8 SL and lowest in untreated check (20.65). The grain yield (q / ha) was recorded highest in Imidacloprid 17.8 SL (37.65) was at par with Fipronil 5 SC (37.10) and Lacenta 40% (37.50) respectively and lowest in untreated check (22.25) (Table 6.10).

Centre: Vijapur

An experiment was conducted under irrigated condition at Wheat Research Station, Vijapur to test the efficacy of different insecticides as broadcasting for the control of termite in wheat crop. The application of insecticides was made on 13-12-2016. The results are presented in Table 6.11. There was no termite damage in all the treatments after 3rd, 4th and 5th weeks of sowing including untreated check. At ear head stage, per cent damaged effective tillers/m row was minimum in fipronil + imidacloprid 40 % WG (Lacenta) @ 400 g. a.i./ha and it was at par with all insecticidal treatment except clothianidin 50 WDG @ 100 g a.i./ha, chlorpyriphos 20 EC @ 600 g a.i. / ha and untreated check. The number of damaged effective tillers/ha was significantly higher in untreated check as compared to insecticidal treatments. Among the insecticidal treatments, it was significantly less in fipronil + imidacloprid 40 % WG (Lacenta) @ 400 g. a.i./ ha and was at par with fipronil 5 SC @ 125 g a.i./ha, imidacloprid 17.8 SL @ 80 g a.i./ha and imidacloprid 600 FS @ 144 g a.i./ha. The grain yield in g/m row revealed non-significant difference among the treatments. The maximum grain yield was obtained in plot treated with higher dose of fipronil + imidacloprid 40 % WG (Lacenta) @ 400 g. a.i./ha and fipronil 5 SC @ 125 g a.i./ha. The grain yield (q/ha) was also found non-significant. Amongst the insecticidal treatment, it was the highest in higher dose of fipronil + imidacloprid 40 % WG (Lacenta) @ 400 g. a.i./ha.

Centre: Kanpur

The experiment was conducted at Research Farm, Nawabganj, Kanpur, under irrigated condition in 23 rows of 4 m length in RBD with 8 treatments with 3 replications (Table 6.12). The initial plant population counts indicated no significant difference among all the treatments. However, the incidence of termite after four weeks of sowing ranged 0.38 to 0.80 while in untreated plot it was 2.63 per cent. The incidence of termite after five weeks of sowing ranged from 1.23 to 1.56 per cent while in untreated plot it was 2.68 per cent. Significantly less damaged shoot were recorded in treated plot fipronil 40% + imidacloprid 40 WG @ 1000gm/ha and thiamethoxam 25WG @ 300gm/ha, which was at par clothianidin 50WDG @ 200gm/ha and imidacloprid 600FS (48%) @ 300ml/ha, which did not differ significantly acephate 50% + imidacloprid 1.8% @ 350gm/ha, fipronil 5SC @ 2.5lt/ha, imidacloprid 17.8% @ 400ml/ha and clorentranilprid 18.5% @ 200ml/ha.

All the treatments showed superiority over control in minimizing the per cent damage effective tillers. The minimum damaged of effective tillers/ha were recorded fipronil 40% + imidacloprid 40WG @ 1000gm/ha and thiamethoxam 25WG @ 300gm/ha treated plot followed by chothianidin 50 WDG@ 200gm/ha and imidacloprid 600FS (48%) @ 300ml/ha. All the treatments showed minimum damaged number of effective tillers /ha as grain yield g/m row and q/ha was significantly higher in treated plot with fipronil 40% + imidacloprid 40WG @ 1000gm/ha and thiamethoxam 25WG @ 300gm/ha followed by chothianidin 50 WDG@ 200gm/ha and imidacloprid 600FS (48%) @ 300ml/ha. The concluded that the insecticide fipronil 40% + imidacloprid 40WG @ 1000gm/ha and thiamethoxam 25WG @ 300gm/ha were superior to chothianidin 50 WDG@ 200gm/ha, imidacloprid 600FS (48%) @ 300ml/ha, acephate 50% + imidacloprid 1.8% @ 350gm/ha, fipronil 5SC @ 2.5lt/ha, imidacloprid 17.8% @ 400ml/ha and chlorentranilprid 18.5% SC 200ml/ha treated plots.

Table 6.9: Management of termite damage through broadcasting of newer insecticides in standing wheat crop during 2016-17 (Centre: Ludhiana)

S.No.	Treatments	Dosage (L)/ha	Plant population/ m row	Per cent damaged shoots/m row			Per cent damaged tillers/m row at earhead stage	No. of damaged effective tillers/ha	Grain yield	
				3 weeks	4 weeks	5 weeks			g/m row	q/ha
1	Thiamethoxam 25WG	300gm	50.43	2.78 (10.43)	0.83 (6.59)	1.15 (7.37)	1.63 (8.39)	9666 (98.32)	64.66	42.64
2	Imidacloprid 17.8 SL	400ml	50.56	3.08 (10.89)	0.77 (6.45)	0.97 (6.94)	1.55 (8.23)	9916 (99.54)	64.00	42.70
3	Fipronil 5 SC	2.5 l	51.03	3.27 (11.19)	0.78 (6.48)	1.12 (7.31)	1.49 (8.10)	9750 (98.66)	66.33	42.55
4	Thiamethoxam 35 FS	250 ml	49.96	3.24 (11.14)	0.79 (6.48)	1.06 (7.17)	1.60 (8.32)	9416 (96.98)	66.00	42.57
5	Imidacloprid 600FS	300 gm	49.33	3.15 (11.00)	0.77 (6.47)	1.00 (7.02)	1.61 (8.33)	9500 (97.42)	65.66	42.56
6	Clothianidin 50 WDG	200 gm	49.56	3.17 (11.03)	0.80 (6.51)	1.11 (7.29)	1.67 (8.46)	9166 (95.74)	66.66	43.03
7	Chlorpyriphos 20%EC	300gm	50.13	3.38 (11.35)	0.95 (6.91)	1.14 (7.33)	1.44 (8.00)	9416 (97.03)	68.33	42.40
8	Untreated check	-	50.30	3.31 (11.26)	3.48 (11.51)	3.53 (11.57)	3.03 (10.82)	16833 (129.71)	64.66	40.20
CD (p=0.05)		-	NS	NS	(1.13)	(0.79)	(0.73)	(6.04)	NS	1.55

* Figures in parentheses are transformed means

Date of sowing	:	05-11-2016	Plot size	:	40 m^2
Date of insecticidal application	:	04-11-2016	Variety	:	PBW 660
Date of harvest	:	14-04-2017	Replications	:	Three

Table 6.10: Management of termite damage through broadcasting of newer insecticides in standing wheat crop during 2016-17 (Location: Durgapura)

S. No	Treatments	Dose ml / gm / lit / ha	Plant population /m row	Per cent damaged shoots / m row at broadcasting	Per cent damaged tillers / m row at ear head stage	No. of damaged effective tillers/ha	Grain yield	
							gm/m row	q/ha
1	Imidacloprid 17.8 SL (Confidor)	400 ml	41.66	4.86* (12.73)	5.50 (13.55)	9925 (96.00)	35.45	37.65
2	Fipronil 5 SC (Regent)	2.5 lit	41.00	5.15 (13.07)	5.86 (13.99)	9670 (98.31)	34.95	37.10
3	Thiamethoxam 35 FS	250 ml	41.33	4.49 (12.22)	8.60 (17.04)	12945 (113.76)	32.10	35.40
4	Imidacloprid 600 FS (Gaucho)	300 ml	41.66	4.76 (12.58)	7.75 (16.15)	10160 (100.79)	32.55	35.95
5	Clothiodin 50 WDG (Dantodsu)	200 gm	41.66	5.03 (12.95)	7.85 (16.26)	11750 (108.35)	32.56	34.60
6	Fipronil 40%+ Imidacloprid 40 % (Lacenta)	1000 gm	41.00	5.26 (13.24)	5.90 (14.05)	9810 (99.04)	35.10	37.50
7	Chlorpyriphos 20 EC	3.0 lit	41.66	4.95 (12.85)	10.46 (18.85)	21895 (147.97)	30.25	30.65
8	Untreated	-	41.00	5.90 (14.05)	19.46 (26.17)	40850 (202.10)	20.65	22.25
	S. Em ±	-	0.74	0.39	0.40	1.47	1.02	0.62
	CD at 5%		NS	NS	1.22	4.48	3.11	1.89

* Transformed values, Figures within parenthesis represent actual mean values;

Date of sowing : 28.11.2016 Plot size Gross : 7 x 3 m Design : RBD
Date of insecticidal application : 25.12.2016 Net : 6.5 x 2.5 m Replication : 3
Date of plant population count : 19.01.2017 Variety : Raj 4083 Condition : Irrigated
Date of harvest : 28.03.2017

Table 6.11. Management of termite damage through broadcasting of newer insecticides in standing wheat crop during 2016-17
(Location: Vijapur)

Sr. No.	Treatment	Dose g a.i./ ha	Per cent damaged shoots/m row after sowing (week)			% Damaged effective tillers/ m row	No. of damaged effective tillers/ha	Grain yield	
			3rd	4th	5th			g/m	q/ha
1.	Imidacloprid 17.8 SL	80	0.00* (0.00)	0.00* (0.00)	0.00* (0.00)	4.40*abc (1.29)	2316**abc (26122)	63	34.86
2.	Fipronil 5 SC	125	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	4.23ab (1.24)	2228ab (26282)	66	36.24
3.	Thiamethoxam 30FS	75	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	5.90abcd (2.39)	3700bcd (65224)	60	32.68
4.	Imidacloprid 600 FS	144	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	5.58abcd (2.12)	3305abcd (54006)	61	34.27
5.	Clothianidin 50 WDG	100	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	11.57de (15.94)	3698bcd (66346)	54	31.84
6.	Fipronil+Imidacloprid 40 % WG (Lacenta)	400	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	3.76a (0.90)	1953a (20032)	66	36.33
7.	Chlorpyriphos 20% EC	600	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	17.91de (22.53)	4012d (103205)	52	31.26
8.	Untreated check	-	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	26.88f (43.33)	6146e (182532)	51	31.09
	S.Em ± C.D. at 5% C.V.%		- - -	- - -	- - -	2.14 6.50 -	503 1526 -	5 NS 13.43	2.21 NS 11.41

* Transformed values, Figures within parenthesis represent actual mean values;
Figures followed with same letter(s) are not differed statistically

Date of sowing : 24/11/2016 Date of insecticide application : 13/12/2016
Date of harvesting : 22/03/2017 Design: R.B D Replications : Three
Spacing : 20 cm between row No. of rows / plot : 12
Plot size: Gross: 14.0m x 2.40m Net: 13.0m x 1.60m Variety: GW 496 Condition : Irrigated

Table 6.12: Management of termite damage through broadcasting of insecticides in standing wheat crop during 2016-17 (Centre: Kanpur)

S. No.	Treatments	Actual Dose gm/ml/lt./ ha.	Plant population/m row	Per cent damaged shoots/m row			Per cent damaged effective tillers/m row at crop maturity	No. of damaged effective tillers/ha at harvest	Grain yield	
				3 weeks	4 weeks	5 weeks			g/m row	q/ha
1.	Thiamethoxam 25 WG	300 gm	39.43	0	0.50 (4.05)	1.35 (6.55)	1.45 (6.80)	2833.33 (53.22)	90.57	41.12
2.	Imidacloprid 17.8 %	400 ml	39.03	0	0.80 (5.13)	1.56 (7.04)	1.60 (7.27)	4333.33 (65.82)	75.18	38.16
3.	Acephate 50% + Imidacloprid 1.8 %	350 gm	38.33	0	0.71 (4.83)	1.48 (6.80)	1.54 (7.04)	4000.00 (63.24)	80.85	39.42
4.	Fipronil 5 SC (regent)	2.5 liter	40.66	0	0.75 (4.97)	1.54 (7.04)	1.57 (7.04)	4166.66 (64.54)	78.85	37.79
5.	Imidacloprid 600 FS (48%)	300 ml	37.93	0	0.61 (4.48)	1.48 (6.80)	1.52 (7.04)	3833.33 (61.91)	81.52	39.58
6.	Clothianidin 50 WDG	200 gm	39.36	0	0.58 (4.37)	1.47 (6.80)	1.50 (7.04)	3666.66 (60.55)	82.56	40.00
7.	Fipronil 40% + Imidacloprid 40 WG	1000 gm	37.70	0	0.38 (3.53)	1.23 (6.29)	1.33 (6.55)	2500.00 (50.00)	92.98	42.62
8.	Chlorantaniliprid (Coragen) 18.5 SC	200 ml	37.43	0	0.84 (5.26)	1.60 (7.27)	1.62 (7.27)	4416.66 (66.45)	74.90	37.79
9.	Control	-	37.06	2.80	2.63 (9.28)	2.68 (9.28)	2.98 (11.39)	13666.66 (116.90)	67.18	34.91
	SEm±		-	-	0.233	0.112	0.149	4.106	1.810	0.552
	CD at 5%		-	-	0.706	0.939	0.450	12.415	5.472	1.670

* Ttransformed values, Figures within parenthesis represent actual mean values; Figures with same alphabets are statistically at par

Date of sowing	: 25.11.2016	Plot size Gross	: 4 x 5m = 20 Sqm.
Date of insecticidal application	: 25.12.2016	Design	: R.B.D.
Date of plant population counts	: 24.12.2016	Variety : K0402	
Date of harvest	: 20.04.2017	No. of rows/plot	: 23
Irrigated/ Unirrigated	: Irrigated	Replication	: Three

III: Chemical control of foliage feeding wheat aphids.

Objectives:
The main purpose of conducting this experiment was to find out molecules belonging to new chemistry, which are more efficient, at lower doses and are less hazardous to environment than presently recommended molecules.

Methodology:
The experiment consisted of eight treatments was conducted at four locations *viz.,* Ludhiana, Niphad Pantnagar and Kanpur. The details of the treatments and their doses are given below:

S.No	Treatment	Dosage (g a.i.) / ha
1	Confidor (Imidacloprid 17.8 SL)	20
2	Dantotsu (Clothianidin 50 WDS)	15
3	Fame (Flubendamide 480 SC)	20
4	Pride (Acetamiprid 20SP)	20
5	Actara (Thiamethoxam 25 WG)	12.5
6	Coragen (Chlorantranilipride 18.5 SC)	20
7	Rogor (Dimethoate 30 EC)	300
8	Control	-

Five tillers were tagged from each plot and the experiment was replicated three times. The aphids were counted from these tagged plants before spray and after spray to know the efficacy of each treatment. The grain yield was recorded to know the amount preventable losses by these treatments.

Summary:

- The spray of Dantotsu (Clothianidin 50 WDS)@ 15 g.a.i./ha was found to be very promising in checking aphid population at all centres.
- The application of a new formulation Fame (Flubendamide 480 SC) @ 20 g.a.i./ha was also found to be quite effective in managing the aphid.

The details of results of experiment of each location are as below:

Centre: Ludhiana
This trial was conducted under irrigated conditions at Plant Breeding Research Farm, PAU, Ludhiana. The wheat variety WH 1105 was sown on 6th Nov.2016 in the plots of 6 rows of 6 m length in a replicated trial. Six insecticides were sprayed when the aphid population reached at 4-5 aphids/earhead. There were total of seven treatments including untreated check and each was replicated three times. For recording observations, five shoots were ear marked in each plot and from these plants observations were recorded one day before spray and then 1, 2, 7 and 15 days after spray.

Aphid population did not differ significantly among all treatments one day before spray except seed treated plots where it was significantly lower than all other treatments (Table 6.13). When observed one day after spray, thiamethoxam recorded minimum (1.41 aphids/earhead) and was at par with all other insecticidal treatments except untreated check (30.20 aphids/earhead). Two days after treatment, acetamiprid (1.01 aphids/earhead) recorded minimum aphid population and was at par with all other insecticidal treatments except untreated check (31.23 aphids/earhead). Seven and fifteen days after spray, thiamethoxam and imidacloprid respectively, were the best treatment, however these was at par with all other insecticidal treatment and better than untreated check.

Grain yield (q/ha) obtained was maximum from thiamethoxam (58.71) treated plots followed by acetamiprid (58.08) treated plots. However, all the insecticidal treatments recorded higher than grain yield than untreated check (50.53).

Centre: Niphad

The data revealed that all the insecticidal treatments were effective against aphids as they showed significantly lower aphids population than untreated control. At 1 day after spray, the plots treated with imidacloprid 17.8 SL @ 20g a.i./ha and thiamethoxam 25 WG @ 12.5g a.i./ha registered significantly minimum (0.87) number of aphids/shoot/plant as compared to rest of the treatments and it was at par with acetamiprid 20 SP @ 20g a.i./ha (0.93), clothianidin 50 WDG @ 15 g.a.i./ha (0.97) and Flubendiamide 480 SC @ 20g a.i./ha (0. 97). At 2 and 7 days after spray the treatment with imidacloprid 17.8 SL @ 20g a.i./ha, clothianidin 50 WDG @ 15 g.a.i./ha, acetamiprid 20 SP@ 20g a.i./ha, thiamethoxam 25 WG @ 12.5g a.i./ha, Flubendiamide 480 SC @ 20g a.i./ha and Quinalphos 25 EC @ 250 g a.i./ha recorded cent per cent control of aphids. At 15 DAS, thiamethoxam 25 WG @ 12.5g a.i./ha recorded minimum number of 6.33 aphids/shoot/plant. The highest (41.00, 42.70, 46.96 and 60.10) number of aphids/shoot/plant were recorded at 1, 2, 7 and 15 days after spray, respectively.

In case of natural enemies, the maximum (3.44/m2) number of natural enemies was recorded in untreated control. The minimum (1.00) number of natural enemies per square meter was recorded in Flubendiamide 480 SC @ 20g a.i./ha and thiamethoxam 25 WG @ 12.5g a.i./ha.

Maximum yield of 66.66 q/ha was obtained in plot treated with clothianidin 50 WDG @ 15 g.a.i./ha which was at par with thiamethoxam 25 WG @ 12.5g a.i./ha (66.11), acetamiprid 20 SP@ 20 g a.i./ha (65.69 q/ha), imidacloprid 17.8 SL @ 20g a.i./ha (63.88) and Quinalphos 25 EC @ 250 g a.i./ha (62.08) as against lowest in control plot (34.72 q/ha) (Table 6.14).

Centre: Pantnagar

Six insecticides viz, Confidor (Imidacloprid 17.8 SL), Dantotsu (Clothianidin 50 WDG)(Dantotsu), Flubendamide 480 SC (Fame), Acetamiprid 20SP (Pride) Thiamethoxam25 WG (Actara) and Chlorantraniliprole 18.5SC (Coragen) were tested for efficacy against wheat aphids. All the treatments effectively reduced the population over untreated check. Out of six insecticides tested, Imidacloprid 17.8 SL was found most effective in minimizing the population of wheat aphid (0.17 aphids/shoot) followed by Clothianidin 50 WDG, Flubendamide 480 SC, Acetamiprid 20SP and Thiamethoxam25 WG after 15 days of insecticidal treatment. Chlorantraniliprole 18.5SC on the other hand was found least effective after 15 days of treatment. However, maximum yield was obtained with Thiamethoxam25 WG followed by Imidacloprid 17.8 SL, Clothianidin 50 WDG, Chlorantraniliprole 18.5SC, Flubendamide 480 SC and Acetamiprid 20SP.Lowest yield on the contrary was recorded with the untreated control (Table 6.15).

Centre: Karnal

The data revealed that aphid population did not differ significantly among all treatments one day before spray. When observed one day after spray, Fame (Flubendamide 480SC) recorded minimum (3.02 aphids/shoot) and it was significantly superior with treatments Pride(Acetamiprid 20SP), and Rogar (Dimethoate 30 EC) in comparison to untreated check (44.25aphids/shoot).Two days after treatment, Actara (Thiamethoxam 25 WG) (2.56aphids/shoot) recorded minimum aphid. Fifteen days after spray, Dantotsu (Clothianidin 50 WDG) recorded lowest aphid population (0.74 aphids/shoot) followed by Fame (Flubendamide 480 SC).

Grain yield (q/ha) obtained was maximum from flubendamide (Fame 480 SC) (60.25qt./ha.) treated plots followed by Dantotsu (Clothianidin 50 WDG) (57.62qt./ha.) and Confidor (Imidacloprid 17.8 SL) (56.54qt./ha.) treated plots. However, all the insecticidal treatments recorded higher than grain yield than untreated check (50.33) (Table 6.16).

Centre: Kharibari

This trial was conducted under irrigated conditions at Regional Research sub-station (Terai Zone) UBKV, Kharibari, Darjeeling, West Bengal, to evaluate the bio-efficacy of eight new synthetic formulation viz., Confidor (Imidacloprid 17.8 SL), Dantotsu (Clothianidin 50 WDG), Flubendamide (Fame 480 SC), Pride (Acetamiprid 20SP), Actara (Thiamethoxam 25 WG), Chlorantranilipride 18.5 SC(Coragen), Thiamethoxam 35 FS (Crusier) and Rogar (Dimethoate 30 EC) The wheat variety DBW 38 was sown on 25th November'2015 in the plots of 6 rows of 6m length in a replicated trial. Eight insecticides were sprayed at two times when the aphid population reached at 9-10 aphids/earhead. There were total of nine treatments including untreated check and each was replicated three times. For recording observations, five shoots were ear marked in each plot and from these plants observations were recorded one day before spray and then 1, 2, 7 and 15 days after spray.

Aphid population did not differ significantly among all treatments 15 days before spray except seed treated plots where it was significantly lower than all other treatments (Table 6.17). The reduction in the wheat aphid population build up of *Rhopalosiphum maidis* due to application of Clothianidin 50 WDG at 0.20 gm/lt., Actara (Thiamethoxam 25 WG) at 0.40gm/lt and Rogar (Dimethoate 30 EC) at 2.00 ml/lt. was found to be 100%, respectively, over untreated control. The other insecticide was found to be at same. Grain yield (q/ha) obtained was maximum from Clothianidin 50 WDG (33.56) treated plots followed by flubendamide (33.45), Thiamethoxam 35 FS (Crusier) (32.65), Rogar (Dimethoate 30 EC) (32.55), Confidor (Imidacloprid 17.8 SL) (31.00), Actara (Thiamethoxam 25 WG) (29.55), Chlorantranilipride 18.5 SC(Coragen) (30.45) and Pride (Acetamiprid 20SP) (28.86) treated plots. However, all the insecticidal treatments recorded higher than grain yield than untreated check (24.35) (Table 6.17).

Table 6.13: Chemical control of foliage feeding aphid on wheat during 2016-17 (Location: Ludhiana)

S. No.	Treatments	Dose ml or g/ ha	Dosages (g a.i./ha)	Aphid population per earhead					Grain Yield (q/ha)
				Before spray	After spray				
				1 day	1 day	2 days	7 days	15 days	
1	Confidor (Imidacloprid 17.8 SL)	100 ml	20	28.87	1.66 (1.62)	1.11 (1.45)	0.85 (1.36)	0.68(1.29)	57.06
2	Dantotsu (Clothianidin 50 WDS)	30 gm	15	29.96	1.65 (1.62)	1.07(1.43)	0.86 (1.36)	0.82 (1.34)	57.64
3	Fame (Flubendamide 480 SC)	250 ml	20	28.86	1.49 (1.57)	1.06 (1.43)	0.91 (1.38)	0.76 (1.32)	57.46
4	Pride (Acetamiprid 20SP)	100 gm	20	30.03	1.50 (1.58)	1.01 (1.41)	0.82 (1.35)	0.75 (1.32)	58.08
5	Actara (Thiamethoxam 25 WG)	50 gm	12.5	30.56	1.41 (1.55)	1.02 (1.41)	0.77 (1.33)	0.79 (1.33)	58.71
6	Quinolphos (Ekalux 25 EC)	1000 ml	250	30.16	1.67 (1.63)	1.08 (1.44)	0.93 (1.38)	0.85 (1.36)	55.64
7	Coragen (Chlorantranilipride 18.5 SC)	100 ml	20	30.03	1.59 (1.60)	1.06 (1.43)	0.90 (1.37)	0.82 (1.34)	57.37
	Control	-	-	28.93	30.20 (5.58)	31.23 (5.67)	30.80 (5.63)	32.23 (5.76)	50.53
CD (p=0.05)				NS	(0.16)	(0.11)	(0.15)	(0.18)	3.54

* Figures within parentheses are transformed means

Date of sowing : 22.11.2016; Plot size : 7.5 m²; Date of insecticidal application:01.03.2017 Variety :WH 1105; Date of harvest :15. 04.2017; Replications : Three

Table 6.14: Chemical control of foliage feeding aphid on wheat during 2016-17 (Location: Niphad)

S. No.	Treatments	Dose g a.i./ha	Av. Population of survived foliage feeding wheat aphids per shoot.					Yield q/ha	Population of N enemies/ m^2 15DAS
			Pre count	1DAS	2DAS	7DAS	15DAS		
1	Imidacloprid 17.8 SL	20	27.33 (5.31)	0.87 (1.37)	0.00 (1.00)	0.00 (1.00)	6.63 (2.76)	63.88	1.22 (1.49)
2	Clothianidin 50 WDG	15	28.33 (5.41)	0.97 (1.40)	0.00 (1.00)	0.00 (1.00)	6.37 (2.71)	66.66	1.06 (1.44)
3	Flubendiamide 480 SC	20	26.80 (5.27)	0.97 (1.40)	0.00 (1.00)	0.00 (1.00)	6.57 (2.75)	59.30	1.00 (1.41)

S. No.	Treatments	Dose g a.i./ha	Av. Population of survived foliage feeding wheat aphids per shoot.					Yield q/ha	Population of N enemies/ m^2 15DAS
			Pre count	1DAS	2DAS	7DAS	15DAS		
4	Acetamiprid 20 SP	20	27.80 (5.36)	0.93 (1.39)	0.00 (1.00)	0.00 (1.00)	6.70 (2.77)	65.69	1.06 (1.44)
5	Thiamethoxam 25 WG	12.5	27.20 (5.30)	0.87 (1.37)	0.00 (1.00)	0.00 (1.00)	6.33 (2.71)	66.11	1.00 (1.41)
6	Quinalphos 25 EC	250	27.66 (5.36)	5.63 (2.57)	0.00 (1.00)	0.00 (1.00)	7.17 (2.86)	62.08	1.94 (1.71)
7	Untreated control	-	27.80 (5.36)	41.00 (6.48)	42.70 (6.61)	46.96 (6.92)	60.10 7.82)	34.72	3.44 (2.11)
	SE ±		0.05	0.20	0.02	0.01	0.03	1.75	0.02
	CD at 5%		NS	0.06	0.05	0.03	0.09	5.41	0.06

DAS- Days after spray, figures in parentheses indicate V_{n+1} transformed value, Date(s) of Insecticidal application: i) 03/12/2016 ii) 19 **Table 6.15: Chemical control of foliage feeding aphid on wheat during 2016-17 (Location: Pantnagar).**

S. No.	Treatment	Dose (ml or g / ha)	Dosage (g a i/ha)	Aphid population (Nos/shoot)					Grain yield (q/ha)
				Before spray	Days after spray				
				1	1	2	7	15	
1	Confidor (Imidacloprid 17.8 SL)	100 ml	20	12.83 (3.65)	1.47 (1.39)	0.8 (1.13)	0.67 (1.07)	0.17 (0.81)	49.63 (7.08)
2	Dantotsu (Clothianidin 50 WDG)	30 g	15	10.63 (3.29)	1.57 (1.42)	1.47 (1.39)	0.63 (1.04)	0.27 (0.87)	46.85 (6.88)
3	Flubendamide (Fame 480 SC)	250 ml	20	13 (3.65)	2.27 (1.66)	1.5 (1.39)	0.97 (1.21)	0.27 (0.87)	41.29 (6.46)
4	Pride (Acetamiprid 20SP)	100 g	20	11.03 (3.39)	1.33 (1.34)	0.67 (1.07)	0.57 (1.03)	0.27 (0.88)	30.18 (5.19)
5	Actara (Thiamethoxam 25 WG)	50 g	12.5	12.63 (3.62)	1.23 (1.29)	1.4 (1.38)	0.43 (0.97)	0.27 (0.87)	52.78 (7.28)
6	Chlorantranilipride 18.5 SC(Coragen)	100 ml	20	13.03 (3.67)	1.53 (1.43)	1.23 (1.31)	0.77 (1.09)	0.33 (0.90)	43.7 (6.64)
7	Untreated check		-	10.67 (3.29)	6.93 (2.67)	4.17 (2.16)	3.57 (2.01)	2.87 (1.83)	37.22 (6.14)
	S.Em±			*0.25*	*0.19*	*0.11*	*0.08*	*0.06*	0.48
	CD at 5%			*0.78*	*0.60*	*0.35*	*0.25*	*0.20*	1.50

*Figures in parenthesis are angular transformed values, Date of sowing: 07/12/2016; Plot size: 2.5 X2.5m ; Date of Harvest : 24/04/2017; Date of I[st] Insecticidal application : 15/02/2017; Variety sown: UP-2565 ; Replications: Three

/12/2016

Table 6.16: Chemical control of foliage feeding aphid on wheat during 2016-17 (Location: Karnal)

S. No.	Treatments	Dosage (g or ml a.i./ha)	Aphid population (nos/shoot/plant (Nos.)					Overall Mean Aphids/ shoot	Grain yield (q/ha)
			Before spray	After Spray					
				1 day	2 days	7 days	15 days		
1	Confidor (Imidacloprid 17.8 SL)	20	43.12	4.22 (2.28)*	2.44 (1.85)	0.69 (1.30)	0.81 (1.34)	3.65	56.54
2	Dantotsu (Clothianidin 50 WDG)	15	45.11	3.45 (2.11)	3.33 (2.08)	0.62 (1.26)	0.74 (1.31)	2.71	57.62
3	Flubendamide (Fame 480 SC)	20	42.00	3.02 (2.00)	3.11 (2.03)	0.60 (1.26)	0.79 (1.33)	2.55	60.25
4	Pride (Acetamiprid 20SP)	20	48.52	3.58 (2.14)	3.89 (2.21)	0.53 (1.23)	0.81 (1.34)	2.58	54.31
5	Actara (Thiamethoxam 25 WG)	12.5	41.23	3.92 (2.22)	2.56 (1.88)	0.64 (1.28)	0.84 (1.35)	2.88	55.63
6	Chlorantranilipride 18.5 SC(Coragen)	20	40.82	4.11 (2.26)	6.67 (2.77)	0.60 (1.26)	0.90 (1.37)	3.31	53.45
7	Rogar (Dimethoate 30 EC)	300	46.58	5.23 (2.50)	4.22 (2.28)	2.56 (1.88)	2.44 (1.85)	4.13	54.69
8	Untreated check	-	44.25	34.21 (5.93)	36.11 (6.09)	30.00 (5.56)	28.33 5.41)	36.48	50.33
	S.Em±		0.14	0.18	0.09	0.12	0.09		1.12
	CD at 5%		NS	0.55	0.28	0.31	0.22		3.54

*Figures in parentheses indicate V_{n+1} transformed value; Date of sowing: 16-11-2016; Plot size : Six row of six meter length at 25 cm spacing

Date of insecticide application : 27-02-2017; Variety : H D 2967 ; Date of harvest : 18-04-2017; Replication : Three; FA = Foliar aphid

Table 6.17: Chemical Control of foliage feeding aphids on wheat during 2016-17 (Location: Kharibari, West Bengal)

Name of Treatment	Dose gm/ml /lt	Before spray Population	Mean no. population of survived foliage feeding wheat aphids/shoot/plant											
			I st Spray				% reduction over control	Before spray Population	II nd Spray				% reduction over control	Grain Yield (qt/ha)
			1 DAT	2 DAT	7 DAT	15 DAT			1 DAT	2 DAT	7 DAT	15 DAT*		
Confidor (Imidacloprid 17.8 SL)	100	88.67 (9.44)	75.37 (8.71)	5.67 (2.48)	0.00 (0.71)	0.45 (0.97)	100.00	20.26 (4.56)	10.80 (3.36)	4.60 (2.26)	0.00 (0.71)	0.50 (1.00) **	99.98	27.00
Dantotsu (Clothianidin 50 WDG)	30	95.57 (9.80)	65.50 (8.12)	5.25 (2.40)	0.00 (0.71)	0.70 (1.10)	99.99	15.30 (3.97)	7.90 (2.90)	2.10 (1.61)	0.00 (0.71)	0.00 (0.71)	100.00	31.56
Flubendamide (Fame 480 SC)	250	80.67 (9.01)	70.45 (8.42)	5.76 (2.50)	0.00 (0.71)	0.48 (0.99)	99.99	18.25 (4.33)	8.90 (3.07)	5.60 (2.47)	0.50 (1.00)	0.10 (0.77)	100.00	32.45
Pride (Acetamiprid 20SP)	100	90.25 (9.53)	78.75 (8.90)	5.45 (2.44)	0.00 (0.71)	0.75 (1.12)	99.99	22.16 (4.76)	12.25 (3.57)	8.60 (3.02)	2.10 (1.61)	1.00 (1.22)	99.97	25.86
Actara (Thiamethoxam 25 WG)	50	80.77 (9.01)	60.35 (7.80)	8.76 (3.04)	0.00 (0.71)	1.86 (1.54)	99.98	20.50 (4.58)	12.50 (3.61)	7.50 (2.83)	3.10 (1.90)	1.50 (1.41)	99.94	23.55
Chlorantranilipride 18.5 SC(Coragen)	100	86.93 (9.35)	60.25 (7.79)	10.15 (3.26)	15.55 (4.01)	20.67 (4.60)	99.79	35.65 (6.01)	22.60 (4.81)	15.70 (4.02)	10.56 (3.33)	14.78 (3.91)	99.68	26.45
Quinolphos 25%EC	1000	80.35 (8.99)	75.89 (8.74)	5.75 (2.50)	0.00 (0.71)	1.10 (1.26)	99.99	19.10 (4.43)	10.40 (3.30)	6.56 (2.66)	2.10 (1.61)	0.45 (0.97)	99.98	28.65
Untreated Control	-----	86.67 (9.34)	88.23 (9.42)	90.56 (9.54)	93.56 (9.70)	100.5 (10.05)		120.4 (11.0)	128.9 (11.3)	134.6 (11.6)	145.7 (12.0)	155.4 (12.4)		20.35
S.Em±	_____	0.75	0.65	0.38	0.30	0.42		0.45	0.33	0.34	0.22	0.26		
C.D at 5%level	_____	2.23	1.91	1.14	0.88	1.25		1.32	0.96	1.00	0.64	0.78		

DAT- Days after Treatment, * Figures in parenthesis are Square root transformed value,

Date of Sowing: 25.11.16

Date of Insecticide Application: 1st 06-01-17 and IInd 25-01-17

Date of harvest: 15-04-17

Plot size: Six rows of 6 meters length at 25cm apace

Variety: HD 2967

Replication: Three

IV: Biorationals for the management of foliage feeding aphids

Objectives:

(1) To identify the promising botanicals and bio-agents for management of foliar aphids of wheat
(2) To manage aphids on wheat by eco-friendly used products.
(3) To reduce indiscriminate use of chemical insecticides.

Treatment details:

1. Neem Seed Extract (NSE)	5 %
2. *Azadirachtin* 1500 ppm	3.0 ml/l
3. Vekhand powder (*Acorus calamus*)	5 g/l
4. *Verticillium lecanni* (2 x 10^8c.f.u)	3 g/l
5. *Beauveria bassiana* (2 x 10^8c.f.u)	5 g/l
6. *Metarhizium anisopliae*	3 g/l
7. Dimethoate 30EC	0.3ml/l
8. Untreated control	-

Centre: Karnal

Five biorational viz, Neem Seed Extract (NSE) *Azadirachtin* 1500 ppm, Vekhand powder (*Acorus calamus*), *Verticillium lecanni* (2 x 10^8c.f.u), *Beaveria bassiana* (2 x 10^8c.f.u), *Metarhizium anisopliae* and the insecticide, Dimethoate 30 EC were tested for their efficacy against wheat aphids. All the treatments effectively reduced the aphid population over untreated check. Out of six treatments, the treatments with *Azadirachtin* 1500 ppm and Dimethoate 30 EC and were found to be the most effective treatment in comparison to all other treatment with biorationals as evidenced by aphid population per shoot and also the grain yield /ha. The average population recorded were 3.80 and 3.96 aphids/shoot in *Azadirachtin* 1500 ppm and Dimethoate 30 EC, respectively. Grain yield (q/ha) obtained was maximum (48.60 q/ha) in Dimethoate 30 EC treatment (Table 6.18).

Centre: Kharibari

This trial was conducted under irrigated conditions at Regional Research sub-station (Terai Zone) UBKV, Kharibari, Darjeeling, West Bengal, to evaluate the bio-efficacy of seven organic formulation viz., Neem Seed Extract (NSE), Azadirahctin 1500 ppm, Dimethoate 30 EC, *Verticillium lecanni* (2 x 108c.f.u), *Beaveria bassiana* (2 x 108c.f.u), *Metarhizium anisopliae*, and Vekhand powder (*Acorus calamus*). There were total of eight treatments including untreated check and each was replicated three times. For recording observations, fifteen shoots were ear marked in each plot and from these plants observations were recorded one day before spray and then 1, 2, 7 and 15 days after spra.

Aphid population did not differ significantly among all treatments 15 days before spray except seed treated plots where it was significantly lower than all other treatments. The reduction in the wheat aphid population build up of Rhopalosiphum maidis due to application of Azadirahctin 1500 ppm at 3.00 ml/lt. was found to be 99.62 – 99.85%, Neem Seed Extract (NSE) at 5% was found to be 99.65 – 99.71 %, Vekhand powder (*Acorus calamus*) at 5gm/lt. was found to be 99.59- 99.74% and farmers check Rogar (Dimethoate 30 EC) at 2.00 ml/lt. was found to be 99.74 – 99.89% , respectively, over untreated control. The other insecticide at Beaveria bassiana (2 x 108c.f.u) at 5gm/lt, *Verticillium lecanni* (2 x 108c.f.u) at 3 gm/lt, and *Metarhizium anisopliae* was found to over control 99.70 – 99.84%, 99.65 – 99.72% and 99.72 – 99.89%.

Grain yield (q/ha) obtained was maximum (28.45 q/ha) in Dimethoate 30 EC treatment followed by from Metarhizium anisopliae (28.26 q/ha). However, all the insecticidal treatments recorded higher than grain yield than untreated check (18.69 q/ha) (Table 6.19).

Table 6.18: Eco-friendly management of foliage feeding aphids on wheat 2016-17 (Centre: Karnal)

S.No.	Treatments	Dosage (g/ml/lt)	Aphid population per shoot					Av. aphid population/shoot after spray	Grain yield (q/ha)	Increase in yield (q/ha)over control
			Before Spray	After spray						
			1 day	1day	2days	7days	15 days			
1.	Neem seed Extract (NSE)	5%	14.47 (3.93)	7.31 (2.88)	7.72 (2.95)	5.42 (2.53)	4.10 (2.26)	6.14 (2.67)	46.25	48.24
2.	Azadirachtin 1500 ppm	3.0 ml	22.33 (4.83)	6.23 (2.69)	3.62 (2.15)	3.12 (2.03)	2.23 (1.80)	3.80 (2.19)	48.12	54.23
3.	Vekhand Powder (*Acorus calamus*)	5.0 g/l	14.80 (3.97)	8.33 (3.05)	7.21 (2.87)	2.94 (1.98)	1.69 (1.64)	5.04 (2.46)	46.56	49.23
4.	*Verticillium lecanni* ($2x10^8$ c.f.u.)	3.0 g/l	18.76 (4.45)	9.23 (3.20)	9.23 (3.20)	3.14 (2.03)	2.09 (1.76)	5.92 (2.63)	47.50	52.24
5.	*Beauveria bassiana* (2x108 c.f.u.)	5.0 g/l	18.90 (4.46)	11.62 (3.55)	8.23 (3.04)	3.95 (2.22)	2.01 (1.73)	6.45 (2.73)	41.13	41.44
6.	*Metarhizium anisopliae*	3.0 g/l	22.8 (4.88)	11.71 (3.57)	4.66 (2.38)	4.08 (2.25)	1.87 (1.69)	5.58 (2.57)	46.56	49.23
7.	Dimethoate 30 EC	0.3 g/l	24.70 (5.07)	7.62 (2.94)	3.21 (2.05)	3.25 (2.06)	1.74 (1.66)	3.96 (2.23)	48.60	55.77
8.	Untreated control	-	20.23 (4.61)	19.99 (4.58)	24.21 (5.02)	5.51 (2.55)	2.99 (2.00)	13.18 (3.76)	31.20	
	SEm±		0.34	0.15	0.254	0.208	0.154	0.22		
	CD5%		1.04	0.47	0.770	0.631	0.466	0.64		

*Figures in parenthesis are arcsin transformed values

Date of sowing : 16/11/2016 Plot size : 10.5 sq. m Date of Harvest : 18/04/2017

Dates of insecticidal applications : 27/02/2017 Variety sown : PBW 343 Replications : Three

Table 6.19: Eco-friendly management of foliage feeding aphids on wheat during 2016-17 (Centre: Kharibari)

Name of Treatment	Dose gm/ml /lt.	Before spray Population	Mean no. population of survived foliage feeding wheat aphids/shoot/plant											Grain Yield (qt/ha)
			I st Spray				% reduction over control	Before spray Population	II nd Spray				% reduction over control	
			1 DAT	2 DAT	7 DAT	15 DAT			1 DAT	2 DAT	7 DAT	15 DAT*		
Neem Seed Extract (NSE)	5 %	65.67 (8.13)	55.57 (7.49)	45.45 (6.78)	30.60 (5.58)	40.67 (6.42)	99.65	50.20 (7.12)	40.67 (6.42)	34.75 (5.94)	25.90 (5.14)	20.50 (4.58) **	99.71	22.52
Azadirahctin 1500 ppm	3.0 ml	45.25 (6.76)	30.67 (5.58)	25.70 (5.12)	20.00 (4.53)	30.25 (5.55)	99.62	42.15 (6.53)	30.25 (5.55)	24.16 (4.97)	18.30 (4.34)	8.90 (3.07)	99.85	23.21
Vekhand powder (*Acorus calamus*)	5 g	55.76 (7.50)	45.96 (6.82)	38.48 (6.24)	30.56 (5.57)	40.76 (6.42)	99.59	50.50 (7.14)	40.10 (6.37)	30.15 (5.54)	25.12 (5.06)	18.16 (4.32)	99.74	24.55
Verticillium lecanni (2 x 108c.f.u)	3 g	65.45 (8.12)	55.35 (7.47)	42.15 (6.53)	32.47 (5.74)	40.45 (6.40)	99.65	46.70 (6.87)	36.15 (6.05)	30.10 (5.53)	22.76 (4.82)	18.20 (4.32)	99.72	21.99
Beaveria bassiana (2 x 108c.f.u)	5 g	48.76 (7.02)	30.57 (5.57)	22.86 (4.83)	18.15 (4.32)	25.76 (5.12)	99.70	35.56 (6.00)	25.25 (5.07)	18.15 (4.32)	12.30 (3.58)	7.90 (2.90)	99.84	27.84
Metarhizium anisopliae	3 g	45.15 (6.76)	35.55 (6.00)	22.67 (4.81)	15.78 (4.03)	22.15 (4.76)	99.72	30.15 (5.54)	20.16 (4.55)	16.35 (4.10)	10.10 (3.26)	4.50 (2.24)	99.89	28.26
Dimethoate 30 EC	0.3ml	55.75 (7.50)	32.25 (5.72)	22.10 (4.75)	14.56 (3.88)	25.75 (5.12)	99.74	32.50 (5.74)	20.20 (4.55)	15.54 (4.00)	10.56 (3.33)	5.20 (2.39)	99.89	28.45
Untreated Control	-----	56.67 (7.56)	68.23 (8.29)	70.56 (8.43)	73.56 (8.61)	100.50 (10.05)		115.30 (10.76)	125.10 (11.21)	135.56 (11.66)	150.10 (12.27)	160.70 (12.70)		18.69
S.Em±		0.42	0.57	0.65	0.59	0.72		0.72	0.69	0.59	0.52	0.51		
C.D at 5%level		1.25	1.67	1.91	1.73	2.12		2.14	2.04	1.73	1.55	1.51		

*DAT- Days After Treatment, ** Figures in parenthesis are Square root transformed value,

Date of Sowing: 01.12.16

Date of Insecticide Application: I[st] 09-01-17 and II[nd] 27-01-17

Date of harvest: 07-04-17

Plot size: Six rows of 6meters length at 25cm apace

Variety: HD 2967

Replication: Three

V: Compatibility of different insecticides used for aphid control with fungicide (Tilt).

Centre: Ludhiana
This trial was sown under irrigated conditions at Plant Breeding Research Farm, PAU, Ludhiana. The wheat variety PBW 621 was sown on 22nd Nov. 2016 in the plots of 6 rows of 6 metre length in a replicated trial. Simultaneous attack of yellow rust and aphids was not recorded, so pesticide applications were not done. Hence, the trial could not be completed.

Centre: Karnal
Aphid population did not differ significantly among all treatments one day before spray (Table 6.20). When observed one day after spray, tilt + imidacloprid sprayed plots recorded minimum (2.27 aphids/earhead) and was significantly lower than tilt sprayed plots as well as untreated control. Similarly two and seven days after treatments, aphid population was significantly lower in all treatments except foliar application of tilt and untreated control. However fifteen days after treatments aphid population was zero in tilt+ insecticides treated plot. It has been observed that aphid control was significantly less when combination of insecticide and tilt in 200 litres of water sprayed as compared to their combination in 100 litres of water.

The incidence of yellow rust varies from 0S in treatments where tilt was applied alone or in combination with imidacloprid/thiamethoxam whereas it was 10-20S in those treatments where only imidacloprid/thiamethoxam was applied. The incidence of yellow rust was 20S in untreated control.

Grain yield (q/ha) obtained was maximum (59.64) from tilt + imidacloprid @ 40 ml/ac in 200 litres of water treated plots and it was at par with all the mixed application of tilt and insecticides as well as application of tilt alone.

Additional Experiment
Management of wheat root aphid (*Rhopalosiphum rufiabdominalis*) with seed treatment of different insecticides.

Centre: Ludhiana
Management by seed treatment: This experiment was conducted in the rainfed fields at Plant Breeding Research Farm PAU Ludhiana. The wheat variety PBW 660 was sown on 5th Nov 2016. Before sowing, the seed was treated with seven different insecticides separately by spraying on the spreaded layer of equal quantity of seed on polyethene sheet. The treated seed was dried overnight before sowing. There were seven treatments including untreated check and each was replicated thrice.

The data on root aphid incidence indicated that 21 days after seed treatment, minimum root aphid population was observed in imidacloprid 600FS @ 4 ml/kg of seed (4.13 aphids/tiller) treated plots and it was significantly lower than thiamethoxam 25 WG, imidacloprid 17.8 SL and untreated control (Table 6.21). Twenty eight days after sowing, minimum root aphid population (4.86 aphids/tiller) was observed in thiamethoxam 35 FS @ 2.4 ml/kg of seed treated plots followed by imidacloprid treated plots (4.83 aphids/tiller). However 35 days after sowing, root aphid population/tiller was minimum in imidacloprid treated plots which were at par with all other insecticidal treatment except thiamethoxam 25WG and imidacloprid 17.8 SL and untreated check. Thus, it was concluded that seed treatment with imidacloprid 600 FS @ 4 ml/kg seed and thiamethoxam 35 FS @ 2.4 g/kg seed can be used for the management of root aphid.

Table 6.20: Compatibility of different insecticides used for aphid control with fungicide (Tilt) during 2016-17 (Centre: Karnal)

S. No.	Treatments	Aphid population per earhead					Yellow rust	Grain Yield (q/ha)
		Before spray	After spray					
		1 day	1 day	2 days	7 days	15 days		
1	Tilt @ 200ml/ac in 200 litres of water	33.00 (5.81)*	21.60 (4.74)	20.70 (4.58)	19.80 (4.56)	12.55 (3.67)	0	54.21
2	Imidacloprid @ 40 ml/ac in 100 litres of water	40.42 (6.39)	3.00 (1.99)	1.40 (1.55)	1.13 (1.45)	0.40 (1.18)	10-20S	57.31
3	Thiamethoxam @ 20ml/ac in 100 litres of water	39.60 (6.28)	3.33 (2.08)	1.53 (1.59)	1.19 (1.48)	0.29 (1.13)	10-20S	55.25
4	Tilt + Imidacloprid @ 40 ml/ac in 100 litres of water	33.01 (5.83)	2.27 (1.80)	1.40 (1.55)	1.35 (1.53)	0.25 (1.11)	0	59.64
5	Tilt + Thiamethoxam @ 20 ml/ac in 100 litres of water	31.67 (5.67)	3.53 (2.12)	1.33 (1.53)	1.33 (1.52)	0.31 (1.14)	0	54.63
6	Tilt + Imidacloprid @ 40 ml/ac in 200 litres of water	29.67 (5.53)	3.87 (2.20)	0.93 (1.39)	1.40 (1.54)	0.00 (1.13)	0	59.10
7	Tilt + Thiamethoxam @ 20 ml/ac in 200 litres of water	33.01 (5.83)	4.07 (2.25)	1.20 (1.48)	1.44 (1.56)	0.00 (1.15)	0	56.18
8	Control	29.27 (5.50)	32.53 (5.79)	21.60 (4.75)	17.94 (4.34)	11.40 (4.67)	20S	52.44
SEm		0.04	0.09	0.10	0.03	0.06		0.70
CD at 5% level		NS	0.20	0.16	0.18	0.21		2.22

Figures in parentheses indicate V_{n+1} transformed value

Date of sowing	:16-11-2016	Plot size	:Six row of six meter length at 25 cm spacing
Date of insecticide application	:27-02-2017	Variety	: HD-2967
Date of harvest	:18-04-2016	Replication	: Three

Table 6.20: Compatibility of different insecticides used for aphid control with fungicide (Tilt) during 2016-17 (Centre: Karnal)

S. No.	Treatments	Aphid population per earhead					Yellow rust	Grain Yield (q/ha)
		Before spray	After spray					
		1 day	1 day	2 days	7 days	15 days		
1	Tilt @ 200ml/ac in 200 litres of water	33.00 (5.81)*	21.60 (4.74)	20.70 (4.58)	19.80 (4.56)	12.55 (3.67)	0	54.21
2	Imidacloprid @ 40 ml/ac in 100 litres of water	40.42 (6.39)	3.00 (1.99)	1.40 (1.55)	1.13 (1.45)	0.40 (1.18)	10-20S	57.31
3	Thiamethoxam @ 20ml/ac in 100 litres of water	39.60 (6.28)	3.33 (2.08)	1.53 (1.59)	1.19 (1.48)	0.29 (1.13)	10-20S	55.25
4	Tilt + Imidacloprid @ 40 ml/ac in 100 litres of water	33.01 (5.83)	2.27 (1.80)	1.40 (1.55)	1.35 (1.53)	0.25 (1.11)	0	59.64
5	Tilt + Thiamethoxam @ 20 ml/ac in 100 litres of water	31.67 (5.67)	3.53 (2.12)	1.33 (1.53)	1.33 (1.52)	0.31 (1.14)	0	54.63
6	Tilt + Imidacloprid @ 40 ml/ac in 200 litres of water	29.67 (5.53)	3.87 (2.20)	0.93 (1.39)	1.40 (1.54)	0.00 (1.13)	0	59.10
7	Tilt + Thiamethoxam @ 20 ml/ac in 200 litres of water	33.01 (5.83)	4.07 (2.25)	1.20 (1.48)	1.44 (1.56)	0.00 (1.15)	0	56.18
8	Control	29.27 (5.50)	32.53 (5.79)	21.60 (4.75)	17.94 (4.34)	11.40 (4.67)	20S	52.44
SEm		0.04	0.09	0.10	0.03	0.06		0.70
CD at 5% level		NS	0.20	0.16	0.18	0.21		2.22

Figures in parentheses indicate V_{n+1} transformed value

Date of sowing	:16-11-2016	Plot size	:Six row of six meter length at 25 cm spacing
Date of insecticide application	:27-02-2017	Variety	: HD-2967
Date of harvest	:18-04-2016	Replication	: Three

Table 6.20: Compatibility of different insecticides used for aphid control with fungicide (Tilt) during 2016-17 (Centre: Karnal)

S. No.	Treatments	Aphid population per earhead					Yellow rust	Grain Yield (q/ha)
		Before spray	After spray					
		1 day	1 day	2 days	7 days	15 days		
1	Tilt @ 200ml/ac in 200 litres of water	33.00 (5.81)*	21.60 (4.74)	20.70 (4.58)	19.80 (4.56)	12.55 (3.67)	0	54.21
2	Imidacloprid @ 40 ml/ac in 100 litres of water	40.42 (6.39)	3.00 (1.99)	1.40 (1.55)	1.13 (1.45)	0.40 (1.18)	10-20S	57.31
3	Thiamethoxam @ 20ml/ac in 100 litres of water	39.60 (6.28)	3.33 (2.08)	1.53 (1.59)	1.19 (1.48)	0.29 (1.13)	10-20S	55.25
4	Tilt + Imidacloprid @ 40 ml/ac in 100 litres of water	33.01 (5.83)	2.27 (1.80)	1.40 (1.55)	1.35 (1.53)	0.25 (1.11)	0	59.64
5	Tilt + Thiamethoxam @ 20 ml/ac in 100 litres of water	31.67 (5.67)	3.53 (2.12)	1.33 (1.53)	1.33 (1.52)	0.31 (1.14)	0	54.63
6	Tilt + Imidacloprid @ 40 ml/ac in 200 litres of water	29.67 (5.53)	3.87 (2.20)	0.93 (1.39)	1.40 (1.54)	0.00 (1.13)	0	59.10
7	Tilt + Thiamethoxam @ 20 ml/ac in 200 litres of water	33.01 (5.83)	4.07 (2.25)	1.20 (1.48)	1.44 (1.56)	0.00 (1.15)	0	56.18
8	Control	29.27 (5.50)	32.53 (5.79)	21.60 (4.75)	17.94 (4.34)	11.40 (4.67)	20S	52.44
SEm		0.04	0.09	0.10	0.03	0.06		0.70
CD at 5% level		NS	0.20	0.16	0.18	0.21		2.22

Figures in parentheses indicate V_{n+1} transformed value

Date of sowing	:16-11-2016	Plot size	:Six row of six meter length at 25 cm spacing
Date of insecticide application	:27-02-2017	Variety	: HD-2967
Date of harvest	:18-04-2016	Replication	: Three

Table 6.21: Effect of different seed treatments on the population dynamics root aphid during 2016-17 (Centre: Ludhiana)

S.No.	Treatments	Dose ml or g / kg of seed	Number of root aphid/tiller		
			21 days after sowing	28 days after sowing	35 days after sowing
1	Thiamethoxam 25WG	3.2 gm	6.30 (2.69)	6.26 (2.69)	6.40 (2.72)
2	Imidacloprid 17.8 SL	3.0 ml	6.03 (2.64)	6.03 (2.45)	6.06 (2.65)
3	Fipronil 5 SC	6.0 ml	4.80 (2.40)	5.06 (2.46)	5.20 (2.48)
4	Thiamethoxam 35 FS	2.4 ml	4.26 (2.29)	4.36 (2.31)	4.86 (2.42)
5	Imidacloprid 600FS	4 ml	4.13 (2.26)	4.83 (2.41)	4.60 (2.36)
6	Clothianidin 50 WDG	1.5gm	4.83 (2.41)	4.76 (2.40)	4.83 (2.41)
7	Chlorpyriphos 20%EC	4 ml	4.96 (5.43)	5.03 (2.45)	5.00 (2.44)
8	Untreated check	-	12.96 (3.73)	13.43 (3.79)	12.66 (3.69)
CD (p=0.05)			(0.21)	(0.23)	(0.15)

* Figures in parentheses are transformed means

Date of sowing	: 05.11.2016	Plot size	:	40 m^2
Date of insecticidal application	: 04.11.2016	Variety	:	PBW 660
Date of harvest	: 14. 04.2017	Replications	:	Three

VI. Chemical control of foliage feeding brown wheat mites (*Petrobia latens*) on wheat crop

Centre: Durgapura

This trial was conducted under irrigated conditions at RARI farms, Durgapura, Jaipur. The wheat variety Raj 4083 was sown on 28th November 2016 in the replicated plots trial. There were 8 treatments including untreated control. The population from each plot was recorded and expressed as mites / 10 cm^2 slide area. Observations were recorded one day before and 3rd, 7th and 10th days after spraying randomly from each plot. The data on grain yield per plot was recorded and converted to q / ha. The data on mean mite incidence one day before spray indicated non-significant differences among all the treatments including untreated check. When observed 3rd day after spray, Spiromecifen 240 SC @ 1 ml/lit treated plots recorded significantly lower mites / 10 cm^2 area (2.67) as compared to all other treatments but at par with Propargite 57 SC (2.85). However, the mite population in all these treatments was significantly lower than untreated control (29.80). Similarly, 7 days after spray, all the insecticidal treatments had significantly lower mite population than untreated control. Also 10 days after spray treatment observations revealed that Spiromesifen 240 SC @ 1 ml/lit (0.65) was superior treatment in their efficiency and at par with Propargite 57 SC (0.71) against brown wheat mite (Table 6.22).

Centre: Ludhiana

This trial was conducted under unirrigated conditions at Experimental Area, Department of Plant Breeding, Genetics and Biotechnology, Punjab Agricultural University, Ludhiana. The wheat variety PBW 660 was sown on 6.11.2016 in the plots of 6 rows, 6 m long in a replicated trial. There were eight treatments including untreated control. The population from each plot was recorded and expressed as mites/10 cm^2 slide area. All the pesticides were applied on 07.03.2017 when mite population reached at its peak. Observations were recorded one day before and one, two and seven days after spraying randomly from each plot. The data on grain yield per plot was recorded and converted to q/ha.

The data on mean mite incidence one day before spray indicted non-significant differences among all the treatments (Table 6.23). When observed one day after spray, propargite @ 1.5 g a.i./ha treated plots recorded significantly lower mites/10cm^2 area (3.63) as compared to all other treatments. However, the mite population in all these treatments was significantly lower than untreated control (48.23). Similarly, two days after spray, all the insecticidal treatments had significantly lower mite population than untreated control. Seven days after treatments observations revealed that spiromesifen @ 1.0 g a.i./ha (0.86) was superior treatment in their efficacy against brown wheat mite.

The efficacy of insecticidal treatments in protecting the grain yield revealed that, propargite @ 1.5 g a.i./ha (47.11) was superior recording highest yield and were at par with all other insecticidal treatments.

Table 6.22: Chemical control of foliage feeding brown wheat mites (*Petrobia latens*) on wheat crop 2016-17 (Centre: Durgapura)

S. No	Treatments	Average number of mites population/10 cm² after spray					Grain yield (q/ha)
		Before spray	3 Days	5 Days	7 Days	15 Days	
1	Dicofol 18.5 EC (Colonel)	19.66a	24.60 (5.00)	3.15 (1.90)	1.26 (1.32)	0.86 (1.16)	42.54
2	Propargite 57 SC (Omite)	19.89a	22.55 (4.79)	2.85 (1.82)	1.12 (1.26)	0.71 (1.09)	42.88
3	Spiromesifen 240 SC(Oberon)	19.66a	23.40 (4.88)	2.67 (1.77)	1.10 (1.25)	0.65 (1.07)	42.96
4	Bifenthrin 10EC (Talstar)	19.44a	24.55 (5.00)	2.95 (1.85)	1.83 (1.52)	0.93 (1.19)	41.51
5	Profenofos 50EC (Karina)	19.11a	22.86 (4.83)	4.47 (2.22)	2.45 (1.70)	1.10 (1.26)	40.86
6	Fenazquine10 EC (Majester)	19.33a	23.75 (4.91)	3.26 (1.93)	2.09 (1.60)	1.03 (1.23)	42.15
7	Ethion 50 E C	19.44a	24.10 (4.95)	4.75 (2.28)	3.55 (2.00)	1.95 (1.56)	40.20
8	Control	19.22a	24.70 (5.01)	29.80 (5.50)	31.93 (5.69)	34.45 (5.99)	34.74
	S. Em ±	0.34	0.11	0.08	0.09	0.03	1.70
	CD 5%	NS	NS	0.26	0.27	0.12	NS

*Figures followed by same alphabets are statistically at par, **Figures in parenthesis are reduction percent based on Henderson-Tilton's formula,

Date of sowing	:28-11-2016	Plot size	: 4.0 x3.0 sq.m.
Date of insecticide application	:27-02-2017	Variety	: Raj-4229
Date of harvest	: 31.03.2017	Replication	: Three

Table 6.23: Chemical control of foliage feeding brown wheat mites (*Petrobia latens*) on wheat crop 2016-17 (Centre: Ludhiana)

S.No.	Treatments	Dosages (ga.i./ha)	Brown wheat mite population/ 10cm²				Grain Yield (q/ha)
			Before spray	After spray			
			1 day	1 day	2 days	7 days	
1	Dicofol 18.5 EC (Colonel)	2.0	54.70	4.33 (2.30)	2.23 (1.79)	1.06 (1.43)	46.80
2	Propargite 57 SC (Omite)	1.5	51.86	3.63 (2.15)	2.13 (1.76)	1.10 (1.44)	47.11
3	Spiromesifen (Oberon 240 SC)	1.0	51.36	3.70 (2.16)	1.73 (1.64)	0.86 (1.36)	46.13
4	Fenazquine (Majester 10 EC)	2.0	50.80	4.10 (2.25)	1.86 (1.69)	0.93 (1.38)	46.71
5	Bifenthrin 10EC (Talstar)	0.8	51.83	3.96 (2.22)	2.06 (1.74)	1.00 (1.41)	47.06
6	Profenofos 50EC (Karina)	1.0	52.06	4.13 (2.26)	1.93 (1.70)	1.16 (1.46)	46.22
7	Dimethoate 30 EC (Rogor)	1.0	50.50	4.06 (2.24)	1.93 (1.71)	1.10 (1.43)	45.91
8.	Control		52.13	48.23 (7.01)	49.56 (7.10)	47.33 (6.95)	41.51
CD (p=0.05)			NS	(0.26)	(0.27)	(0.24)	3.30

* Figures within parentheses are transformed means

Date of sowing : 06. 11.2016
Date of insecticidal application : 07. 03.2017
Date of harvest : 15. 04.2017

Plot size : 7.5m²
Variety : PBW 660
Replications : Three

(C) INTEGRATED PEST MANAGEMENT

I: Integrated management of shootfly on wheat crop.

Centre: Dharwad

Field experiment on chemical management of shootfly was conducted at Main Agricultural Research Station, University of Agricultural Dharwad during the rabi, 2016-17 using the shootfly susceptible variety, UAS 304. The results indicated that ST with Imidaclorprid 500 FS @ 6.00 ml per kg of seeds followed by a foliar spray of Fipronil 5 SC @ 500 ml per ha at an interval 12 DAE has recorded least shootfly incidence of 24.85% with higher grain yield (29.33q/ ha), TGW (37.68 g) and biomass (7.92 t/ha) (Table 6.24).

Centre: Niphad

The data regarding the per cent dead heart produced by shoot fly damage are presented in Table 3. The shoot fly incidence at 7 days after germination was not observed. The treatments clothianidin 50 WDG @2.50g/kg seed (T1), imidacloprid 600 FS @6.0 ml/kg seed (T2), Foliar spray of emamectin benzoate 5SG @ 225 g/ha at 8 DAE (T4), seed treatment with clothianidin 50 WDG @ 2.5 g/kg seed + foliar spray of fipronil 5 SC @ 500 ml/ha (12 DAE) (T5), seed treatment with imidacloprid 600 FS @ 6.0 ml/kg seed + foliar spray of fipronil 5 SC @ 500 ml/ha (12 DAE) (T6) and phorate 10G @ 10 kg/ha (T7) were not recorded the deadhearts produced by shoot fly at 15 and 30 days after emergence. It indicated that the cent per cent control of shoot fly was registered. The maximum (10.36) and (12.58) per cent dead heart were recorded in untreated control at 15 and 30 days after emergence, respectively.

Maximum yield of 56.52 q/ha was obtained in plot treated with seed treatment with imidacloprid 600 FS @ 6.0 ml/kg seed + foiar spray of fipronil 5 SC @ 500 ml/ha (12 DAE) (T6) and it was at par with seed treatment with clothianidin 50 WDG (T1), seed treatment with imidacloprid 600 FS (T2), seed treatment with clothianidin 50 WDG @ 2.5 g/kg seed + Foliar spray of fipronil 5 SC @ 500 ml/ha (12 DAE) (T5) and phorate 10G @ 10 kg/h (T7). The untreated control recorded 28.75 q/ha yield of wheat grain (Table 6.25).

Table 6.24: Integrated management of shootfly on wheat crop 2016-17 (Centre: Dharwad)

S.no.	Treatments	Dosage	Plant height (cm)	Shootfly incidence (%)	Grain yield (q/ha)	TGW (g)	Biomass (t/ha)
1.	ST with Clothianidin 50 WDG	2.5 g per kg of seeds	71.53	35.25* 33.47)**	22.72	38.27	7.92
2.	ST with Imidaclorprid 500 FS	6.00 ml per kg of seeds	70.27	30.41 (25.67)	27.23	37.83	9.17
3.	Foliar spray of Fibronil 5 SC	500 ml per ha at 8 DAE	72.27	38.66 (39.23)	26.41	38.68	7.92
4.	Foliar spray of Proclaim	225 g per ha at 8 DAE	70.33	35.14 (33.13)	27.23	37.25	7.50
5.	ST with Clothianidin 50 WDG + Foliar spray of Fipronil 5 SC	2.5 g per kg of seeds+500 ml/ ha at 12 DAE	68.53	33.74 (30.86)	25.70	36.35	6.67
6.	ST with Imidaclorprid 500 FS + Foliar spray of Fipronil 5 SC	6.00 ml per kg of seeds+500 ml per ha at 12 DAE	78.33	29.85 (24.85)	29.33	37.68	7.92
7.	Phorate 10 G	10 kg per ha	72.20	31.30 (27.05)	27.11	37.37	8.33
8.	Azadirachctin 10,000 ppm	2 ml / l at 8 DAE and 15 DAE	73.87	35.48 (33.74)	20.70	37.68	7.92
9.	Foliar spray of Chlorpyriphos 20 EC	2 ml/ litre at 8 DAE	74.87	33.67 (30.80)	25.42	36.72	6.67
10.	Foliar spray of Profinophos 50 EC	2 ml/ litre at 8 DAE	75.00	37.24 (36.74)	25.98	37.27	7.08
11.	Foliar spray of Dimethoate 30 EC	2 ml/ litre at 8 DAE	73.33	36.68 (35.84)	26.77	36.40	7.92
12.	Control		68.07	42.30 (45.35)	18.08	37.08	7.50
	SEm±		3.17	2.33	1.49	0.76	0.35
	CD (p=0.05)		9.31	6.84	4.37	2.24	1.03
	CV %		7.59	11.55	10.23	3.54	7.86

*- Arc sine values, **- Figures in parenthesis are original percentage values, TGW- Thousand grains weight

Location:MARS, UAS, Dharwad
Date of sowing: 14.12.2016
Date of insecticide sprays:31.12.2016, 04.01.2017 and 07.01.2017
Date of first appearance of shoot fly: 23.12.2016
Date of harvest:24.03.2017

Variety: UAS 304
No. of replications: 3
No. of treatments: 12
Plot size: Gross plot: 2.7m X 2.0m
Net plot: 2.0m X 2.0m

Table 6.25: Integrated management of shootfly on wheat crop 2016-17 (Centre: Niphad)

S.No.	Treatments	Dosage	Shoot fly damage (%) i.e. % dead heart				Grain yield (q/ha)
			7 DAE	15 DAE	30 DAE	60DAE	
1	Seed treatment with clothianidin 50 WDG	2.50 g/kg seed	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	55.13
2	Seed treatment with imidacloprid 600 FS	6.00 ml/kg seed	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	56.52
3	Foliar spray of fipronil 5 SC at 8 DAE	500.0 ml/ha	0.0 (0.0)	2.76 (9.63)	4.62 (12.39)	0.0 (0.0)	38.88
4	Foliar spray of emamectin Benzoate 5WG (proclaim) at 8 DAE	225.0 g/ha	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	37.50
5	Seed treatment with clothianidin 50 WDG + Foliar spray of fipronil	2.50 g/kg seed + 500 ml/ha	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	55.55
6	Seed treatment with imidacloprid 600 FS @ 6.0 ml/kg seed + Foliar spray of fipronil 5 SC @ 500 ml/ha (12 DAE)	6.0 ml/kg seed + 500 ml/ha	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	55.97
7	Phorate 10G @ 10 kg/h	10 kg/ha	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	54.58
8	Azadirachtin 10000 ppm @ 2.0 ml/l at 7 DAE & 15 DAE	2.0 ml/liter	0.0 (0.0)	3.69 (11.09)	4.81 (12.66)	0.0 (0.0)	37.50
9	Untreated control	-	0.0 (0.0)	10.36 (18.81)	12.58 (20.79)	0.0 (0.0)	28.75
SE ±			-		-	0.20	0.19
CD at 5%			-		-	0.60	0.58

Days after emergence (DAE) *Figures in parentheses indicate arc sin value

II. Development of IPM module for management of insect- pests on wheat.
Objective: To find out the effective and economical IPM schedule against pest of wheat

Treatment details:

T1.IPM module:

- Seed treatment with combination of reduced dose of Carboxin 70 WP @ 1.25g + bio-agent fungus Trichoderma viride @ 4 g/kg seed to avoid the disease like loose smut of wheat
- Seed treatment with thiamethoxam 30% FS@ 0.75g/kg of seed to avoid incidence of termite or aphids upto 45 days after sowing.
- Broadcasting of fipronil 5% SC @ 125 g a.i./ ha (2.5 L/ha) mixed with 50 kg sand at the time of termite or pink stem borer infestation followed by irrigation for termite or pink stem borer control.
- Installation yellow sticky traps @12 to 15/ha for monitoring aphids incidence.
- Border rows spraying of imidacloprid 17.8 SL @ 20g a.i. /ha (100ml/ha) as considering the pest / aphids economic injury level as 10 to 15 aphids / shoot / plant.
- One sprays of either Metarhizium anisopliae or Verticillium lecanii 1.15% WP @ 40g/10 liter water followed by thiamethoxam 25 WG @ 1g /10 lit. water at an interval of 15 days, after the notice of infestation for the control of wheat aphid.
- Spray of propiconazole 25% EC 0.1% for management of yellow rust.
- 80 to 90 days after sowing application of poison bait of Bromadiolone a.i. 0.005% w/w. or Zinc Phosphide -Mixing 1 part zinc phosphide 80 % with 49 parts crushed grains and little quantity of any edible oil (sweet oil).

T2.Farmers practice

Centre: Ludhiana

The comparison of the results of IPM module with farmer's practices revealed a difference in termite and pink stem borer (PSB) damage. The termite damage ranged from 1.99-2.65 per cent in farmer's practices while it was 0.38-0.74 per cent in IPM field. Similarly there were 0.91-2.04 PSB damaged plants per metre row length in farmer's practice while it was 0.19-0.89 in IPM field. The aphid incidence remained below economic threshold level of 5 aphids per earhead in IPM field while it ranged from 14.20 to 19.66 aphids/tiller in farmer's practice. The insecticides were sprayed in IPM field when incidence of aphid was observed in the border strip of field which prevented it's further spread into the interiors of the field. The numbers of plants infested with aphids were also higher in farmer's practice. However, the coccinellid beetles/m^2 area was relatively less in IPM field as compared to farmer's practice (Table 6.26a).

Centre: Niphad

The data presented in Table 6.26b revealed that the IPM module recorded least (8.90 and 3.80) number of aphids/shoot/plant at 60 and 70 days after sowing whereas it was 69.10 and 73.40 in farmer practices treated plot. The population of aphid in IPM module plot was not observed upto 60 days after sowing. The minimum (10.90, 8.00 and 3.10) number of jassids/plant were recorded in IPM module at 40, 50 and 60 days after sowing as against farmers practice plot it was 31.40, 41.30 and 32.50. The highest grain yield of 53.00 q/ha was recorded in IPM treated plot and lowest (36.00 q/ha) in farmers practice plot.

Centre: Karnal

The data indicated that population of aphid, termite and pink stem borer was comapartively lower in IPM treatment as compared to Farmer practice. However, in FP treatment the population of natural ememies was little higher than IPM treatment. The highest population of aphids was recored after 50 days i.e 163 aphids/shoot in IPM treatment as compared to 89.60 aphids/shoot in FP treatment. The highest grain yield of 52.50 q/ha was recorded in IPM treated plot and lowest (43.60 q/ha) in farmers practice plot (Table 6.26c).

III: Survey of pests infesting wheat and their natural enemies

Centre: Durgapura

Survey of wheat and barley field were carried out in the adjoining districts of Jaipur during the crop season.The termite and mite damage in wheat fields remained moderate throughout the crop season.The population of H. armigera and Pink stem borer was very low, While the other pests like Spodoptera, Surface gram hopper, Shoot fly and Jassids were occasional and in negligible form. Somehow the cut work population was observed in Tank bed condition of Tonk districts. In barley fields the Aphid population was not observed throughout the crop season.Among natural enemies predators like Coccinellide beetles, Chrysoperla were frequently noticed.

Centre: Niphad

Survey was carried out in the villages of Nashik district at different crop stages. Medium to heavy incidence of aphids was recorded in Nasik district. The Coccinellid predatory grubs, beetles and Chrysoppa feeding on the aphid infested fields were also observed. The incidence of jassids was recorded in medium intensity and stem borer infestation in traces. (Table 6.27).

Centre: Ludhiana

In order to monitor the insect pest of wheat, survey of Punjab state were undertaken during 2016-17 crop season. Moderate to severe incidence of aphids was observed some fields at villages viz. Nagar (near Phillour), Lasara (SBS nagar) Langroya and Hayatpur (near Gharshankar) in the month of March, 2017. Sporadic incidences of aphids were also observed in the month of February, 2017 at villages Dburji (Deenanagar), Ladhowal (Ludhiana) and some parts of Gurdaspur. The natural enemies viz. grubs and adults of coccinellid beetles, syrphid fly and chrysoperla were observed in some of the fields infested with aphids. In most parts of Punjab, farmers practiced insecticide application when aphid incidence exceeded economic threshold level of 5 aphids per head.

Table 6. 26a: Effect of treatments of IPM modules on pests of wheat during 2016-17 (Locations: Ludhiana, Niphand and Karnal)

S. No.	Days after sowing	Treat-ments	Avg. no. aphids/ shoot	Avg. lady bird beetle /m²	Avg. termite infestation (%)	Avg. no.of jassids/plant	Avg. no. of mites/10 cm²	Avg. stem borer infestation (%)
1.	Pre-count	IPM	0	0	0	-	0	0
		FP	0	0	0	-	0	0
2.	30	IPM	0	0	0.38 (2.72)	-	-	0.19 (1.97)
		FP	0	0	1.99 (8.07)	-	-	0.91 (5.46)
3.	45	IPM	0	0	0.74 (4.86)	-	-	0.89 (5.37)
		FP	0	0	2.65 (9.33)	-	-	2.04 (7.67)
4.	60	IPM	0	0	0	-	-	0
		FP	0	0	0	-	-	0
5.	75	IPM	0-1	0	0	-	-	0
		FP	0-1	0	0	-	-	0
6.	90	IPM	03.20 (1.96)	0	0	-	-	0
		FP	14.20 (3.88)	0	0	-	-	0
		t value	(0.42)	-	-	-	-	
7.	At earhead stage	IPM	04.46 (2.27)	6.06 (2.63)	0	-	07.26 (2.83)	0
		FP	19.66 (4.52)	1.46 (1.51)	0	-	37.86 (6.21)	0
		t value	(0.32)	(0.27)	-	-	(0.41)	-
8.	Yield (qt/ha)	IPM	52.2 q/ha					
		FP	48.4 q/ha					

IPM = Integrated Pest Management FP = Farmers Practice

Table 6.26b: Effect of IPM module and farmers practice on population of aphids, jassids, natural enemies and yield during 2016-17

S No	Days	Treatments	No. of aphids/ shoot/plant	No. of jassids /plant	No. of Brown wheat mite 10 cm² /leaves	No. of natural enemies/m²	Termite damage %	Stem borer % infested tillers	Yield q/ha
Niphad									
1.	30	IPM	0.00	0.00	0.00	0.00	0.00	0.00	IPM 53.00
		FP	16.70	6.50	0.00	0.00	0.00	0.00	
2.	40	IPM	0.00	10.90	0.00	0.90	0.00	0.00	
		FP	30.60	31.40	0.00	2.20	0.00	0.00	
3.	50	IPM	0.00	8.00	0.00	1.00	0.00	0.00	
		FP	56.40	41.30	0.00	6.10	0.00	0.00	
4.	60	IPM	8.90	3.10	0.00	2.90	0.00	0.00	FP (Non IPM) 36.00
		FP	69.10	32.50	0.00	9.40	0.00	0.00	
5.	70	IPM	3.80	0.00	0.00	12.50	0.00	0.00	
		FP	73.40	1.20	0.00	13.00	0.00	0.00	
6.	80	IPM	0.00	0.00	0.00	10.90	0.00	0.00	
		FP	31.80	0.00	0.00	7.30	0.00	0.00	
Karnal									
1.	30	IPM	16.00	0.00	0.00	0.00	2.33	0.00	IPM 52.50
		FP	24.00	0.00	0.00	0.00	3.21	0.00	
2.	40	IPM	79.00	0.00	0.00	0.75	1.23	0.00	
		FP	146.00	0.00	0.00	1.34	4.56	0.00	
3.	50	IPM	89.60	0.00	0.00	2.20	1.10	0.00	
		FP	163.00	0.00	0.00	5.16	4.89	0.00	
4.	60	IPM	56.00	0.00	0.00	4.45	0.00	2.56	FP (Non IPM) 43.66
		FP	92.60	0.00	0.00	11.68	0.00	4.63	
5.	70	IPM	45.60	0.00	0.00	13.56	0.00	2.63	
		FP	24.00	0.00	0.00	14.15	0.00	4.65	
6.	80	IPM	11.40	0.00	0.00	10.45	0.00	1.21	
		FP	16.20	0.00	0.00	7.30	0.00	2.23	

IPM= Integrated Pest Management, FP= Farmers practice (Non IPM)

Table 6.27: Survey & surveillance of wheat growing areas 2016-17 (Centre: Niphad)

Locality and date of visit	Area surveyed (Rainfed/ Irrigated)	No. of samples observed	Variety and Stage of growth	Crop pest			Natural enemy
				Name	Type of damage	Intensity	
Kundewadi, Niphad Tal. Niphad 09.1.2017	Irrigated	20	NIAW 34, HD 2189, NIAW 301, Ajit 102 Vegetative, Booting	Aphids Jassids	Major Minor	Heavy	*Coccinellids* Beetles
Nandgaon and Nastanpur, Tal. Nandgaon 12.1.2017	Irrigated	25	LOK-1, Ajit 102, Ajit 72, Private companies Vegetative, Booting	Aphids Jassids	Major Minor	Medium/Heavy	*Coccinellids* Beetles
Parmori, Ambaner, Chinchkhed, Jopul and Lokhandewadi Tal. Dindori 23.02.2017	Irrigated	60	LOK-1, Private companies, HD 2189, NIAW 34, Ajit 72, NIDW 295 Booting, Flowering, grain filling	Aphids Stem borer	Major Minor	Medium	*Coccinellids* Beetles
Surad, Tarola, Waghada, Mohpada, Palasdar Tal. Surgana 23.02.2017	Irrigated	50	Private companies, HD 2189, Mohan wander, Ajit 72, Ankur Booting, Flowering, grain filling	Aphids Stem borer	Major Minor	Medium	*Coccinellids* Beetles
Vadali Bhoi, Chandwad and Shirwade vani Tal. Chandwad 06.03.2017	Irrigated	25	LOK-1, HD 2189, Ajit 102, Mohan wander, Private companies Flowering, grain filling	Aphids Jassids Stem borer	Minor Minor Minor	Low	*Coccinellids* Beetles

Table 6.28: Survey of pests infesting wheat and their natural enemies 2016-17 (Centre: Kanpur)

Locality and date of visit	Rainfed / Irrigated	No. of samples	Variety and stage of growth	Crop pest			Natural enemies	
				Name	Status	Intensity (Attack % damage or population)	Name	Stage Parastization / Predation
04.02.2017 Udhav Nivada, Man Nivada, Atin (Aroul), Hazaratpur,	Irrigated	10 10 10 10	Halna, PBW343, DBW15, DBW14 K1006, K0402, HUW234, Halna, PBW343, Halna, HUW234	Shootfly Pink stem borer Shootfly Shootfly Termite Termite	Minor Major Minor Minor Major Major	08 03 08 05 10 10	- - - - - -	- - - - - -
04.02.2017 Saultnpur Kheda Nagla, Bhatpura (Kannoj)	Irrigated	10 10	Barley (LS) – Local, Halna	Aphid Termite	Major Major	HS, index 5.0 (50-60 aphids/pl) 10	*Coccinella* septumpunctata -	Adult and grubs -
04.02.2017 Farrukhabad	Irrigated	10	K307, PBW550, HD2967, Halna, DBW17	Aphid only LS wheat	Minor	5-10 aphids/pl index 3.0, MR	*Coccinella* septumpunctata	Adult and grubs
07.02.2017 Bithoor, Kulva, Devi Purwa	Irrigated	10	PBW343, K0307 and Halna	Shootfly Termite	Minor Major	08 12		
Unnao, Hasnapur, Pawa, Chaklawanshi, Safipur, Jamaladdin pur	Irrigated	10	K402, K307, Halna, PBW343	Termite shootfly	Major Minor	10 05	- -	- -
Hardoi, Bilgram, Jaroli, Atroli, Dhulian, Fardapur, Kursam	Irrigated	10 10	HD2967, K0307, Halna, PBW343, K551, PBW343, Halna, HD2329, K0307	Shootfly Aphid	Minor Major	05 HS, Index-5.0 40 aphids/pl.	- *Coccinella septumpunctata*	- Adult and grubs
09.02.2017 Fatehpur, Bindiki, Korsam, Mohal	Irrigated	10	HD2967, K307, Halna and Local Barley Prakhar (TS)	Termite Pink stem borer	Minor Minor No incidence of aphid	10 02 -	- - -	-. - -

Centre: Vijapur

Survey of wheat & barley fields were carried out in the state during the crop season. The termite and aphid damage in wheat fields remained moderate through out the crop season. The population of *H. armigera*, pink stem borer and surface grasshopper were very low. While, the other pests like spodoptera, thrips, shoot fly, brown mite, jassids and cut worm were in occasional form and in negligible form. Besides, in barley fields the aphid population was moderate to high. Among natural enemies, Campolatis chlorideae, a larval parasite of *H. armigera* was observed. Predators like coccinellid beetles, chrysoperla and syrphid fly were frequently noticed predating on wheat and barley aphids.

Centre: Kanpur

Survey was made at Udhav Nivada, Man Nivada, Araul and Hazaratpur dated 04.02.2017. The incidence of shootfly was observed 08 per cent and pink stem borer infestation 03 per cent in varieties PBW343, K1006, K0402, PBW115, DBW14 and Halna. The incidence of termite was observed in irrigated crop 10 per cent village Hazartpur varieties viz., PBW343, HUW234 and Halna, Village Sultanpur, Kheda Nagla, Bhatpur (Kannauj) barley late sown variety Local aphid infestation observed 50-60 aphids per plants. Survey of district Farrukhabad the infestation of wheat aphid was observed in late sown wheat varieties K-307, Halna and PBW550, 05-10 aphids per plant and predator coccinella septumpunctata two adult per plant.

During the survey of pest infesting wheat crop in 07.02.2017 at Bithoor, Kulva and Devipurwa in irrigated wheat crop var. PBW343, K0307 and Halna was observed shootfly infestation 08 per cent and termite 12 per cent. In district Unnao village Hasanapur, Pawa, Chkalwanshi, Atwa, Jamaladdinpur, Safipur in wheat irrigated crop variety K402, K0307, Halna and PBW343, the shootfly infestation observed 08 per cent and termite 10 per cent. The survey of district Hardoi village Bilgram, Jaroli, Atroli, Dhulian, Fardapur and Kuram was observed shootfly infestation 05 per cent and aphid infestation on barley crop highly susceptible (index 5.0) in variety K551 and shootfly variety Halna, HD2967 and K0307. The survey of 2nd week of Feb., 2017 district Fatehpur village Bindki, Korsam and Mohal at full poding stage of wheat termite infestation was observed 10 per cent variety HD2967, K0307, Halna and Local variety. The aphid infestation was not observed in barley variety Prakhar. The infestation of pink stem borer was observed 02 per cent in varieties HD2967, K0307 and Halna (Table 6.28).

Centre: Karnal

The survey of wheat in Punjab and Haryana state were undertaken during 2016-17 crop season. Moderate to severe incidence of foliar wheat aphid was observed. The minor damage of termite and root aphids was also observed in early period of crop growth in Karnal as its nearby locations Kunjpura, Kathial, Racina and Hajwna.In some fields, incidence of pink stemborer was observed in early (December month) and alter in the season (March month). The grubs and adults of coccinellid beetles were seen frequently in fields infested with aphids.

The areas that were covered in Haryana during survey included Indri, Khanpur, Ban, Ladwa, Kheridav Bakana, Radaur Ratangarh, Bamboli, Mustafabad, Yamunanagar and Ambala. In Punjab the survy was conducted in Chaukiman, Monga Khurd, Janera, Monga, Nevara, Talwandi, Ferozpur, Jalekhan, Ferozpur, Kulgarhi, Gulam Patra, Sri Muktsar Sahib,Buttar Sirnih,KotheChetsing Wale, Bhatinda

Centre: Pantnagar

Field survey was done to explore various insect pests of wheat and their natural enemies in and around Pantnagar. Peak activity and population of natural enemies of aphids was found to synchronize with the peak population and activity period of wheat aphids.

The arthropod pests attacking wheat crop in various degree of incidence were : Aphids (*Rhopalosiphum maidis*, *R. padi*, *Macrosiphum* sp), armyworm (*Mythimna separata*) *Helicoverpa armigera*, stem borer (*Sesamia inference*), grasshoppers, leaf miner, stink bug (*Nazara* sp), termites (*Microtermis obesi*, *Odontotermis obesus*), thrips (*Thrips hawaiiensis*, *T flavus* and *T. tabaci*), cutworm (*Agrotis* spp), wireworm and mites. Of these, wheat aphid exhibited marked predominance over all other pests. Out of three species of foliar aphids viz., *Rhopalosiphum maidis*, and *Macrosiphum* sp showed higher abundance. The flag leaf, flowering and milky stages were noticed to be more susceptible stages for the aphids and thrips.*Thrips hawaiiensis* and *T flavus* were identified as the most predominant species as evident by their abundance.

Various predators of aphids recorded are: adults and grubs of *Coccinella septempunctata*, *C. transversalis*, *Micraspis allardi*, *Adonia* sp, *Hippodamia variegate*, *Harmonia eucharis*, , *Coelophora bissellata*, *Cheilomenes sexmaculata*, *Propylea dissecta* (Coccinellidae; Coleoptera) larvae of *Chrysoperla carnea* (Chrysopidae: Neuroptera) and maggots of syrphids such as *Episyrphus balteatus*, *Ischiodon scutellaris*, *Syrphus corrolae* and *Melanostoma* sp. and *Paragus tibialis* and *Lasiopticus sclaniticus* (Syrphidae: Diptera). The grubs and adults of *C. septempunctata*, *C. transversalis* and maggots of *E. balteatus* and *I. scutellaris* were observed as the predominant predators of wheat aphids. The predatory bug, *Eocanthocona furcellata* (Pentatomidae) was also found to prey upon the larvae of *Helicoverpa armigera* .

Among the parasitoids, field parasitization by *Aphelinus gossypii* (Aphelinidae: Hymenoptera) *Aphidius uzbekistanicus*, and *Lysiphlebia mirza* (Braconidae: Hymenoptera) on wheat aphids was recorded. Fair population of parasitoids viz., *Apenteles flavipes* and *Aphidius* sp (Hymenoptera: Brachonidae) parasitizing the larvae of army worm, *Mythimna separata* were also observed.

IV: Incidence and population build of major insect pest in different dates of sowing. (Fourth Year)

Objective:

1) To test the response of various wheat varieties/lines of wheat to aphid attack on different sowing dates under field condition.

2) To determine the effect of sowing dates on population built up of aphids on wheat.

The experiment conducted for Incidence and population build of major insect pest in different dates of sowing at 15 days interval under irrigated conditions 2016-17 at Niphad, Ludhiana and Karnal centre.

Methodology and observations to be recorded

The crop was sown at three different dates of sowing at 15 days interval and no insecticide was applied to control any pest in this trial. However, all other agronomic practices were followed for crop raising. The data on all major pests viz. Foliage feeding aphids, root aphid, BWM, termites Pink stem borer etc. were recorded at fortnightly interval starting from 21 days after sowing until maturity of crop. The first incidence and population build of different pests were recorded and documented in Tabular form.

Centre: Niphad

Incidence of aphids and jassids were recorded on wheat crop sown at various dates i.e. starting from 1st Nov. to 16th Dec. at 15 days interval. It is noticed from Table 6.29, that the aphid incidence was started from 26 days after sowing on crop sown at 1st Nov. (D1). The peak (80.06) number of aphids/shoot/plant was recorded in 2nd Meteorological week i.e. second week of January. The crop sown at 16th Nov. (i.e. 45 days after sowing) the incidence of aphid was started in 2nd week of January and it reached to peak in 5th Meteorological week. In case of crop sown at 1st Dec. (D3) and 16th Dec. (D4), the aphid incidence was started in 3rd & 4th Meteorological week, respectively. Delayed sowing affected the population build up of aphid.

The incidence of jassids in crop sown at 1st Nov. (D1), 16th Nov. (D2), 1st Dec. (D3) & 16th Dec. (D4) were started in 48, 1, 3 & 4th MW, respectively. The highest average yield of 37.49 q/ha was recorded in crop sown at 1st Dec. (D3) and it was lowest (30.58q/ha) in crop sown at 1st Nov. (D1).

Centre: Kharibari

An experiment was conducted at Regional Research sub-station (Terai Zone) UBKV, Kharibari, Darjeeling. The wheat variety HD2697 was sown on 1st December'2016, 15th December'2016 and 30th December'2016. The experiment was laid out in Randomized Block Design with four replication and the plots of 5m X 4m length.

The mean number of aphid population was record from randomly selected fifteen tagged plants per plot taking their 10 cm twigs. The observations were taken at weekly intervals starting from 46th standard week and continuing upto 14th standard week. These recorded data were correlated with various abiotic parameters like temperature (Maximum and Minimum), Relative Humidity (Maximum and Minimum) and rainfall for determining the relationship of prevailing environmental factors with population fluctuation of aphid (Table 6.30).

Centre: Ludhiana

This experiment was conducted in the irrigated fields at Plant Breeding Research Farm, PAU Ludhiana. The wheat variety WH 1105 was sown at four different dates of sowing at 15 days interval and no insecticide was applied to control any pest in this trial. However, all other agronomic practices were followed as per recommendations of PAU package of practices. The data on major insect pests viz. foliage feeding aphids, root aphid, pink stem borer, termites etc. were recorded throughout crop growing season at peak period of their activity (Table 6.31).

1.**Termite damage:** The termite damage recorded at seedling stage in different dates of sowing indicated that early sown crop (1 Nov. 2016) suffered more termite damage as compared to timely, late and very late sown crop. At earing stage, again termite damage was maximum in early sown crop followed by timely and late sown crop.

2. **Aphid incidence:** The aphids first appeared in second week of December in early and timely sown crop while it appeared in last week of December and 3rd week of January in late and very late sown conditions. The data recorded indicated that the aphid incidence got

delayed with the delay in sowing time. The peak of aphid incidence was recorded in 8th, 9th, 10th and 10th standard meteorological weeks of 2017 in early, timely, late sown and very late sown crop respectively.

3. **Pink stem borer Damage**: The pink stem borer damage was higher in early and timely sown crop as compared to late and very late sown crop on all dates of observations.

Table 6.29: Effect of different dates of sowing on the population dynamics of wheat aphids 2016-17 (Centre-Niphad)

Standard Weeks	Rain fall (mm)	Relative Humidity (%)		Temperature (⁰C)		Mean aphid incidence (Aphids/plant/tiller)				Mean jassid incidence (Jassid/plant)			
		Max	Min.	Max.	Min.	Ist DOS (1st Nov.)	IInd DOS (16th Nov.)	IIIrd DOS (1st Dec.)	IVth DOS (16th Dec.)	Ist DOS (1st Nov.)	IInd DOS (16th Nov.)	IIIrd DOS (1st Dec.)	IVth DOS (16th Dec.)
48(26Nov-2Dec)	0.0	74	25	31.4	9.5	**5.33**	0.00	-	-	**4.33**	-	-	-
49 (3 to 9 Dec)	0.0	78	32	29.3	9.9	**14.40**	0.00	-	-	**12.40**	-	-	-
50 (10-16 Dec)	0.0	78	31	29.2	9.8	**27.86**	0.00	0.00	-	**34.53**	0.00	0.00	-
51 (17-23 Dec)	0.0	78	29	29.2	8.9	**50.53**	0.00	0.00	-	**42.73**	0.00	0.00	-
52 (24-31 Dec)	0.0	73	26	29.5	7.3	**57.40**	0.00	0.00	0.00	**38.60**	0.00	0.00	0.00
1 (1-7 Jan)	0.0	72	26	28.7	6.9	**70.26**	0.00	0.00	0.00	**3.73**	**1.40**	0.00	0.00
2 (8-14 Jan)	0.0	69	29	26.0	6.4	**80.06**	**10.53**	0.00	0.00	0.00	**2.53**	0.00	0.00
3 (15-21 Jan)	0.0	75	41	27.6	11.0	**43.33**	**19.00**	**2.73**	0.00	0.00	**4.00**	**1.06**	0.00
4 (22-28 Jan	0.0	75	33	29.7	10.1	**23.06**	**26.93**	**7.66**	**1.86**	0.00	**5.13**	**4.80**	**1.80**
5 (29 Jan-4Feb)	0.0	68	27	30.8	10.0	0.00	**34.80**	**12.40**	**6.86**	0.00	**7.93**	**7.33**	**3.13**
6 (5-11 Feb)	0.0	61	32	30.8	11.0	0.00	**9.93**	**13.46**	**15.86**	0.00	**2.40**	**7.00**	**7.53**
7 (12-18 Feb)	0.0	71	29	31.3	11.5	0.00	0.00	**7.66**	**22.20**	0.00	0.00	0.00	**9.06**
8 (19-25 Feb)	0.0	69	18	33.6	10.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**4.26**
9 (26Feb-4 Mar)	7.4	67	20	33.9	10.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10 (5-11 Mar)	0.0	68	25	32.3	10.8	-	-	-	0.00	-	-	-	0.00
11 (12-18 Mar)	0.0	72	23	33.0	10.1	-	-	-	0.00	-	-	-	0.00
12 (19-25 Mar)	0.0	70	24	35.4	14.4	-	-	-	0.00	-	-	-	0.00
13 (26Mar-1Apr)	0.0	72	25	39.6	17.8	-	-	-	0.00	-	-	-	0.00
14 (2-8 Apr)	0.0	73	23	36.8	15.4	-	-	-	-	-	-	-	-
15 (9-15 Apr)	0.0	68		38.9	15.2	-	-	-	-	-	-	-	-
16 (16-22 Apr)	0.0					-	-	-	-	-	-	-	-
Yield q/ha						**30.58**	**31.25**	**37.49**	**32.63**	-	-	-	-

Table 6.30: Effect of different dates of sowing on the population dynamics of wheat aphids 2016-17 (Centre-Kharibari)

Standard Weeks	RAIN FALL IN mm	Relative humidity		Temperature ^{0}C		Aphid incidence (Aphids/tiller)					
		Max RH	Min RH	Max Temp	Min Temp	Date of sowing 01.12.16	Yield qt/ha	Date of sowing 15.12.16	Yield qt/ha	Date of sowing 30.12.16	Yield qt/ha
48	0.00	28.28	14.13	89.25	54.00	0.00	26.45	0.00	27.85	0.0	25.95
49	0.00	27.20	12.03	91.71	48.00	0.00		0.00		0.0	
50	0.00	25.20	10.39	91.43	53.29	12.00		0.00		0.0	
51	0.00	27.34	12.31	90.57	46.57	27.85		0.00		0.0	
52	1.51	22.66	21.86	83.57	43.46	44.55		20.00		0.0	
53	9.41	0.00	89.57	40.71	25.93	95.65		40.00		0.0	
1	8.57	0.00	91.86	41.00	24.31	102.60		53.20		0.00	
2	8.57	0.00	91.57	43.43	25.20	138.90		65.20		2.45	
3	11.20	0.00	86.57	39.29	27.00	275.45		95.90		32.56	
4	10.76	0.00	89.71	51.43	24.70	325.50		135.76		85.86	
5	11.94	0.00	89.86	51.00	27.17	266.56		232.79		145.95	
6	12.44	0.00	89.00	44.57	27.30	185.75		188.45		196.90	
7	13.66	1.77	89.29	52.86	27.89	110.10		165.25		245.67	
8	13.43	0.00	89.00	47.71	28.11	65.90		112.55		194.87	
9	13.06	5.73	88.71	52.71	28.23	37.90		55.67		155.70	
10	12.69	0.29	90.14	52.29	27.06	27.70		35.90		120.26	
11	14.54	6.09	89.14	51.57	27.97	20.00		19.56		65.50	
12	15.31	1.74	92.86	69.14	26.96	8.00		10.00		28.90	
13	18.09	0.14	89.29	54.00	31.10	6.00		4.00		14.50	
14	0.00	28.28	14.13	89.25	54.00	2.0		0.0		0.00	

Table 6.31: Effect of sowing dates on population build of major insect pests in wheat 2016-17 (Centre-Ludhiana)

Standard Weeks	Rainfall (mm)	Relative humidity (%)		Temperature (^{0}C)		Mean Aphid incidence (Aphids/plant/tiller)				Stem borer/Termites (% affected tillers/meter row)			
		Max	Min	Max	Min	Ist DOS (01-NOV.)	IIndDOS (16-NOV.)	IIIrd DOS (01-DEC.)	IVth DOS (16-DEC.)	Ist DOS (01- NOV.)	IIndDOS (16-NOV.)	IIIrd DOS (01-DEC.)	IVth DOS (16-DEC.)
50(10Dec-16Dec)	0	97	63	20.0	10.1	0.4	0.2	0	0	2.05/4.39	1.63/3.82	-	-
51(17Dec-23Dec)	0	95	44	22.5	6.6	0	0.6	0	0	2.47/4.27	2.14/3.75	1.28/2.22	-
52(24Dec-31Dec)	0	93	48	21.1	7.9	0.2	0.2	0.2	0	1.46/4.31	1.09/3.60	1.79/2.95	1.10/2.22
1(1Jan-7Jan)	4	95	57	20.9	9.7	0	0	0	0	-	-	0.67/2.81	1.20/1.98
2(8Jan-14Jan)	0	95	43	16.3	3.5	0.2	0	0	0	-	-	-	-
3(15Jan-21Jan)	1.6	94	64	16.0	6.2	0.8	0	0	0	-	-	-	-
4(22Jan-29Jan)	40.4	93	64	19.5	10.3	3.4	1.2	0.6	0.2	-	-	-	-
5(29 Jan-4Feb)	5.2	96	64	19.8	8.7	6	3.6	2.2	0.4	-	-	-	-
6(5Feb-11Feb)	0	92	53	20.7	8.2	12.4	5.2	2.8	1.8	-	-	-	-
7(12Feb-18Feb)	0	90	44	24.3	9.7	19	7.2	6	3.2	-	-	-	-
8(19Feb-25Feb)	0	89	39	24.8	10.6	27.2	10.8	8.2	7.6	-/3.66	-/3.02/	-/3.05	-/2.00
9(26 Feb-4Mar)	0	90	34	25.5	9.5	14.6	21.6	15.6	14	-	-	-	-
10(5Mar-11Mar)	40.8	86	46	20.9	10.5	5	17.2	26.2	22.6	-	-	-	-
11(12Mar-18Mar)	0	88	42	23.2	8.9	1.2	7.6	13.8	22.4	-	-	-	-
12(19Mar-25Mar)	0	84	33	30.4	14.8	0	1.4	5.8	10.8	-	-	-	-
13(26 Mar-1Apr)	0	85	31	34.9	18.5	0	0	0	6.8	-	-	-	-
14(2Apr-8Apr)	6.2	66	29	32.9	19.3	0	0	0	0.8	-	-	-	-

V: Basic studies for development of IPM

a: Pest modelling for foliage aphids.

Centre: Ludhiana

The data was recorded by randomly selecting ten individual tillers from 500 m^2 area while moving in a diagonal path in the field. The population of *Coccinella septempunctata* was recorded in 1 m^2 area around the individual plant. Weekly observations were recorded to study the first incidence and population build up of aphid and Coccinellid beetle.

Population dynamics of Wheat aphid: The aphid first appeared on 31.01.2017 on wheat crop and it started rising and reached its peak on 07.03.2017 (Table 6.32a). Thereafter population of wheat aphid started declining and it drastically decreased after 28.03.2017. The population of Coccinellid beetle remained low up to 28.02.2017 and thereafter it started rising and reach its peak on 14.03.2017 (one week after the peak period of activity of wheat aphid).

Population dynamics of barley aphid: The aphid population first appeared on 17.01.2017 on barley crop and it started rising and reached its first peak on 07.03.2017 (Table 6.32b). Thereafter aphid population started declining and become almost negligible after 21.03.2017. The population of coccinellid beetles remained low up to 28.02.2017 (the peak period of activity of barley aphid) and thereafter it stated rising and reached its peak on 21.03.2017 (two weeks after the peak period of activity of aphid).

Thus, it can be concluded from the data that coccinellid beetle appeared after the peak period of aphid infestation on wheat and barley crop.

Table 6.32a: Population dynamics of wheat aphid and Coccinellid beetle during 2016-17 (Location-Ludhiana)

Date of observation	Plant No.(No. of aphids/tiller)											Collateral host (Barley)			
	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**Avg.**	**P1**	**P2**	**P3**	**Avg.**
17.01.2017	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0.00**
24.01.2017	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0.00**
31.01.2017	1	0	0	0	2	0	0	1	0	0	**0.4**	0	2	0	**0.67**
07.02.2017	4	2	1	3	2	2	3	3	5	1	**2.6**	0	4	6	**3.33**
14.02.2017	6	1	2	7	3	3	4	5	2	3	**3.6**	8	7	6	**7.00**
21.02.2017	7	5	4	9	15	10	12	15	7	20	**10.4**	7	2	10	**6.33**
28.02.2017	40	30	20	22	14	15	14	22	31	10	**21.8**	16	13	15	**14.67**
07.03.2017	30	28	40	35	50	42	36	60	60	50	**43.1**	30	35	28	**31.00**
14.03.2017	10	7	15	15	6	7	5	10	8	15	**9.8**	60	80	52	**64.00**
21.03.2017	3	6	2	10	4	3	0	1	5	0	**3.4**	70	130	100	**100.00**
28.03.2017	0	2	0	2	1	3	0	0	4	0	**1.2**	20	4	25	**16.33**
03.04.2017	0	0	0	0	0	0	0	1	0	0	**0.1**	10	5	9	**8.00**
Date of observation	**Plant No.(Coccinellid beetle/sq m area)**											**Collateral host (Barley)**			
	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**Avg.**	**P1**	**P2**	**P3**	**Avg.**
17.01.2017	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0.00**
24.01.2017	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0.00**
31.01.2017	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0.00**
07.02.2017	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0.00**
14.02.2017	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0.00**
21.02.2017	1	0	0	0	0	1	0	2	0	1	**0.5**	0	0	0	**0.00**
28.02.2017	9	4	7	5	6	0	0	0	0	1	**3.2**	0	0	4	**0.00**
07.03.2017	8	7	4	0	0	9	0	7	2	0	**3.7**	0	0	0	**1.33**
14.03.2017	11	16	10	8	9	4	0	7	8	15	**8.8**	10	0	4	**0.00**
21.03.2017	8	7	5	4	2	0	9	10	0	2	**4.7**	9	15	10	**4.67**
28.03.2017	4	2	0	0	4	1	1	2	3	1	**1.8**	20	21	18	**11.33**
03.04.2017	0	0	0	0	1	0	2	0	0	1	**0.4**	10	8	7	**19.67**

Table 6.32b: Population dynamics of barley aphid and Coccinellid beetle during 2016-17 (Location-Ludhiana)

Date of observation	Plant No.(No. of aphids/tiller)											Collateral host (wheat)			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Avg.	P1	P2	P3	Avg.
03.01.2017	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0.00**
10.01.2017	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0.00**
17.01.2017	0	2	0	0	3	0	0	1	2	0	**0.8**	0	0	0	**0.00**
24.01.2017	0	4	6	0	0	4	5	0	8	1	**2.8**	1	0	0	**0.33**
31.01.2017	8	7	6	10	1	5	5	7	6	1	**5.6**	4	2	1	**2.33**
07.02.2017	7	2	10	8	15	11	6	7	5	6	**7.7**	6	1	2	**3.00**
14.02.2017	16	13	15	11	20	6	15	14	12	7	**12.9**	7	5	4	**5.33**
21.02.2017	30	35	28	30	40	45	25	32	25	45	**33.5**	40	30	20	**30.00**
28.02.2017	60	80	52	90	60	85	75	75	70	90	**73.7**	30	28	40	**32.67**
07.03.2017	70	130	100	90	105	65	50	95	100	85	**89**	10	7	15	**10.67**
14.03.2017	20	4	25	10	18	30	10	15	16	9	**15.7**	3	6	2	**3.67**
21.03.2017	10	5	9	15	8	7	6	10	15	12	**9.7**	0	2	0	**0.67**
28.03.2017	0	0	2	0	0	4	0	4	1	2	**1.3**	0	0	0	**0.00**
Date of observation	Plant No.(Coccinellid beetle/sq m area)											Collateral host (wheat)			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Avg.	P1	P2	P3	Avg.
03.01.2017	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**
10.01.2017	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**
17.01.2017	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**
24.01.2017	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**
31.01.2017	0	0	0	0	0	0	0	1	0	0	**0.10**	0	0	0	**0.00**
07.02.2017	0	0	0	3	0	0	0	0	0	0	**0.30**	0	0	0	**0.00**
14.02.2017	0	0	0	0	1	0	0	0	2	2	**0.50**	1	0	0	**0.33**
21.02.2017	0	0	4	5	0	2	5	0	0	0	**1.60**	9	4	7	**6.67**
28.02.2017	0	0	0	0	0	6	0	7	4	8	**2.50**	8	7	4	**6.33**
07.03.2017	10	0	4	8	6	0	8	11	4	9	**6.00**	11	16	10	**12.33**
14.03.2017	9	15	10	8	0	2	4	9	12	2	**7.10**	8	7	5	**6.67**
21.03.2017	20	21	18	19	10	6	9	18	19	17	**15.70**	4	2	0	**2.00**
28.03.2017	10	8	7	5	6	11	8	8	4	2	**6.90**	0	0	0	**0.00**

Centre: Niphad

The weekly observations on wheat aphids were recorded along with different weather parameters. Data presented in Table 6.33 revealed that the maximum number of aphids/shoot/plant (73.00) was observed in 2nd Meteorological week when the maximum and minimum temperatures were 26.0 and 6.4 °C respectively and average relative humidity was 49.0 per cent. The incidence of jassids on wheat was also recorded. The maximum (41.10) population of the jassids/plant were recorded in 51st Meteorological week when the maximum and minimum temperatures were 29.2 and 8.9 °C, respectively. The maximum (13.20) natural enemies/m2 was recorded in 2nd MW when maximum and minimum temperature were 26.0 and 6.4°C, respectively and average humidity was 49 per cent.

Table 6.33: Seasonal incidence of the aphids and lady bird beetle on wheat during 2016-17 (Location-Niphad)

MW	No. of Aphids /Shoot/plant	No. of Jassids/ plant	Population of natural enemies/m²	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)
				Max.	Min.	Morn.	Even.	
45	0.00	0.00	0.00	29.9	9.1	76	23	0.0
46	0.00	0.00	0.00	29.7	10.5	77	24	0.0
47	0.40	2.40	0.00	29.8	8.7	77	25	0.0
48	2.70	4.10	0.00	31.4	9.5	74	25	0.0
49	10.50	11.90	0.00	29.3	9.9	78	32	0.0
50	29.70	35.10	2.20	29.2	9.8	78	31	0.0
51	51.70	41.10	5.80	29.2	8.9	78	29	0.0
52	60.20	38.00	9.60	29.5	7.3	73	26	0.0

MW	No. of Aphids /Shoot/plant	No. of Jassids/ plant	Population of natural enemies/m²	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)
				Max.	Min.	Morn.	Even.	
1	69.10	6.30	11.20	28.7	6.9	72	26	0.0
2	73.00	0.00	13.20	26.0	6.4	69	29	0.0
3	41.50	0.00	7.70	27.6	11.0	75	41	0.0
4	20.10	0.00	0.00	29.7	10.1	75	33	0.0
5	0.00	0.00	0.00	30.8	10.0	68	27	0.0
6	0.00	0.00	0.00	30.8	11.0	61	32	0.0
7	0.00	0.00	0.00	31.3	11.5	71	29	0.0
8	0.00	0.00	0.00	33.6	10.9	69	18	0.0
9	0.00	0.00	0.00	33.9	10.6	67	20	0.0
10	0.00	0.00	0.00	32.3	10.8	68	25	0.0

Centre: Karnal

The data was recorded by randomly selecting ten individual tillers from 500 m² area while moving in a diagonal path in the field. The population of *Coccinella septempunctata* was recorded in 1m² area around the individual plant. Weekly observations were recorded to study the first incidence and population build up of aphid and Coccinellid beetle.

Population dynamics of Wheat aphid: The aphid first appeared on 27.1.2016 on wheat crop and it started rising and reached its peak on 24.02.2016 (Table 6.34a). Thereafter population of wheat aphid started declining. The population of Coccinellid beetle started from 10-02-2017 and reach it's peak on 16.03.2017.

Population dynamics of barley aphid: The aphid population was high as compared to wheat during the whole crop season (Table 6.34b). It first appeared on 27.01.2017 on barley crop and it started rising and reached its first peak on 24.02.2016. The population of coccinellid beetles remained low up to 25.02.2017 (the peak period of activity of barley aphid) and thereafter it stated rising and reached its peak on 09.03.2017. Thereafter its population started declining.

Thus, it can be concluded from the data comparatively high population of aphid appeared on barley as compared to wheat crop. The data also indicated that coccinellid beetle appeared after the peak period of aphid infestation on wheat and barley crop.

Table 6.34a: Population dynamics of wheat aphid and Coccinellid beetle during 2016-17 (Location-Karnal)

Date of observation	Plant No.(No. of aphids/tiller)											Collateral host (Barley)			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Av.	P1	P2	P3	Av.
27.01.2017	4	0	0	7	5	2	5	3	4	6	3.6	11	22	16	16.3
03.02.2017	12	21	18	10	9	15	13	1	7	12	11.8	26	41	26	31.0
10.02.2017	54	35	53	24	34	21	26	40	41	32	36	32	32	40	34.7
17.02.2017	62	42	35	41	52	47	50	46	32	65	47.2	55	74	42	57.0
24.02.2017	85	45	65	36	45	60	42	74	85	78	61.5	85	64	112	87.0
02.03.2017	74	32	69	65	74	56	62	54	46	62	59.4	82	45	41	56.0
09.03.2017	25	32	20	24	24	35	42	25	22	25	27.4	46	32	42	40.0
16.03.2017	32	15	14	21	15	23	32	36	11	9	20.8	32	16	35	27.7
24.03.2017	6	9	6	12	14	8	12	13	16	21	11.7	9	24	9	14.0
Date of observation	Plant No.(Coccinellid beetle/sq m area)											Collateral host (Barley)			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Av.	P1	P2	P3	Av.
27.01.2017	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0.0
03.02.2017	0	0	2	2	0	3	0	0	0	0	0.7	0	2	3	1.7
10.02.2017	1	0	2	3	0	2	4	2	2	1	1.7	2	3	1	2.0

Date of observation	Plant No.(No. of aphids/tiller)											Collateral host (Barley)			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Av.	P1	P2	P3	Av.
17.02.2017	5	2	1	2	2	4	5	8	2	2	3.3	3	4	2	3.0
24.02.2017	7	5	4	3	5	8	6	1	3	2	4.4	4	3	5	4.0
02.03.2017	20	1	14	4	2	3	7	2	2	6	6.1	5	5	10	6.7
09.03.2017	16	8	13	10	5	13	3	5	6	2	8.1	6	7	11	8.0
16.03.2017	10	5	16	6	3	5	12	13	11	4	8.5	9	10	6	8.3
24.03.2017	8	4	7	8	2	3	10	7	5	1	5.5	4	6	10	6.7

Table 6.34b: Population dynamics of barley aphid and Coccinellid beetle during 2016-17 (Location-Karnal)

Date of observation	Plant No.(No. of aphids/tiller)											Collateral host (wheat)			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Av.	P1	P2	P3	Av.
27.01.2017	10	5	7	5	20	15	25	20	10	10	12.7	8	6	6	6.67
03.02.2017	35	30	45	55	30	60	44	35	30	40	40.4	15	25	30	23.33
10.02.2017	55	65	95	35	75	80	45	70	60	95	67.5	35	50	45	43.33
17.02.2017	75	105	90	110	100	75	120	45	60	77	85.7	45	75	65	61.67
24.02.2017	10	140	105	140	160	175	110	75	165	70	115	75	80	110	88.33
02.03.2017	55	70	90	45	40	75	95	40	100	55	66.5	40	55	35	43.33
09.03.2017	25	15	75	45	75	33	25	45	15	30	38.3	22	20	40	27.33
16.03.2017	11	20	40	10	30	10	25	30	20	35	23.1	25	10	15	16.67
24.03.2017	8	6	20	5	9	7	15	25	10	20	12.5	8	10	11	9.67
Date of observation	Plant No.(Coccinellid beetle/sq m area)											Collateral host (wheat)			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Av.	P1	P2	P3	Av.
27.01.2017	1	0	0	1	0	1	0	1	0	1	0.5	0	0	0	0.00
03.02.2017	1	2	1	0	1	0	0	5	2	0	1.2	1	1	1	1.00
10.02.2017	1	9	2	1	0	2	1	5	1	0	2.2	3	1	2	2.00
17.02.2017	2	2	10	1	3	5	1	10	0	2	3.6	7	1	2	3.33
24.02.2017	9	4	7	1	2	1	9	2	2	5	4.2	2	9	1	4.00
02.03.2017	5	9	2	11	8	3	10	2	11	7	6.8	4	5	7	5.33
09.03.2017	13	1	10	2	8	3	6	14	11	8	7.6	6	7	4	5.67
16.03.2017	12	14	2	13	1	10	2	3	11	5	7.3	5	6	8	6.33
24.03.2017	10	13	2	9	1	10	2	3	6	5	6.1	4	0	6	3.33

Centre: Pantnagar

The population of wheat aphid and their predators as recorded in the field during the crop season 2016-17 is presented in Table 6.35a. The first appearance of aphid (average 0.5 aphid/ tiller) was recorded on 15th January, 2017. The aphid population gradually increased in the following months and attained peak population of 28.0 aphids/ tiller on 16.3.2017 when maximum, minimum temperatures , morning and evening RH, rainfall, sunshine hrs, wind speed, wind direction and morning and evening soil moisture temperatures were 28.0OC, 9.9OC, 83%, 36%, 0.0 mm, 10.3 hrs, 6.4hrs, WNW, 18.5-23.1, respectively.

A more or less similar trend of fluctuations was observed in population of natural enemies of aphids during the activity period of these pests. Data obtained on the population of natural enemies are depicted in Table 6.35b. The first appearance of natural enemies was marked on 15.1.17 when the population of predators was to the extent of 0.1 predators /m^2. Maximum population of 5.5 predators/m^2 was observed on 16.3.2017 followed by a gradual decrease with the maturity of the crop (0.8 predators/ m2 on 15.4.2017). The biotic potential of natural enemies of aphids was thus found to synchronize with the increasing activity period and population of aphids resulting in the effective suppression of aphids through natural control. Weather parameters on different dates of observations during the wheat crop season are presented in Table 6.35c.

Table 6.35a: Aphid population /tiller on wheat variety, UP 2565 at Pantnagar during 2016-17

Date of Observation	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Total	Average
15.1.2017	0	02	0	1	0	0	1	0	0	1	5	0.5
30.1. 2017	8	9	3	7	3	10	2	8	6	14	70	0.8
14.2. 2017	7	13	18	11	15	9	22	14	7	3	118	11.8
1.3. 2017	17	03	34	10	25	19	33	29	23	39	133	20.2
16.3. 2017	34	14	55	29	41	19	39	44	56	39	280	28.0
31.3. 2017	8	0	13	6	11	5	09	13	0	7	72	7.2
15.4.2017	0	4	0	2	0	0	3	1	0	1	11	1.1

Table 6.35b: Population of natural enemies in wheat (variety: UP 2565) ecosystem at Pantnagar (2016-17)

Date of Observation	Number of lady bird beetle adults/larvae and syrphid larvae etc./ m² (Replications 10)											
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Total	Average
15.1.2017	0	0	0	0	0	0	0	0	1		1	0.1
30.1. 2017	0	1	0	1	1	0	0	1	0	1	5	0.5
14.2. 2017	2	0	2	0	0	4	2	0	3	1	22	1.4
1.3. 2017	1	5	9	7	3	2	7	6	11	03	54	5.4
16.3. 2017	11	6	3	7	5	8	9	3	4	9	65	5.5
31.3. 2017	1	3	0	4	5	1	7	0	2	8	31	3.1
15.4.2017	0	1	1	0	3	0	0	1	1	1	8	0.8

Table 6.35c: Weather parameters on different dates of observations at Pantnagar during the wheat crop season (2016-17)

Parameter	15.1. 17	30.1. 17	14.2. 17	1.3. 17	16.3. 17	31.3. 17	15.4. 17
Maximum (°C)Temperature	20.0	16.9	25.2	27.5	28.0	37.0	36.8
Minimum Temperature(°C)	8.9	9.4	7.0	12.0	9.9	15.8	19.5
Relative Humidity (%) 0730 hrs	92	97	89	91	83	67	52
Relative Humidity (%) 14000 hrs	39	61	51	33	36	38	32
Rainfall (mm)	0.0	0.0	0.0	0.8	0.0	0.0	0.0

b: Basic studies on seasonal incidence and parasitism of *Helicoverpa*
Centre: Vijapur

a.Seasonal incidence of H. armigera

Study on seasonal incidence of *H. armigera* was undertaken at Wheat Research Station, Vijapur. For this, wheat crop was observed at weekly interval for the presence of larval population right from germination to harvesting stage of crop. Data presented in Table-5 revealed that the first appearance of the pests was noticed in the first week of February which continued till the first week of March (Table 6.36a).

b. Studies on parasites of wheat crop pests

With a view to know the naturally presence of parasites of wheat pests, periodical collection of larvae of H. armigera from the wheat crop was made and brought to the laboratory for rearing and further study. Data on parasitism given in Table-6.36b indicated that 12.50 per cent parasitism by *Campoletis chlorideae* on *H. armigera* larvae.

Table 6.36a: Seasonal activity of *H .armigera* (Location: Vijapur) (2016-17)

S. No.	Date of observation	No. of larval / 50 plant
1.	27/01/17	0
2.	03/02/17	1
3.	10/02/17	1
4.	17/02/17	1
5.	24/02/17	1
6.	02/03/17	1
7.	09/03/17	0
8.	16/03/17	0

Table 6.36b: Studies on natural parasitism of *H. armigera* (Location: Vijapur) (2016-17)

Sr. No.	Life stage observed	Date of collection	No. of larvae observed	No. of larvae parasitized	Percent parasitism	Name of parasite
1.	Larval	27/01/17	0	0	12.50	*Campoletis chlorideae*
		03/02/17	5	0		
		10/02/17	6	1		
		17/02/17	7	1		
		24/02/17	7	1		
		02/03/17	7	1		
		09/03/17	0	0		
		16/03/17	0	0		

(D) STORED GRAIN PEST MANAGMENT

I: Studies on the insecticidal treatment on viability of store grain pests under ambient condition

Centre: Ludhiana

The experiment was conducted at Wheat Entomological Laboratories, PAU, Ludhiana during 2016-17. Freshly harvested seed with high percentage of germination and low moisture content (>10 %) was taken for experimental purpose. Seven insecticidal treatments were done with required quantity of insecticides diluted in 5 ml water to treat the 1 kg of seed for proper coating. After drying in shade, out of 1 kg seed, only 200 gm of seeds were placed in battery jars covered with muslin cloth and kept under ambient condition in B.O.D. and each treatment was replicated thrice.

One month after insecticidal application, spinosad (1.69 % damage) was the most effective treatment and it was at par all treatments except deltamethrin and untreated control . Similar trend was observed two months after treatment. After four month, spinosad and emamectin benzoate (1.97 % damage) was the best treatment followed by indoxacarb (3.13 % damage). All insecticidal treatments were at par with each other except novaluron @ 0.05 ml/kg, deltamethrin @ 0.04 ml of seeds and including untreated control (8.76 % damage) (Table 6.37a).

Centre: Kharibari

This trial was conducted under normal room temperature conditions at Regional Research sub-station (Terai Zone) UBKV, Kharibari, Darjeeling, West Bengal, to study the insecticidal treatments on seed viability during storage under ambient condition against store grain pests, *Trogoderma granarium* or *Rhizopertha dominica* following randomized block design. After 20 DAT, Deltamethrin 2.8 EC and Indoxacarb (Avaut) recorded lowest poulation insects i.e 15.65 and 18.65, respectively (Table 6.37b).

Centre: Karnal

The experiment was conducted in Entomology laboratory of IIWBR, Karnal at room temperature. Freshly harvested seed with moisture content less than 10 % was taken for experimental purpose. The required quantity of insecticides was diluted in 5 ml water to treat the 1 kg of seed for proper coating. After drying in shade, out of 1 kg seed, only 200 gm of seeds were placed in battery jars covered with muslin cloth and kept under ambient condition in B.O.D. and each treatment was replicated thrice.

After one month of treatment, Emamectin benzoate (2.61%) was the most effective treatment and it was at par with spinosad (2.74 % damage).However, after 2 months of treatment spinosa registered 3.48 % damage and it was at par with all the treatments except Deltamethrin 2.8 EC, Novaluron (Rimon) @0.02 ml/kg and untreated control.The experiment is in progress and 4 months observations are yet to be taken (Table 6.37c).

Table 6.37a: Studies on the effect of insecticidal seed treatment on seed viability during storage under ambient conditions against store grain pests 2016-17 (Centre-Ludhiana)

S. No.	Treatments	Dosage (mg or ml/kg seed)	Damage (%)		
			1 month	2 month	4 months
1	Emamectin benzoate (Proclaim)	40.0 mg/kg	1.75 (1.65)	2.52 (1.87)	2.91 (1.97)
2	Spinosad (Tracer)	5.0 mg/kg	1.69 (1.63)	2.43 (1.85)	2.90 (1.97)
3	Indoxacarb (Avaut)	15 mg/kg	1.86 (1.69)	2.60 (1.89)	3.13 (2.03)
4	Rynaxypyr (Coragen)	100 mg/kg	1.83 (1.68)	2.51 (1.87)	3.26 (2.06)
5	Novaluron (Rimon)	0.02 ml/kg	1.98 (1.72)	2.70 (1.92)	3.53 (2.12)
6	Novaluron (Rimon)	0.05 ml/kg	2.08 (1.75)	2.79 (1.94)	3.69 (2.16)
7	Deltamethrin 2.8 EC	0.04 ml/kg	2.94 (1.98)	3.55 (2.13)	5.30 (2.51)
8	Untreated check	-	4.85 (2.41)	7.03 (2.83)	8.76 (3.12)
	CD (p =0.05)		(0.12)	(0.14)	(0.18)

Table 6.37b: Studies on the effect of insecticidal seed treatment on seed viability during storage under ambient conditions against store grain pests 2016-17 (Centre-Kharibari)

S. No.	Name of Treatment	Dose gm/ml/lt.	Before Application Population in fresh grain	Mean no. Insect population			
				1 DAT	5 DAT	10 DAT	20 DAT
1	Emamectin benzoate (Proclaim)	40.0 gm	0.00	0.00	0.00	0.00	35.55
2	Spinosad (Tracer)	5.0 gm	0.00	0.00	0.00	0.00	20.35
3	Indoxacarb (Avaut)	15.0 gm	0.00	0.00	0.00	0.00	18.65
4	Rynaxypyr (Coragen)	100 gm	0.00	0.00	0.00	0.00	45.46
5	Novaluron (Rimon)	0.02ml	0.00	0.00	0.00	0.00	32.78
6	Novaluron (Rimon)	0.05 ml	0.00	0.00	0.00	0.00	24.27
7	Deltamethrin 2.8 EC	0.04 ml	0.00	0.00	0.00	0.00	15.65
8	Untreated check	-	0.00	0.00	3.70	18.65	38.90

Table 6.37c: Effect of insecticidal seed treatment on seed viability during storage under ambient conditions against store grain pests 2016-17 (Centre-Karnal)

S. No.	Treatments	Dosage (mg or ml/kg seed)	Damage (%)	
			1 month	2 month
1	Emamectin benzoate (Proclaim)	40.0 mg/kg	2.61 (1.90)	3.52 (2.13)
2	Spinosad (Tracer)	5.0 mg/kg	2.74 (1.93)	3.48 (2.12)
3	Indoxacarb (Avaut)	15 mg/kg	2.82 (1.95)	3.63 (2.15)
4	Rynaxypyr (Coragen)	100 mg/kg	2.85 (1.96)	3.51 (2.12)
5	Novaluron (Rimon)	0.02 ml/kg	3.22 (2.05)	4.96 (2.16)
6	Novaluron (Rimon)	0.05 ml/kg	2.96 (1.99)	3.50 (2.16)
7	Deltamethrin 2.8 EC	0.04 ml/kg	3.14 (2.03)	7.45 (2.44)
8	Untreated check	-	5.42 (2.53)	7.03 (2.91)
	CD (p =0.05)		(0.17)	(0.15)

II: Efficacy of various plant materials as seed protectant to wheat seed against grain weevil (*Sitophilus oryzae* or *Rhizopertha dominica*)

An experiment was intitaed to test parts of some medicinal plants as seed protectant to wheat seed/grains against major store grain insect pests; *Sitophilus oryzae* or *Rhizopertha dominica* at Niphad and Karnal location. The experiment started during April, 2017 and recording of observations is still in progress.

Treatment details:

TN	Treatments	Dose(g/kg seed)
T1	Neem leaves powder (*Azadirachta indica)*	10 g/kg seed
T2	Vekhand powder (*Acorus calamus*)	10 g/kg seed
T3	Jangli imli powder (*Phyllanthus niruri*)	10 g/kg seed
T4	Giloe (*Tinospora cordifolia*)/Gulvel powder	10 g/kg seed
T5	Vekhand powder + Neem leaves	5+5 g/kg seed
T6	Jangli imli + Neem leaves	5+5 g/kg seed
T7	Giloe + Neem leaves	5+5 g/kg seed
T8	Vekhand powder + Jangli imli	5+5 g/kg seed
T9	Vekhand powder + Giloe	5+5 g/kg seed
T10	Jangli imli + Giloe	5+5 g/kg seed
T11	Untreated control	--

CO-OPERATORS

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ANNEXURES

ANNEXURE 1.1: Seedling Resistance Test of AVT-II against pathotypes of stem rust (*Puccinia graminis tritici*) at Shimla during 2016-17

S. NO.	VARIETY/LINE	PATHOTYPES																				Postulated genes
		11	11A	15-1	21	21-1	21A-2	24A	34-1	40A	40-2	40-3	42B	117A-1	117-1	117-3	117-4	117-5	117-6	122	295	
I - Northern HILLS Zone																						
1	HPW251 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
2	HS375 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+2+*
3	HS490 (C)	S	S	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	MS	R	*Sr9b+2+*
4	HS507 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
5	HS542 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr5+8a+9b+11+*
6	VL829 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+*
7	VL892 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2+*
8	VL907 (C)	NS																				-
II. NORTH WESTERN PLAINS ZONE																						
9	DBW173	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+*
10	DBW88 (C)	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr11+2+*
11	DBW90 (C)	S	S	MS	R	R	MS	S	R	MS	S	MS	MR	MR	MR	MR	MR	R	R	R	MS	*Sr13+2+*
12	HD3043 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
13	HD2967 (C)	R	MR	MS	R	R	R	R	R	S	S	MR	R	R	R	R	R	R	R	R	R	*Sr11+8a+2+*
14	HD3059 (C)	MS	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	MR	R	R	R	R	*Sr11+2+*
15	HD3086 (C)	S	S	S	R	R	MS	MS	R	MS	S	S	R	MR	MS	MR	R	R	MR	R	S	*Sr7b+2+*
16	PBW644 (C)	R	R	R	R	R	R	MR	R	S	R	S	R	R	R	MR	MR	R	R	MR	R	*Sr11+2+*
17	WH1021 (C)	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
18	WH1080 (C)	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	MR	R	R	*Sr9e+2+*
19	WH1105 (C)	MR	R	R	R	R	R	R	R	R	R	NG	R	R	R	R	R	R	R	R	R	*Sr11+2+*
20	WH1124 (C)	S	MS	S	R	MS	R	MS	R	MS	S	R	MR	R	MS	R	MS	MS	MR	MR	R	*Sr7b+2+*
21	WH1142 C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
III. NORTH EASTERN PLAINS ZONE																						
22	HI1612	S	S	S	R	R	R	MR	R	R	S	R	R	MR	MR	S	MR	R	R	R	R	*Sr7b+2+*
23	C306 (C)	S	S	R	S	S	MR	S	MR	S	S	S	S	S	MS	S	S	R	S	S	S	-
24	DBW39 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
25	HD2733 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
26	HD2888 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+2+*
27	HD3171 (I) (C)	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	S	R	*Sr11+7b+2+*
28	K8027 (C)	R	R	R	R	S	R	R	MS	S	MS	R	R	R	R	R	R	R	S	R	R	*Sr11+2+*
29	K0307 (C)	MS	R	R	R	R	R	R	R	S	R	S	R	R	R	R	R	R	R	R	R	*Sr2+*

S. NO.	VARIETY/LINE	PATHOTYPES																				Postulated genes
		11	11A	15-1	21	21-1	21A-2	24A	34-1	40A	40-2	40-3	42B	117A-1	117-1	117-3	117-4	117-5	117-6	122	295	
30	K1006 (C)	MS	R	R	R	R	R	R	R	S	R	S	MR	R	R	R	R	R	R	R	R	*Sr8a+9b+11+*
31	K1317 (I) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
IV. CENTRAL ZONE																						
32	DBW110 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-
33	HI8627 (d) (C)	R	MS	MR	R	R	R	R	R	S	R	R	R	MS	S	MS	MR	R	R	R	R	*Sr9e+2+*
34	MP3288 (C)	R	R	R	R	NG	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	*Sr24+*
V. PENINSULAR ZONE																						
35	DBW168	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
36	HI8777 (d)	S	S	MR	R	R	R	MS	R	S	R	S	S	S	MS	MR	R	R	S	MR	MS	*Sr7b+*
37	MACS 4028 (d)	R	R	R	R	R	R	S	R	R	R	MS	R	R	MR	S	S	S	MS	R	R	*Sr7b+*
38	UAS375	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	*Sr7b+2+*
39	AKDW2997-16 (d)(C)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	*Sr7b+2+*
40	GW322 (C)	S	S	R	R	R	R	R	R	R	R	R	R	R	MS	MS	MS	R	R	R	MS	*Sr11+2+*
41	MACS6222 (C)	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
42	MACS6478 (C)	S	MS	S	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	*Sr28+*
43	NI5439 (C)	S	R	R	R	R	R	S	R	S	R	S	R	MS	R	R	R	R	R	R	R	*Sr11+*
44	NIAW1415 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
45	UAS304 (C)	R	R	R	R	R	R	R	R	R	MR	MS	R	R	R	R	R	R	R	R	R	*Sr28+8a+*
46	UAS446 (C)	R	R	MR	R	R	R	MS	R	S	R	S	MR	MS	S	MS	MR	S	MR	R	R	*Sr11+2+*
VI. SOUTHERN HILLS ZONE																						
47	HW2044 (C)	R	R	R	NG	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+*
48	HW5216 (C)	R	R	R	R	NG	NG	R	R	R	R	R	R	R	R	R	R	NG	R	R	NG	*Sr31+*
49	CoW (W) -1 (C)	R	R	R	R	R	R	NG	NG	R	R	R	R	NG	R	R	R	R	R	R	R	*Sr31+*
VII. SPECIAL TRIAL (MABB-IR-LS-CZ/PZ/WB)																						
50	DBW14 (C)	MS	R	R	R	R	R	R	R	MS	R	MS	R	R	R	R	R	R	R	R	R	*Sr28+11+2+*
51	DBW71 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+*
52	DDK1029 (C)	MR	R	R	R	R	R	S	R	R	R	MR	S	R	MS	MS	MR	MS	R	R	MS	*Sr11+*
53	HW1098 (C)	MS	R	MR	MR	R	R	S	R	R	R	S	S	R	MR	MR	MR	MS	MR	R	MR	*Sr11+2+*
54	Kharchia 65 (C)	S	S	MR	R	R	R	S	MR	S	S	S	S	S	S	S	S	S	R	S	S	*Sr7b+*
55	KRL19 (C)	MR	R	S	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	*Sr8b+9b+11+2+*
56	KRL210 (C)	S	S	S	R	R	S	MR	R	MS	S	MS	MS	R	R	MS	MS	MR	R	MR	S	*Sr7b+2+*
57	PBW550 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*

S. NO.	VARIETY/LINE	PATHOTYPES																				Postulated genes
		11	11A	15-1	21	21-1	21A-2	24A	34-1	40A	40-2	40-3	42B	117A-1	117-1	117-3	117-4	117-5	117-6	122	295	
58	TL2942 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2+*
59	TL2969 (C)	MS	MR	R	R	R	R	R	R	R	R	R	R	NG	R	R	R	R	S	R	R	*Sr2+*
60	WR544 (C)	R	R	R	R	R	R	R	R	S	R	S	R	R	R	R	R	R	R	MR	MS	*Sr28+8a+2+*

ANNEXURE 1.2: Seedling Resistance Test of AVT-II against pathotypes of leaf rust (*Puccinia triticina*) at Shimla during 2016-17

S. NO.	VARIETY/LINE	PATHOTYPES																					Postulated genes
		11	12-2	12-5	12-7	16-1	77	77-1	77-2	77-5	77-7	77-8	77-9	77-10	77A-1	104-2	104-3	104B	106	108-1	162-1	162A	
I - Northern HILLS Zone																							
1	HPW 251 (C)	R	R	R	R	R	R	S	R	S	S	R	R	S	R	S	R	R	R	R	R	R	*Lr26+23+*
2	HS 375 (C)	R	R	MR	R	NG	R	NG	R	MX	MS	-	R	S	NG	R	R	NG	NG	NG	R	R	*Lr26+34+*
3	HS 490 (C)	R	MS	R	R	R	R	R	S	S	NG	R	R	S	R	MS	MR	R	R	R	R	R	*Lr23+*
4	HS 507 (C)	MX	NG	R	R	R	R	R	R	R	NG	R	R	R	R	R	R	R	R	R	R	R	*Lr26+1+*
5	HS 542 (C)	R	R	R	R	R	S	MR	MS	MS	MR	R	NG	S	S	R	R	R	R	R	R	R	*Lr13+10+*
6	VL 829 (C)	R	R	R	R	R	R	MX	R	MR	S	NG	R	MX	R	S	S	R	R	R	R	R	*Lr26+34+*
7	VL 892 (C)	R	R	R	R	MX	R	MS	S	R	S	NG	MR	MS	R	S	R	R	R	R	R	R	-
8	VL 907 (C)																						
II. NORTH WESTERN PLAINS ZONE																							
9	DBW 173	R	R	R	R	R	R	R	R	S	S	R	R	S	R	R	R	R	R	R	R	R	*Lr26+10+3+*
10	DBW 88 (C)	R	R	R	R	R	R	R	S	S	S	S	R	S	S	MS	R	R	R	R	R	S	*Lr13+10+3+*
11	DBW 90 (C)	R	MS	R	S	R	R	S	S	S	S	R	S	S	R	S	S	R	R	R	R	S	*Lr13+10+3+*
12	HD 3043 (C)	R	R	R	S	R	R	S	R	S	S	R	S	NG	R	S	S	R	R	R	R	R	*Lr23+10+*
13	HD 2967 (C)	R	R	MS	R	R	R	R	MS	S	S	R	R	S	R	R	R	R	R	R	R	R	*Lr23+*
14	HD 3059 (C)	R	R	R	R	R	R	S	MS	S	S	MX	S	S	S	R	R	R	R	R	R	R	*Lr13+*
15	HD 3086 (C)	R	MS	R	S	R	R	S	S	S	S	R	S	S	MX	S	S	R	R	R	R	R	*Lr13+10+3+*
16	PBW 644 (C)	R	R	R	R	R	S	S	S	S	S	R	MS	S	R	S	S	S	R	R	R	R	*Lr13+1+*
17	WH 1021 (C)	R	R	R	R	R	R	S	R	R	MX	R	R	R	R	R	R	R	R	R	R	R	*Lr26+1+*
18	WH 1080 (C)	R	MS	S	S	R	R	S	S	S	S	R	S	S	S	S	S	R	R	R	R	MS	*Lr13+*
19	WH 1105 (C)	R	R	R	R	R	S	S	R	S	NG	S	NG	S	S	R	R	R	R	R	R	R	*Lr13+*
20	WH 1124 (C)	R	MS	R	S	R	R	S	S	S	NG	NG	S	S	NG	S	MX	MX	R	R	R	NG	*Lr13+10+*
21	WH 1142 C)	R	R	R	S	R	R	S	R	S	S	R	R	R	R	S	S	R	R	R	R	R	*Lr26+23+*
III. NORTH EASTERN PLAINS ZONE																							
22	HI 1612	R	S	R	R	R	R	R	R	R	R	R	R	R	R	S	S	R	R	R	R	R	*Lr23+*

S. NO.	VARIETY/LINE	PATHOTYPES																					Postulated genes
		11	**12-2**	**12-5**	**12-7**	**16-1**	**77**	**77-1**	**77-2**	**77-5**	**77-7**	**77-8**	**77-9**	**77-10**	**77A-1**	**104-2**	**104-3**	**104B**	**106**	**108-1**	**162-1**	**162A**	
23	C 306 (C)	R	R	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	R	R	S	S	*Lr34+*
24	DBW 39 (C)	R	R	R	R	R	R	R	R	R	R	R	R	MX	S	S	R	R	R	R	R	R	*Lr26+23+10+*
25	HD 2733 (C)	R	R	S	MS	R	R	R	R	S	S	R	S	R	R	S	S	R	R	R	MS	R	*Lr26+34+*
26	HD 2888 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr24+*
27	HD 3171 (I) (C)	R	R	NG	R	R	R	MS	MS	S	S	R	R	S	R	S	S	MS	R	R	R	R	*Lr23+13+10+*
28	K 8027 (C)	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	*Lr13+1+*
29	K 0307 (C)	R	R	R	R	R	R	S	MS	S	S	R	S	S	S	S	S	R	R	R	R	R	*Lr23+1+*
30	K 1006 (C)	R	R	R	R	R	S	MS	R	S	S	R	S	S	S	S	S	MS	R	R	R	R	*Lr13+1+*
31	K 1317 (I) (C)	R	R	R	R	R	S	S	MS	S	R	R	S	S	S	S	S	R	R	S	R	R	-
IV. CENTRAL ZONE																							
32	DBW 110 (C)	R	R	R	R	R	S	S	S	MR	R	R	MR	S	S	R	MS	R	R	R	R	R	*Lr13+*
33	HI 8627 (d) (C)	MS	MS	S	MS	R	R	S	S	S	R	R	S	R	R	S	S	MS	S	R	S	R	-
34	MP 3288 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr24+*
V. PENINSULAR ZONE																							
35	DBW 168	R	R	S	R	R	R	S	R	S	MS	R	R	R	R	R	R	R	R	R	S	R	*Lr26+*
36	HI 8777 (d)	R	S	S	S	S	R	MX	R	S	R	R	R	R	R	S	S	S	MS	R	MS	R	-
37	MACS 4028 (d)	S	MS	S	S	S	S	MS	S	S	S	R	S	S	S	S	S	R	S	R	MX	MX	-
38	UAS 375	R	R	R	R	R	R	S	R	R	S	R	R	R	R	R	R	R	R	R	R	R	*Lr13+1+*
39	AKDW 2997-16 (d))C)	R	R	S	R	MX	R	R	MR	R	R	R	S	R	R	R	R	R	R	R	S	R	-
40	GW 322 (C)	R	R	R	R	R	S	S	S	R	S	R	R	S	S	R	R	R	R	R	R	R	*Lr13+1+*
41	MACS 6222 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr26+1+*
42	MACS 6478 (C)	R	R	R	R	R	R	R	R	MS	MS	R	S	S	R	R	R	R	R	R	R	R	*Lr23+1+*
43	NI 5439 (C)	R	S	MS	S	R	R	S	S	S	S	S	S	S	S	S	S	S	S	R	S	S	*Lr34+*
44	NIAW 1415 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr26+1+*
45	UAS 304 (C)	R	R	R	R	NG	R	R	MS	R	S	MX	S	S	R	R	R	R	R	R	R	R	*Lr23+1+*
46	UAS 446 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
VI. SOUTHERN HILLS ZONE																							
47	HW 2044 (C)	R	R	R	NG	NG	NG	R	R	R	R	R	R	R	R	MX	NG	R	R	R	R	R	*Lr24+*
48	HW 5216 (C)	NG	R	R	R	R	NG	NG	NG	R	R	NG	NG	NG	NG	R	R	R	R	NG	NG	NG	*Lr26+*
49	CoW (W) -1 (C)	R	R	R	R	R	NG	R	NG	R	R	NG	R	NG	NG	R	NG	NG	R	R	R	NG	*Lr26+*
VII. SPECIAL TRIAL (MABB-IR-LS-CZ/PZ/WB)																							
50	DBW 14 (C)	R	R	R	R	R	R	R	MS	S	S	R	MS	S	R	S	S	R	R	R	R	R	*Lr23+*
51	DBW 71 (C)	R	R	S	S	R	R	S	R	S	S	R	R	R	R	S	S	R	R	R	S	S	*Lr26+*
52	DDK 1029 (C)	R	R	S	R	S	R	R	MS	MS	R	R	R	R	R	S	MR	MR	S	R	R	R	*Lr13+*
53	HW 1098 (C)	R	R	S	R	MS	R	R	MS	S	R	R	R	R	R	S	R	MS	S	R	R	R	-
54	Kharchia 65 (C)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	MX	S	S	-
55	KRL 19 (C)	R	MS	MX	S	R	MS	S	MS	S	NG	R	S	S	S	S	S	MR	R	R	R	R	*Lr13+*

S. NO.	VARIETY/LINE	PATHOTYPES																					Postulated genes
		11	12-2	12-5	12-7	16-1	77	77-1	77-2	77-5	77-7	77-8	77-9	77-10	77A-1	104-2	104-3	104B	106	108-1	162-1	162A	
56	KRL 210 (C)	R	R	R	S	R	R	S	S	S	S	R	S	S	R	S	S	R	R	R	S	S	*Lr13+10+*
57	PBW 550 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr26+*
58	TL 2942 (C)	R	R	R	R	R	R	R	R	R	R	NG	R	R	R	R	R	R	R	R	R	R	*Lr13+10+*
59	TL 2969 (C)	R	MR	MS	MS	R	R	MR	R	S	S	MS	MR	S	S	S	MS	S	R	R	R	MS	*Lr23+*
60	WR 544 (C)	R	R	R	R	R	S	R	S	MR	S	R	R	S	MR	R	R	MX	R	R	R	R	*Lr13+1+*

ANNEXURE 1.3: Seedling Resistance Test of AVT-II against pathotypes of stripe rust (*Puccinia striiformis* f. sp. *tritici*) at Shimla during 2016-17

S. NO.	Variety/Line	PATHOTYPES																		Postulated gene
		110S119	79S68	111S68	110S84	46S119	110S247	78S84	6S0	79S4	238S119	110S68	T	P	K	L	38A	7S0	31	
I - Northern HILLS Zone																				
1	HPW 251 (C)	S	R	R	Mix	S	S	R	R	R	Mix	R	R	R	R	R	R	R	R	*Yr9+*
2	HS 375 (C)	-	R	R	R	-	R	-	-	R	-	-	-	-	-	-	-	-	-	*Yr9+18+*
3	HS 490 (C)	S	R	R	R	MS	S	R	R	R	S	R	R	R	R	R	R	R	R	*YrA+*
4	HS 507 (C)	S	R	R	R	R	R	R	-	R	R	-	R	R	R	R	R	R	R	*Yr2+9+*
5	HS 542 (C)	S	R	R	R	S	S	R	R	R	S	Mix	MS	R	R	R	R	R	R	*Yr2+*
6	VL 829 (C)	S	R	R	R	S	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr9+18+*
7	VL 892 (C)	S	R	R	S	R	S	R	R	R	Mix	R	Mix	R	R	R	R	R	R	*YrA+*
8	VL 907 (C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
II. NORTH WESTERN PLAINS ZONE																				
9	DBW 173	S	R	R	R	R	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr9+A+*
10	DBW 88 (C)	S	R	R	R	R	S	R	R	R	MS	R	R	R	R	R	R	R	R	*YrA+*
11	DBW 90 (C)	S	R	R	MS	MS	S	R	R	R	MS	R	S	S	R	R	R	R	R	*Yr2+*
12	HD 3043 (C)	S	R	R	R	R	Mix	R	R	R	Mix	R	R	R	R	R	R	R	R	*Yr2+*
13	HD 2967 (C)	S	R	R	R	MS	S	R	R	R	S	R	S	S	S	MS	R	R	R	*Yr2+*
14	HD 3059 (C)	S	R	R	Mix	R	S	R	R	R	S	R	MR	R	R	R	R	R	R	*Yr2+*

S. NO.	Variety/Line	PATHOTYPES																		Postulated gene
		110S119	79S68	111S68	110S84	46S119	110S247	78S84	6S0	79S4	238S119	110S68	T	P	K	L	38A	7S0	31	
15	HD 3086 (C)	S	R	R	R	MS	S	R	R	R	S	S	S	S	S	R	R	R	R	*Yr2+*
16	PBW 644 (C)	S	Mix	MS	S	R	S	R	R	R	S	S	R	R	R	S	R	R	R	*Yr2+*
17	WH 1021 (C)	S	R	R	R	R	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr9+*
18	WH 1080 (C)	S	R	MS	Mix	MS	S	Mix	R	R	S	R	Mix	S	S	R	R	S	S	*Yr2+*
19	WH 1105 (C)	S	R	R	R	R	S	R	R	R	R	R	MS	R	R	R	R	R	R	*Yr2+*
20	WH 1124 (C)	S	Mix	R	MS	MS	S	R	R	R	MS	R	S	S	MS	R	R	R	R	*Yr2+*
21	WH 1142 C)	S	R	R	R	S	S	R	R	R	S	R	S	MS	R	R	R	R	R	*Yr9+*
III. NORTH EASTERN PLAINS ZONE																				
22	HI 1612	S	R	R	R	S	S	R	R	R	S	R	S	MS	R	R	R	R	R	*Yr2+*
23	C 306 (C)	S	MS	R	MS	MS	S	R	R	R	S	R	S	Mix	R	R	R	R	R	*Yr18+*
24	DBW 39 (C)	S	R	R	R	MS	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr9+*
25	HD 2733 (C)	S	R	R	Mix	S	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr9+18+*
26	HD 2888 (C)	S	R	R	R	MS	Mix	R	R	R	MS	R	S	MS	R	R	R	R	R	*Yr2+*
27	HD 3171 (I) (C)	MS	R	R	R	R	MS	R	R	R	R	R	R	R	S	R	R	R	R	*Yr2+*
28	K 8027 (C)	S	R	R	R	MR	MS	R	R	R	S	R	MS	MS	S	R	R	R	R	*Yr2+*
29	K 0307 (C)	S	R	MS	S	MS	S	R	R	R	S	S	S	R	S	S	S	R	MS	*Yr2+*
30	K 1006 (C)	S	R	S	S	S	R	R	R	R	S	Mix	S	R	S	R	S	R	Mix	*Yr2+*
31	K 1317 (I) (C)	S	R	S	R	S	R	R	R	R	Mix	-	MS	R	S	R	R	R	R	*Yr9+A+*
IV. CENTRAL ZONE																				
32	DBW 110 (C)	S	R	R	MS	S	S	R	R	R	S	R	Mix	S	R	R	R	R	R	*Yr2+*
33	HI 8627 (d) (C)	S	R	R	R	S	MR	R	R	R	S	R	R	R	R	R	R	R	R	*Yr2+*
34	MP 3288 (C)	S	R	R	S	MS	R	R	R	R	S	MS	MS	MS	MS	R	R	R	R	*Yr2+*
V. PENINSULAR ZONE																				
35	DBW 168	S	R	R	R	S	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr9+*
36	HI 8777 (d)	S	R	R	R	MS	MS	MS	R	R	S	R	R	R	S	R	R	R	R	*Yr2+*
37	MACS 4028 (d)	S	S	S	Mix	S	S	S	R	S	S	S	S	S	S	S	Mix	S	Mix	-
38	UAS 375	S	R	R	R	Mix	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr2+*

S. NO.	Variety/Line	PATHOTYPES																		Postulated gene
		110S119	79S68	111S68	110S84	46S119	110S247	78S84	6S0	79S4	238S119	110S68	T	P	K	L	38A	7S0	31	
39	AKDW 2997-16 (d))C)	S	R	MS	R	S	S	S	MS	R	S	MS	Mix	S	S	MS	MR	Mix	R	-
40	GW 322 (C)	S	R	MS	MS	S	S	S	Mix	R	S	MS	S	S	S	MS	R	R	MS	*Yr2+*
41	MACS 6222 (C)	S	R	MS	MS	S	Mix	MS	R	R	Mix	Mix	MS	MR	R	R	R	R	MS	*Yr9+27+*
42	MACS 6478 (C)	S	R	MS	S	MS	S	R	R	R	S	S	R	R	MS	R	R	R	R	*Yr2+*
43	NI 5439 (C)	S	S	S	S	S	S	MS	R	S	S	S	S	S	S	S	S	R	MS	*Yr2+18+*
44	NIAW 1415 (C)	S	R	R	R	S	S	MS	R	R	S	R	R	R	R	R	R	R	R	*Yr9+*
45	UAS 304 (C)	S	MS	S	S	MS	S	R	R	MS	S	Mix	Mix	S	S	S	MS	R	R	*Yr2+*
46	UAS 446 (C)	S	S	MS	MS	R	R	MS	R	R	R	S	Mix	Mix	MS	MS	R	MS	R	*Yr2+*
VI. SOUTHERN HILLS ZONE																				
47	HW 2044 (C)	MS	R	R	MS	R	S	-	-	-	-	MR	R	R	R	-	-	-	-	*Yr2+*
48	HW 5216 (C)	S	R	R	R	-	R	R	-	-	-	R	R	-	R	-	R	-	-	*Yr9+*
49	CoW (W) -1 (C)	S	R	-	-	S	R	R	-	-	S	-	R	R	R	R	R	R	-	*Yr9+*
VII. SPECIAL TRIAL (MABB-IR-LS-CZ/PZ/WB)																				
50	DBW 14 (C)	S	R	R	S	MS	S	MS	R	R	S	MS	R	R	R	MS	R	R	R	*Yr2+*
51	DBW 71 (C)	S	R	R	R	S	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr9+*
52	DDK 1029 (C)	S	S	S	MS	S	MR	MS	R	S	S	S	MS	MS	MS	MS	MS	R	R	-
53	HW 1098 (C)	S	S	MS	MS	MS	MR	MS	R	R	MS	MS	MS	MS	MS	MR	MS	Mix	R	-
54	Kharchia 65 (C)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	-
55	KRL 19 (C)	S	Mix	S	S	S	S	R	R	R	S	R	S	R	S	R	R	R	R	*Yr2+*
56	KRL 210 (C)	S	R	R	R	S	S	R	R	R	S	MS	S	MS	S	MS	R	R	R	*Yr9+A+*
57	PBW 550 (C)	S	R	R	R	S	S	S	R	R	S	R	R	R	R	R	R	R	R	*Yr9+*
58	TL 2942 (C)	S	R	R	MR	S	MS	R	R	R	MR	R	R	R	R	R	R	R	R	-
59	TL 2969 (C)	S	R	R	R	MS	MS	R	R	R	MS	R	R	R	R	R	R	R	R	-
60	WR 544 (C)	S	Mix	MS	S	S	S	MS	R	R	S	S	S	S	S	S	R	Mix	Mix	*Yr2+*

ANNEXURE 1.4: Seedling Resistance Test of AVT-I against pathotypes of stem rust (*Puccinia graminis tritici*) at Shimla during 2016-17

S. NO.	VARIETY/LINE	PATHOTYPES																				Postulated genes
		11	11A	15-1	21	21-1	21A-2	24A	34-1	40A	40-2	40-3	42B	117A-1	117-1	117-3	117-4	117-5	117-6	122	295	
Northern HILLS Zone																						
1	DBW179	R	R	R	R	R	R	R	R	MR	R	S	R	R	R	R	R	R	R	R	R	*Sr*8a+5+2+
2	DBW204	NS																				
3	HPW434	NS																				
4	HPW438	NS																				
5	HPW439	S	S	S	R	R	R	R	MS	S	S	S	R	MS	R	R	R	R	R	MS	R	*Sr*7b+
6	HPW440	MR	R	R	R	R	R	R	R	S	R	MS	R	R	R	R	R	R	R	R	R	*Sr*7b+9e+2+
7	HPW448	R	R	R	R	R	R	NG	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*31+2+
8	HPW449	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*31+
9	HS629	MR	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	NG	R	*Sr*28+
10	HS630	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*2+
11	HS643	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*2+
12	HS644	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*31+5+
13	HS645	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	*Sr*5+8a+11+
14	HS646	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*31+5+2+
15	HS647	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*31+5+
16	HS648	MS	S	S	R	R	R	R	R	S	S	R	MR	R	R	R	R	R	R	R	R	*Sr*28+2+
17	UP2992	S	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	S	*Sr*5+11+2+
18	UP2993	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*5+2+
19	VL1011	S	R	R	R	R	R	R	R	R	R	S	MS	MR	S	R	MR	MS	R	R	S	*Sr*7b+11+
20	VL1012	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*2+
21	VL1013	S	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	S	*Sr*5+11+
22	VL3013	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*2+
23	VL3014	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr*25+
24	VL3015	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	MR	*Sr*7b+
25	VL4002	R	NG	R	R	NG	R	R	R	R	NG	R	NG	R	NG	R	NG	R	NG	R	NG	R
26	VL4003	S	NG	R	R	R	NG	NG	R	NG	NG	R	R	R	R	R	R	R	R	R	R	-
North Western PLAINS Zone																						
27	BRW3773	S	R	R	R	R	R	R	R	R	R	R	MS	R	MR	R	MR	R	R	R	R	*Sr*13+11+
28	CG1023	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*28+
29	DBW189	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*9b+11+2+
30	DBW196	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*9b+11+5+2+

S. NO.	VARIETY/LINE	PATHOTYPES																				Postulated genes
		11	11A	15-1	21	21-1	21A-2	24A	34-1	40A	40-2	40-3	42B	117A-1	117-1	117-3	117-4	117-5	117-6	122	295	
31	HD3226	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
32	HD3237	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
33	HI1617	R	MR	MR	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr*28+5+2+
34	HI1619	S	S	S	R	MR	S	MR	R	MS	S	R	R	MR	MR	MR	MS	R	R	R	MR	-
35	HI1620	S	R	R	R	R	R	R	R	R	R	MS	R	R	MR	R	R	R	R	R	R	*Sr*7b+11+
36	HP1963	S	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	*Sr*11+5+
37	HS611	R	R	MS	R	NG	R	MS	R	R	S	R	S	R	S	R	MR	R	MR	R	MR	*Sr*2+
38	MACS6677	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	-
39	MP1318	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
40	PBW750	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*5+11+
41	PBW752	S	R	R	R	R	R	R	R	R	R	S	S	R	R	R	R	R	R	R	R	*Sr*13+11+
42	UP2942	S	MS	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	*Sr*5+28+
43	WH1202	S	MS	S	R	MR	MR	R	R	S	S	MR	S	R	MR	MR	MR	MR	S	R	MR	-
North East PLAINS Zone																						
44	DBW187	S	S	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	*Sr*30+
45	HD3219	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
46	UAS384	S	R	R	R	R	R	R	R	MR	MR	R	R	R	S	R	R	R	R	R	R	*Sr*9b+11+2+
Central Zone																						
47	BRW3775	S	R	MS	R	R	R	R	R	R	MR	MR	R	R	R	R	R	R	R	R	R	*Sr*28+
48	HI8791 (d)	R	R	R	R	R	R	MR	R	MR	R	R	R	MR	R	R	MR	R	MR	R	R	*Sr*11+
49	UAS385	R	R	R	R	R	R	R	R	MS	R	MR	R	R	S	MR	MS	R	R	R	R	*Sr*9b+11+
50	UAS462 (d)	R	R	MS	R	R	R	S	R	S	R	MS	R	S	S	MS	MR	R	R	R	R	*Sr*7b+
South HILLS Zone																						
51	UAS387	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*S* 31+
Special Trial (Dicc. MABB)																						
52	DBW246	MR	R	R	R	R	R	R	R	R	R	S	MR	R	R	R	R	R	R	R	R	*Sr*9b+11+2+
53	DBW247	R	R	MS	R	R	R	MR	R	R	R	S	S	MR	MR	R	MR	R	R	MR	MS	*Sr*7b+2+
54	DBW248	S	MR	S	R	R	R	R	R	S	MS	S	R	R	R	MR	R	R	R	MR	MS	*Sr*7b+
55	DDK1052	MS	R	MS	MR	R	R	S	R	MS	R	R	S	MR	MR	R	MR	MR	MR	MS	S	*Sr*7b+
56	DDK1053	MS	R	R	R	R	R	S	R	R	R	R	S	MS	MR	R	MR	R	MS	S	MS	*Sr*7b+11+
57	KRL370	MR	R	MR	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	*Sr*30+5+2+
58	KRL377	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R
59	KRL384	R	R	S	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	*Sr*30+

S. NO.	VARIETY/LINE	PATHOTYPES																				Postulated genes
		11	11A	15-1	21	21-1	21A-2	24A	34-1	40A	40-2	40-3	42B	117A-1	117-1	117-3	117-4	117-5	117-6	122	295	
60	KRL386	R	R	S	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	*Sr*30+2+
61	MACS5047	MS	R	R	R	R	R	S	R	R	R	R	S	R	MR	MR	MR	R	S	R	R	*Sr*11+13+
62	MACS5049	MR	R	R	R	R	R	MS	R	MR	R	R	MS	MR	MR	R	R	R	R	MS	MR	*Sr*7b+11+
63	PBW779	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*31+5+
64	PBW780	R	R	MS	R	R	R	R	R	R	MS	MS	R	R	R	R	R	R	R	R	R	-
65	WH1316	MR	R	S	MR	R	R	R	R	R	MR	MR	R	R	R	R	R	R	R	R	R	*Sr*28+2+
Special Trials (Triticale)																						
66	TL3011	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*31+2+
67	TL3012	R	R	R	R	R	R	R	R	R	R	R	NG	R	R	NG	R	NG	R	R	R	-
68	TL3013	R	R	R	R	R	R	R	R	R	R	NG	R	R	R	R	R	R	R	R	R	*Sr*31+
69	TL3014	R	R	R	R	R	R	R	R	MR	R	NG	R	R	R	R	R	R	R	R	R	*Sr*31+2+
70	TL3015	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	NG	NG	R	-
Special Trials (Very Late sown)																						
71	DBW249	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MS	*Sr*5+11+
72	DBW250	MR	R	S	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	*Sr*28+2+
73	DBW251	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr*25+
74	HD3271	S	S	S	R	MS	MS	S	R	S	S	S	MR	R	MS	MR	MR	MS	MR	S	MS	*Sr*2+
75	HD3272	S	R	S	R	R	R	R	R	S	MR	MR	R	R	S	R	MS	R	R	R	R	*Sr*7b+
76	HI1621	R	S	S	R	R	R	R	R	R	S	MS	R	R	R	R	R	R	R	R	R	*Sr*28+
77	PBW757	S	R	R	R	R	R	R	R	MR	R	MR	R	R	R	R	R	R	R	R	R	*Sr*5+8a+2+
78	PBW777	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*31+
79	PBW778	R	R	MS	R	R	R	R	R	R	S	R	R	R	S	R	R	R	R	R	R	*Sr*9e+7b+
80	WH1232	R	R	MR	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	*Sr*28+
81	WH1233	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*30+5+2+
82	HS 375 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	NG	*Sr*31+5+
83	HS 490(C)	S	MS	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	*Sr*28+
84	DBW 204	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr*2+
85	HPW 434	S	R	MS	R	R	R	R	R	S	MR	R	R	R	MR	R	R	R	R	R	R	*Sr*7b+
86	HPW 438	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	NG	R	R	R	*Sr*31+

ANNEXURE 1. 5: Seedling Resistance Test of AVT-I against pathotypes of leaf rust (*Puccinia triticina*) at Shimla during 2016-17

S. NO.	VARIETY/LINE	PATHOTYPES																					Postulated genes
		11	12-2	12-5	12-7	16-1	77	77-1	77-2	77-5	77-7	77-8	77-9	77-10	77A-1	104-2	104-3	104B	106	108-1	162-1	162-A	
Northern HILLS Zone																							
1	DBW 179	R	R	R	R	R	R	S	MS	S	R	R	MS	S	R	R	MS	R	R	R	R	R	*Lr13+10+1+*
2	DBW 204	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	HPW 434	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	HPW 438	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	HPW 439	R	R	R	R	R	R	R	R	MS	MS	R	MS	S	R	MS	S	R	R	R	R	R	*Lr23+10+*
6	HPW 440	R	R	S	R	R	R	R	R	MS	R	MS	S	S	R	R	R	R	R	R	MR	R	*Lr23+13+*
7	HPW 448	NG	NG	S	R	NG	NG	MS	NG	S	R	R	NG	MX	R	R	R	R	NG	R	R	R	*Lr26+23+*
8	HPW 449	R	R	R	R	R	R	MS	R	R	R	R	NG	MX	R	R	R	R	R	R	R	R	*Lr26+10+1+*
9	HS 629	R	NG	NG	MS	R	S	S	MS	S	MR	NG	S	MS	NG	MS	MS	R	R	NG	R	NG	*Lr13+*
10	HS 630	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	*R*
11	HS 643	R	R	S	MS	R	R	R	MS	R	NG	R	S	NG	R	S	S	R	R	R	R	R	*Lr23+13+*
12	HS 644	R	R	R	R	R	R	S	R	R	MS	R	R	R	R	MX	R	R	R	R	R	NG	*Lr26+1+*
13	HS 645	R	NG	R	R	R	R	R	MS	R	NG	NG	S	S	R	S	S	R	R	NG	R	R	*Lr23+13+*
14	HS 646	R	R	R	R	R	R	R	R	MR	MS	R	R	R	R	S	S	R	R	R	R	R	*Lr26+23+*
15	HS 647	R	R	R	S	R	R	R	R	S	R	R	MS	S	R	MS	MS	R	R	R	R	R	*Lr26+10+*
16	HS 648	R	R	R	R	R	R	R	S	MS	MS	R	R	R	R	R	R	R	R	R	R	R	*Lr23+1+*
17	UP 2992	R	R	R	R	R	R	R	S	MR	NG	R	R	S	R	R	R	R	R	R	R	R	*Lr23+1+*
18	UP 2993	R	MS	R	R	R	S	S	S	S	NG	R	R	MR	S	S	S	R	R	R	R	S	*Lr13+*
19	VL 1011	R	S	S	S	R	S	S	S	S	R	NG	S	S	S	S	S	S	R	R	S	MS	*Lr13+*
20	VL 1012	R	R	R	R	R	NG	S	S	S	MS	R	MS	S	S	R	R	R	R	R	R	R	*Lr13+10+1+*
21	VL 1013	R	S	S	*	R	S	R	R	S	R	R	S	S	R	S	S	NG	R	NG	MX	S	*Lr13+*
22	VL 3013	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	NG	R	R	R	R	*R*
23	VL 3014	R	R	R	NG	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Lr19+*
24	VL 3015	R	R	R	NG	R	R	R	R	MR	MX	R	MS	MS	MS	R	R	R	R	R	R	R	*Lr13+10+1+*
25	VL 4002	NG	R	R	R	NG	NG	NG	R	MR	NG	NG	NG	R	MS	NG	R	MS	R	R	NG	R	*Lr13+1+*
26	VL 4003	R	NG	R	MS	NG	NG	MR	R	NG	S	NG	NG	MS	S	S	NG	R	R	R	R	NG	*Lr13+10+*
North Western PLAINS Zone																							
27	BRW 3773	R	R	R	R	R	S	S	S	MR	MS	R	MR	S	S	MR	R	R	R	R	R	R	*Lr13+*
28	CG 1023	R	R	S	MS	R	S	MR	R	S	R	R	S	S	S	S	S	S	R	R	S	R	*Lr13+10+*
29	DBW 189	R	R	R	R	R	R	S	S	S	S	R	S	S	R	R	R	R	R	R	S	R	*Lr13+10+*
30	DBW 196	R	R	R	R	R	MR	S	MS	R	S	R	S	S	S	R	R	R	R	R	R	R	*Lr13+10+1+*

S. NO.	VARIETY/LINE	PATHOTYPES																					Postulated genes
		11	**12-2**	**12-5**	**12-7**	**16-1**	**77**	**77-1**	**77-2**	**77-5**	**77-7**	**77-8**	**77-9**	**77-10**	**77A-1**	**104-2**	**104-3**	**104B**	**106**	**108-1**	**162-1**	**162-A**	
31	HD 3226	R	MS	R	S	R	R	R	MS	S	S	R	MR	S	R	S	S	R	R	R	MX	S	*Lr23+10+*
32	HD 3237	R	MS	MX	MS	R	S	S	S	S	S	S	MR	S	S	S	S	R	R	R	R	R	*Lr13+3+*
33	HI 1617	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	*Lr23+10+1+*
34	HI 1619	R	R	R	S	R	R	R	S	S	MS	R	NG	S	R	S	S	R	R	R	R	R	*Lr13+10+3+*
35	HI 1620	R	R	R	R	R	R	MX	S	MS	S	R	S	MS	R	R	R	R	R	R	R	R	*Lr13+10+3+*
36	HP1963	R	MS	R	MS	R	S	S	S	S	S	S	MR	S	MX	S	MS	MR	R	MS	R	S	*Lr13+10+*
37	HS 611	R	S	S	S	NG	MS	R	MS	S	NG	R	S	S	R	R	R	MS	R	R	R	R	*Lr13+*
38	MACS 6677	R	S	R	MS	R	R	S	S	S	S	S	S	S	MS	S	S	R	R	R	*	R	*Lr10+3+*
39	MP 1318	R	NG	MX	R	R	S	S	MS	MR	R	NG	S	S	S	S	S	MS	R	S	R	R	*Lr13+1+*
40	PBW 750	R	R	R	R	R	R	R	R	RR	R	MR	S	R	R	R	R	R	R	R	R	R	*Lr23+10+*
41	PBW 752	R	R	R	R	R	R	S	S	MS	R	S	S	S	R	R	R	R	R	R	MS	R	*Lr13+10+*
42	UP 2942	R	R	R	R	R	R	S	R	MS	R	S	MR	S	NG	R	R	R	R	NG	R	R	*Lr13+1+*
43	WH 1202	R	R	R	R	R	R	S	S	S	S	R	S	S	R	S	S	MR	R	R	R	MS	*Lr13+10+*
North East PLAINS Zone																							
44	DBW 187	R	R	R	R	R	R	R	R	MS	MX	R	R	MS	R	R	R	R	R	R	R	R	*Lr23+10+2a+*
45	HD 3219	R	R	R	R	R	R	S	MX	R	S	R	MR	S	S	R	R	R	R	R	R	R	*Lr13+1+*
46	UAS 384	R	R	R	MX	R	R	R	MS	R	MX	R	S	S	MX	R	MX	R	R	R	R	R	*Lr23+3+1+*
Central Zone																							
47	BRW 3775	R	R	R	R	R	MR	S	S	S	S	S	S	NG	S	R	R	R	R	R	R	R	*Lr**13+3+1+***
48	HI 8791 (d)	R	MS	S	MS	MS	S	MS	MS	S	R	R	R	R	R	S	S	MS	S	R	R	R	*Lr**13+3+***
49	UAS 385	R	R	R	MX	R	S	S	S	MR	S	R	S	S	S	R	R	R	R	R	R	R	*Lr13+1+*
50	UAS 462 (d)	R	MS	S	MS	MS	S	R	MX	S	MS	R	S	MS	R	S	S	MS	MS	R	MX	R	*Lr13+3+*
South HILLS Zone																							
51	UAS 387	R	R	MS	MS	R	R	MS	R	S	S	R	S	R	R	S	S	R	R	R	R	R	*Lr26+*
Special Trial (Dicc. MABB)																							
52	DBW 246	R	R	R	R	R	R	MS	MR	S	S	R	R	S	R	R	R	R	R	R	R	R	*Lr23+10+*
53	DBW 247	R	S	S	NG	R	S	MR	MS	S	S	R	S	S	S	S	S	S	R	R	R	R	*Lr13+3+*
54	DBW 248	R	R	R	R	R	S	S	S	S	R	R	S	S	S	S	MS	R	R	S	R	R	*Lr13+1+*
55	DDK 1052	MS	R	MX	R	NG	R	R	R	R	R	R	R	R	MX	S	R	MS	S	R	MR	R	-
56	DDK 1053	R	R	S	R	MS	R	R	S	S	R	R	R	R	R	R	R	R	S	R	R	R	-
57	KRL 370	R	R	R	R	R	R	R	R	S	MS	R	R	MS	R	R	R	R	R	R	R	R	*Lr23+11+2a+*
58	KRL 377	R	R	R	R	R	S	S	MR	S	S	R	MR	MS	S	R	R	R	R	R	R	R	*Lr13+1+*
59	KRL 384	R	S	R	R	R	MR	S	S	S	S	R	MR	S	MX	R	MX	R	R	R	R	R	*Lr13+10+2a+*

S. NO.	VARIETY/LINE	PATHOTYPES																					Postulated genes
		11	12-2	12-5	12-7	16-1	77	77-1	77-2	77-5	77-7	77-8	77-9	77-10	77A-1	104-2	104-3	104B	106	108-1	162-1	162-A	
60	KRL 386	R	S	S	MS	R	R	R	R	S	R	R	MR	R	R	S	S	R	R	R	R	R	*Lr23+3+2a+*
61	MACS 5047	MS	R	R	R	S	R	R	MS	MR	R	R	MR	R	R	R	R	MR	S	R	R	R	-
62	MACS 5049	MS	R	S	R	R	R	R	MS	MX	MX	R	R	R	MS	R	R	MR	R	R	R	R	-
63	PBW 779	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr26+23+10+*
64	PBW 780	R	R	S	MS	R	MX	R	R	S	NG	R	R	S	R	S	R	NG	R	NG	R	R	*Lr23+*
65	WH 1316	R	S	R	S	R	R	S	S	S	NG	R	MR	S	R	S	S	R	R	R	R	R	*Lr13+10+3+*
Special Trials (Triticale)																							
66	TL 3011	R	R	R	R	R	R	R	R	R	MR	R	NG	R	R	R	R	R	R	R	R	R	*Lr26+23+1+*
67	TL 3012	NG	R	R	R	NG	R	R	MR	R	S	NG	R	MS	S	R	R	R	R	R	R	NG	*Lr13+*
68	TL 3013	R	R	R	MS	R	R	R	R	R	R	R	R	MX	R	S	MR	R	R	R	R	R	*Lr26+10+3+*
69	TL 3014	R	R	MS	R	NG	R	R	R	R	MR	MR	R	R	R	R	R	R	R	R	R	R	*Lr26+23+*
70	TL 3015	MS	R	R	MS	R	S	S	R	S	S	MS	S	MS	S	MS	S	R	S	R	MS	R	-
Special Trials (Very Late sown)																							
71	DBW249	R	R	R	R	R	R	S	S	MS	R	R	S	S	MS	R	R	R	R	R	R	R	*Lr13+3+1+*
72	DBW250	R	MS	S	S	R	R	R	R	S	R	R	MR	R	R	S	S	R	R	R	R	S	*Lr13+*
73	DBW251	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Lr19+*
74	HD3271	R	R	R	MS	R	R	R	R	S	MS	R	R	S	R	R	R	R	R	R	R	R	*Lr13+10+*
75	HD3272	R	MS	MS	MS	R	MR	R	S	S	MS	R	MR	S	S	S	S	R	R	R	R	R	*Lr13+3+*
76	HI1621	R	MS	MS	R	R	S	S	S	S	S	S	MR	S	S	R	R	R	R	R	R	R	*Lr13+*
77	PBW757	R	R	R	R	R	R	S	S	S	S	S	S	S	MS	R	R	R	R	R	R	R	*Lr13+10+1+*
78	PBW777	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	*Lr26+23+1+*
79	PBW778	R	R	R	R	R	R	R	R	R	R	NG	MR	MS	R	R	R	R	R	NG	R	R	*Lr23+1+*
80	WH1232	R	MS	R	R	R	R	R	R	R	R	MS	R	R	R	R	MS	R	R	R	R	R	*Lr23+10+3+*
81	WH1233	R	R	S	R	R	S	S	MS	R	MS	R	R	R	S	R	R	R	R	R	R	R	*Lr13+3+2a+*
82	HS 375 (C)	R	R	R	R	NG	R	S	R	S	NG	NG	R	R	NG	R	MX	NG	R	NG	R	NG	*Lr26+1+*
83	HS 490(C)	R	R	MS	R	R	R	R	S	MS	R	R	R	S	R	S	S	R	R	R	R	R	*Lr23+3+*
84	DBW 204	R	R	R	R	R	R	R	MR	R	S	R	S	S	R	R	R	R	R	NG	R	R	*Lr23+13+*
85	HPW 434	R	S	S	R	R	NG	MS	S	S	S	R	S	S	MS	S	S	R	R	R	R	NG	*Lr13+3+*
86	HPW 438	R	R	MS	R	R	NG	R	R	S	S	R	R	R	R	S	S	R	R	NG	R	R	*Lr26+23+*

ANNEXURE 1.7: SRT of AVT wheat genotypes against pathotypes of stem rust during 2016-17 at Mahableshwar

Sr. No.	Genotypes	Reaction against stem rust pathotypes									
		R-11	R-24-A	R-34	R-40-A	R-42	R-117-3	R-117-4	R-117-6	R-122	R-295
AVT I											
Central Zone											
47	BRW-3775	R	R	R	R	R	R	R	R	R	R
48	HI-8791(d)	R	R	R	S	R	S	R	R	R	S
49	UAS-385	R	R	R	R	R	R	R	R	R	R
50	UAS-462 (d)	R	R	R	R	S	S	S	R	R	R
AVT – II											
Central Zone											
32	DBW-110 (C)	R	R	R	R	R	R	R	R	R	R
33	HI-8627 (d) (C)	R	R	R	S	S	S	R	R	R	R
34	MP-3288 (C)	R	R	R	R	R	R	S	R	R	S
PENINSULAR ZONE											
35	DBW-168	R	R	R	R	R	R	R	R	R	R
36	HI-8777 (d)	R	R	R	R	R	R	S	S	R	R
37	MACS-4028 (d)	R	R	R	R	R	R	R	R	R	R
38	UAS-375	R	R	R	R	R	R	R	R	R	R
39	AKDW-2997-16 (d)(C)	S	R	R	R	S	R	S	R	R	S
40	GW-322 (C)	R	R	R	R	S	R	R	R	R	R
40A	INFECTOR	S	S	S	S	S	S	S	S	S	S
41	MACS-6222 (C)	R	R	R	R	R	R	R	R	R	S
42	MACS-6478 (C)	R	R	R	R	R	R	S	NG	R	NG
43	NI-5441 (C)	NG	R	R	S	R	S	R	R	R	S
44	NIAW-1415 (C)	R	R	R	R	R	R	R	R	R	R
45	UAS-304 (C)	NG	R	R	R	R	S	S	NG	R	S
46	UAS-446 (C)	S	S	R	R	R	S	S	R	S	S

ANNEXURE 1.8: SRT of AVT against pathotypes of leaf rust during 2016-2017 at Mahabaleshwar

Sr. No.	AVT I Genotypes	Reaction against leaf rust pathotypes															
		77-1	77-2	77-3	77-4	77-5	77-6	77-8	77-9	12-2	12-3	12-5	104-1	104-2	104B	162-1	162-2
AVT II																	
32	DBW-110 (C)	R	S	R	R	R	R	R	S	R	R	R	R	R	R	R	R
33	HI-8627 (d) (C)	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R
34	MP-3288 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
35	DBW-168	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
36	HI-8777 (d)	R	S	R	S	R	R	R	NG	R	R	R	R	R	R	R	R
37	MACS-4028 (d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
38	UAS-375	R	S	S	R	S	R	S	NG	S	R	R	R	S	R	R	S
39	AKDW-2997-16 (d)(C)	S	S	R	R	R	R	R	NG	R	R	R	R	R	R	R	R
40	GW-322 (C)	R	S	R	R	R	R	R	NG	R	R	R	R	R	R	R	R
40A	INFECTOR	S	S	S	S	S	NG	S	S	NG	S	S	S	S	S	S	S
41	MACS-6222 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
42	MACS-6478 (C)	R	S	S	R	S	R	S	S	S	R	S	R	S	R	R	S
43	NI-5441 (C)	R	S	S	S	S	R	S	S	S	R	S	S	S	R	R	S
44	NIAW-1415 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
45	UAS-304 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
46	UAS-446 (C)	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R
AVT I																	
47	BRW-3775	R	S	S	R	S	R	S	S	NG	R	S	R	S	S	R	S
48	HI-8791(d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
49	UAS-385	R	S	S	S	S	R	NG	S	R	R	R	R	R	R	R	S
50	UAS-462 (d)	R	R	S	S	S	R	R	S	S	R	S	R	S	R	R	S

ANNEXURE 1.9 : Reaction of NIVT wheat genotypes at seedling stage against pathotypes of stem rust during 2016-17 at Mahabaleshwar

Sr. No.	NIVT 4 Genotypes	Reaction against stem rust pathotypes									
		R-11	R-24-A	R-34	R-40-A	R-42	R-117-3	R-117-4	R-117-6	R-122	R-295
1.	HI8801	R	R	R	R	S	S	R	R	S	S
2.	GW1341	R	R	R	R	R	R	R	R	R	R
3.	NIAW1101	R	NG	R	R	S	S	R	R	NG	NG
4.	AKDW5012	R	S	R	S	S	S	R	R	R	R
5.	DDW44	R	R	R	S	R	S	R	R	R	S
6.	GW1339	R	R	R	NG	R	R	S	R	R	S
7.	MACS4064	R	R	R	R	R	R	R	R	R	R
8.	MACS4067	R	R	R	R	R	R	R	R	R	R
9.	UPD99	S	S	R	S	S	S	S	S	R	R
10.	AKDW5013	R	R	R	R	R	R	R	R	R	R
11.	PBND5128	R	R	R	R	R	S	R	S	S	S
12.	HI8800	R	R	R	R	R	S	R	R	R	S
13.	PDW351	R	NG	NG	S	R	R	R	R	R	NG
14.	MPO1344	R	R	S	R	R	S	R	R	R	S
15.	PDW354	R	S	S	NG	R	S	R	S	R	NG
16.	MACS4071	R	R	R	NG	R	R	R	R	R	S
17.	HI8799	R	R	R	R	R	R	R	R	R	R
18.	PDW353	NG	R	R	R	S	R	NG	R	NG	R
19.	GW1338	R	R	R	R	R	R	R	R	R	R
20.	UAS465	R	R	R	R	R	R	R	S	S	S
21.	MPO1343	R	R	R	R	R	R	R	R	R	R
22.	WHD961	R	NG	NG	R	S	S	R	R	R	R
23.	RKD320	R	R	R	R	R	S	R	R	R	NG
24.	PDW352	R	R	NG	NG	R	NG	S	S	R	R
25.	GW1340	R	R	R	R	R	S	R	R	NG	NG
26.	HI8797	S	R	R	R	R	R	R	R	S	R
27.	UAS464	R	R	R	R	S	R	R	R	R	S
28.	HI8795	R	R	R	R	S	R	R	S	R	R
29.	NIAW1100	S	R	R	R	S	R	R	R	S	R
30.	RKD318	R	R	R	R	R	R	R	R	R	R
31.	WHD962	R	R	R	R	R	R	R	R	R	R
32.	HI8798	S	R	R	R	R	R	R	R	R	S
33.	UAS428(c)	R	S	R	R	S	S	S	S	S	R
34.	DDW43	S	S	S	S	S	S	S	S	S	S
35.	HI8737(c)	R	R	R	S	S	R	R	R	R	R
36.	HI8796	S	S	R	S	R	R	R	R	R	R

ANNEXURE 1. 10: Reaction of NIVT wheat genotypes at seedling stage against leaf pathotypes of leaf rust during 2016-2017 at Mahabaleshwar

Sr. No.	NIVT 4 Genotypes	Reaction against leaf rust pathotypes															
		77-1	77-2	77-3	77-4	77-5	77-6	77-8	77-9	12-2	12-3	12-5	104-1	104-2	104B	162-1	162-2
1	HI8801	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R
2	GW1341	NG	R	R	R	R	R	R	NG	R	R	R	R	R	R	R	R
3	NIAW1101	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
4	AKDW5012	R	R	R	R	R	R	R	S	S	R	S	R	R	R	R	R
5	DDW44	R	S	R	R	R	R	R	NG	R	R	R	R	R	R	R	R
6	GW1339	R	R	R	S	R	R	R	NG	NG	R	R	R	R	R	R	R
7	MACS4064	R	R	R	R	R	R	R	NG	R	R	R	R	R	R	R	R
8	MACS4067	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R
9	UPD99	R	S	S	R	R	R	R	S	S	R	R	R	R	R	R	R
10	AKDW5013	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R
11	PBND5128	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
12	HI8800	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R
13	PDW351	R	S	R	R	R	R	R	NG	R	R	R	R	R	R	R	R
14	MPO1344	R	R	R	R	S	R	R	S	R	R	R	R	R	R	R	R
15	PDW354	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R
16	MACS4071	R	S	R	R	R	R	R	S	S	R	S	R	R	R	R	R
17	HI8799	R	S	S	S	R	R	R	NG	R	R	R	R	R	R	R	R
18	PDW353	R	R	S	R	R	NG	R	R	R	R	R	R	R	R	R	R
19	GW1338	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
20	UAS465	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
21	MPO1343	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
22	WHD961	NG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
23	RKD320	NG	NG	R	S	R	R	R	S	S	R	S	R	R	R	R	R
24	PDW352	NG	R	NG	S	R	R	R	R	R	R	R	R	R	R	R	R
25	GW1340	R	S	R	R	R	R	R	S	R	R	S	R	R	R	R	R
26	HI8797	R	S	R	S	R	R	R	R	R	R	R	R	R	R	R	R
27	UAS464	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R
28	HI8795	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R
29	NIAW1100	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
30	RKD318	R	R	NG	S	R	R	R	R	R	R	R	R	R	R	R	R
31	WHD962	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
32	HI8798	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
33	UAS428(c)	NG	S	R	S	R	R	R	R	R	R	R	R	R	R	R	R
34	DDW43	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R
35	HI8737(c)	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R
36	HI8796	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

Annexure Table 1.11. Reactions of IPPSN entries against rusts and leaf blight, 2016-17

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
1. Dr. N. S. Bains, Punjab Agricultural University, Ludhiana											
1	BWL 5179	10MS	3.0	20MS	3.4	0	0.0	0	0.0	46	35
2	BWL 5196	10MS	7.3	20MS	4.0	0	0.1	10S	5.0	67	45
3	BWL 5199	TR	0.1	5MS	0.9	0	0.1	20S	10.0	47	24
4	BWL 5205	30S	11.6	30S	7.6	10MR	1.3	10S	2.5	47	34
5	BWL 5233	40S*	16.5	10MS	1.6	TMR	0.1	60S	19.3	47	46
6	BWL 5240	30S	14.7	20MS	5.0	0	0.0	TMS	0.3	67	46
7	BWL 5241	20 MS	8.7	5 MS	1.8	0	0.0	5MS	2.8	58	46
8	BWL 5302	10MS	3.4	20S	4.3	0	0.0	10S	4.0	67	45
9	BWL 5303	5S	1.9	60S	19.2	40S	15.0	0	0.0	46	35
10	BWL 5328	30S	13.1	30S	7.7	40MR	7.0	5S	2.5	67	35
11	BWL 5333	40MS	16.3	5MS	0.8	0	1.7	10S	3.8	46	35
12	BWL 5336	20 MS	10.8	5MS	1.6	10MR	1.3	5MS	1.0	56	35
13	BWL 5339	40MS	12.4	20MS	3.2	0	0.0	0	0.0	67	35
14	BWL 5352	40S*	15.0	20MS	3.8	10MR	1.3	20S	6.0	46	35
15	BWL 5373	10S	5.2	40S	10.4	40S*	13.3	5R	0.3	56	46
16	BWL 5388	40S*	18.7	10MS	1.8	0	0.0	10MS	3.6	67	46
17	BWL 5390	60S	27.3	10MS	1.8	10MR	1.3	10MR	2.1	57	46
18	BWL 5391	80S	34.0	10MS	1.8	0	0.0	10MS	5.2	46	35
19	BWL 5401	20MS	11.7	TMS	0.2	0	0.0	TMR	0.1	36	35
20	BWL 5417	40MS-S	13.1	40S	9.6	0	0.0	5S	1.3	46	35
20. A	INFECTOR	100S	86.7	100S	82.0	80S	73.3	80S	80.0	89	79
21	BWL 5425	80S	34.7	30S	11.2	5S	1.7	TR	0.1	56	35
22	BWL 5426	80 S	36.9	60S	16.4	10MR	1.3	0	0.0	56	45
23	BWL 5429	10S	4.1	10S	2.0	0	0.0	10S	2.5	78	57
24	BWL 5431	40S	20.3	10MS	2.8	20S	6.7	60S	65.0	67	56
25	BWL 5432	10MS	4.7	10MS	2.4	10S	3.6	60S	60.0	78	57
26	BWL 5433	10S	4.9	10S	2.9	20S	13.6	60S	24.5	78	57
27	BWL 5434	30S	26.0	20S	5.6	5S	1.7	40S	23.3	78	56
28	BWL 5435	20MS	12.7	10MS	2.6	10MR	1.3	40S	16.5	68	57
29	BWL 5436	20S	13.3	10MS	2.6	0	0.0	5MS	1.6	47	35
30	BWL 5437	20S	10.7	10S	3.6	20MR	4.3	5MS	2.8	46	35
31	BWL 5438	20MS	8.0	TS	0.2	TR	0.1	10S	2.5	68	57
32	BWL 5439	30S	18.0	5S	2.7	TMS	0.3	80S	65.0	57	45
33	BWL 5440	10S	7.3	5S	1.4	TMR	0.1	5S	1.3	68	57
34	BWL 5441	30S	12.7	10MS	1.6	0	0.0	40S*	12.5	47	36
35	BWL 5442	20MS-S	11.7	5MS	0.8	0	0.0	40S*	12.8	56	45
36	BWL 5443	20 S	10.7	10MS	2.4	0	0.0	0	0.0	57	46
37	BWL 5444	40S	21.0	10MS	2.4	0	0.0	20S	6.8	45	35
38	BWL 5445	80S	34.8	30MS	11.2	40S	26.7	5MS	1.0	78	57
39	BWL 5446	20S	8.3	10S	3.6	0	0.0	40S	20.5	47	35
40	BWL 5447	40S*	13.8	10MS	2.6	20MS	5.3	40S	32.0	46	35
40. A	INFECTOR	100S	80.0	100S	82.0	80S	73.3	80S	75.0	89	79
41	BWL 5448	40 S*	15.7	20S	7.2	0	0.0	40S	32.5	36	24
42	BWL 5449	30S	11.7	20S	6.7	20MS	5.3	5S	1.3	36	35
43	BWL 5450	10MS	2.9	20S	9.2	10MS	2.7	40S	20.0	37	35
44	BWL 5451	15S	6.7	5MS	0.9	20S	6.7	5S	2.3	37	25
45	BWL 5479	10MS-S	7.0	60S	20.0	40S	20.1	20S	14.0	67	56
46	BWL 5480	10S	6.3	60S	16.4	40S	20.7	10MS	6.3	67	46
47	BWL 5481	10MS-S	5.8	40S	14.7	60S	26.8	20MS	9.5	58	57
48	BWL 5482	20S	9.3	10MS	1.8	20S	7.4	0	0.0	78	57
49	BWL 5483	40S*	18.2	10MS	1.6	10MR	1.4	40S	16.1	46	35
50	BWL 6301	10S	4.8	20S	4.1	10MS	2.7	10S	2.5	57	46
51	BWL 6302	10S	3.7	TMS	0.2	10MS	2.7	5S	1.5	57	57

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
52	BWL 6303	20S	11.3	20S	4.8	0	0.0	20S	7.3	67	57
53	BWL 6304	10MS	3.3	10S	2.1	TS	0.3	10S	3.5	67	56
54	BWL 6305	10MS	3.3	5S	1.0	10S	3.3	10S	2.5	58	47
55	BWL 6306	TMR	0.1	10S	2.9	5S	1.7	5S	2.3	79	57
56	BWL 6307	20S	7.1	20S	7.6	10S	3.3	60S*	18.0	58	46
57	BWL 6308	10MS	4.6	10MS	3.4	0	0.0	10S	7.0	46	35
58	BWL 6309	40S*	13.7	20MS	3.2	0	0.0	40S	16.3	56	46
59	BWL 6310	40S	20.7	30S	9.3	20S	6.7	40S	20.1	67	46
60	BWL 6311	20MS	6.7	20S	5.6	0	0.0	40S	20.0	57	46
60. A	INFECTOR	100S	86.7	100S	80.0	80S	73.3	80S	75.0	89	79
61	BWL 6312	20MS	5.6	20S	5.7	5S	1.7	60S	40.5	67	57
62	BWL 6313	10MR	1.5	5S	1.1	0	0.0	40S	15.0	89	67
63	BWL 6314	TMR	0.1	TR	0.0	0	0.0	10MR	1.2	89	67
64	BWL 6315	5MR	1.3	40S	8.4	20S	6.7	20S	8.5	89	68
65	BWL 6316	30S	17.7	60S	42.4	40S	29.3	10MS	4.0	78	67
66	BWL 6317	40S	21.0	40S	16.0	TMR	0.1	5S	1.3	58	57
67	BWL 5610	10MS	5.3	60S	14.6	20S	6.7	10MS	4.1	78	67
68	BWL 5638	5MR	0.9	5MS	0.8		0.1	5S	3.3	68	56
69	BWL 5670	20MS	8.0	20S	7.4	20S	6.7	5S	3.5	78	57
70	BWL 5714	20MS	11.7	20S	5.6	5S	1.7	20S	6.5	78	67
71	BWL 5802	30MS-S	15.0	5MS	0.8	10MR	1.3	5S	1.3	68	68
72	BWL 5850	30MR-MS	14.7	20S	9.4	20S	13.3	20S	6.3	79	58
73	BWL 5857	10MS	6.3	40S	10.1	0	0.0	20S	9.3	68	67
74	BWL 5913	10MS	3.0	5MS	0.8	0	0.0	10S	3.8	58	57
75	BWL 5927	30MS-S	9.3	10S	2.2	TS	0.3	20S	12.5	79	57
76	BWL 5988	10MS	4.0	10S	2.2	0	0.0	20S	7.8	89	57
77	BWL 5530	20MS	5.7	5S	1.9	TS	0.3	10S	7.0	68	57
78	BWL 5706	40S	29.0	20S	7.2	10S	3.3	20S	10.3	89	57
79	BWL 5886	10MR	8.1	TMS	0.2	0	0.0	20S	7.3	89	57
80	BWL 5905	60S	29.3	30MS	12.9	10MR	1.3	40S	15.5	89	57
80. A	INFECTOR	100S	86.7	100S	84.0	80S	73.3	80S	75.0	89	78
81	BWL 4795	20S	15.3	TR	0.0	0	0.0	20S	9.8	57	57
82	BWL 5053	15MS	9.3	20S	4.0	20MS	7.0	5S	5.0	89	57
83	BWL 5158	20S	21.0	10MS	2.4	TR	0.1	5S	2.6	89	57
84	BWL 5564	20S	13.0	10MS	2.0	0	0.0	10S	5.0	47	36
85	BWL 5584	10MS	4.1	10S	5.2	20S	6.7	10S	3.8	58	46
86	BWL 5611	10S	6.1	5MS	9.3	0	0.0	10MS	2.0	78	56
87	BWL 5808	30R-MR	5.7	TMS	0.2	20S	6.7	20S	8.8	89	57
88	BWL 5796	30S	17.3	20S	5.6	0	0.0	10S	5.5	89	56
89	BWL 5851	50S	32.0	10MS	2.4	0	0.0	5S	3.3	89	57
90	BWL 5959	50S	26.0	20MS	5.3	20S	10.0	10S	6.5	89	67
91	BWL 5989	10MS	3.4	TMS	0.2	10MR	1.3	40S	10.1	89	67
92	BWL 5969	20S	6.7	10MS	1.7	10MR	1.3	5S	3.5	79	67
93	BWL 5991	20S	7.4	40S	17.7	0	0.0	40S*	10.0	89	56
94	BWL 3586	60S	28.2	30S	11.7	10S	4.0	5S	1.3	78	57
95	BWL 6318	60MS-S	38.0	60S	32.4	40S*	13.4	20S	7.6	68	46
96	BWL 6319	50S	42.0	20S	7.2	5S	1.7	40S	16.1	46	46
97	BWL 6320	40S	38.7	20S	5.8	TR	0.1	40S	15.0	58	47
98	BWL 6321	60S	29.7	40S	14.1	40S	13.3	10S	5.3	57	36
99	BWL 6322	60S	31.7	80MS	21.6	60S	26.7	20S	10.5	45	36
100	BWL 6323	80S	58.0	80MS	20.8	0	0.0	40S	14.3	45	46
100. A	INFECTOR	100S	86.7	100S	84.0	80S	66.7	80S	80.0	89	79
101	BWL 6324	80S	60.7	80S	20.8	0	0.0	10S	3.8	67	46
102	BWL 5189	10MS	6.7	10MS	1.7	0	0.0	0	0.0	46	35
103	BWL 6012	20MS	7.7	20MS	8.2	20S	8.0	40S	15.5	47	46

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
104	BWL 6080	60S	35.3	40S	21.2	20S	6.7	60S	32.0	57	46
105	BWL 6090	30S	15.7	20S	10.0	10S	3.4	60S	40.5	67	57
106	BWL 6325	20MS	14.7	10MS	1.8	5S	1.7	40S*	10.5	78	46
107	BWL 6326	30R-MR	8.3	5MS	1.2	TR	0.1	0	0.0	78	57
108	BWL 5688	10MS	4.3	20S	5.0	TR	0.1	20S	8.3	79	58
109	BWL 5071	30S	16.7	10MS	2.6	0	0.0	5S	1.8	78	57
110	BWL 5553	40S	25.3	20S	7.2	10S	4.7	10S	3.8	79	57
111	T 4014	TMR	0.2	TMS	0.2	0	0.0	20S	6.5	79	58
112	T 4023	5MS	1.4	TR	0.0	0	0.0	40S	12.5	68	46
113	T 4028	TR	0.1	10MS	1.6	0	0.0	5MR	1.0	89	68
114	T 4030	TR	0.1	10MR	0.8	0	0.0	15R	0.8	89	68
115	T 4032	TR	0.1	TMS	0.2	0	0.0	10R	0.6	79	67
116	T 4036	TR	0.1	TR	0.0	0	0.0	5R	0.3	79	67
117	T 4044	TR	0.1	TMS	0.2	0	0.0	5MR	0.8	78	57
118	T 4048	TR	0.1	5MR	0.4	0	0.0	5MR	1.5	68	46
119	T 4049	5MR-MS	1.1	TMR	0.1	0	0.0	5MR	1.5	69	57
120	T 4051	10MR-MS	2.1	10MS	1.6	0	0.0	5MR	2.0	58	47
120. A	INFECTOR	100S	80.0	100S	72.0	80S	73.3	80S	80.0	89	79
121	DW542	40S	21.3	30MS-S	14.2	10S	7.0	20S	8.0	79	57
122	DW544	30MR-MS	18.0	30S	9.7	20MR	2.7	5S	1.3	78	57
123	DW545	20S	13.0	20MS	6.4	10S	4.7	5S	1.5	78	56
124	DW547	20S	12.0	10S	4.4	10MR	1.6	10MS	2.1	89	57
125	DW548	20S	11.3	20MR-MS	6.8	20MS	5.6	10MS	2.5	79	57
126	DW550	20S	13.3	10S	3.6	10MS	2.7	5S	1.8	79	57
127	DW553	20S	14.0	10S	4.1	TR	0.1	5S	2.8	68	46
128	DW554	30S	34.7	10MS	2.7	0	0.0	TS	0.8	78	56
129	DW555	40S	26.0	20MS	5.4	10MR	1.3	10S	3.3	79	57
130	DW556	20MS	12.7	20S	7.0	10MR	1.3	5S	4.3	78	46
2. Dr. H. K. Jaiswal, BHU, Varanasi											
131	HUWL 1601	40S*	15	20S	6.0	10S	3.3	60S	60.0	68	46
132	HUWL 1602	40S*	15.3	20S	4.1	20S	6.7	60S	31.3	67	46
133	HUWL 1603	20S	12.3	10S	2.0	5S	1.7	60S	50.0	58	47
134	HUWL 1604	20S	12.0	20S	7.4	0	0.0	40S*	12.9	68	57
135	HUWL 1605	10MS	4.5	20S	4.2	10S	3.3	60S	60.0	57	47
136	HUWL 1606	10MS	3.1	10S	2.8	0	0.0	60S	45.0	67	46
137	HUWL 1607	40S	20.1	10S	3.6	10S	4.7	60S	23.0	67	57
138	HUWL 1608	20S	16.0	20MS	7.2	0	0.0	40S*	12.5	68	46
139	HUWL 1609	20S	12.7	10MS	2.7	0	0.0	60S	39.0	78	47
140	HUWL 1610	40MS	12.5	10MS	2.8	0	0.0	60S	33.0	67	46
140. A	INFECTOR	100S	80.0	100S	78.0	80S	66.7	80S	75.0	89	78
141	HUWL 1611	50S	27.3	30S	12.2	0	0.0	40S	31.0	57	35
142	HUWL 1612	30S	11.3	10MS	1.8	0	0.0	60S*	18.8	67	45
143	HUWL 1613	40MS-S	16.3	TMR	0.1	0	0.0	10S	2.8	68	57
144	HUWL 1614	60S	34.7	20MS	8.1	0	0.0	40S	17.0	58	46
145	HUWL 1615	80S	45.3	40S	9.6	0	0.0	5S	2.5	67	57
146	HUWL 1616	10MS	3.0	20S	4.8	0	0.0	10S	3.8	78	47
147	HUWL 1617	60S *	24.0	40S	8.8	10S	3.4	80S	70.0	78	57
148	HUWL 1618	30S	22.0	20S	9.7	20S	6.7	60S	55.0	68	57
149	HUWL 1619	50S	29.3	60S	16.9	40S*	13.4	40S	18.0	78	57
150	HUWL 1620	20S	18.0	10MS	2.7	0	0.0	80S	55.0	58	47
151	HUWL 1621	20S	10.3	20S	7.6	10S	3.3	20S	10.0	68	57
152	HUWL 1622	40S*	17.7	10S	3.6	5S	1.7	20S	7.5	46	36
153	HUWL 1623	40S	29.3	20MS	6.2	0	0.0	40S	39.0	56	36
154	HUWL 1624	60S*	21.5	20S	4.2	0	0.0	80S	65.0	57	46

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
155	HUWL 1625	60S	28.3	20S	8.0	5S	1.7	60S	48.0	47	47
156	HUWL 1626	10MS	4.1	10MS	2.4	0	0.0	80S	70.0	57	46
157	HUWL 1627	40MS	17.5	20S	5.7	5S	1.7	60S	41.0	67	45
158	HUWL 1628	20MS	13.3	80S	45.6	60S	26.7	80S	65.0	57	47
159	HUWL 1629	90 S	51.3	80S	32.5	10S	4.7	80S	65.0	68	57
160	HUWL 1630	60S	33.3	60S	19.8	20MS	5.4	60S	35.0	67	47
160. A	INFECTOR	100S	86.7	100S	84.0	80S	73.3	80S	80.0	89	79
3. Wheat Breeder, University of Agricultural Sciences, Dharwad.											
161	UASD 1601	40S*	16.0	20MS	3.4	5S	1.7	60S	41.0	57	47
162	UASD 1602	30S	18.0	20S	7.6	0	0.0	60S	55.0	57	57
163	UASD 1603	20S	14.0	20S	6.4	0	0.0	60S	47.0	68	57
164	UASD 1604	20MS-S	13.0	10S	4.8	20S	6.7	60S	26.8	68	57
165	UASD 1605	20S	12.5	5MS	1.1	5S	1.7	80S	52.0	68	47
166	UASD 1606	30S	14.7	5S	1.9	0	0.0	60S	46.0	68	57
167	UASD 1607	20MS	8.7	20S	5.8	20S	6.7	40S	32.0	69	58
168	UASD 1608	40S	20.0	20MS	4.6	20MR	2.7	20S	16.3	68	57
169	UASD 1609	10MS	4.1	TMS	0.2	0	0.0	60S	70.0	57	46
170	UASD 1610	10MS	4.0	10S	3.8	0	0.0	60S	30.5	56	47
171	UASD 1611	30S	12.0	20MS	4.4	10S	3.3	40S	32.0	57	47
172	UASD 1612	TR	0.1	TMS	0.2	0	0.0	80S	50.0	56	47
173	UASD 1613	5R	0.6	TR	0.1	0	0.0	60S	35.0	68	57
174	UASD 1614	60S	40.0	20MS	3.4	0	0.0	10MS	11.0	67	57
175	UASD 1615	20S	9.7	10MS	2.2	5S	1.7	60S	40.0	67	57
176	UASD 1616	30MS	11.0	10S	3.8	0	0.0	80S	55.0	57	47
177	UASD 1617	20MS	9.3	10MS	2.2	0	0.0	80S	55.0	68	57
178	UASD 1618	30S	26.7	20MS	5.4	20S	6.7	60S	40.0	57	57
179	UASD 1619	50S	26.0	20MS	5.5	TR	0.1	60S	55.0	78	68
180	UASD 1620	20S	14.0	20MS	3.3	10MR	1.3	**60S***	**18.8**	89	68
180. A	INFECTOR	100S	80.0	100S	76.0	80S	73.3	80S	80.0	89	79
181	UASD 1621	20S	12.0	40MR	4.8	0	0.0	10MS	3.4	78	57
182	UASD 1622	10S	6.3	10MS	2.0	0	0.0	5S	2.3	68	46
183	UASD 1623	10S	5.3	20S	4.0	0	0.0	5S	1.4	79	57
184	UASD 1624	10MS-S	7.0	20MR	3.6	20S	6.7	5S	2.3	79	57
185	UASD 1625	30MS	12.7	5MS	1.2	0	0.0	5S	1.5	79	57
186	UASD 1626	20S	8.0	40MR-MS	6.6	10MR	1.3	5S	1.5	68	47
187	UASD 1627	20MS	6.8	20MR-MS	5.6	TMR	0.1	10S	4.0	68	47
188	UASD 1628	20MS	9.3	10MRMS	2.8	5MR	0.7	10MS	3.3	89	57
189	UASD 1629	20S	10.0	10MRMS	2.8	TMR	0.1	TS	0.6	79	58
190	UASD 1630	20S	8.7	5MR	1.2	TMR	0.1	5S	1.3	78	57
4. Dr. A. A. Patel, SDAU, Vijapur, Gujarat											
191	VA 2015-08	20MS	9.0	TMS	0.3	0	0.0	80S	65.0	78	68
192	VA 2015-09	30S	14.7	5MS	3.6	0	0.0	80S	65.0	78	67
193	VA 2015-11	20S	8.3	20S	4.8	0	0.0	60S	50.0	78	67
194	VA 2015-14	10MS	3.1	TMS	0.2	0	0.0	80S	75.0	78	68
195	VA 2015-18	10MS	5.7	20S	5.6	0	0.0	80S	75.0	79	78
196	VA 2015-21	10MS	3.1	5MS	0.8	0	0.0	80S	70.0	89	68
197	VA 2015-25	5MS	3.7	TMS	0.2	0	0.0	80S	70.0	89	78
198	VA 2015-26	20MS	8.3	10MS	2.4	0	0.0	80S	60.0	89	67
199	VA 2015-30	20MS	8.0	10S	4.4	0	0.0	80S	65.0	79	67
200	VA 2015-34	20MS	13.3	60S	26.8	20S	13.6	80S	49.0	79	68
200. A	INFECTOR	100S	80.0	100S	76.0	80S	66.7	80S	75.0	89	79
201	VA 2015-38	20MS	8.7	10MS	2.6	0	0.0	80S	70.0	78	67
202	VA 2015-41	10MS	6.0	5MS	1.0	0	0.0	80S	80.0	89	67

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
203	VA 2015-42	10MS	6.0	5MS	1.0	0	0.0	80S	65.0	89	68
204	VA 2015-43	20MS	8.7	5MS	1.4	0	0.0	80S	75.0	89	67
205	VA 2015-44	20S	8.3	5MS	1.0	0	0.0	60S	42.5	89	57
206	VA 2015-45	20S	7.7	TR	0.1	0	0.0	60S	55.0	89	57
207	VA 2015-46	10MS	4.1	5MS	2.0	TR	0.1	60S	31.0	89	67
208	VA 2015-49	10MS	5.0	5MS	1.4	0	0.0	80S	60.0	89	68
209	VA 2015-55	10S	4.7	TMS	0.3	0	0.0	80S	35.0	79	68
210	VD 15-21	10MR-MS	3.4	40R-MR	3.0	TR	0.1	10S	7.5	89	68
211	VD 15-6	5S	1.9	5MR	0.5	0	0.0	10S	5.5	89	67
212	VD 15-13	20S	8.0	15MS	4.0	TR	0.1	30MS	18.5	89	68
213	VD 15-7	5MS	2.0	5MR	0.6	0	0.0	40S	18.0	79	68
214	VD 15-9	10MS	2.9	TR	0.1	0	0.0	10S	4.8	89	68
215	VD 15-14	TMS	0.4	TR	0.1	0	0.0	5MS	1.5	89	68
216	VD 15-26	10MS	6.3	20MS	5.2	10S	3.3	20MS	11.0	89	68
217	VD 15-17	10S	6.0	40MS-S	8.3	10S	3.3	20MS	11.3	78	67
218	VD 2016-1	TMS	1.7	5MS	0.9	10S	3.3	40S	17.5	89	68
219	VD 2016-2	10S	4.1	5S	1.1	TR	0.1	20S	9.0	89	67
220	VD 2016-3	20S	7.0	10MS	2.2	TR	0.1	40S	12.3	78	67
220. A	INFECTOR	100S	86.7	100S	82.0	80S	73.3	80S	75.0	89	79
221	J 15-06	80S	34.8	60S	18.4	20S	6.7	60S	60.0	68	67
222	J 15-18	20S	12.5	40S	16.8	0	0.0	80S	65.0	78	67
223	J 15-22	40S	26.3	20S	5.8	40S*	13.3	60S	55.0	68	57
224	J 15-27	20S	14.0	20S	7.2	TR	0.1	80S	65.0	89	68
225	J 15-31	60S	31.3	60S	29.2	60S*	20.1	80S	80.0	89	68
226	J 15-29	20S	10.0	20S	6.8	5S	1.7	80S	60.0	89	68
227	J 15-39	20MS	9.3	20S	4.8	0	0.0	80S	80.0	89	67
228	J 15-45	40S	24.0	80S	24.1	60S*	20.1	60S	51.0	78	57
229	J 15-24	40S	25.3	40S	18.8	40S*	13.5	80S	75.0	68	57
230	JD 15-18	10S	3.7	5MS	1.6	20MR	2.7	20MS	7.0	89	68
231	JD 15-10	5S	7.7	5MR	0.8	20MR	2.7	20MS	7.7	89	68
232	JD 15-04	TMR	0.3	10MR	0.9	10MR	1.3	5S	1.3	78	67
233	DR 15-08	5MS	2.4	20S	8.8	0	0.0	60S	48.0	89	68
234	DR 15-13	20S	10.1	20S	9.6	0	0.0	60S	60.0	89	78
235	DR 15-14	20S	9.7	60MR-MS	14.0	20MS	5.3	40S	32.0	89	78
236	DR 15-16	20MS	9.4	TMR	1.1	TR	0.1	60S	70.0	99	68
5. Dr. R. S. Shukla, JNKVV, Jabalpur (MP)											
237	MP 3488	20MS	11.7	30MS	12.1	40S*	13.6	60S	50.0	89	57
238	MP 3489	30S	22.7	60S	31.2	20S	8.3	60S	55.0	57	47
239	MP 3490	20S	16.0	60S	27.4	40S	16.7	80S	65.0	89	67
240	MP 3491	20S	17.3	80S	40.8	20S	8.3	60S	55.0	89	68
240. A	INFECTOR	100S	80.0	100S	80.0	80S	73.3	80S	80.0	89	78
241	MP 3492	20MS	9.3	20S	8.0	40S	15.1	60S	44.0	78	57
242	MP 3493	10MS	4.2	TMS	0.2	0	0.0	20S	12.0	78	67
243	MP 3494	20MS	11.0	20S	4.1	0	0.0	TS	0.3	78	57
244	MP 3495	5MS	1.5	10S	2.1	0	0.0	60S	45.0	68	57
245	MP 3496	30S	23.3	10S	3.6	0	0.0	60S	60.0	89	67
246	MP 3497	30MS-S	12.0	10S	2.0	0	0.0	80S	60.0	58	46
247	MP 3498	TMS	0.3	20S	6.1	0	0.0	60S	55.0	68	47
248	MP 3499	5MR-MS	1.3	10S	4.0	TR	0.1	60S	35.0	78	47
249	MP 3500	30S	16.3	20S	10.0	40S*	13.6	60S	60.0	79	67
250	MP 3501	20S	16.0	60S	32.4	40S*	13.3	60S	60.0	78	56
251	MP 3502	20S	10.1	20S	4.1	TR	0.1	40S	15.4	67	46
252	MP 3503	5MR	1.0	40S	12.2	10S	3.3	60S	45.0	68	47
253	MP 3504	20S	18.0	40S	20.0	0	0.0	100S	55.0	78	57

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
254	MP 3505	40S	20.7	TMS	0.3	TR	0.1	80S	48.0	79	68
255	MP 3506	10MS	2.9	60S	16.1	0	0.0	60S	39.0	68	46
256	MP 3507	5MS	2.7	40S	12.1	10S	3.3	40S	38.0	58	36
6. Dr. M. K. Shrivastava, JNKVV, RARS, Sagar (M.P.)											
257	JWS 608	10S	5.3	20S	6.0	0	0.0	60S	45.0	46	46
258	JWS 710	20MS	10.7	10S	2.2	0	0.0	80S	55.0	57	46
259	JWS 734	10MS	4.1	10MS	1.6	10S	3.3	40S	27.5	68	67
260	JWS 809	80S	35.3	40S	18.0	0	0.0	40S	26.0	78	67
260. A	INFECTOR	100S	86.7	100S	80.0	80S	73.3	80S	80.0	89	78
261	JWS 819	80S	34.0	60S	24.1	20S	6.7	60S	39.0	58	57
262	JWS 825	60S	48.0	60S	16.0	60S*	20.0	40S	22.5	67	57
263	JWS 829	10MS	4.8	10S	3.5	40S*	13.3	60S	45.5	78	67
264	JWS 835	40MS*	11.9	15MS	5.2	40S	20.0	60S	43.0	67	57
265	JWS 855	5MR	1.0	30S	8.1	0	0.0	60S	55.0	78	67
266	JWS 150	30S	22.7	20S	11.4	5S	1.7	80S	52.5	68	57
7. Wheat Breeder, CCS HAU, Hisar, Haryana											
267	P 12953	40S	29.3	40S	15.2	20S	6.7	40S*	10.5	69	57
268	P 13203	40S	24.7	20S	5.7	20S	6.7	5MS	2.1	78	56
269	P 12294	40MR-MS	17.3	20S	6.1	20S	6.7	10S	2.8	89	68
270	P 13497	40MR-MS	14.0	20S	4.5	5S	1.7	20S	5.5	68	57
271	P 13510	20MS	8.7	20S	4.1	0	0.0	40S	10.0	58	57
272	P 13514	40MR-MS	20.0	20MS	7.4	40S	20.0	20S	12.0	56	46
273	P 13515	20MS	11.7	20S	8.4	60S	26.7	20S	7.5	58	47
274	P 13516	20S	9.7	TR	0.0	20S	10.1	40S	17.0	67	57
275	P 13523	30MS	18.7	10MS	1.7	20S	8.3	40S	24.3	46	46
276	P 13524	20S	13.0	5S	1.0	20S	6.7	20S	6.3	57	46
277	P 13526	10MS	7.3	20S	8.2	40S	20.0	20S	11.3	67	56
278	P 13527	20MS	11.3	TR	0.1	10S	3.3	40S	17.0	67	57
279	P 13528	40S	29.3	20S	7.6	0	0.0	60S	39.0	46	46
280	P 13530	30S	24.7	10S	5.2	0	0.0	60S	30.5	58	46
280. A	INFECTOR	100S	86.7	100S	76.0	80S	66.7	80S	80.0	89	78
281	P 13532	30S	11.5	10S	4.0	40S	20.0	40S	14.1	58	57
282	P 13537	20S	12.7	30S	13.3	40S	20.0	20S	7.4	67	46
283	P 13538	20MS	9.0	TMS	0.2	20S	6.7	5MS	1.0	67	56
284	P 13540	10MS	4.9	10S	4.1	0	0.0	20S	6.0	68	56
285	P 13541	10MS-S	6.0	20S	8.0	TR	0.1	10S	3.5	57	56
286	P 13543	30S	20.7	10S	2.1	10S	6.7	20S	6.3	79	57
287	P 13544	30MS	17.3	20S	10.4	20S	6.7	20S	6.2	68	57
288	P 13548	30S	15.3	40S	13.7	10S	3.3	40S	11.5	56	46
289	P 11933	40S	28.0	20S	6.0	0	0.0	40S	13.6	67	56
290	P 12272	20MS	9.0	20S	6.3	20S	6.7	60S	16.1	47	46
291	P 12329	20S	12.7	TMS	0.2	20S	6.7	5S	2.5	68	57
292	P 12399	40S	23.0	20S	4.8	0	0.0	20S	6.2	56	36
293	P 12499	40S	23.7	15S	3.2	TR	0.1	5S	2.3	78	56
294	P 12713	60S	38.7	30S	7.6	20S	6.7	20S	10.0	68	46
295	P 12715	20MS	12.0	20MS	3.4	0	0.0	40S	18.0	67	57
296	P 12725	50S*	21.3	20S	7.6	20S	10.0	20S	14.0	58	47
297	P 12729	20MS	8.3	20MS	7.4	20S	8.3	20S	9.1	68	57
298	P 12946	80S	45.3	40S	16.0	20S	8.3	5MS	1.5	47	46
299	P 12956	80S	48.0	40S	18.1	20S	6.7	20S	22.5	67	67
300	P 12966	40S	25.3	60S	18.0	40S	20.0	TMR	0.1	58	46
300. A	INFECTOR	100S	86.7	100S	80.0	80S	53.3	80S	75.0	89	79
301	P 12968	20MR-MS	4.1	TMS	0.2	5S	1.7	10S	4.8	68	67
302	P 13570	20MS-S	11.4	TR	0.1	20S	10.0	20MS	6.4	46	46
303	P 13575	20MS	9.0	30S	9.6	10S	3.3	TS	0.3	67	46

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
304	P 13349	20S	13.3	40S	15.6	40S	20.0	10S	6.5	58	47
305	P 13380	30MS-S	21.0	5MS	1.7	5S	1.7	20S	7.1	57	46
306	P 13412	20S	16.0	20S	7.2	20S	8.3	20S	8.1	58	46
307	P 13339	10MS	4.5	20S	6.1	20S	6.7	5MS	1.2	58	46
308	P 13581	20S	14.7	20S	4.1	40S	16.7	40S	17.0	58	47
309	P 13584	10S	3.7	10S	4.1	10S	3.3	10S	3.8	67	46
310	P 13237	20MS-S	7.6	TMS	0.2	5S	1.7	10S	6.3	68	57
311	P 13301	10MS	4.3	10S	2.1	10S	3.3	20S	16.5	67	46
312	P 4101	5S	3.1	15MS	2.5	0	0.0	60S	32.5	68	47
313	P 4125	5S	3.7	20S	4.4	0	0.0	20S	22.5	78	57
314	P 4149	30S	16.7	40S	12.1	40S	20.0	20S	17.5	67	57
315	P 4179	20S	12.7	20S	6.4	5S	1.7	60S	60.0	78	57
316	P 4196	30MR-MS	14.0	10S	5.6	0	0.0	20S	7.5	78	57
317	P 4199	30S	12.7	15MS	2.8	0	0.0	60S	40.0	78	57
318	P 4233	20S	10.0	40S	14.4	5S	1.7	60S	55.0	67	46
319	P 4283	5MS-S	2.9	5MR	0.4	0	0.0	60S	40.0	68	47
320	P 4271	40S*	18.0	20S	7.2	5S	2.0	60S	13.3	67	57
320. A	INFECTOR	100S	86.7	100S	80.0	80S	66.7	80S	80.0	89	79
321	P 4276	40S*	17.3	20MS	5.2	0	0.0	40S	20.0	67	57
322	P 13607	20MS-S	13.0	TMR	0.2	10MS	2.7	20S	6.0	57	46
323	P 13608	20MS	6.8	10S	3.0	0	0.1	20S	7.8	78	56
324	P 13609	40S	32.0	40S	12.9	20S	6.7	20S	6.3	57	56
325	P 13610	40MS-S	23.7	20MS	4.6	0	0.0	20S	8.9	57	46
326	P 13611	20S	10.7	40S	13.2	60S	33.3	10S	3.8	67	46
327	P 13612	40MS-S	24.0	40S	12.6	20S	6.7	40S	15.0	78	57
328	P 13613	40MS-S	24.0	10MS	3.8	20S	13.3	20S	7.0	67	56
329	P 13614	20S	10.7	40S	11.2	40S	13.3	20MS	7.3	68	57
330	P 13615	20S	13.3	20S	8.1	20S	8.3	20S	6.0	78	57
331	P 13616	20S	13.3	20S	6.2	40S	15.0	20S	7.0	78	56
332	P 7682	30MS	15.7	20S	6.5	0	3.3	60S	65.0	57	46
333	P 9130	20S	9.6	15MS	4.0	10S	3.3	10S	2.5	56	46
334	P 9131	20MSS	11.3	10S	2.9	10S	3.3	40S	19.5	57	56
335	P 9136	80S*	30.3	20S	5.2	5S	1.7	5MR	1.9	57	46
336	P 9137	5S	4.3	10MS	1.8	TR	0.1	40S	30.0	56	45
337	P 8127	40MS-S	18.7	10MS	3.0	10MR	1.4	10S	4.6	68	57
338	P 8131	30MS-S	15.7	TMS	0.2	0	0.0	10S	2.6	68	46
339	P 8164	10MS-S	3.3	TR	0.1	0	0.0	20S	8.5	78	67
340	P 8166	60MS-S	30.0	20MS	6.9	10MR	1.3	10S	2.8	78	67
340. A	INFECTOR	100S	80.0	100S	80.0	80S	73.3	80S	80.0	89	78
341	P 8146	20S	7.1	20MR	2.6	10MR	1.4	10S	3.7	79	67
8. Dr. C.P. Singh, Lokbharti Gramvidyapith, Bhavnagar (Gujrat)											
342	Lok-2016-1	TMR	0.1	10R	0.4	0	0.0	60S	44.0	78	67
343	Lok-2016-2	5MR	0.7	10S	2.0	0	0.0	60S	37.5	67	57
344	Lok-2016-3	20S	7.3	TMR	0.1	0	0.0	80S	70.0	67	57
345	Lok-2016-4	5MR	1.3	TR	0.0	0	0.0	80S	75.0	78	57
346	Lok-2016-5	10MS	3.7	TMS	0.2	0	0.0	80S	65.0	67	56
9. Dr. Tuhina Dey, SKUAS&T, Chatha, Jammu											
347	JAUW 655	20MS	6.3	10MS	1.6	0	0.0	40S	17.0	46	35
348	JAUW 656	20MS	6.4	TMR	0.2	0	0.0	60S	35.0	68	57
349	JAUW 657	10MS-S	5.9	15MS	5.2	0	0.0	60S	24.5	78	56
350	JAUW 658	10S	5.7	20S	5.7	0	0.0	60S	32.0	67	46
351	JAUW 659	30MS-S	18.3	20S	4.0	0	0.0	60S	35.0	35	34
352	JAUW 660	30S	14.3	20S	4.0	0	0.0	60S	45.0	47	46
353	JAUW 661	5MS	1.5	20S	4.1	0	0.0	60S	40.0	57	46
354	JAUW 662	10MS	2.9	20S	4.4	0	0.0	40S	23.0	67	46

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
355	JAUW 663	40S*	15.5	40S	13.7	10MR	1.3	60S	45.0	58	46
356	JAUW 664	10MS	5.8	20S	9.6	10MR	1.3	60S	38.8	46	35
10. Dr. N. R. Potdukhe, Wheat Research Unit, P.D.K.V., Akola											
357	AKDW-4271	5RMR	0.6	5MR	0.6	TR	0.1	5S	2.4	78	56
358	AKDW-4883	5RMR	0.6	5MR	0.5	TR	0.1	5MS	1.5	78	57
359	AKAW-4903	40S*	17.7	40S	16.0	10S	3.4	60S	45.0	67	56
360	AKAW-4909	80S	39.3	60S	36.0	40S*	13.4	60S	50.0	57	46
360. A	INFECTOR	100S	86.7	100S	84.0	80S	73.3	80S	75.0	89	79
361	AKAW-4921	10MS	6.0	20S	6.0	10MR	1.3	60S	39.0	78	57
362	AKAW-4927	10MS	6.0	5MS	0.9	0	0.0	60S	47.5	78	67
363	AKAW-5018	5MS	1.7	40S	15.2	0	0.0	60S	52.5	47	46
364	AKAW-5023	20MR	6.7	40S	12.1	TR	0.1	60S	55.0	78	67
365	AKAW-5024	20MS	10.0	80S	47.6	20S	6.7	60S	52.5	68	67
366	AKAW-5077	5MS	3.0	20S	4.5	5S	1.7	60S	43.8	78	57
367	AKAW-5078	5MS	1.8	20S	4.1	0	0.0	40S	32.5	78	68
368	AKDW-5079	5R	0.5	10S	3.4	TR	0.1	20S	5.1	79	47
369	AKAW-5082	5MS	3.0	TMS	0.2	TR	0.1	60S	50.0	78	56
370	AKAW-5083	30S	26.7	20S	12.2	TR	0.1	40S	28.8	57	46
371	AKDW-5084	5R	0.5	15MS	4.0	TR	0.1	10S	3.8	79	47
11. Dr. Surya Prakash, BAU, Kanke, Ranchi											
372	JKW 246	20S	14.0	40S	32.9	0	0.0	60S	55.0	78	57
373	JKW 247	30S	20.7	20MS	3.2	0	0.0	60S	50.0	46	35
374	JKW 248	20MS	5.7	20S	6.4	40S	16.7	60S	55.0	35	24
375	JKW 249	5S	1.7	20S	5.6	0	0.0	60S	45.0	46	35
376	JKW 250	10MS	5.4	10S	2.2	5S	1.7	60S	50.0	57	46
377	JKW 251	10MS	6.3	20MS	3.3	0	0.0	20S	15.0	67	46
378	JKW 252	20S	12.5	30MS	6.9	0	0.0	60S*	17.0	78	57
379	JKW 253	20MR-MS	9.3	10S	4.8	0	0.0	40S	11.5	68	46
380	JKW 254	20S	29.0	20S	10.4	0	0.0	60S	29.5	68	57
380. A	INFECTOR	100S	80.0	100S	76.0	80S	80.0	80S	70.0	89	79
381	JKW 255	20S	17.3	10S	2.8	0	0.0	40S	21.5	78	67
12. Dr. V. S. Kandalkar, RVSKVV, Gwalior (M.P.)											
382	RVW 4261	20S	11.3	60S*	13.8	TR	0.1	80S	60.0	79	68
383	RVW 4262	10MS	4.8	20S	6.6	0	0.0	60S	60.0	79	67
384	RVW 4263	20S	10.3	40S	14.4	TR	0.1	60S	47.5	78	46
385	RVW 4264	10S	6.0	20S	4.6	TR	0.1	10S	3.0	79	57
386	RVW 4265	30MS-S	9.3	TMR	0.1	0	0.0	10S	3.9	68	57
387	RVW 4266	5MS	1.5	20S	5.0	TR	0.1	80S	65.0	78	57
388	RVW 4268	10MS	6.3	20S	12.8	40S*	13.3	60S	60.0	47	46
389	RVW 4269	20S	16.7	40S	13.6	10S	3.3	60S	40.0	89	57
390	RVW 4270	20MS	6.1	20MS	3.7	TMS	0.3	80S	75.0	89	67
391	RVW 4271	80S	70.7	80S	60.0	60S*	25.3	100S	80.0	89	67
13. Dr. (Mrs) Indu Bhagat, PAU Regional Station, Gurdaspur (Punjab)											
392	WG 0500	20MS	11.3	20S	9.3	10MR	1.3	40S	28.0	46	35
393	WG 0506	20MS	5.7	5MS	0.8	0	0.0	40S	25.5	45	24
394	WG 0515	5S	3.1	20S	4.1	0	0.0	40S	18.0	47	46
395	WG 0522	30S	15.7	10MS	1.6	0	0.0	10S	6.0	35	35
396	WG 0536	30S	13.0	10MS	1.6	0	0.0	10S	7.5	36	35
397	WG 0540	30S	11.7	10MS	1.7	10S	3.3	20MS	8.5	36	35
398	WG 0545	10MS	7.3	20S	8.0	40S	15.0	5S	1.8	57	46
399	WG 0548	30S	11.7	20S	7.2	40S	15.0	40S	16.3	46	35
400	WG 0550	40S*	18.0	20S	12.0	40S	16.7	40S	19.0	57	46
400. A	INFECTOR	100S	80.0	100S	80.0	80S	73.3	80S	80.0	89	79
401	WG 0554	10MS	5.5	20S	9.6	0	0.0	40S	13.5	56	46
402	WG 0562	10MS	3.0	20S	9.6	20S	6.7	10S	7.5	57	57

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
403	WG 0565	10MS-S	5.7	5MS	0.8	0	0.0	10S	5.3	56	46
404	WG 0570	5MS	2.9	20S	8.0	10MR	1.3	20S	12.5	45	34
405	WG 0573	20S	8.7	5MS	1.8	40S*	13.3	20S	11.6	46	35
406	WG 0578	TR	0.1	TR	0.0	0	0.0	40S	24.5	46	24
407	WG 0579	10MS-S	4.4	TMS	0.2	0	0.0	20S	10.5	45	24
408	WG 0582	5MS	1.6	10S	2.0	0	0.0	20S	13.5	47	35
409	WG 0585	40MS-S	18.7	20S	5.2	20MR	2.7	40S*	13.5	47	35
410	WG 0591	10S	5.0	TR	0.0	0	0.0	20MS	12.0	35	24
411	WG 0603	5MS	1.5	TR	0.0	20S	6.7	60S	50.0	34	23
412	WG 0606	TR	0.1	TS	0.2	0	0.0	40S	31.0	45	24
413	WG 0629	20MS	5.7	10S	3.7	0	0.0	60S	47.5	46	35
414	WG 0647	10MS	3.1	10S	4.8	0	0.0	20S	6.3	36	35
415	WG 0655	10S	7.7	5MS	0.9	0	0.0	20S	11.3	57	46
416	DWG 662	30MS-S	12.4	5MR	0.7	TR	0.1	5MS	2.5	67	45
417	DWG 694	60MS-S	28.3	20MS	4.8	TR	0.1	10MS	2.1	68	46
418	DWG 697	5S	2.7	10MR	0.9	0	0.0	5MS	2.1	78	46
419	DWG 700	20MS	9.0	10MS	3.4	10MR	1.3	5MS	1.2	78	56
420	DWG 706	20MS	10.7	5MS	2.2	20S	6.7	5MS	1.3	68	46
420. A	INFECTOR	100S	76.7	100S	78.0	80S	73.3	80S	80.0	89	78
421	DWG 716	5MS	1.5	TMR	0.2	0	0.0	5MS	1.4	67	46
14. Dr. Arvind Kumar, ICAR-CSSRI, Karnal											
422	KRL 390	5MS	1.9	30S	6.8	40S	16.7	40S	19.3	56	46
423	KRL 391	20MS	9.7	20S	11.6	40S	16.7	80S	47.5	58	57
424	KRL 392	20MS	6.9	10MS	2.4	0	0.0	60S	35.0	56	45
425	KRL 393	30MR-MS	16.7	20S	7.6	10S	3.3	80S	50.0	47	46
426	KRL 394	40S	21.5	20S	13.0	TMS	0.3	80S	70.0	78	57
427	KRL 395	10MS	6.0	20S	9.0	20S	10.0	40S	22.6	78	46
428	KRL 396	20S	10.3	60S	18.4	20S	6.7	80S	57.5	78	57
429	KRL 397	20MS	8.1	30S	7.6	20S	6.7	80S	60.0	79	57
430	KRL 398	20MS	9.5	80MS	38.8	20S	10.1	20S	8.5	78	57
431	KRL 399	80S	39.3	30S	16.0	40S	18.7	10S	10.0	78	57
15. Dr. J. P. Jaiswal, GBPUA&T, Pantnagar, Uttarakhand											
432	UP - 01	TMR	0.2	TR	0.0	0	0.0	20MS	8.0	45	34
433	UP - 02	40S*	15.1	10MS	1.6	20S	6.7	60S	42.5	46	34
434	UP - 03	20MS	5.7	30S	8.6	20S	6.7	60S	50.0	47	46
435	UP - 04	10MS	2.9	30S	6.0	10S	3.3	60S	47.5	47	46
436	UP - 05	40MS-S	14.7	TR	0.1	0	0.0	40S	27.5	35	34
437	UP - 06	5MS	1.4	20S	4.0	0	0.0	60S	47.5	57	46
438	UP - 07	20MS	6.9	20S	4.9	5S	1.7	40S	32.5	67	56
439	UP - 08	5MS	3.0	TR	0.0	0	0.0	60S	27.0	68	57
440	UP - 09	TMS	0.4	TR	0.1	0	0.0	40S	19.0	47	35
440. A	INFECTOR	100S	80.0	100S	80.0	80S	73.3	80S	80.0	89	79
441	UP - 10	20MS	7.3	20S	7.7	10S	3.4	60S	50.0	57	47
442	UP - 11	40MS	22.3	20MS	5.3	0	0.0	40S	38.8	47	46
443	UP - 12	10MS	2.7	5MS	0.8	0	0.0	10MS	5.3	47	35
444	UP - 13	30S	17.2	20S	7.2	0	0.0	10MS	5.8	47	35
445	UP - 14	20MS	5.7	30S	8.0	5S	1.7	60S	60.0	46	46
446	UP - 15	20MS	5.4	10MS	1.7	0	0.0	40S	40.0	45	34
447	UP - 16	40MS-S	22.3	20S	8.3	0	0.0	60S	47.5	57	46
448	UP - 17	20MS	6.1	10MS	1.6	5S	1.7	40S	33.8	46	35
449	UP - 18	20MS	8.7	20S	6.0	0	0.0	60S	45.0	57	45
450	UP - 19	10MS	4.2	5MS	0.9	0	0.0	60S	52.5	46	36
451	UP - 20	TR	0.1	10MR	0.9	0	0.0	40S	26.5	57	46
452	UP - 21	20MS-S	8.8	5MS	0.8	0	0.0	60S*	17.8	35	24
453	UP - 22	30MS-S	12.0	20S	4.8	TR	0.1	60S*	23.3	35	24

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
454	UP - 23	20MS	10.0	30S	8.7	0	0.0	60S	45.0	57	57
455	UP - 24	10MS	5.7	5S	2.6	0	0.0	60S	60.0	78	57
456	UP - 25	20S	11.3	20S	9.2	10S	3.3	80S	65.0	78	57
457	UP - 26	30MS-S	15.7	20S	6.0	0	0.0	80S	70.0	79	57
458	UP - 27	5MS	1.8	10S	2.2	0	0.0	10S	8.8	78	46
459	UP - 28	5MS	1.7	5S	1.1	0	0.0	60S	30.1	78	57
460	UP - 29	TR	0.2	TR	0.1	0	0.0	60S	45.0	78	56
460. A	INFECTOR	100S	80.0	100S	76.0	80S	73.3	80S	75.0	89	79
461	UP - 30	40MS-S	15.0	TR	0.1	0	0.0	40S	12.4	67	57
462	UP - 31	20MS	5.5	10S	3.7	0	0.0	40S	37.5	68	57
463	UP - 32	10MS	3.1	5MS	0.8	5S	1.7	40S*	14.6	57	46
464	UP - 33	20MS	5.9	20S	5.6	0	0.0	40S	15.1	67	56
465	UP - 34	10S	6.0	20S	6.0	5S	1.7	60S	50.0	67	56
466	UP - 35	20MS-S	8.9	10S	2.8	0	0.0	10S	3.5	78	57
467	UP - 36	TR	0.1	5S	1.0	0	0.0	10S	3.5	78	46
468	UP - 37	TR	0.1	TR	0.0	0	0.0	60S	60.0	67	45
469	UP - 38	10MS	6.3	30MS	7.2	0	0.0	10S	3.0	79	57
470	UP - 39	10MS	4.0	10S	2.9	10S	3.3	60S	20.3	67	46
471	UP - 40	20MS	5.7	10MS	1.7	0	0.0	10S	5.0	78	47
472	UP - 41	30MS	10.1	10MS	2.4	0	0.0	60S	27.5	78	57
473	UP - 42	10MS	4.1	20S	5.1	10MS	2.7	40S*	12.5	78	57
474	UP - 43	20MS	6.4	20S	6.1	10MR	1.3	0	0.0	78	57
475	UP - 44	TMS	0.5	20S	5.8	0	0.0	60S	55.0	67	56
476	UP - 45	10MS	2.9	5S	1.9	20S	6.7	10S	3.8	79	57
477	UP - 46	TMR	0.1	10S	2.0	0	0.0	10S	6.4	67	46
478	UP - 47	10MS	2.7	5S	2.0	0	0.0	20S	6.3	78	57
479	UP - 48	20MS	8.7	10MS	2.6	10MR	1.3	10S	7.6	67	46
480	UP - 49	40MS	17.0	20S	6.5	0	0.0	10S	3.8	78	57
480. A	INFECTOR	100S	80.0	100S	76.0	80S	73.3	80S	70.0	89	79
481	UP - 50	30S	10.1	30S	9.6	0	0.0	40S	25.0	57	46
482	UP - 51	20S	13.0	40S	13.7	10S	3.3	30S	11.8	67	57
483	UP - 52	40S	21.0	20MS	5.3	0	0.0	60S	31.5	67	46
484	UP - 53	20MS	5.7	10MS	2.7	0	0.0	40S	35.0	78	57
485	UP - 54	20MS	6.4	5MS	0.9	0	0.0	60S	25.0	79	68
486	UP - 55	10MS	6.0	5MS	0.8	20S	6.7	60S	39.3	67	57
487	UP - 56	10MS-S	5.7	5S	1.9	0	0.0	60S	41.3	57	46
488	UP - 57	10MSS	3.1	TR	0.1	0	0.0	60S	38.8	67	56
489	UP - 58	30MRMS	11.3	10S	2.9	TR	0.1	60S	35.0	67	46
490	UP - 59	10MS	6.8	5MS	1.6	TR	0.1	10S	3.5	78	46
491	UP - 60	20S	12.3	5MS	0.9	0	0.0	10S	3.5	78	56
16. Officer In-charge, ARS Washim											
492	WSM - 109-4	10MS	3.1	40S	13.7	20S	8.3	40S	50.0	78	56
493	WSM - 116 D	20MS	5.6	10MS	2.1	TMR	0.1	10MS	5.5	79	67
494	WSM - 138	10MS	5.5	5MS	0.9	TR	0.1	80S	55.0	67	57
495	WSM - 141-1	10MS	2.9	10MS	2.4	TR	0.1	60S	50.0	57	35
496	WSM - 180	40MS-S	35.3	60S	35.2	60S	25.3	60S	40.0	78	57
17. Dr. S.C. Bhardwaj, RS, ICAR-IIWBR, Flowerdale Shimla (H.P.)											
497	FLW 34	20MS	6.1	10MS	1.7	0	0.0	80S	70.0	78	68
498	FLW 35	10MS	3.5	5MS	0.9	0	0.0	20S	8.5	78	57
499	DBWS 1	10MS	2.9	5MS	0.8	0	0.0	40S	20.2	78	57
500	DBWS 2	10MS	2.7	5MS	0.9	0	0.0	20MS	6.4	67	57
500. A	INFECTOR	100S	86.7	100S	76.0	100S	80.0	80S	80.0	89	79
501	DBWS 3	40MRMS	13.3	5MS	1.6	40S*	13.3	20S	11.5	78	67
18. Dr. Yashavantha Kumar K. J., Agharkar Research Institute, Pune											

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
502	MACS 4072	10MR	2.7	20MRMS	2.5	10MS	2.7	60S	35.0	79	67
503	MACS 4073	60MS-S*	22.7	10MR	0.9	10MS	2.7	5MS	1.4	79	67
504	MACS 4074	20MR	4.1	10S	3.6	10MR	1.3	0	0.0	78	67
505	MACS 4075	10MR	2.7	10MR	1.2	TMR	0.1	40S	26.0	79	68
506	MACS 4076	60MS-S*	22.7	10MR	0.9	TMR	0.1	60S	45.0	89	67
507	MACS 4077	30MS-S	11.8	5MS	0.9	TR	0.1	80S	85.0	79	68
508	MACS 4078	10MR	2.1	20RMR	1.7	TR	0.1	40S	19.5	79	57
509	MACS 4079	10MR-MS	3.4	5R	0.4	TR	0.1	10S	4.5	89	57
510	MACS 4080	60MS-S*	20.7	10MR	0.9	0	0.0	20MS	9.0	89	67
511	MACS 4081	10MR	1.5	TR	0.1	0	0.0	10MS	4.1	78	67
512	MACS 4082	10MS	3.2	5MS	1.5	0	0.0	60S	37.0	79	67
513	MACS 4083	20MS	5.9	10MS	2.1	0	0.0	40S	23.0	89	78
514	MACS 4084	5MR	1.2	30R	2.3	0	0.0	40S*	13.0	68	67
515	MACS 4085	10MS	5.5	30R	2.5	0	0.0	60S	43.0	79	67
516	MACS 4086	10MS	6.0	5MS	1.7	0	0.0	20S	5.0	89	67
517	MACS 6716	60S	31.3	40S	20.5	10S	3.3	80S	65.0	67	57
518	MACS 6717	40S	22.0	20MS	3.3	0	0.0	80S	57.5	57	57
519	MACS 6718	80S	48.0	30S	14.4	60S*	20.0	60S	45.0	57	57
520	MACS 6719	20MS	11.3	10MS	2.1	0	0.0	80S	70.0	89	67
520. A	INFECTOR	100S	86.7	100S	74.0	80S	73.3	80S	80.0	89	79
521	MACS 6720	60S*	24.7	20S	11.3	10S	3.6	80S	70.0	67	56
522	MACS 6721	20MS	7.2	20MS	3.3	TR	0.1	80S	65.0	79	57
523	MACS 6722	10MS	4.0	5MS	0.9	0	0.0	100S	80.0	67	57
524	MACS 6723	20MS	7.2	10MS	2.5	0	0.0	80S	55.0	67	56
525	MACS 6724	10MS	4.5	10MS	1.6	0	0.0	80S	60.0	89	67
526	MACS 6725	TR	0.1	TR	0.1	5S	1.7	80S	65.0	68	57
527	MACS 6726	20MS-S	14.0	10MS	1.7	10S	3.3	40S	11.0	78	67
528	MACS 6727	10MS	4.3	40S	12.4	10S	3.5	60S	60.0	78	67
529	MACS 6728	20S	10.3	40S	22.6	TMR	0.1	100S	85.0	67	56
530	MACS 6729	5MS	1.7	5MS	0.9	TR	0.1	100S	85.0	89	67
531	MACS 6730	40S	20.7	20S	11.8	60S*	20.1	80S	70.0	67	57
532	MACS 6731	40S	30.7	20S	7.2	TR	0.1	80S	70.0	89	57
533	MACS 6732	5MR	1.1	TR	0.1	0	0.0	20S	13.0	68	56
534	MACS 6733	10MS	4.7	5MS	1.0	0	0.0	80S	70.0	79	57
535	MACS 5050	10S	12.4	TMR	0.2	0	0.0	80S	55.0	79	57
536	MACS 5051	20MS-S	7.4	TR	0.1	0	0.0	80S	54.0	68	57
19. Dr. V. K. Singh, ICAR-IARI, New Delhi											
537	PS-1185	TR	0.2	10MR	0.8	0	0.0	60S	38.8	67	57
538	PS-1186	TR	0.1	20MR	1.7	0	0.0	60S	43.8	57	46
539	PS-1187	40S	23.3	20S	15.6	10S	3.3	60S	60.0	67	57
540	PS-1188	20MS	5.9	20S	12.0	10S	3.3	60S	50.0	68	56
540. A	INFECTOR	100S	86.7	100S	80.0	80S	73.3	80S	80.0	89	79
541	PS-1189	20MS	8.1	60S	28.4	60S*	23.3	60S	47.5	56	46
542	IND-454	20MS	5.4	60S	13.6	TR	0.1	60S	45.1	68	57
543	IND-455	10MR	2.4	TR	0.1	0	0.0	80S	55.0	69	57
544	WBM 3693	5RMR	0.6	20MR	1.9	20S	6.7	40S	22.5	78	57
545	DW1615	10MS	6.0	10S	3.7	TR	0.1	40S	16.3	68	67
546	DW 1616	20MS	6.9	10MS	2.5	TR	0.1	60S	35.5	89	67
547	DW1617	20MS	6.4	10MS	1.7	10S	3.3	60S	30.0	68	56
548	DW1618	40S	22.4	20MS	3.2	0	0.0	40S	20.0	67	46
549	DW1619	40MS-S	13.4	TR	0.1	0	0.0	20S	9.8	78	57
550	DW1620	20MRMS	6.7	5MS	0.8	0	0.0	40S	27.5	46	35
551	SBP 16-01	60MS-S	32.7	20MS	4.8	5S	1.7	40S	12.7	78	56
552	SBP 16-02	20S	6.9	20MS	7.6	10S	3.3	60S	42.5	78	57
553	SBP 16-03	10MS	4.7	10S	4.5	0	0.0	80S	55.0	67	56

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
554	SBP 16-04	10MS	2.9	TR	0.1	10S	3.3	60S	50.0	89	57
555	SBP 16-05	20MS	6.4	5MS	0.9	10S	3.3	40S	17.3	89	67
556	SBP 16-06	5MS	3.0	20MS	4.3	5S	1.7	60S	55.0	46	35
557	CSW 109	20MS	8.1	20S	5.8	0	0.0	10S	3.5	68	57
558	CSW 114	60MS-S*	22.0	10MS	1.6	5S	1.7	40S	18.8	67	46
559	CSW 132	60S	38.1	30S	6.1	20S	6.7	20S	17.5	57	35
560	CSW 133	40S*	16.7	10MS	3.4	0	0.0	40S	28.8	46	35
560. A	INFECTOR	100S	86.7	100S	84.0	80S	73.3	80S	80.0	89	78
561	CSW 134	20MS-S	6.1	5MR	0.5	0	0.0	40S	23.0	46	35
562	CSW 135	10MS	7.3	10S	2.1	0	0.0	10S	3.6	78	57
563	CSW 136	20MS	8.7	TR	0.1	0	0.0	5S	1.3	68	46
564	QBP 16-1	20MS	8.3	5MS	1.3	20S	6.7	60S	40.0	67	57
565	DL2450	20MS	6.9	20S	5.6	40S	13.3	40S	20.0	47	35
566	DL2478	TR	0.1	TR	0.1	5S	1.7	60S	40.0	89	68
567	DL2599	40S	22.7	20MS	3.2	10S	3.3	60S	45.0	35	35
568	DL2607	40S*	15.3	20MS	4.8	10S	3.3	60S	32.0	67	45
569	DL2670	10MS	2.7	5MS	0.9	5S	3.0	60S	45.0	78	57
570	DL2691	10MS	16.3	20S	4.9	40S	15.0	60S	45.0	89	67
571	PS-1190	80S	42.0	40S	19.2	40S*	13.3	40S	22.5	89	46
572	PS-1191	80S*	27.3	40S	16.2	40S	26.7	60S	42.5	78	57
573	PS-1192	TR	0.1	40S	14.4	80S*	26.7	60S	45.0	37	35
574	PS-1193	10MS	4.3	40S	14.4	0	0.0	60S	50.0	46	36
575	PS-1194	10MS	3.4	10S	3.7	5S	1.7	60S	44.0	67	46
576	PS-1195	20S	6.7	5MS	0.8	0	0.0	80S	65.0	67	47
577	PS-1196	80S*	30.1	20MS	6.1	0	0.0	60S	38.8	68	57
578	PS-1197	5MR	0.7	TR	0.1	0	0.0	80S	65.0	78	67
579	IND-456	10MR	1.7	TR	0.1	0	0.0	80S	65.0	89	67
580	IND-457	5MR	0.7	TR	0.1	0	0.0	80S	80.0	89	67
580. A	INFECTOR	100S	86.7	100S	76.0	80S	73.3	80S	80.0	89	79
581	IND-458	5R	1.7	TR	0.1	0	0.0	80S	80.0	89	67
582	HW 1909-1	TR	0.1	TR	0.1	0	0.0	80S	31.0	68	57
583	DW1621	30S	10.1	40S	11.6	10S	3.4	40S	7.5	89	68
584	DW1622	40S	28.7	20MS	3.3	0	0.0	40S	17.7	78	57
585	DW1623	20MS	8.1	20S	11.6	40S	16.7	40S	21.0	67	57
586	DW1624	80S*	29.3	40S	9.1	10MS	2.7	20MS	12.5	78	57
587	DW1625	40S	21.5	40S	14.4	40S*	13.3	40S	26.5	78	57
588	DW1626	10MS	4.1	10MS	1.7	0	0.0	30S	18.0	78	57
589	SBP 16-07	10MS	5.7	20S	8.8	40S*	13.3	80S	50.0	89	67
590	SBP 16-08	5MS	1.8	40S	12.4	10S	3.3	80S	75.0	68	57
591	SBP 16-09	30MS	19.3	40S	12.8	0	0.0	80S	75.0	57	46
592	SBP 16-10	60S*	22.7	40S	18.0	20S	6.7	80S	60.0	68	57
593	CSW 137	30MS-S	17.7	10MS	1.6	0	0.0	40S	16.5	78	57
594	CSW 138	10MS	4.4	5MS	0.8	0	0.0	10MS	4.3	68	47
595	CSW 139	40S	17.4	20MS	4.2	0	0.0	20S	7.7	68	56
596	CSW 140	60S	24.3	20MS	3.2	0	0.0	60S	30.3	46	45
597	CSW 141	60S	26.1	20MS	5.3	10MR	1.4	10S	8.0	67	57
598	CSW 142	30MS	17.3	20MS	8.8	0	0.0	20S	9.8	67	57
599	QBP 16-2	60S	27.2	20MS	6.5	20S	6.7	60S	50.0	67	57
600	QBP 16-3	80S*	27.7	40S*	8.0	0	0.0	80S	70.0	68	57
600. A	INFECTOR	100S	86.7	100S	80.0	80S	66.7	80S	80.0	89	78
601	DL2616	20MS	5.5	10MS	3.1	5S	1.7	80S	60.0	68	57
602	DL2618	10MS	2.7	10MS	2.8	0	0.0	80S	65.0	78	57
603	DL2620	10MS	2.7	10S	3.8	5S	1.7	80S	70.0	67	46
604	DL2701	5MS	1.4	20S	4.0	0	0.0	80S	60.0	57	47
605	PS-1210	5MS	1.4	10S	2.1	0	0.0	80S	75.0	78	46

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
606	PS-1211	20MS	5.4	10MS	1.6	0	0.0	80S	80.0	67	35
607	PS-1212	20S	8.7	40S	23.2	40S	20.0	80S	70.0	68	45
608	IND-459	10MS	4.3	5MS	0.8	0	0.0	80S	70.0	78	56
609	IND-460	5MS	3.0	60S*	13.3	0	0.0	80S	70.0	78	68
610	IND-461	TR	0.1	5S	1.1	0	0.0	80S	65.0	89	67
611	IND-462	5R	0.5	TR	0.1	0	0.0	80S	65.0	89	68
612	IND-463	5R	0.5	TMR	0.2	0	0.0	80S	60.0	78	68
613	IND-464	TR	0.1	TR	0.1	0	0.0	80S	80.0	78	57
614	IND-465	TMR	0.3	TR	0.1	0	0.0	80S	85.0	78	57
615	IND-466	10MS	3.4	5MS	0.9	0	0.0	80S	75.0	68	57
616	IND-467	20MS	9.0	10MS	2.8	0	0.0	80S	75.0	78	57
617	DW1627	30MS	15.7	40S	15.4	10S	3.3	80S	75.0	68	57
618	DW1628	40MS	16.0	20MS	4.0	0	0.0	80S	70.0	78	57
619	SBP 16-11	20MS	7.3	20S	7.2	0	0.0	100S	80.0	68	57
620	SBP 16-12	10MS	3.1	5S	1.8	0	0.0	80S	65.0	78	57
620. A	INFECTOR	100S	86.7	100S	84.0	80S	66.7	80S	80.0	89	79
621	SBP 16-13	20MS	7.1	20S	9.7	0	0.0	80S	70.0	67	57
622	SBP 16-14	60S	48	20S	5.9	0	0.0	80S	57.5	67	57
623	CSW 143	30S	17.6	20MS	3.3	80S	14.3	80S	43.3	78	68
624	CSW 144	20MS	5.4	10S	2.9	0	0.0	40S	34.0	67	57
625	DL2694	10MS	3.0	5MS	0.9	0	0.0	60S	50.0	68	57
626	DL2695	10MS	2.7	5MS	9.3	0	0.0	60S	41.3	78	57
627	PS-1202	20MS	9.2	40S	10.5	40S*	13.3	20S	12.5	78	57
628	PS-1203	30MS	23.7	10S	5.2	0	0.0	60S	42.0	57	47
629	PS-1204	20MS	5.7	10MS	1.6	0	0.0	60S	45.0	57	46
630	PS-1205	20S	12.3	40S	14.8	0	0.0	60S	65.0	67	57
631	IND-468	TR	0.1	TR	0.1	0	0.0	60S	55.0	78	67
632	IND-469	5R	0.5	TR	0.1	0	0.0	60S	70.0	78	68
633	DW1629	5MS	1.4	40S	10.4	0	0.0	60S	55.0	78	67
634	DW1630	30S	11.1	20MS	4.2	0	0.0	60S	45.0	46	35
635	DW1631	30S	10.7	20MS	4.3	0	0.0	60S	32.5	47	35
636	DW1632	40MS-S	24.0	40S	12.9	0	0.0	60S	32.0	36	35
637	DW1633	20MS	7.2	40S	17.9	20S	8.3	40S	25.5	46	35
638	DW1634	10S	8.0	40S	12.0	10S	3.3	60S	21.3	36	35
639	SBP 16-15	30MR	10.0	40S	8.8	TR	0.1	80S	65.0	46	24
640	SBP 16-16	80S	50.0	40S	12.1	TR	0.1	60S	50.0	47	35
640. A	INFECTOR	100S	86.7	100S	72.0	100S	80.0	80S	70.0	89	79
641	SBP 16-17	60S	37.3	20S	4.1	0	0.0	60S	44.0	57	46
642	SBP 16-18	10MS	2.7	10S	2.9	0	0.0	60S	45.0	67	57
643	SBP 16-19	TR	0.1	5S	1.1	0	0.0	60S	31.8	57	46
644	SBP 16-20	20MR-MS	8.0	5MS	0.9	5S	1.7	60S	22.0	67	46
645	SBP 16-21	40S	30.7	80S	32.1	TMS	0.3	80S	70.0	78	57
646	SBP 16-22	5R	0.5	20S	4.2	TR	0.1	40S	13.5	78	45
647	SBP 16-23	20S	8.1	20S	5.6	0	0.0	60S	37.5	67	46
648	SBP 16-24	10MS	2.8	20S	8.8	0	0.0	60S	37.5	67	46
649	SBP 16-25	20MS	5.7	10MS	1.7	10S	3.3	60S	26.3	68	46
650	CSW 145	20S	12.1	60S	14.5	0	0.0	40S*	14.0	57	36
651	CSW 146	30S	10.3	10MS	1.6	5S	1.7	40S	35.0	46	35
652	CSW 147	20S	16.0	10S	4.4	TR	0.1	40S	27.5	68	36
653	CSW 148	20MS	8.0	40S	9.6	TR	0.1	10S	6.0	57	45
654	QBP16-4	10MS	3.1	10MS	2.5	0	0.0	60S	18.0	68	57
655	QBP16-5	10MS	2.7	5S	1.9	10S	3.3	40S	55.0	57	46
656	QBP16-6	10MS	2.9	5MS	0.8	0	0.0	60S	37.5	57	35
657	DL2693	20MS	5.5	20MR	2.5	5S	1.7	60S	55.0	57	46
658	DL2705	10MS	3.5	40S	9.7	20S	6.7	60S	50.0	69	58

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
659	DL2759	10MS	2.7	5MS	1.6	0	0.0	40S	40.0	67	46
660	DL2795	40S*	14.9	20S	7.2	20S	6.7	60S	25.3	57	34
660. A	INFECTOR	100S	86.7	100S	80.0	100S	80.0	80S	75.0	89	79
661	PS-1206	20MS	5.8	20S	7.2	5S	1.7	60S	60.0	67	57
662	PS-1207	10MS	2.9	20S	4.8	0	0.0	60S	50.0	68	46
663	PS-1208	10S	4.4	60S*	13.8	0	0.0	80S	65.0	57	46
664	PS-1209	30MS-S	11.7	5MS	0.8	0	0.0	60S	50.0	56	45
665	IND-470	20MS	7.0	5MS	0.9	0	0.0	100S	75.0	89	57
666	IND-471	TMR	0.3	5R	0.3	0	0.0	60S	60.0	78	68
667	IND-472	TR	0.1	TR	0.1	0	0.0	80S	65.0	89	67
668	IND-473	TMR	0.3	TR	0.1	0	0.0	60S	65.0	78	57
669	IND-474	TMR	0.3	TR	0.1	0	0.0	100S	80.0	89	78
670	IND-475	5MS	1.5	5MS	0.9	0	0.0	100S	75.0	89	68
671	IND-476	5MS	1.7	TR	0.1	0	0.0	80S	70.0	89	68
672	IND-477	TMR	0.3	TR	0.1	0	0.0	80S	60.0	89	68
673	ID 1645 (d)	TMR	0.3	TR	0.1	0	0.0	5MS	2.0	78	56
674	ID 1646 (d)	5MS	2.1	5MR	0.5	0	0.0	5MS	1.1	79	56
675	ID 1647 (d)	TR	0.1	TMR	0.2	0	0.0	5MS	3.2	78	67
676	ID 1648 (d)	5MR	0.8	TMR	0.2	0	0.0	10MS	3.0	79	68
677	HW 1904-1	10MS	4.0	5MS	1.4	0	0.0	60S	50.0	68	47
678	HW 1902-1	10MS	3.1	5MS	0.8	0	0.0	80S	70.0	68	58
679	DW1635	40S	22.4	20MS	3.2	0	0.0	60S	45.0	68	57
680	DW1636	20MS	5.5	10S	4.4	5S	1.7	60S	50.0	89	67
680. A	INFECTOR	100S	86.7	100S	76.0	80S	73.3	80S	80.0	89	78
681	DW1637	40S	19.4	20S	8.2	TR	0.1	80S	55.0	89	67
682	DW1638	40S	20.0	40S	13.8	20S	6.7	80S	65.0	89	68
683	SBP 16-26	40S*	16.7	80S	32.6	40S	16.0	100S	80.0	89	57
684	SBP 16-27	20MS	9.4	20MS	5.9	5S	1.7	60S	45.0	67	46
685	SBP 16-28	60S	36.7	20MS	4.0	TR	0.1	80S	60.0	78	57
686	SBP 16-29	10MS	3.2	5MS	1.2	0	0.0	40S	11.5	69	56
687	SBP 16-30	20MS	5.8	40S	12.2	TR	0.1	60S	60.0	89	68
688	SBP 16-31	TMR	0.3	20S	8.1	TR	0.1	80S	75.0	89	67
689	DW1639	10MS	3.7	5MS	1.2	0	0.0	60S	60.0	89	57
690	DW1640	20MS	6.9	10MS	2.4	0	0.0	60S	40.0	89	57
691	CSW 149	20MS	6.0	10MS	1.6	0	0.0	40S	12.5	68	67
692	CSW 150	10MS	4.1	5MS	1.4	10MR	1.3	10S	4.5	89	67
693	DL2431	20MR-MS	6.8	10MS	1.6	0	0.0	80S	55.0	89	57
694	DL2882	10MS	3.1	5MS	0.9	0	0.0	80S	70.0	89	57
695	ID 1601	TMS	0.4	5MR	0.5	TR	0.1	40S	13.5	89	68
696	ID 1602	10MS	2.7	5MS	0.9	TR	0.1	5MS	1.3	89	68
697	ID 1603	5R	0.5	TR	0.1	0	0.0	10MS	7.8	89	67
698	ID 1604	5R	0.5	TR	0.1	0	0.0	10MS	4.5	89	67
699	ID 1605	5R	0.5	5MR	0.5	10MR	1.3	5MS	1.9	89	67
700	ID 1606	30S	11.1	30S	6.9	5MR	0.7	5MS	2.0	89	78
700. A	INFECTOR	100S	86.7	100S	80.0	80S	73.3	80S	70.0	89	78
701	ID 1607	TR	0.1	TMR	0.1	10MR	1.3	10MR	2.1	89	67
702	ID 1608	TR	0.1	TR	0.1	0	0.0	5S	3.4	89	67
703	ID 1609	5S	1.8	TMR	0.2	0	0.0	20S	12.0	79	57
704	ID 1610	TR	0.1	TR	0.1	0	0.0	5MS	2.5	79	57
705	ID 1611	TR	0.1	TMR	0.1	TR	0.1	5MS	2.5	89	68
706	ID 1612	5MS	2.0	5MS	1.3	TR	0.1	5MS	1.6	89	68
707	ID 1613	TMR	0.2	TR	0.1	0	0.0	5MS	1.0	89	67
708	ID 1614	TMR	0.2	TR	0.0	0	0.0	20S	8.5	89	67
709	ID 1615	5R	0.4	10MR	0.9	TMR	0.1	10MS	5.3	89	68
710	ID 1616	TR	0.1	5MR	0.5	TMR	0.1	10S	6.5	79	68

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
711	ID 1617	TR	0.1	TR	0.1	0	0.0	20S	8.5	89	67
712	ID 1618	5S	2.2	TMR	0.2	TMR	0.1	10S	6.5	89	78
713	ID 1619	TR	0.1	TMR	0.1	0	0.0	5S	2.3	79	57
714	ID 1620	5R	0.4	TR	0.1	0	0.0	10S	4.0	78	68
715	ID 1621	5MS	1.5	5MR	0.6	0	0.0	10MS	5.0	79	57
716	ID 1622	10MS	2.8	5MS	0.9	0	0.0	5MS	1.1	89	79
717	PS-1198	40S	23.0	20MS	10.8	0	0.0	80S	65.0	68	57
718	PS-1199	40S	29.7	40S	12.2	0	0.0	80S	65.0	47	36
719	PS-1200	40S	22.0	40S	20.8	10S	3.3	80S	60.0	46	35
720	PS-1201	20MS	5.5	20MS	4.3	0	0.0	60S	60.0	58	47
720. A	INFECTOR	100S	86.7	100S	88.0	80S	73.3	80S	80.0	89	78
721	IND-478	20S	6.7	10MR	0.8	0	0.0	80S	70.0	89	57
722	IND-479	10MS	4.1	TR	0.1	0	0.0	80S	40.0	89	56
723	IND-480	40S	23.7	10S	3.7	10S	3.4	80S*	25.1	89	57
724	IND-481	40S	22.0	10MS	3.3	TR	0.1	80S	32.0	89	68
725	IND-482	40S	28.0	20S	5.6	10S	3.3	80S	57.5	89	57
726	IND-483	30MS	9.3	10MS	1.7	0	0.0	80S	45.0	89	78
727	IND-484	5R	3.1	TR	0.1	5S	1.7	80S	48.0	89	67
728	IND-485	TR	0.1	TR	0.1	0	0.0	80S	60.0	89	56
729	WBM 3660	20MS	11.7	TR	0.1	0	0.0	20S	18.5	67	57
730	WBM 3643	10MS	3.1	15MS	2.5	TR	0.1	80S	50.0	78	57
731	HW 5507	20S	21.0	10MS	2.1	0	0.0	60S	37.5	47	47
732	DW1641	20S	11.3	10MS	1.6	0	0.0	20S	8.8	68	68
733	SBP 16-32	10MS	5.5	10MR	1.2	0	0.0	60S	52.5	68	57
734	SBP 16-33	30MS	18.7	20S	7.6	0	0.0	60S	33.0	68	67
735	SBP 16-34	20MS	5.9	10S	2.1	0	0.0	10S	4.8	78	57
736	SBP 16-35	20S	14.0	20MS	5.3	0	0.0	20S	6.5	69	57
737	SBP 16-36	40S	28.7	30S	16.0	20S	10.0	60S	38.0	68	57
738	SBP 16-37	5R	0.5	5MR	0.5	0	0.0	20S	6.0	89	67
739	SBP 16-38	TR	0.1	TR	0.1	0	0.0	20S	8.3	89	67
740	SBP 16-39	30MS	14.3	10MR	0.8	5S	1.7	60S	50.0	89	68
740. A	INFECTOR	100S	86.7	100S	84.0	80S	73.3	80S	80.0	89	79
741	SBP 16-40	40S*	13.5	20S	8.1	5S	1.7	40S	31.0	67	57
742	SBP 16-41	20S	12.3	30S	16.0	40S	13.3	60S	45.0	89	67
743	CSW 151	40S	20.7	20MS	5.2	10S	3.3	40S	21.8	69	68
744	CSW 152	20S	13.0	15MR	3.1	10S	4.0	40S	37.5	89	57
745	CSW 153	30MS-S	14.3	20MR	3.5	5MR	0.7	40S	17.8	89	56
746	QBP 16-7	20MS	10.0	20MS	7.2	10S	3.3	60S	50.0	89	57
747	DL2349	20MS	5.8	30MS	5.3	10S	4.0	20MS	10.0	68	57
748	DL2572	20S	10.3	30MS	10.9	10S	4.0	40S	25.0	56	45
749	DL2654	10MS	3.1	20MS	5.3	0	0.0	60S	42.5	67	46
750	ID 1623	5MR	0.8	5MRMS	0.8	0	0.0	20S	9.0	89	67
751	ID 1624	10MS	6.7	10MR	1.6	5MR	0.7	20S	8.8	89	78
752	ID 1625	20MS	7.5	20MRMS	2.9	10MR	1.3	10S	3.7	89	68
753	ID 1626	10MS	4.7	20MRMS	4.5	10MR	1.3	10S	4.0	89	67
754	ID 1627	10MS	3.4	10MRMS	2.1	5MR	0.7	20MS	5.1	89	67
755	ID 1628	5MRMS	1.1	5MR	0.9	TMR	0.1	10MS	3.0	89	68
756	ID 1629	5RMR	0.7	5MR	0.5	TR	0.1	10MS	2.2	89	67
757	ID 1630	20MS	8.3	TMR	0.2	TR	0.1	10MS	3.4	89	68
758	ID 1631	5MS	2.3	TMS	0.2	TR	0.1	10S	5.3	89	68
759	ID 1632	5MS	2.1	TR	0.1	0	0.0	5MS	3.1	79	68
760	ID 1633	20MS	7.0	5S	1.4	0	0.0	5MS	1.0	89	78
760. A	INFECTOR	100S	93.3	100S	84.0	80S	73.3	80S	80.0	89	79
761	ID 1634	10MS	5.5	TR	0.1	10MR	1.3	5MS	2.1	69	57
762	ID 1635	10MR	1.5	TMR	0.2	0	0.0	10MS	3.1	89	67

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
763	ID 1636	TR	0.2	TMR	0.2	0	0.0	5MS	2.5	79	78
764	ID 1637	10S	3.7	TR	0.1	0	0.0	10MS	2.8	89	67
765	ID 1638	TR	0.2	TMR	0.5	0	0.0	5MS	1.1	89	67
766	ID 1639	10MS	2.7	TR	0.1	0	0.0	5MS	1.0	78	57
767	ID 1640	10S	3.7	TR	0.0	0	0.0	10MS	3.0	89	67
768	ID 1641	TMR	0.3	TR	0.1	0	0.0	20MS	10.6	89	68
769	ID 1642	10MS	3.1	TR	0.1	0	0.0	20MS	7.6	89	78
770	ID 1643	TR	0.1	TR	0.1	0	0.0	40S*	12.6	89	78
771	ID 1644	20MS	5.5	10MS	2.0	0	0.0	5MS	1.8	79	67
772	WBM 3653	40S	26.0	60S	21.8	5S	1.9	10MS	4.0	78	57
773	WBM 3661	40S	29.3	20S	4.3	TMS	0.3	20S	6.4	89	68
774	WBM 3642	20MS	8.3	30S	8.8	0	0.0	60S	42.5	89	68
775	WBM 3644	60S	40.0	20S	7.8	0	0.0	20S	5.0	89	68
776	WBM 3645	60S	40.0	20S	8.0	5S	1.7	20S	5.3	89	68
777	WBM 3666	60S	33.3	40S	24.0	60S	26.7	20S	6.3	78	57
778	WBM 3669	60S	39.3	20S	10.2	40S	20.0	20S	8.5	67	57
779	WBM 3694	40S	19.2	20MR	2.6	5S	1.7	10S	3.9	89	67
780	WBM 3689	10MS	3.4	TR	0.1	0	0.0	60S	27.7	89	67
780. A	INFECTOR	100S	93.3	100S	80.0	80S	73.3	80S	80.0	89	79
781	WBM 3682	40MS-S	12.2	TR	0.1	0	0.0	10S	3.8	57	46
782	WBM 3647	10MS	6.3	10S	3.2	20S	6.7	5MS	1.2	68	67
783	WBM 3640	20S	13.3	60S	20.8	10S	3.3	10MS	2.5	78	57
784	WBM 3692	10MS	2.9	40S*	8.1	20S	8.3	40S	20.0	68	57
785	HW 5522-1	TMR	0.2	TR	0.1	0	0.0	80S	80.0	47	46
786	WBM 3700	20MS	9.3	20S	6.1	0	0.0	20S	11.3	58	47
787	WBM 3699	20MS	5.5	10S	4.0	TR	0.1	40S	29.0	68	57
788	WBM 3695	10MS	4.7	10MS	1.6	0	0.0	20MS	5.0	78	57
789	WBM 3696	60MS-S	26.0	10S	7.6	0	0.0	10MS	2.0	67	46
790	WBM 3667	60S	37.3	40S	21.2	60S	26.7	20S	8.0	68	57
791	WBM 3670	60S	38.7	20S	8.2	10S	3.3	80S	40.0	78	67
792	HW 5501-2	20MS	8.0	15S	3.0	0	0.0	80S	80.0	89	78
793	HW 5522	10MS	2.7	30S	6.0	0	0.0	80S	80.0	58	46
794	HW 5506	20MS	5.4	5MS	0.8	0	0.0	80S	75.0	89	68
795	HW 5508-1	20MRMS	6.7	10MR	0.8	0	0.0	60S	40.0	68	67
796	HW 5510	20MS	9.0	5MR	0.4	0	0.0	40S	18.0	89	78
797	HW 1904	10MS	3.1	TMR	0.2	0	0.0	60S	55.0	78	67
798	HW 1906	10MS	5.0	10S	2.0	0	0.0	60S	60.0	68	57
799	HW 1914	30S	19.3	20S	4.7	TR	0.1	80S	65.0	89	78
800	HW 1902	40S	21.0	20MS	4.8	TR	0.1	80S	65.0	68	57
800. A	INFECTOR	100S	93.3	100S	80.0	80S	73.3	80S	75.0	89	79
801	HW 1936	TMR	0.1	10S	2.0	0	1.7	60S	55.0	68	57
802	HW 5055	5MS	1.7	TR	0.0	0	0.0	60S	45.0	78	68
803	HW 5056	10S	4.0	10S	2.0	0	0.0	60S	55.0	78	67
804	HW 5057	40MRMS	14.7	TR	0.1	0	0.0	10S	3.8	68	57
805	HW 5058	40MRMS	20.0	TR	0.1	0	0.0	5S	2.8	67	47
806	IND-486	10MS	6.0	TR	0.1	0	0.0	80S	65.0	89	67
807	IND-487	10MS	4.7	20S	4.0	0	0.0	80S	60.0	89	67
808	DW1642	20MS-S	11.5	10MR	1.2	0	0.0	60S	22.5	68	45
809	DW1643	20MS-S	12.7	10MS	1.6	0	0.0	60S	38.8	47	36
810	DW1644	10S	6.1	15MS	2.4	0	0.0	40S	32.0	47	46
811	DW1645	20S	10.0	10S	2.2	0	0.0	60S	32.5	57	46
812	SBP 16-42	20S	8.3	TMR	0.1	TR	0.1	60S	52.5	68	57
813	SBP 16-43	40S*	17.0	40S	9.8	TR	0.1	20S	7.5	68	57
814	SBP 16-44	10MS	3.4	20S	6.4	20S	6.7	40S	13.5	68	67
815	SBP 16-45	20S	7.1	40S	8.9	20S	6.7	20S	7.0	68	67

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
816	SBP 16-46	20S	13.0	TMS	0.2	10MR	1.4	20S	15.8	89	67
817	SBP 16-47	20MS	5.6	15MS	2.4	0	0.0	60S	50.0	89	67
818	SBP 16-48	20MS	11.3	10MS	2.0	40S*	13.3	20S	13.3	89	57
819	SBP 16-49	20S	13.0	20MS	6.4	40S	16.7	20S	7.0	69	57
820	CSW 154	40S*	15.5	TR	0.1	0	0.0	60S	35.0	69	58
820. A	INFECTOR	100S	93.3	100S	60.0	100S	80.0	80S	80.0	89	79
821	CSW 155	20S	13.0	TR	0.1	0	0.0	20MS	7.4	89	67
822	CSW 156	30MS	14.0	10MS	1.6	0	0.0	40S	16.5	89	68
823	CSW 157	40S	20.7	10MS	5.7	40S*	13.3	20S	11.0	89	67
824	CSW 158	20MS	10.0	10MS	2.0	0	0.0	60S	40.0	89	68
825	DL2681	30MS	17.3	TR	0.1	10S	3.3	10S	4.8	89	68
826	DL2757	60MS-S	38.0	10MR	1.0	10S	3.3	10S	3.8	89	57
827	WBM 3697	10MS	2.7	10MS	1.6	0	0.0	10S	3.8	89	57
828	WBM 3639	40MS-S	20.3	10MS	1.7	0	0.0	60S	17.8	89	57
829	WBM 3665	40S*	17.3	40S	12.8	40S	16.7	60S	30.1	68	57
830	WBM 3641	40S*	18.7	60S	15.2	20S	6.7	40S	23.0	89	67
831	WBM 3664	20S	10.7	20MS	3.2	0	0.0	60S	23.5	57	56
832	WBM 3698	40MRMS	14.7	10MR	0.9	0	0.0	20S	9.5	67	56
833	WBM 3637	TMR	0.2	5MR	0.5	TMR	0.1	40S	20.3	58	46
834	WBM 3651	40S	29.3	60S	30.0	40S	32.0	60S	22.0	68	57
835	WBM 3659	30S	16.7	20S	6.8	0	0.0	10S	2.7	78	57
836	WBM 3662	40S	29.7	20S	5.0	0	0.0	20S	6.3	58	57
837	WBM 3668	60S	48.3	30S	6.9	40S	20.0	10S	4.5	68	56
838	WBM 3675	40S*	16.3	20MS	7.5	40S	13.3	60S	45.0	89	57
839	WBM 3676	40S	24.7	10MS	4.0	10S	3.3	60S	33.8	78	67
840	WR 3055	30MS-S	17.0	TR	0.1	0	0.0	20S	7.5	79	58
840. A	INFECTOR	100S	86.7	100S	74.0	80S	66.7	80S	80.0	89	78
841	WR 3056	40S	22.7	20S	4.0	0	0.0	60S	26.3	68	46
842	WR 3057	30S	18.0	10MS	1.6	0	0.0	60S	22.0	89	67
843	WR 3058	20MS	10.0	10MR	1.2	0	0.0	60S	21.0	47	46
844	WR 3059	10MS	2.8	TR	0.1	0	0.0	60S	55.0	89	57
845	WR 3060	TR	0.1	TR	0.1	0	0.0	40S	18.8	46	35
846	WR 3061	20S	6.8	TR	0.1	0	0.0	60S	30.0	78	46
847	WR 3062	10MR	1.7	TR	0.1	0	0.1	60S	38.8	58	47
848	WR 3063	20MS	9.5	10S	5.5	10S	4.0	80S	65.0	68	67
849	WR 3064	40MS	18.7	20MS	8.8	60S	20.7	100S	80.0	78	57
20. Dr. Nitish De, Bihar Agricultural College, Sabour, Bhagalpur											
850	BRW 3808	40S	40.0	40S	13.4	40S*	13.4	80S	37.5	67	57
851	BRW 3809	30S	23.3	20S	15.6	60S	22.7	80S	60.0	67	56
852	BRW 3810	20MS	8.8	20S	7.2	0	6.7	60S	39.0	78	67
853	BRW 3811	10S	9.3	10S	3.6	10S	3.4	60S	50.0	89	68
854	BRW 3812	20S	12.7	10MR	0.8	0	0.1	60S	42.5	89	68
855	BRW 3813	20S	13.7	20S	5.0	20S	6.7	80S	60.0	89	67
856	BRW 3814	10S	6.4	40S*	9.2	10S	3.3	40S	18.5	89	67
857	BRW 3815	5S	3.1	TMR	0.1	0	0.0	40S	25.5	47	46
858	BRW 3816	40S	28.0	20S	12.7	40S	14.7	60S	52.5	78	67
859	BRW 3817	10MS	4.7	40S	22.1	60S	40.1	60S	45.0	57	46
860	BRW 3818	20MS	6.1	5MS	2.0	10S	3.3	60S	33.5	57	46
860. A	INFECTOR	100S	93.3	100S	76.0	80S	66.7	80S	80.0	89	79
861	BRW 3819	60S	39.0	40S	13.6	40S*	13.3	80S	50.0	78	57
862	BRW 3820	40S	24.7	20S	6.6	60S*	20.0	60S	43.8	57	47
863	BRW 3821	20S	11.3	10MS	4.2	20MR	2.7	60S	38.8	78	57
864	BRW 3822	40MS-S	20.7	20S	7.0	40S*	13.4	60S	35.5	58	46
865	BRW 3823	40MS-S	20.0	10MR	1.9	0	0.0	40S	14.2	67	57
866	BRW 3824	60S	40.0	40S	20.0	40S*	16.0	60S	45.0	58	57

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
867	BRW 3825	40MS-S	17.5	10MRMS	1.3	0	0.0	60S	30.1	47	36
868	BRW 3826	TMR	0.3	60S	15.6	20S	6.7	40S	27.5	78	57
869	BRW 3827	5S	2.0	60S	14.1	20S	6.7	40S	37.5	47	46
21. Ajay Prakash Agrawal, IGKV, TCB College of Agriculture & Res. Station, Bilaspur (C.G.)											
870	CG 1601	20MS	7.5	60S*	12.5	0	0.0	60S	45.2	89	68
871	CG 1602	10MS	4.7	TMR	0.1	0	0.0	80S	70.0	68	57
872	CG 1603	40MS-S	17.4	10MS	1.6	20S	6.7	80S	65.0	78	67
873	CG 1604	10MS	5.4	20S	5.8	40S*	13.3	60S	28.0	78	57
874	CG 1605	TR	0.1	TR	0.1	0	0.0	80S	75.0	78	57
875	CG 1606	10MS	6.0	5MR	0.4	0	0.0	40S	25.5	78	58
876	CG 1607	20MS	8.0	60S*	12.8	0	0.0	60S	29.5	68	57
877	CG 1608	10MS	3.7	TR	0.1	0	0.0	60S	60.0	78	57
878	CG 1609	30S	14.7	10MS	2.0	40S*	13.3	100S	75.0	89	68
879	CG 1610	40S	35.3	20S	6.8	5S	1.7	80S	75.0	89	79
880	CG 1611	80S	34.7	40S	13.4	5S	1.7	80S	53.8	89	78
880. A	INFECTOR	100S	86.7	100S	80.0	80S	73.3	80S	80.0	89	89
881	CG 1612	60MS-S	44.7	80S	34.4	60S*	20.0	80S	75.0	89	78
882	CG 1613	10MR	2.7	10MR	0.8	0	0.0	80S	75.0	89	78
883	CG 1614	10MS	2.7	10S	3.2	20S	6.7	60S	43.0	68	57
884	CG 1615	5MS	1.5	5S	1.0	10S	3.3	60S	50.0	58	47
885	CG 1616	20MS	5.5	40S	15.2	40S	18.7	80S	49.0	67	57
886	CG 1617	10S	3.3	20MS	5.2	0	0.0	40S	20.0	56	46
887	CG 1618	20S	9.4	20MS	3.3	0	0.0	80S	50.0	89	68
888	CG 1619	30MR	5.4	TMR	0.2	0	0.0	80S	75.0	89	78
889	CG 1620	20MR	4.1	TR	0.1	0	0.0	80S	75.0	89	68
22. Dr. Vinod Singh, NDUA&T, Faizabad (UP)											
890	NW 7028	20MS	12.0	10S	2.2	20S	10.0	20S	8.8	89	68
891	NW 7029	20S	13.3	20MS	3.6	20S	6.7	60S	27.5	79	67
892	NW 7030	20MS	8.0	TR	0.1	0	0.0	40S	20.0	68	57
893	NW 7031	20MS	9.3	20S	8.4	10S	3.3	60S	55.0	89	67
894	NW 7032	30S	16.7	10MS	2.6	5S	1.7	80S	70.0	89	68
895	NW 7033	30S	13.7	TR	0.1	0	0.0	40S	16.0	89	78
896	NW 7034	40S*	14.9	10S	3.0	0	0.0	40MS	11.3	89	68
897	NW 7035	30MS	18.7	15MS	3.4	0	0.0	60S	38.0	89	68
898	NW 7036	40S*	16.1	10MR	1.2	0	0.0	60S	40.0	89	78
899	NW 7037	40S*	14.3	20MS	3.3	0	0.0	40S	15.3	89	68
900	NW 7038	60S*	23.0	20S	8.8	0	0.0	60S	35.0	89	67
900. A	INFECTOR	100S	93.3	100S	76.0	80S	66.7	80S	80.0	89	79
901	NW 7039	30S	11.1	TR	0.0	0	0.0	80S	60.0	89	78
902	NW 7040	30S	10.7	20S	4.1	0	0.0	80S	62.5	78	67
903	NW 7041	10S	3.7	10MR	0.8	0	0.0	20S	7.1	68	57
904	NW 7042	10MS	4.3	20S	4.1	0	0.0	60S	27.8	67	46
905	NW 7043	10MS	7.0	30MS	8.9	10S	3.3	60S	34.0	67	57
906	NW 7044	20MS	7.1	10MS	1.6	0	0.0	60S	50.0	67	57
907	NW 7045	30S	10.8	TR	0.1	0	0.0	80S	70.0	57	56
908	NW 7046	30S	12.1	10MS	1.6	0	0.0	60S	37.5	78	56
909	NW 7047	40S*	16.0	20S	4.0	5S	1.7	20MS	9.0	78	68
910	NW 7048	20S	8.4	10MS	1.7	0	0.0	40MS	33.0	78	67
911	NW 7049	20MS	5.7	20MS	3.3	0	0.0	40S	14.8	58	47
912	NW 7050	20MS	5.5	30S	7.6	0	0.0	60S	45.0	46	46
913	NW 7051	20MS	7.3	20S	10.4	0	0.0	60S	55.0	68	57
914	NW 7052	30S	11.9	10MR	0.8	TS	0.3	40S	33.8	89	57
3. Dr. V. D. Salunke, Wheat and Maize Reseach Unit, Parbhani											
915	PBN 4949	40S	29.3	40S	22.0	20S	9.3	80S	60.0	78	56
916	PBN 4751-02	20MS	8.1	60S	18.4	5MR	0.7	80S	80.0	68	57

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
917	PBN 4027-2	10MS	8.0	60S	16.7	5S	2.3	60S	50.0	78	68
918	PBND 1625-01	10MS	3.4	20RMR	1.6	5MR	0.7	10S	7.5	78	47
919	PBND 100	5R	1.7	TR	0.1	TR	0.1	60S	48.0	79	57
24. Dr. Saikat Das, UBKV, Pundibari, Coochbehar (WB)											
920	UBKV 2016-01	20MS	5.6	TR	0.1	0	0.0	60S	25.0	58	46
920. A	INFECTOR	100S	86.7	100S	76.0	80S	73.3	80S	80.0	89	79
921	UBKV 2016-02	40S	25.7	10MR	0.8	0	0.0	60S	48.8	68	46
922	UBKV 2016-03	20MS	10	10MS	1.6	0	0.0	60S	45.0	68	46
923	UBKV 2016-04	30S	13	20S	4.0	0	0.0	60S	55.0	78	47
924	UBKV 2016-05	10MS	4.0	10MS	2.7	0	0.0	40S	20.0	47	47
925	UBKV 2016-06	20MS	5.5	30MS	4.8	40S	20.0	20S	20.0	47	35
926	UBKV 2016-07	20MS	5.4	20MS	3.2	20S	20.0	60S	55.0	68	67
927	UBKV 2016-08	10MS	2.8	TR	0.1	5S	1.7	60S	42.5	67	56
928	UBKV 2016-09	10MS	3.8	TR	0.1	0	0.0	60S	55.0	68	57
929	UBKV 2016-10	30S	11.3	10MR	0.8	10S	3.3	60S	30.0	78	46
930	UBKV 2016-11	20MS	6.0	10MR	1.0	0	0.0	60S	52.5	46	46
931	UBKV 2016-12	60S	32.7	10MS	1.7	0	0.0	60S	36.0	67	57
932	UBKV 2016-13	30MS	9.6	20S	7.2	10S	3.3	60S	55.0	68	47
933	UBKV 2016-14	40S	27.3	20S	4.1	20S	6.7	40S	17.5	57	46
934	UBKV 2016-15	40S	20.1	10S	2.8	0	0.0	60S	34.5	78	57
935	UBKV 2016-16	40S*	13.5	20MS	3.3	5S	1.7	80S	70.0	78	67
936	UBKV 2016-17	40S*	15.3	30MS	8.1	5S	1.7	60S	55.0	67	57
937	UBKV 2016-18	60S	26.7	20S	6.4	5S	1.7	60S	40.0	67	47
938	UBKV 2016-19	40S*	16.1	10S	2.1	0	0.0	60S	30.1	78	57
939	UBKV 2016-20	40S	18.8	20MS	3.3	0	0.0	60S	45.0	57	57
25. Dr. B. K. Das, Bhabha Atomic Research Centre, Mumbai, India											
940	TNIAW-1	20MS	11.7	20MS	3.2	0	0.0	80S	50.0	89	57
940. A	INFECTOR	100S	93.3	100S	80.0	80S	73.3	80S	80.0	89	78
941	TNIAW-2	20MS	7.3	5MS	0.9	0	0.0	80S	55.0	89	67
942	HD 2189	40S	19.3	40S	13.6	20S	6.7	60S	45.0	89	68
943	TAW-13	40S	19.7	40S	14.0	20S	10.0	40S	12.5	68	56
944	TAW-33	60S	45.3	60S	29.6	0	0.0	80S	65.0	78	57
945	TNIAW-97	40S	20.0	40S	22.0	0	0.0	80S	75.0	89	67
946	TAW-1006	40S	24.0	40S	17.6	0	0.0	60S	45.0	89	67
26. Dr. Vijay Rana, CSK HPKVV, Rice & Wheat Research Centre, Malan (H.P.)											
947	PW 1077	20MS	12.3	5MS	0.8	0	0.0	20S	11.5	46	35
948	PW 1078	20S	13.0	30MS	10.8	0	0.0	40S	15.0	67	57
949	PW 1079	40S	18.7	5MR	0.9	0	0.0	10S	6.5	78	57
950	PW 1080	40S	19.7	20S	4.2	0	0.0	40S	21.5	78	57
951	PW 1081	40MS-S	20.0	10MS	1.7	0	0.0	10MS	5.4	89	67
952	PW 1082	20MS	12.0	30MS	9.8	40S*	13.3	40S	16.0	68	57
953	PW 1083	20MS	7.1	20S	9.6	0	0.0	40S	25.0	78	57
954	PW 1084	30MS	8.8	10MS	3.2	20S	6.7	5MS	1.0	78	68
955	PW 1085	30S	11.6	5S	1.1	10S	3.3	40S*	14.0	68	67
956	PW 1086	20S	14.7	20S	9.2	20S	6.7	20MS	10.0	89	68
957	PW 1088	30MS	13.0	40S	16.1	TR	0.1	40S*	11.0	89	67
958	PW 1089	30S	13.7	10S	5.2	20S	6.7	10S	3.5	58	57
959	PW 1090	20MS	13.3	20S	5.4	20S	6.7	40S	20.1	89	57
960	PW 1091	20S	16.0	10S	2.8	0	0.0	10S	3.5	67	57
960. A	INFECTOR	100S	93.3	100S	80.0	80S	73.3	80S	80.0	89	79
961	BW 245	20MS	6.7	20S	6.1	20S	6.7	40S*	13.2	67	57
962	BW 246	20S	9.8	20S	4.3	20S	6.7	20S	9.0	89	67
963	BW 247	10S	6.0	15MS	3.0	10MR	1.3	20S	11.0	57	46
964	BW 248	20MS	5.4	10MS	1.7	0	0.0	20S	12.0	89	57
965	BW 249	20MS	5.4	10S	2.0	0	0.0	40S	13.6	67	46

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
966	BW 250	20MS	5.5	20S	6.0	10S	3.3	5S	1.3	67	45
967	BW 251	10MS	2.7	20S	6.8	10MR	1.3	60S	22.5	78	57
968	BW 252	30MS-S	17.7	20S	9.0	0	0.0	60S	25.0	57	46
969	BW 253	20MS	7.0	20S	8.1	20S	6.7	40S	20.1	89	68
970	BW 254	10MS	4.7	5S	1.9	0	0.0	40S	16.3	89	68
971	DW 231	10S	7.7	5MR	0.6	10S	3.3	60S	23.5	89	67
972	DW 232	30MS	8.4	20S	5.2	0	0.0	40S	16.3	68	57
973	DW 233	20MS	7.3	20S	4.4	0	0.0	60S	32.1	89	67
974	DW 234	60S	27.7	40S	15.8	20S	6.7	40S	12.3	78	68
975	DW 235	30S	15.3	40S	18.0	10S	3.3	40S	25.0	68	57
976	DW 236	30S	13.3	20S	6.0	0	0.0	60S	28.0	89	78
27. Dr. Ramanand Patil, Maharashtra Hybrid Seeds Co. Ltd.											
977	MWL 6357	20MS	9.0	10S	4.0	0	0.0	40S	17.0	78	57
978	MWL 6655	30S	11.4	5MR	0.9	5S	1.7	40S	19.5	78	57
28. Dr. Mahabal Ram, SHIATS, Allahabad											
979	AAI-W15	20MS	11.0	10S	2.5	0	0.0	60S	38.0	58	46
980	AAI-W18(MR-26-1)	80S	48.7	20S	12.4	0	0.0	80S	50.0	89	67
980. A	INFECTOR	100S	80.0	100S	78.0	80S	73.3	80S	80.0	89	78
981	AAI-W19(MR-1128)	40S	26.0	30S	14.0	0	0.0	80S	80.0	89	67
982	AAI-W28 (MR-3014/10/4/11)	20MS	14.7	30S	12.8	0	0.0	80S	85.0	89	68
983	AAI-W20(MR-2020)	60S	48.0	40S	20.8	20S	6.7	80S	70.0	89	78
29. Dr. A. P. Padhye, MPKV, ARS, Niphad											
984	NIAW 3245	60S*	20.1	20S	10.6	0	0.0	40S	20.2	78	67
985	NIAW 3270	10MS	5.7	30MS	4.8	0	0.0	60S	50.0	89	68
986	NIAW 3309	10R	1.4	10S	3.6	5S	1.7	60S	33.8	89	68
987	NIAW 3340	10MS	5.0	10S	2.1	5S	1.7	80S	70.0	89	67
988	NIAW 3354	30S	14.7	10S	3.2	0	0.0	40S	21.0	68	57
989	NIAW 3386	20MS	9.7	10MR	0.9	0	0.0	60S	30.5	68	57
990	NIAW 3390	30MS	12.0	TR	0.1	0	0.0	40S	16.5	57	46
991	NIAW 3423	40S	26.7	30S	10.8	20S	6.7	20MS	10.0	57	46
992	NIAW 3433	60S	29.3	30S	10.9	5S	1.7	40S	25.0	79	68
993	NIAW 3442	40S	24.7	10MS	3.6	20S	6.7	20S	7.0	78	57
994	NIAW 3467	60S	29.3	20S	4.2	5S	1.7	20S	11.0	68	57
995	NIAW 3500	60S*	22.0	30S	10.0	0	0.0	60S	45.0	57	57
996	NIAW 3523	20MS	12.7	15MS	5.6	10S	3.3	60S	43.0	78	67
997	NIAW 3525	30S	13.0	20MS	3.7	0	0.0	60S	35.0	78	56
998	NIDW 1148	10S	4.7	10S	2.1	0	0.0	20S	8.0	89	68
999	NIDW 1149	10S	7.3	20MS	4.0	0	0.0	10S	8.8	89	67
1000	NIDW 1152	20S	14.0	10S	2.1	0	0.0	20S	6.1	89	67
1000. A	INFECTOR	100S	80.0	100S	82.0	80S	73.3	80S	80.0	89	79
1001	NIDW 1156	5M	2.0	TMR	0.2	TR	0.1	10S	3.8	78	57
1002	NIDW 1158	10MS	3.7	TR	0.1	TR	0.1	10S	2.7	68	57
1003	NIDW 1171	10MS	3.1	TMR	0.2	TR	0.1	10S	6.3	78	67
30. Wheat Breeder, JNKVV, ZARS, Powarkheda (MP)											
1004	MP 17-01	20S	13.3	10S	2.9	10S	3.4	80S	47.5	78	67
1005	MP 17-02	20S	10.3	10MR	0.8	0	0.0	60S	45.0	56	46
1006	MP 17-03	10MS	3.1	TR	0.1	0	0.0	60S	40.0	57	47
1007	MP 17-04	10MS	4.7	TMR	0.2	20S	6.7	80S	60.0	67	56
1008	MP 17-05	20MS	10.7	TR	0.1	0	0.0	40S	14.5	47	46
1009	MP 17-06	10MS	4.0	5MS	1.6	0	0.0	20S	10.0	56	45
1010	MP 17-07	30MRMS	11.7	20S	4.2	0	0.0	10S	3.5	67	46
1011	MP 17-08	20MS	8.3	20S	6.0	5S	1.7	80S	33.0	78	67
1012	MPO 17-09	10MS	3.7	20R-MR	1.3	0	0.0	TMS	0.5	68	56
1013	MPO 17-10	20MS	5.7	10MS	1.7	0	0.0	40S*	10.5	68	56
1014	MPO 17-11	30MS	9.4	20MS	3.9	0	0.0	60S	32.0	68	67

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
1015	MPO 17-12	20MS	8.1	10MS	1.8	0	0.0	40S	18.0	78	57
1016	MPO 17-13	40S*	16.3	TMR	0.1	0	0.0	5S	1.3	68	57
1017	MPO 17-14	10MS	3.1	10R-MR	0.7	TR	0.1	10MR	2.5	78	57
1018	MPO 17-15	20MR-MS	10.0	10S	4.1	TR	0.1	5MS	1.1	68	57
1019	MPO 17-16	20S	10.3	10S	2.1	0	0.0	10S	2.6	78	57
1020	MP 17-17	20MS	7.3	15MS	4.6	0	0.0	60S	41.0	78	67
1020. A	INFECTOR	100S	80.0	100S	76.0	80S	73.3	80S	80.0	89	79
1021	MP 17-18	20S	16.0	10S	2.1	10MS	4.3	40S	16.3	68	57
1022	MP 17-19	10MS	3.5	40S	14.1	20S	13.3	20S	22.0	89	67
1023	MP 17-20	10MS	2.7	20S	4.3	10S	3.3	60S	55.0	67	57
1024	MP 17-21	20MS	8.1	10S	4.2	0	0.0	60S	50.0	67	57
1025	MP 17-22	5MS	2.4	TR	0.1	0	0.0	60S	50.0	58	46
1026	MP 17-23	20S	8.7	60S	21.4	40S*	13.3	60S	50.0	78	57
1027	MP 17-24	30MS	19.3	15MS	2.5	0	0.0	10S	4.5	78	57
1028	MP 17-25	20MS	8.0	10MS	3.2	5S	1.7	80S	70.0	78	67
1029	MP 17-26	10MS	3.1	TR	0.1	0	0.0	60S	45.0	68	57
1030	MP 17-27	20MS	10.0	40S	14.4	10S	3.3	80S	80.0	78	68
1031	MP 17-28	30MS	16.0	50S	14.5	20S	6.7	80S	70.0	79	68
1032	MP 17-29	20MS	6.4	20MS	3.3	0	0.0	80S	75.0	68	57
1033	MP 17-30	10MS	5.0	10MR	1.0	0	0.0	80S	65.0	58	57
31. Dr. D. Mohan, ICAR-IIWBR, Karnal											
1034	QBP 1601	5MS	1.4	TR	0.1	0	0.0	40S	22.0	67	46
1035	QBP 1602	10MS	2.8	10S	2.8	0	0.0	40S	16.0	67	57
1036	QBP 1603	20MS-S	14.0	10	2.1	0	0.0	40S	23.5	67	57
1037	QBP 1604	20MS	5.4	TR	0.0	0	0.0	40S	13.8	47	46
1038	QBP 1605	10S	6.1	30S	8.8	0	0.0	60S	31.0	67	46
1039	QBP 1606	10S	6.0	10MS	3.3	5S	1.7	60S	50.0	58	47
1040	QBP 1607	10MS	3.4	40S*	8.9	0	0.0	60S	34.0	78	67
1040. A	INFECTOR	100S	76.7	100S	80.0	80S	66.7	80S	80.0	89	79
1041	QBP 1608	40S*	16.4	10MR	0.9	10S	3.3	20S	7.5	89	68
1042	QBP 1609	20S	6.7	TR	0.0	0	0.0	60S	50.0	89	68
1043	QBP 1610	TR	0.1	TR	0.1	0	0.0	60S*	16.0	57	35
1044	QBP 1611	10MS	6.0	TR	0.1	0	0.0	20S	6.3	58	47
1045	QBP 1612	10MS	4.0	10MS	1.6	0	0.0	60S	37.5	67	57
1046	QBP 1613	10S	6.0	TR	0.1	0	0.0	20S	7.8	68	47
1047	QBP 1614	TR	0.1	TR	0.0	0	0.0	20MS	6.6	78	57
1048	QBP 1615	TR	0.1	TR	0.0	0	0.0	10S	3.0	68	56
1049	QBP 1616	5MS	1.4	TR	0.1	10S	3.3	60S	40.0	47	35
1050	QBP 1617	10S	6.0	20S	4.1	0	0.0	40S	28.0	68	57
32. Dr. Hoshiyar Singh, RARI, Durgapura, Jaipur (Raj.)											
1051	WR 1855	10MS	3.1	TR	0.1	0	0.0	60S	50.0	89	67
1052	WR 1856	10MS	3.4	10S	2.1	0	0.0	60S	50.0	89	68
1053	WR 1857	10MS	3.1	10MR	0.8	0	0.0	60S	50.0	89	78
1054	WR 1858	5MS	1.7	TS	0.3	0	0.0	60S	42.5	89	68
1055	WR 1859	10MS	3.1	TR	0.1	0	0.0	60S	40.0	89	67
1056	WR 1860	10MS	4.1	10MR	0.9	0	0.0	60S	35.0	89	57
1057	WR 1861	10MS	5.4	10S	3.7	0	0.0	40S	18.3	67	56
1058	WR 1862	10MS	3.1	TR	0.1	0	0.0	60S	50.0	68	57
1059	WR 1863	10MS	3.3	20S	4.8	0	0.0	80S	60.0	89	68
1060	WR 1864	40S	32.3	20S	9.9	10S	3.3	60S	44.0	89	67
1060. A	INFECTOR	100S	80.0	100S	80.0	80S	73.3	80S	80.0	89	79
1061	WR 1865	40S*	17.7	30MS	5.6	40S	13.3	40S	24.0	89	68
1062	WR 1866	10MS	3.1	10MR	1.6	20S	6.7	60S	45.0	89	67
1063	WR 1867	10MS	5.7	TR	0.1	0	0.0	60S	50.0	89	67
1064	WR 1868	10MS	3.1	10MR	0.9	0	0.0	80S	60.0	89	67

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
1065	WR 1869	10MS	3.1	TR	0.1	0	0.0	60S	55.0	89	78
1066	WR 1870	10MS	3.1	TR	0.1	0	0.0	60S	45.0	89	68
1067	WR 1871	20S	10.0	20MR	2.2	5S	1.7	60S	55.0	89	68
1068	WR 1872	10MS	2.7	TR	0.1	0	0.0	60S	55.0	89	78
1069	WR 1873	20MS	6.1	TR	0.1	0	0.0	80S	60.0	89	78
1070	WR 1874	20MS	5.9	TR	0.1	0	0.0	80S	70.0	68	47
1071	WR 1875	5MS	1.9	TR	0.1	0	0.0	60S	47.5	89	68
1072	WR 1876	10S	4.7	TR	0.1	0	0.0	20S	11.5	89	78
1073	WR 1877	20MS	5.3	TR	0.0	0	0.0	100S	75.0	68	47
1074	WR 1878	5MR	0.8	20S	4.9	5MR	0.7	20MS	6.8	89	68
1075	WR 1879	10MS	3.2	10MR	1.3	5S	1.7	80S	44.0	89	67
1076	WR 1880	10MS	5.0	TR	0.0	TR	0.1	60S	32.5	89	78
1077	WR 1881	5MS	2.7	10MR	0.9	0	0.0	80S	65.0	46	35
1078	WR 1882	10MS	4.7	TMR	0.1	0	0.0	60S	32.0	78	58
1079	WR 1883	TMS	0.3	TR	0.1	0	0.0	40S	30.0	78	67
1080	WR 1884	20MS	7.0	40S	11.2	0	0.0	60S	41.0	78	57
1080. A	INFECTOR	100S	73.3	100S	80.0	80S	73.3	80S	80.0	89	79
1081	WR 1885	20MS	6.7	80S	26.0	80S*	26.9	80S	60.0	89	78
1082	WR 1886	10MS	3.5	10MR	0.8	TR	0.1	60S	42.5	89	67
1083	WR 1887	30S	10.4	TR	0.1	0	0.0	60S	21.0	89	57
1084	WR 1888	20MS	6.7	10MS	1.6	0	0.0	100S	80.0	68	57
1085	WR 1889	20MS	6.0	10MR	0.8	0	0.0	100S	80.0	68	47
1086	WR 1890	10MS	3.3	TR	0.1	0	0.0	60S	40.0	89	78
1087	WR 1891	5MR	1.4	20S	4.9	0	0.0	60S	42.5	89	67
1088	WR 1892	5MS	1.7	TR	0.1	0	0.0	60S	50.0	89	68
1089	WR 1893	10MS	4.0	TS	0.2	0	0.0	60S	45.0	89	78
1090	WR 1894	10MS	3.6	TR	0.1	0	0.0	5S	2.3	89	68
1091	WR 1895	20MS	6.1	10MS	1.6	0	0.0	40S	12.3	89	57
1092	WR 1896	20S	12.1	10S	2.0	0	0.0	40S	15.5	67	46
1093	WR 1897	20MS	8.7	15MS	2.5	0	0.0	60S	30.0	47	46
1094	WR 1898	30S	14.1	20S	7.2	0	0.0	40S	15.1	89	67
1095	WR 1899	20MS	6.7	TR	0.1	0	0.0	60S	55.0	89	78
1096	WR 1900	20MS	5.5	20S	4.4	0	0.0	60S	38.8	89	68
1097	WR 1901	10MS	3.3	10MR	0.8	5S	1.7	40S	15.1	89	67
1098	WR 1902	10MS	3.1	5S	1.3	0	0.0	60S	47.5	89	67
1099	WR 1903	20MS	5.7	TR	0.1	10S	3.3	10S	8.0	89	58
1100	WR 1904	40S	20.3	20S	4.1	0	0.0	60S	47.0	68	56
1100. A	INFECTOR	100S	86.7	100S	80.0	80S	73.3	80S	80.0	89	79
1101	WR 1905	20S	12.3	30S	10.0	0	0.0	80S	60.0	89	67
1102	WR 1906	20MS	14.0	20S	7.6	0	0.0	80S	60.0	68	58
1103	WR 1907	20MS	8.7	TMR	0.2	0	0.0	60S	50.0	89	68
1104	WR 1908	20MS	11.3	TR	0.1	5S	3.0	40S	17.5	89	68
1105	WR 1909	30S	17.3	20S	6.4	40S	16.7	40S*	14.5	89	67
1106	WR 1910	20S	13.3	10S	4.0	0	0.0	60S	35.0	68	57
1107	WR 1911	20S	14.0	15MS	4.4	20S	6.7	40S	14.7	89	67
1108	WR 1912	10MS	3.4	TR	0.2	0	0.0	80S	65.0	69	57
1109	WR 1913	5MS	1.5	TR	0.1	0	0.0	60S	50.0	89	67
1110	WR 1914	5R	0.5	TR	0.1	0	0.0	40S*	14.5	89	78
33. PI, Crop Improvement, ICAR-IIWBR, Karnal											
1111	CI- 2016-1	10MRMS	2.1	TMR	0.2	0	0.0	5MS	1.0	89	67
1112	CI- 2016-2	20S	10.7	TS	0.3	0	0.0	40S*	14.0	89	67
1113	CI- 2016-3	20MS	6.9	10MR-MS	1.7	0	0.0	10MS	3.0	89	56
1114	CI- 2016-4	20S	8.1	10MS	1.9	0	0.0	10S	3.5	68	56
1115	CI- 2016-5	10S	5.3	TS	0.2	0	0.0	40S	16.0	58	57
1116	CI- 2016-6	60S*	20.3	20MS	7.6	0	0.0	20MS	10.5	89	67

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
1117	CI- 2016-7	10R-MR	1.1	TR	0.1	0	0.0	10S	4.8	89	57
1118	CI- 2016-8	30MR-MS	11.4	TR	0.1	0	0.0	5MS	1.4	89	57
1119	CI- 2016-9	20MS	9.4	10MR	0.9	0	0.0	10MS	3.0	89	67
1120	CI- 2016-10	20S	11.0	5R-MR	0.4	0	0.0	10MS	4.1	89	68
1120. A	INFECTOR	100S	80.0	100S	85.0	80S	73.3	80S	80.0	89	79
1121	CI- 2016-11	10MS	4.7	20MR-MS	2.6	0	0.0	20S	7.1	79	68
1122	CI- 2016-12	10MS	2.9	15MS	2.4	0	0.0	60S	30.0	78	68
1123	CI- 2016-13	TMR	0.3	40S	9.6	10S	3.3	60S	49.0	69	57
1124	CI- 2016-14	TR	0.1	20S	4.1	20S	6.7	60S	55.0	89	67
1125	CI- 2016-15	10MS	5.4	10S	2.0	5S	1.7	60S	50.0	67	47
1126	CI- 2016-16	10MS	4.1	TR	0.1	0	0.0	40S	39.0	57	46
1127	CI- 2016-17	TS	0.5	TR	0.1	10S	3.3	60S	35.0	57	46
1128	CI- 2016-18	TR	0.1	TR	0.1	0	0.0	40S	17.3	68	57
1129	CI- 2016-19	60MS-S	23.4	S	0.2	5S	1.7	20S	8.8	68	57
1130	CI- 2016-20	40MR-MS	14.0	10MR	0.9	0	0.0	40S	18.3	57	46
1131	CI- 2016-21	30MS-S	14.4	30S	8.1	20MR	2.7	40S	20.3	68	57
1132	CI- 2016-22	10MS	5.4	60S*	12.9	40S	20.0	5S	1.5	68	68
1133	CI- 2016-23	10MS-S	6.0	30S	7.8	40S*	13.3	20S	5.1	67	57
1134	CI- 2016-24	30S	12.7	10MS	1.6	0	0.0	20S	5.0	68	46
1135	CI- 2016-25	10MS	2.9	TS	0.2	0	0.0	80S	60.0	78	56
1136	CI- 2016-26	10MS	3.1	10MR	0.8	20S	6.7	80S	50.0	78	57
1137	CI- 2016-27	10S	6.7	10MR	0.8	20S	6.7	20S	7.5	68	46
1138	CI- 2016-28	20S	14.0	20S	4.4	0	0.0	10S	8.3	89	57
1139	CI- 2016-29	40S	35.3	40S	10.7	5S	4.3	40S*	14.8	68	47
1140	CI- 2016-30	40S*	15.1	30S	10.0	0	0.0	80S	50.0	47	46
1140. A	INFECTOR	100S	86.7	100S	80.0	80S	73.3	80S	80.0	89	78
1141	CI- 2016-31	40MR-MS	16.7	20MR	1.8	0	0.0	40S	19.5	89	57
1142	CI- 2016-32	30MR-MS	12.0	20S	7.2	0	0.0	40S	12.2	89	68
1143	CI- 2016-33	40MR-MS	16.7	20S	6.3	0	0.0	10S	6.0	89	57
1144	CI- 2016-34	20MS	10.0	TMR	0.2	20MR	2.7	10S	4.5	89	57
1145	CI- 2016-35	10MS	4.1	10S	2.0	0	0.0	80S	65.0	89	46
1146	CI- 2016-36	10MS	2.7	10S	2.1	40S	15.0	40S	21.0	89	57
1147	CI- 2016-37	20MS	6.7	40S	16.0	40S	20.0	40S	23.0	56	34
1148	CI- 2016-38	10MS	6.0	30S	11.0	40S*	13.3	10S	3.5	78	68
1149	CI- 2016-39	5MS	1.7	TR	0.1	0	0.0	0	0.0	78	67
1150	CI- 2016-40	30MR-MS	14.0	TR	0.1	10MR	1.3	20S	5.0	78	56
1151	CI- 2016-41	5R	0.5	TR	0.1	0	0.0	5MS	1.2	89	67
1152	CI- 2016-42	40S	31.3	30S	8.0	10S	3.3	60S	44.0	78	57
1153	CI- 2016-43	TR	0.1	5MR	0.5	10S	3.3	40S	25.5	57	35
1154	CI- 2016-44	20MS	6.3	10S	2.2	40S	13.3	TS	0.3	78	57
1155	CI- 2016-45	20MS	8.7	30MS-S	12.6	40S	13.3	80S	55.0	78	57
1156	CI- 2016-46	20MS	5.9	15MS	2.4	TS	0.3	10S	3.5	89	67
1157	CI- 2016-47	20MS	10.7	40S	12.4	60S	26.7	5S	2.3	89	67
1158	CI- 2016-48	20MS-S	9.0	10MR	0.9	20S	6.7	60S	32.5	78	68
1159	CI- 2016-49	40S*	16.7	30MS	8.8	0	0.0	80S	55.0	78	56
1160	CI- 2016-50	40S	45.3	40S	10.0	0	0.0	60S	52.5	56	46
1160. A	INFECTOR	100S	86.7	100S	76.0	80S	66.7	80S	80.0	89	78
1161	CI- 2016-51	20MS	16.0	10S	2.1	40S	15.0	20S	7.3	58	46
1162	CI- 2016-52	10MS	6.0	10S	2.2	20S	6.7	20S	7.5	78	67
1163	CI- 2016-53	20S	10.3	40S	18.4	40S	20.0	40S	27.5	68	46
1164	CI- 2016-54	30S	17.3	40S	16.4	40S	28.3	40S	17.5	78	67
1165	CI- 2016-55	10S	6.7	30S	8.0	40S	15.1	40S*	11.0	57	46
1166	CI- 2016-56	30MS	11.0	20S	5.1	10S	3.3	60S	32.5	68	57
1167	CI- 2016-57	10MS	4.1	5S	1.1	20S	6.7	20S	15.3	57	47
1168	CI- 2016-58	10MS	6.3	10S	2.9	20S	6.9	20MS	6.5	68	56

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
1169	CI- 2016-59	10S	9.0	20S	7.5	TR	0.1	60S	34.0	68	57
1170	CI- 2016-60	20MS	9.7	20S	4.1	20S	6.7	60S	43.8	67	46
1171	CI- 2016-61	10S	6.3	20S	7.5	10S	3.3	80S	45.0	58	47
1172	CI- 2016-62	20MS-S	11.3	10S	3.9	20S	6.7	60S	35.0	47	47
1173	CI- 2016-63	10MS	4.2	TR	0.1	0	0.0	60S	37.5	57	46
1174	CI- 2016-64	10MS	2.7	20S	4.1	10S	3.4	60S	55.0	68	47
1175	CI- 2016-65	30MS	15.3	10MS	1.9	10S	3.4	60S	36.3	78	67
1176	CI- 2016-66	50S	26.7	30S	6.2	TR	0.1	40S	24.5	89	67
1177	CI- 2016-67	TR	0.1	TR	0.0	0	0.0	40S	25.1	56	24
1178	CI- 2016-68	10MS	2.9	5S	1.1	0	0.0	60S	35.1	57	46
1179	CI- 2016-69	10MS	2.9	5S	1.9	0	0.0	20S	6.0	56	56
1180	CI- 2016-70	20MS	8.1	TR	0.1	10MR	1.3	0	0.0	57	57
1180. A	INFECTOR	100S	80.0	100S	72.0	80S	60.0	80S	80.0	89	78
1181	CI- 2016-71	30S	13.4	20S	6.5	10S	3.3	40S	30.1	58	46
1182	CI- 2016-72	30MS-S	21.0	10S	2.0	0	0.0	60S	19.6	78	46
1183	CI- 2016-73	30MS-S	17.0	10MS	1.7	20S	6.7	60S	35.0	68	57
1184	CI- 2016-74	20MS	6.1	15MS	2.7	10S	3.3	60S	50.0	68	57
1185	CI- 2016-75	30S	10.1	TR	0.1	0	0.0	60S	37.5	57	47
1186	CI- 2016-76	10MS	3.1	10MR	0.8	0	0.0	40S	28.0	56	46
1187	CI- 2016-77	TMS	0.5	10S	2.1	0	0.0	80S	60.0	57	46
1188	CI- 2016-78	10MS-S	6.0	TR	0.0	0	0.0	60S	45.0	78	56
1189	CI- 2016-79	TR	0.1	10S	2.1	0	0.0	60S	50.0	58	57
1190	CI- 2016-80	40S*	16.7	10S	2.0	0	0.0	80S	60.0	79	57
1191	CI- 2016-81	20MS	6.9	10MR	0.8	0	0.0	60S	60.0	56	46
1192	CI- 2016-82	5MS	1.3	10MR	0.9	0	0.0	80S	60.0	57	47
1193	CI- 2016-83	20MS	8.2	20S	4.0	5S	1.7	60S	45.0	78	57
1194	CI- 2016-84	20S	13.3	20S	8.4	0	0.0	80S	56.0	78	68
1195	CI- 2016-85	40S*	17.3	30S	6.0	0	0.0	60S	41.0	47	36
1196	CI- 2016-86	20MS	7.0	20S	10.4	20MR	2.7	60S	32.0	47	46
1197	CI- 2016-87	20MS	5.4	15MS	6.1	0	0.0	60S	47.5	67	57
1198	CI- 2016-88	10MS	3.0	15S	4.9	0	0.0	60S	52.5	56	46
1199	CI- 2016-89	10MS	5.3	10S	2.3	0	0.0	60S	55.0	67	57
1200	CI- 2016-90	20MS	10.0	10S	3.8	0	0.0	80S	60.0	67	57
1200. A	INFECTOR	100S	80.0	100S	76.0	80S	73.3	80S	80.0	89	79
1201	CI- 2016-91	5S	1.7	5S	1.1	0	0.0	40S	25.2	57	57
1202	CI- 2016-92	TS	0.5	10S	2.1	0	0.0	40S	23.0	68	46
1203	CI- 2016-93	20S	10.0	30S	6.0	5S	1.7	40S	19.3	68	57
1204	CI- 2016-94	5R	0.7	TMR	0.2	0	0.0	60S	42.5	67	56
1205	CI- 2016-95	TR	0.1	30S	7.4	0	0.0	100S	70.0	58	46
1206	CI- 2016-96	60MS-S	27.3	10S	3.0	40S*	13.3	5S	2.3	46	35
1207	CI- 2016-97	5MR	1.1	20S	4.1	40S*	15.1	60S	45.0	67	56
1208	CI- 2016-98	20MS	7.2	60S	25.0	40S	23.3	10MS	2.0	57	36
1209	CI- 2016-99	30MS-S	12.0	20S	4.0	40S	14.7	60S	19.5	78	57
1210	CI- 2016-100	30MS	17.3	40S	17.0	60S	34.7	20S	5.0	68	57
1211	CI- 2016-101	TMS	0.3	5S	1.1	5MS	1.3	40S	18.3	68	57
1212	CI- 2016-102	5S	2.1	TR	0.1	TR	0.1	80S	55.0	68	46
1213	CI- 2016-103	10MR	1.5	10MR	0.8	0	0.0	80S	55.0	89	78
1214	CI- 2016-104	10MS	3.7	15MR	1.3	0	0.0	80S	50.0	67	56
1215	CI- 2016-105	20MS	5.7	80S	24.1	40S	15.0	60S	55.0	57	36
1216	CI- 2016-106	10MS	4.1	TR	0.1	0	0.0	60S	60.0	67	57
1217	CI- 2016-107	10MS	3.4	TMS	0.2	0	0.0	80S	60.0	57	57
1218	CI- 2016-108	20MS	9.7	TR	0.1	0	0.0	60S	55.0	56	45
1219	CI- 2016-109	20MS	5.4	5S	2.0	10S	3.3	60S	50.0	67	56
1220	CI- 2016-110	20MS	5.4	20S	4.0	10S	3.3	60S	50.0	56	45
1220. A	INFECTOR	100S	76.7	100S	72.0	80S	66.7	80S	80.0	89	79

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
1221	CI- 2016-111	20MS	7.7	20MR	1.6	0	0.0	80S	65.0	47	25
1222	CI- 2016-112	20MS-S	7.7	TR	0.1	0	0.0	60S	35.5	35	25
1223	CI- 2016-113	TS	0.4	10S	2.1	40S	15.0	60S	38.8	56	46
1224	CI- 2016-114	TR	0.1	TR	0.1	0	0.0	80S	70.0	58	47
1225	CI- 2016-115	60S	26.1	TS	0.2	0	0.0	60S	22.6	68	45
1226	CI- 2016-116	40S*	16.7	TR	0.1	10S	3.3	60S	55.0	57	45
1227	CI- 2016-117	20MS	6.5	20S	6.9	0	0.0	60S	55.0	67	57
1228	CI- 2016-118	20MS	8.7	TR	0.0	0	0.0	60S	42.5	56	34
1229	CI- 2016-119	5MR	1.1	30S	9.8	0	0.0	60S	45.0	68	57
1230	CI- 2016-120	30MS-S	17.1	TR	0.0	0	0.0	60S	55.0	89	57
1231	CI- 2016-121	TR	0.1	20S	5.1	0	0.0	60S	55.0	57	57
1232	CI- 2016-122	30MS-S	14.4	15MS	2.4	0	0.0	60S	27.5	57	35
1233	CI- 2016-123	40S	19.0	10MS	1.8	0	0.0	60S	47.5	56	35
34. Dr. Monika Garg, NABI, Mohali											
1234	NABIMG - 1	10MS	3.3	10S	4.0	5S	3.0	20S	12.5	57	36
1235	NABIMG - 2	10MS	2.7	10S	2.5	0	0.0	20S	11.3	56	36
35. Dr. Jeet Mal Dhakar, ARS, Ummedganj, Kota											
1236	RKD 323	60S*	23.4	10S	2.9	10MS	2.7	20MS	8.0	68	46
1237	RKD 324	10R	1.1	TS	0.4	5MR	0.7	10S	3.5	68	56
1238	RKD 325	20R-MR	2.1	30MR	2.9	10MR	1.3	20MS	9.0	78	67
1239	RKD 326	60S*	23.4	30R-MR	2.7	10MR	1.3	20MS	8.5	68	57
1240	RKD 327	10S	7.3	20MR	2.9	10MR	1.3	5MS	1.4	78	57
1240. A	INFECTOR	100S	80.0	100S	72.0	80S	73.3	80S	80.0	89	78
1241	RKD 328	20MS-S	9.4	20S	4.5	TR	0.1	20S	17.0	67	57
1242	RKD 329	60S	23.4	TS	0.4	TR	0.1	5MR	0.8	68	57
1243	RKD 330	60MR-MS*	12.4	30R-MR	3.0	10MR	1.4	5MR	0.5	78	56
1244	RKD 331	10S	6.3	60MR-MS	9.7	TR	0.1	TS	0.5	78	57
1245	RKD 332	10MS	3.5	15MR	1.7	TR	0.1	10MR	1.0	78	57
36. Dr. H. G. Prakash, CSAUA&T, Kanpur (U.P.)											
1246	KA 1601	10MS	3.8	60S	24.2	40S	26.7	80S	55.0	78	46
1247	KA 1602	40S*	16.1	TR	0.0	TR	0.1	60S	27.5	67	57
1248	KA 1603	40MS-S	24.0	30S	6.1	40S*	13.3	60S	38.0	57	46
1249	KA 1604	20MS	6.3	20S	6.0	0	0.0	40S	20.5	78	57
1250	KA 1605	10MS	3.7	20S	4.1	0	0.0	60S	47.5	67	46
1251	KA 1606	TR	0.1	TR	0.1	20S	6.7	60S	36.3	58	46
1252	KA 1607	10S	4.4	10MR	0.9	0	0.0	60S	36.0	67	57
1253	KA 1608	20S	7.1	20S	4.0	0	0.0	60S	27.5	67	57
1254	KA 1609	30S	14.3	10S	2.0	0	0.0	60S	30.0	46	35
1255	KA 1610	10MS	3.3	5S	1.0	5S	1.7	10S	4.8	67	57
1256	KA 1611	20MS	8.0	10S	2.1	5S	1.7	60S	31.0	57	57
1257	KA 1612	20MS	8.3	5S	1.4	20S	6.7	60S	35.8	78	68
1258	KA 1613	30S	11.3	20S	5.0	0	0.0	60S	36.3	89	57
1259	KA 1614	20MS	7.2	5S	1.2	10S	3.3	60S	37.5	89	68
1260	KA 1615	20MS	5.7	10MR	1.2	0	0.0	80S	52.5	68	57
1260. A	INFECTOR	100S	76.7	100S	80.0	80S	73.3	80S	80.0	89	79
1261	KA 1616	60S	26.7	20S	4.1	0	0.0	80S	60.0	89	68
1262	KA 1617	30S	12.3	40S*	8.4	0	0.0	80S	57.5	67	57
1263	KA 1618	20MS	7.1	40S	8.8	0	0.0	60S	27.5	78	57
1264	KA 1619	5S	1.7	5S	1.2	0	0.0	40S	18.5	58	35
1265	KA 1620	10S	3.5	10MR	0.9	0	0.0	40S	28.5	47	35
1266	KA 1621	30MS	11.4	20S	4.1	20S	6.7	60S	47.5	67	46
1267	KA 1622	40MR-MS	11.0	10S	6.8	0	0.0	60S	32.5	89	56
1268	KA 1623	TR	0.1	TR	0.1	0	0.0	40S	17.5	89	67
1269	KA 1624	TR	0.1	TMR	0.2	0	0.0	40S	24.5	67	47
1270	KA 1625	10MS	5.4	20S	6.4	0	0.0	60S	22.0	78	56

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
1271	KA 1626	10MS	4.3	5MR	0.6	20S	6.7	60S	42.5	67	46
1272	KA 1627	20S	10.3	5S	2.2	0	0.0	60S	22.0	58	47
1273	KA 1628	10S	7.3	15MR	3.0	0	0.0	80S	52.5	57	46
1274	KA 1629	10MS	3.7	5S	1.3	0	0.0	20S	27.0	68	57
1275	KA 1630	10MS	7.0	5MR	0.5	0	0.0	60S	45.0	67	57
1276	KA 1631	10MS	3.1	TR	0.0	0	0.0	60S	31.0	68	57
1277	KA 1632	20S	10.0	10S	3.8	0	0.0	40S	16.0	68	57
1278	KA 1633	50MR-MS	18.7	40MS	13.4	0	0.0	60S	30.0	67	58
1279	KA 1634	20S	12.5	30S	12.8	0	0.0	60S	42.5	68	67
1280	KA 1635	30S	17.7	20S	9.0	0	0.0	60S	32.5	56	46
1280. A	INFECTOR	100S	86.7	100S	76.0	80S	73.3	80S	80.0	89	89
1281	KA 1636	30S	16.0	15MS	6.0	40S	16.7	40S*	16.3	89	78
1282	KA 1637	60MR-MS	24.0	15S	6.2	10S	3.3	20S	12.5	69	57
1283	KA 1638	10S	6.7	30S	11.2	10S	3.4	60S	45.0	78	58
1284	KA 1639	20MS	5.8	15MS	2.8	0	0.0	80S	60.0	57	57
1285	KA 1640	20MS	6.3	TR	0.1	0	0.0	60S	38.8	68	57
1286	KA 1641	30S	19.3	40S	17.2	40S	16.7	60S	45.0	89	67
1287	KA 1642	20MS	5.5	10MS	2.1	5S	1.7	40S	35.0	89	67
1288	KA 1643	20S	13.0	10S	4.0	10S	3.3	60S	55.0	89	56
1289	KA 1644	60S	42.0	40S	10.7	TR	0.1	60S	40.0	68	57
1290	KA 1645	30S	12.3	40S	15.6	5S	3.1	40S	25.5	58	57
1291	KA 1646	20S	8.7	40S	8.5	10S	3.3	80S	60.0	58	57
1292	KA 1647	30MS	10.3	40S	10.0	0	0.0	60S	21.8	78	68
1293	KA 1648	40MS-S	23.3	40S	10.6	40S*	13.3	10S	2.8	68	56
1294	KA 1649	30MS-S	13.3	20S	4.5	10S	3.3	60S	60.0	68	57
1295	KA 1650	20MS	7.5	TR	0.1	0	0.0	5S	2.0	67	47
37. Dr. Lakshmi Kant, ICAR-VPKAS, Almora, Uttarakhand											
1296	VW 1601	20MS	12.7	20S	4.8	20S	6.7	0	0.0	67	46
1297	VW 1602	60MS-S	34.7	20S	12.2	20S	6.7	10S	2.5	46	35
1298	VW 1603	60MS-S	38.0	20S	8.8	20S	10.0	0	0.0	56	46
1299	VW 1604	40S	32.0	40S	14.8	20S	10.0	0	0.0	67	45
1300	VW 1605	30S	18.7	20S	10.0	20S	10.0	0	0.0	46	35
1300. A	INFECTOR	100S	80.0	100S	64.8	80S	66.7	80S	80.0	89	78
1301	VW 1606	20S	7.4	TR	0.9	0	0.0	60S	31.0	58	47
1302	VW 1607	10S	8.0	10S	2.8	0	0.0	40S	20.0	47	35
1303	VW 1608	10S	3.4	TR	0.9	0	0.0	40S	25.0	58	47
1304	VW 1609	30S	16.7	TMR	0.9	0	1.7	5S	1.4	67	46
1305	VW 1610	60S	33.7	20S	6.8	40S	13.3	10S	3.8	67	56
1306	VW 1611	30S	16.3	15MS	5.8	60S	26.7	60S	18.0	68	57
1307	VW 1612	30S	15.7	20S	7.0	20S	6.7	20S	6.3	68	57
1308	VW 1613	10MS	6.3	40S*	9.0	40S	15.0	0	0.0	58	46
1309	VW 1614	10MS	2.9	30MS	9.6	40MR	8.7	0	0.0	56	46
1310	VW 1615	20MS	10.7	5S	1.9	TR	0.1	40S	13.9	68	46
1311	VW 1616	30S	17.3	20S	6.8	0	0.0	10S	5.8	89	57
1312	VW 1617	10MS	2.7	20S	5.8	0	0.0	40S	21.3	89	68
1313	VW 1618	10MS	4.1	TR	0.9	TS	0.3	40S	20.0	89	57
1314	VW 1619	30S	21.3	20S	6.4	0	0.0	40S	17.5	89	57
1315	VW 1620	40MR-MS	16.0	15MS	5.4	20S	6.7	20S	8.0	68	57
1316	VW 1621	40MR-MS	13.4	TMS	1.0	60S	23.3	40S*	11.3	68	57
1317	VW 1622	30S	13.4	15MS	3.2	0	0.0	60S	55.0	78	58
1318	VW 1623	40S	27.0	20S	7.8	20S	10.0	5S	2.0	68	57
1319	VW 1624	40S	29.0	10S	7.0	20S	6.7	10S	2.7	68	57
1320	VW 1625	40S	16.0	20S	9.0	40S	20.0	5S	1.6	78	57
1320. A	INFECTOR	100S	80.0	100S	64.8	80S	66.7	80S	80.0	89	79
1321	VW 1626	40S	23.0	30S	8.8	60S	33.3	20S	6.5	68	68

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
1322	VW 1627	30MS-S	15.7	20MS	6.0	0	0.0	20S	12.0	89	57
1323	VW 1628	30MS-S	17.1	30S	8.8	0	0.0	40S	18.0	67	57
1324	VW 1629	30MS-S	17.3	20MS	6.3	TR	0.1	60S	27.5	89	68
1325	VW 1630	20MS	10.7	TR	0.9	TR	0.1	60S	28.0	89	68
1326	VW 1631	20MS	6.7	10S	5.6	TR	0.1	80S	40.0	89	57
1327	VW 1632	TR	0.1	TR	0.9	0	0.0	80S	60.0	89	67
1328	VW 1633	20MS	6.1	TR	0.9	10MR	1.3	40S	16.0	47	46
1329	VW 1649	20MS	11.7	10MS	2.4	0	0.0	5S	1.5	89	68
1330	VW 1650	40S	24.0	30S	12.2	40S	16.7	5S	1.5	68	67
1331	VW 1651	TR	0.1	10S	2.8	10S	5.0	80S	42.5	78	57
1332	VW 1652	TR	0.1	10S	3.6	0	0.0	80S	43.8	89	68
1333	VW 1653	40S	19.5	20MS	5.2	0	0.0	20S	6.0	57	57
1334	VW 1654	30S	14.3	30MS	13.6	40S*	13.3	5S	1.3	68	68
1335	VW 1655	40S*	15.4	10MR	2.4	0	0.0	20S	9.0	68	57
1336	VW 1656	60S*	20.7	20S	9.4	40MR	5.3	40S*	12.0	58	57
1337	VW 1657	40S*	14.1	30S	7.8	20MR	2.7	40S*	12.0	78	68
1338	VW 1658	40S	28.7	20MS	8.2	20MR	2.7	60S	31.2	68	56
1339	VW 1659	30S	13.4	20S	7.4	20S	6.7	40S*	10.0	89	57
1340	VW 1660	40S	22.7	30S	12.8	20MR	2.7	40S*	15.5	89	67
1340. A	INFECTOR	100S	80.0	100S	64.8	80S	66.7	80S	80.0	89	78
38. Dr. J.P. Jaiswal, GBPUA&T, Pantnagar, Uttarakhand											
1341	UPMAS 1	40S	40.0	60S	33.2	10MS	2.7	80S	60.0	47	46
1342	UPMAS 2	40S	29.3	30S	20.8	40S	29.3	60S	21.3	58	46
1343	UPMAS 3	40MR-MS	20.0	30S	13.6	20S	10.1	60S	43.8	68	56
1344	UPMAS 4	40S	25.3	10S	5.2	20S	6.7	40S	19.5	58	35
39. Dr. S. Tamhankar, Agharkar Research Institute, Pune											
1345	ARI 7	20MS	5.7	40MS	7.6	0	0.0	0	0.0	68	67
1346	ARI 8	40MS-S	17.4	10MS	2.3	TMR	0.1	0	0.0	89	67
1347	ARI 9	20MS	5.7	20S	5.3	TMR	0.2	0	0.0	89	68
1348	ARI 10	40MS-S	20.1	30S	10.1	10MS	2.7	0	0.0	89	68
1349	ARI 11	20MS	5.9	10MS	2.3	0	0.1	20MS	4.0	89	78
1350	ARI 12	30S	19.1	20MS	4.5	20S	7.7	0	0.0	89	78
40. Dr. Ravish Chatrath, ICAR-IIWBR, Karnal											
1351	QBP 16-8	20MS	8.3	10S	4.6	20S	6.7	80S	42.5	67	57
1352	QBP 16-9	30S	10.8	10MR	0.9	0	0.0	60S	47.5	58	57
1353	QBP 16-13	30S	19.3	20S	6.4	TR	0.1	60S	50.0	47	46
1354	QBP 16-15	30S	18.3	10MR	2.0	60S*	20.0	60S	45.0	68	67
1355	QBP 16-27	40S	24.7	10S	4.6	TR	0.1	60S	50.0	46	36
1356	QBP 16-31	30S	13.0	20MS	3.2	0	0.0	60S	35.0	56	46
1357	QBP 16-34	60S*	20.6	30MS	5.0	0	0.0	60S	55.0	67	57
1358	QBP 16-37	30S	10.4	20S	4.1	0	0.0	40S	21.5	78	58
1359	CG 1626	40MR-MS	10.7	20MS	3.2	20S	6.7	80S	60.0	68	67
1360	CG 1627	60MS-S	31.4	20MR	2.4	20S	6.7	60S	37.0	68	47
1360. A	INFECTOR	100S	80.0	100S	80.0	80S	66.7	80S	80.0	89	79
1361	CG 1628	60S*	25.3	20MS	7.4	10S	4.7	60S	55.0	89	67
1362	AKDW 4910	60MS-S	28.3	30MS	9.2	5MS	1.3	80S	55.0	67	57
1363	DWAP 1616	TMR	0.2	TR	0.1	TR	0.1	40S*	14.0	58	47
1364	DWAP 1617	10MS	2.7	5S	1.0	0	0.0	40S	25.5	68	57
1365	DWAP 1618	20MS	6.7	5MR	0.4	TR	0.1	40S	15.4	89	68
1366	DWAP 1619	TR	0.1	10S	3.1	TR	0.1	60S	43.0	68	57
1367	BWL 5061	20MS	5.5	15MS	2.6	0	0.0	5S	1.3	47	46
1368	BWL 5781	20MS	5.9	10MS	1.6	5S	1.7	20MS	6.5	67	57
1369	BWL 5825	20MS	6.7	TS	0.3	10M	1.3	5S	1.3	56	35
1370	BWL 5854	10MS	5.0	TR	0.1	0	0.0	5S	1.3	89	57
1371	BWL 5882	30MR-MS	10.3	15MR	1.3	0	0.0	40S*	12.3	58	57

S.No.	Entry	Stem rust		Leaf rust				Stripe rust		Leaf blight score	
		South		South		North		North		(0-9 scale, dd)	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av
1372	BWL 5916	10S	4.4	10R	0.5	10MR	1.3	40S*	11.3	78	58
1373	BWL 5917	5S	2.4	TR	0.1	0	0.0	5S	2.5	78	67
1374	BWL 5933	10MS	2.9	TMR	0.1	0	0.0	TS	0.3	58	57
1375	BWL 5948	5MR	0.9	TR	0.1	0	0.0	40S*	11.3	68	57
1376	BWL 5693	20MS	6.1	10MR	0.8	0	0.0	60S	37.5	56	47
1377	BWL 5987	10R-MR	1.2	10S	2.1	5S	3.3	40S*	11.0	57	47
1378	BWL 6327	20MS	7.7	10MS	1.8	40S*	13.3	60S	50.0	57	47
1378. A	INFECTOR	100S	80.0	100S	76.0	80S	73.3	80S	80.0	78	68
41. Dr.(Mrs.) Parveen Chhuneja, PAU, Ludhiana											
1379	BWL 6328	30S	11.7	20MS	4.0	40S	16.7	20S	6.25	56	46
1380	BWL 6329	40S	22.0	40S	13.2	0	0.0	10S	2.5	57	46
42 Arvind Kumar, ICAR-CSSRI, Karnal											
1381	KNL 400	60S	50.0	20S	10.0	60S	50.0	60S	50.0	68	57
1382	KNL 401	30MS	8.3	40S	13.7	20S	6.7	80S	57.5	78	57
1383	KNL 402	20MS	8.0	5MR	0.6	40S	20.0	40S	20.0	68	56
1384	KNL 403	20MS	5.7	10MR	1.6	40S	13.3	60S	40.0	57	57
1385	KNL 404	20MS	7.4	10MR	0.9	0	0.0	80S	60.0	68	47
1386	KNL 405	60S*	23.5	20MS	6.0	20S	6.7	100S	85.0	67	57
1387	KNL 406	20MS-S	11.4	TR	0.1	0	0.0	80S	60.0	68	57
1388	KNL 407	40S*	13.4	15MR	1.3	0	0.0	80S	60.0	78	68
1389	KNL 408	30MS	8.2	20MS	3.2	0	0.0	60S	40.0	78	57
1390	KNL 409	20MS	12.7	20S	5.0	0	0.0	60S	60.0	67	57
1390. A	INFECTOR	100S	76.7	100S	68.0	80S	73.3	80S	80.0	89	79

Annexure Table 2.1. Confirmed sources identified for multiple rust resistance in Elite Plant Pathological Screening Nursery(2016-17)

S. No.	Entry	Rusts							
		Stem rust South		Leaf rust South		Leaf rust North		Stripe rust North	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI
A. Resistant to all three rusts									
Source: AVT II Year 2015-16									
1	HI 8759 (d)	20MS	7.0	TR	0.0	0	0.0	10MS	2.0
2	PBW 723	5MR	1.0	TR	0.0	0	0.0	10MS	3.8
Source: AVT Ist Year 2015-16									
3	HI 8774 (d)	10MS	2.7	TR	0.1	0	0.0	5MS	1.7
4	HPPAU 05	20S	6.8	20S	10.0	10S	2.5	10MS	2.1
5	HPW 423	20S	7.6	10MR	1.3	0	0.0	10S	2.1
6	HPW 433	20S	8.0	TR	0.0	0	0.0	10MS	2.0
7	HS 622	20S	7.1	TMS	0.2	0	0.0	10MS	1.2
8	HS 623	20MS	5.6	TR	0.0	0	0.0	10S	2.6
9	HS 626	20S	8.6	10MS	2.6	0	0.0	5MS	1.1
10	HS 628	20MS	6.5	TR	0.0	0	0.0	5S	0.7
11	PBW 725	10MS	3.4	20MS	5.3	TMS	0.2	10S	1.5
12	PBW 756	10S	3.6	TR	0.0	0	0.0	20S	7.2
13	PBW 757	40S	14.6	TR	0.0	0	0.0	5R	0.1
14	PBW 760	20MS	6.3	TR	0.0	0	0.0	5R	0.1
15	RKD 283 (d)	TMR	0.2	5MR	0.5	TR	0.0	20S	9.4
16	TL 3006 (T)	TR	0.2	TR	0.0	0	0.0	TR	0.0
17	TL 3007 (T)	TR	0.0	TR	0.0	0	0.0	10R	0.2
18	TL 3008 (T)	TR	0.0	TR	0.0	0	0.0	5S	0.8
19	TL 3009 (T)	TMR	0.2	TR	0.0	0	0.0	TMR	0.1
20	UAS 459 (d)	40S	13.6	TR	0.0	TR	0.0	10MS	2.0
20A	INFECTOR	100S	73.3	100S	66.6	80S	52.5	90S	74.2
21	UP 2954	30MS	11.3	5MR	0.7	0	0.0	40S	5.9
22	UP 2955	5MR	0.9	20S	6.6	0	0.0	40S	18.2
23	VL 3002	TMR	0.2	10MS	2.6	20S	5.5	40S	8.1
24	VL 3010	20S	8.6	40S	20.0	0	0.0	40S	10.7
25	VL 3011	10MS	2.8	5S	3.0	0	0.0	40S	11.0
26	VL 3012	5MS	3.0	10S	6.0	5S	1.3	20S	4.8
27	WH 1181	10MS	2.8	20S	8.3	10S	2.5	30S	10.0
28	WH 1216	20MS	5.6	10MR	1.3	0	0.0	10S	3.0
29	WH 1310	10MR	1.7	10S	3.4	0	0.0	20MS	5.2
B. Resistant to Stem and Leaf rusts									
Source: AVT II Year 2015-16									
30	HD 3171	10MS	4.0	10MS	2.6	5S	3.8	40S	15.0
31	HD 3209	60S	21.1	10MR	1.3	10MS	3.0	80S	47.1
32	HI 1605	40S	16.5	20MR	2.6	5MR	0.5	60S	21.4

S. No.	Entry	Rusts							
		Stem rust South		Leaf rust South		Leaf rust North		Stripe rust North	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI
33	K 1317	40S	14.3	10MR	1.3	5MR	0.5	40S	12.5
34	WB 2	10MS	4.0	20MS	5.3	5S	1.3	40S	15.4
Source: AVT Ist Year 2015-16									
35	AKAW 4842	20MS	8.0	TR	0.0	10MS	2.3	80S	52.1
36	DBW 179	TMS	0.3	TR	0.0	TS	0.5	30MS	13.8
37	DBW 216	TMR	0.2	20S	6.6	10S	2.5	40S	22.4
38	DBW 217	5MR	0.8	TR	0.0	0	0.0	40S	23.1
39	DBW 219	10MR	2.1	TR	0.0	0	0.0	40S	23.8
40	DDK 1050 (dic.)	40S	16.0	TR	0.0	10MS	3.1	60S	30.1
40A	INFECTOR	100S	66.6	100S	60.0	80S	45.0	90S	62.8
41	DDK 1051 (dic.)	20S	8.6	TR	0.0	10MS	4.1	80S	33.2
42	GW 477	40S	15.6	TR	0.0	10MS	3.1	90S	70.0
43	MACS 5044 (dic.)	20S	7.1	TR	0.0	10MS	3.1	60S	21.4
44	MACS 5046 (dic.)	10MS	4.0	TR	0.1	10MS	4.1	40S	25.8
45	NW 6094	TMR	0.2	TR	0.0	TR	0.0	40S	10.5
46	PBW 621	TMR	0.1	10MS	2.6	5S	1.8	50S	35.7
47	RKD 292 (d)	20MS	5.8	20MR	2.7	TR	0.0	40S	20.0
48	VL 4001	TR	0.0	TR	0.0	0	0.0	40S	14.9
49	WH 1215	10MS	2.8	TR	0.0	0	0.0	20S	9.4
C. Resistant to Leaf and Stripe rusts									
Source: AVT Ist Year 2015-16									
50	DBW 220	60MS	21.3	TR	0.0	TS	0.3	10S	5.5
51	HPBW 02	10S	14.5	TR	0.0	5S	1.2	40S	16.0
52	HPPAU 08	10MR	2.0	TR	0.0	0	0.0	40S	16.8
53	HPPAU 10	60S	26.6	20S	6.6	0	0.0	5S	0.7
54	HPW 424	40S	22.3	20MS	5.3	TR	0.0	20MS	4.4
55	HS 627	10MS	4.0	5MS	1.4	0	0.0	10S	1.4
56	NW 6046	40MS	12.0	TMS	0.3	0	0.0	5S	1.4
57	PDW 344 (d)	40S	14.0	10MR	1.6	0	0.0	5MS	1.1
58	WH 1184	20MS-S	6.1	TR	0.0	10S	2.5	5MR	0.2
D. Resistant to Stem and Stripe rusts									
Source: AVT Ist Year 2014-15									
59	HS 580	10MS	1.9	20S	13.3	0	0.0	5S	0.8
60	VL 1009	TMR	2.0	20S	8.3	5S	1.2	60S	16.2
60A	INFECTOR	100S	66.6	100S	80.0	80S	47.5	90S	71.4

Annexure Table 2.2. Confirmed sources of resistance identified through testing of entries in multiple diseases screening nursery (2016-17)

Sr. No.	Entry	Rusts								LB (0-9 dd)		KB %	PM (0-9)		FS %		CCN
		Stem		Leaf				Stripe									
		South		South		North		North									
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV.	HS	HS	AV.	HS	AV.	HS
A. Resistant to all three rusts																	
Source: AVT II Year 2014-15																	
1	PBW 723	5R	0.4	TR	0.10	0	0.0	20MS	6.1	47	36	3.4	7	5	12.5	11.8	HS
Source: AVT Ist Year 2014-15																	
2	HI 8765 (d)	20MS	8.3	20MR	2.1	TR	0.1	10S-20MS	5.5	68	57	0.0	7	6	10.0	3.3	HS
3	HPBW 08	10MS	2.6	10MR	1.0	0	0.0	40S	16.5	46	46	10.0	5	4	0.0	0.0	HS
4	HPBW 09	10S	3.5	10S	2.6	0	0.0	30S	14.4	46	25	4.7	7	4	11.8	3.9	HS
5	HPW 422	10MR	2.3	20S	7.6	0	0.0	10MS	2.3	57	47	7.7	6	3	0.0	0.0	HS
6	HS 580	20MS-S	8.6	20S	8.6	0	0.0	10S	3.0	57	57	12.5	5	4	11.5	6.4	HS
7	HS 596	5MR	1.3	NG	7.0	10S	4.6	20S	7.5	46	25	6.1	7	4	5.6	1.9	HS
8	HS 597	5MR	1.6	TMS	0.3	0	0.0	10S	2.5	37	25	6.7	6	5	0.0	0.0	HS
9	HS 599	10MS	3.4	5MS	1.1	TMR	0.1	0	0.0	57	46	0.0	5	3	12.5	7.9	HS
10	K 1312	10MR	1.4	TMR	0.2	TR	0.0	20S	16.0	57	46	0.0	7	3	0.0	0.0	HS
11	K 1314	20S	8	5MS	1.1	10S	3.4	10S	4.1	78	45	12.4	4	3	15.0	5.0	HS
12	MACS 4024	10MR	1.6	TR	0.1	0	0.0	5MS	0.7	79	57	36.0	8	4	0.0	0.0	HS
13	MACS 3970 (d)	10MS	5.3	10MR	1.1	TR	0.1	5MR	0.8	79	46	0.0	6	3	0.0	0.0	HS
14	MACS 3972 (d)	5S	2.1	10MR	2.1	10MR	1.3	20S	5.0	78	46	0.0	8	4	0.0	0.0	HS
15	PBW 709	10S	7.1	20S	7.4	TR	0.1	10S	4.2	67	46	4.0	3	3	13.3	8.1	HS
16	PBW 718	40S	19.6	10MR	1.1	0	0.0	5S	0.8	78	46	4.6	3	2	0.0	0.0	HS
17	TL 3001 (T)	TMS	0.3	TR	0.1	0	0.0	TS	0.1	58	46	2.3	5	2	0.0	0.0	HS
18	TL 3002 (T)	TR	0	TR	0.1	0	0.0	TS	0.1	78	57	0.0	2	1	0.0	0.0	HS
19	TL 3003 (T)	TMR	0.2	TR	0.1	0	0.0	0	0.0	78	57	4.1	1	1	0.0	0.0	HS
20	TL 3004 (T)	TR	0	TMR	0.1	0	0.0	0	0.0	78	57	1.2	1	1	0.0	0.0	HS

Sr. No.	Entry	Rusts								LB (0-9 dd)		KB %	PM (0-9)		FS %		CCN
		Stem		Leaf				Stripe									
		South		South		North		North									
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV.	HS	HS	AV.	HS	AV.	HS
20A	Infector for Rust (C)	100S	60	60S	27.5	80S	50.0	90S	68.3	-	-	-	-	-	-	-	-
20D	RAJ 4015 for L.B.(C)	-	-	-	-	-	-	-	-	68	68		-	-	-	-	-
20B	UP 2338 for K.B.(C)	-	-	-	-	-	-	-	-	-	-	34.6	-	-	-	-	-
20C	PBW 343 for P.M.(C)	-	-	-	-	-	-	-	-	-	-	-	9	5	-	-	-
20E	Sonalika for F.S.(C)	-	-	-	-	-	-	-	-	-	-	-	-	-	20	15.1	-
21	TL 3005 (T)	TR	0	TR	0.1	0	0.0	TS	0.5	78	56	1.8	2	1	0.0	0.0	HS
22	UAS 453 (d)	60S	22.6	TR	0.1	0	0.0	0	0.0	68	46	0.0	6	3	0.0	0.0	HS
23	UAS 455 (d)	40S	14.4	5MS	1.1	0	0.0	0	0.0	68	47	0.0	7	3	0.0	0.0	HS
24	VL 3007	20MS	6.1	10S	3.6	TR	0.1	20S	6.1	68	46	20.8	7	3	0.0	0.0	HS
25	VL 3008	TMR	0.1	5MR	0.6	TMR	0.2	60S	27.1	68	57	3.6	6	3	8.3	2.8	HS
26	WB5	10MS	3.3	TR	0.1	0	0.0	10S	2.8	68	47	4.2	6	4	0.0	0.0	HS
B. Resistant to Stem and Leaf rusts																	
Source:AVT Ist Year 2014-15																	
27	DBW 147	40MR-MS	14.6	TR	0.1	0	0.0	10S	4.1	67	46	4.2	7	4	0.0	0.0	HS
28	DBW 150	20MS-S	8.6	20MS	4.0	TR	0.0	60S	39.1	57	35	5.0	7	4	40.0	18.1	HS
29	DBW 181	10MS-S	3.4	20S	15.0	0	0.0	60S	36.6	36	24	6.0	9	4	16.7	11.4	HS
30	DBW 182	5MS	1.4	20MS	5.3	20S	8.3	60S	28.1	57	47	5.5	7	4	25.0	14.2	HS
31	DBW 183	20S	10.6	10MR	0.0	0	0.3	40S	13.6	68	46	9.0	9	4	10.7	3.6	HS
32	DDK 1048 (dic.)	10MS	3	TR	0.1	TR	0.0	40S	22.0	67	46	0.0	8	3	0.0	0.0	HS
33	DDK 1049 (dic.)	5R-MR	1.1	TR	0.1	TR	0.0	40S	21.5	67	46	0.0	4	2	0.0	0.0	HS
34	DDW 31	10MS	4.2	TR	0.1	0	0.0	20S	4.4	67	46	0.5	3	2	0.0	0.0	HS
35	GW 1315 (d)	10MR	1.6	10MR	1.1	10S	3.4	60S	40.0	78	57	0.0	3	2	0.0	0.0	HS
36	GW 463	10MS	2.8	TR	0.1	TR	0.0	60S	34.0	68	46	0.0	5	4	5.0	1.7	HS
37	HD 3164	20MS	7.4	10MS	4.1	20S	8.0	60S	27.8	78	57	17.1	7	4	14.3	6.6	HS

Sr. No.	Entry	Rusts								LB (0-9 dd)		KB %	PM (0-9)		FS %		CCN
		Stem		Leaf				Stripe									
		South		South		North		North									
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV.	HS	HS	AV.	HS	AV.	HS
38	HPBW 01	5R-MR	1.1	TMS	0.3	10S	3.3	40S	14.0	78	56	37.0	8	3	11.1	3.7	HS
39	HPBW 02	10R-MR	1.6	10MR	1.3	10S	3.3	40S	17.1	58	47	8.1	8	2	0.0	0.0	HS
40	HPBW 05	30S	13.3	20MS	7.5	10S	3.6	40S	26.0	68	57	23.3	8	4	8.7	2.9	HS
40A	Infector for Rust (C)	100S	60	60S	37.5	80S	53.3	90S	68.3	57	47	34.8	5	5	12.5	11.5	S
40D	RAJ 4015 for L.B.(C)	-	-	-	-	-	-	-	-	68	57	-	-	-	-	-	-
40B	WL UP 2338 for K.B.(C)	-	-	-	-	-	-	-	-	-	-	34.0	-	-	-	-	-
40C	PBW 343 for P.M.(C)	-	-	-	-	-	-	-	-	-	-	-	9	6	-	-	-
40E	Sonalika for F.S.(C)	-	-	-	-	-	-	-	-	-	-	-	-	-	11.9	11	-
41	HUW 695	10MR	2.6	20MR	2.2	TR	0.0	40S	18.5	58	47	3.5	8	3	0.0	0.0	HS
42	HUW 712	10MS	2.6	10MS	2.2	20S	6.6	40S	11.3	68	47	17.1	6	3	12.5	10.5	HS
43	JWS 712	20MS	6	TMR	0.2	40S	16.1	60S	34.0	68	47	11.1	5	3	14.3	9.2	HS
44	K 1313	10MS	2.6	10MR	1.2	10S	3.6	60S	32.5	57	47	7.4	7	4	4.5	1.5	HS
45	K 1315	10MS	4.3	TMR	0.2	TR	0.0	40S	32.5	57	35	0.0	7	4	50.0	18.6	HS
46	KRL 350	TMR	0.2	20MS	4.5	TR	0.0	40S	31.6	46	35	0.6	6	3	12.5	7.7	HS
47	KRL 351	20MS	9.3	TR	0.1	0	0.0	5MS	1.5	57	36	0.7	7	4	0.0	0.0	HS
48	MACS 4020 (d)	5MR	0.8	10MR	1.5	TR	0.0	20S	14.3	68	57	0.0	5	3	0.0	0.0	HS
49	MACS 5041	10MR	2.6	TMR	0.2	TR	0.0	40S	19.0	68	57	0.0	6	2	0.0	0.0	HS
50	MACS 5043	10MS-S	5.6	TR	0.1	TR	0.0	40S	23.0	99	68	0.0	6	3	0.0	0.0	HS
51	PBW 716	20MS-S	7.4	TR	0.1	0	0.0	60S	46.6	46	36	2.9	5	4	40.0	20.0	HS
52	PBW 719	TR	0	TR	0.1	0	0.0	40S	20.8	57	47	4.8	4	3	20.0	11.9	S
53	UP 2883	10S	3.4	TR	0.1	20S	8.0	60S	30.8	47	46	0.0	6	4	21.4	10.2	HS
54	VL 4001	TR	0	TR	0.1	0	0.0	40S	17.6	47	35	6.7	4	4	0.0	0.0	HS
55	WB1	5MS	2.6	5MR	0.6	0	0.0	40S	15.6	57	35	1.1	4	2	4.5	1.5	HS
56	WH 1309	20S	9.3	10MS	2.0	10S	4.0	20MS	8.6	47	47	7.4	5	4	0.0	0.0	HS
C. Resistant to Leaf and Stripe rust																	

Sr. No.	Entry	Rusts								LB (0-9 dd)		KB %	PM (0-9)		FS %		CCN
		Stem		Leaf				Stripe									
		South		South		North		North									
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV.	HS	HS	AV.	HS	AV.	HS
Source:AVT Ist Year 2014-15																	
57	DDW 32	60MS-S	25.3	10S	2.7	TR	0.0	10S	1.6	68	57	2.9	7	5	0.0	0.0	HS
58	HD 3165	60MR-MS	22.6	20MR	2.2	0	0.0	20S	6.3	57	46	6.0	7	4	50.0	19.6	HS
59	HS 600	10MS-S	4.3	TR	0.1	5S	1.6	40S	14.1	76	45	1.4	6	4	0.0	0.0	HS
60	PBW 721	10R-MR	1.1	TR	0.1	20S	10.0	20MS	6.5	57	47	1.4	5	4	8.3	2.8	HS
60A	Infector for Rust (C)	100S	60	60S	37.5	80S	50.0	90S	68.3	57	47	28.0	8	6	28.6	19.4	S
60D	RAJ 4015 for L.B.(C)	-	-	-	-	-	-	-	-	68	57	-	-	-	-	-	-
60B	WL UP 2338 for K.B.(C)	-	-	-	-	-	-	-	-	-	-	24.4	-	-	-	-	-
60C	PBW 343 for P.M.(C)	-	-	-	-	-	-	-	-	-	-	-	8	5	-	-	-
60E	Sonalika for F.S.(C)	-	-	-	-	-	-	-	-	-	-	-	-	-	20.0	16.3	-
D. Resistant to Stem and Stripe rusts																	
Source:AVT IInd Year 2014-15																	
61	UAS 428 (d)	20S	8	TMS	0.3	0	0.0	20S	5.7	68	46	0.0	6	3	0.0	0.0	HS
Source:AVT Ist Year 2014-15																	
62	DBW 184	10MS	2.7	10MS	2.2	0	0.0	10S	3.0	57	46	5.8	6	3	0.0	0.0	HS
63	HD 3159	10S	3.8	5MS	1.1	60S	23.3	20MS	9.1	68	46	7.5	9	5	14.3	4.8	HS
64	HI 1604	20MS	6.3	10S	2.1	10S	4.6	40S	17.5	68	46	7.8	9	6	0.0	0.0	HS
65	HPBW 07	10MS	3	5S	1.8	10S	4.0	5S	3.2	57	47	13.7	7	3	0.0	0.0	HS
66	HS 583	20MS	9.6	10MR	1.1	0	0.0	10MS	3.9	68	46	0.0	9	6	13.3	7.5	HS
67	HS 601	30MS-S	14.3	20S	10.3	10S	3.3	20MS	4.3	68	57	6.3	8	4	11.1	3.7	HS
68	PBW 707	20MS	6	20S	9.5	0	0.0	5S	1.5	57	47	0.6	9	4	16.7	5.6	HS
69	VL 1006	40S	22.3	50S	14.5	0	0.0	10S	6.1	47	35	4.3	8	4	0.0	0.0	HS

Table 2.3. Confirmed sources of resistance against loose smut in multiple diseases screening nursery 2015-16

Sr. No.	Entry	Loose smut (% infected tillers)				
		Hisar	Ludhiana	Durgapura	HS	AV.
A. Resistant to all three rusts						
Source: AVT II YEAR 2013-14						
1	HI 8737 (d)	5.0	0.0	0.0	5.0	1.7
2	PBW 681	60.0	16.7	32.0	60.0	36.2
Source: AVT I YEAR 2013-14						
3	DBW 129	5.0	9.1	3.3	9.1	5.8
4	DBW 95	75.0	23.3	42.9	75.0	47.1
5	DDW 30 (d)	12.5	0.0	0.0	12.5	4.2
6	HD 4728 (d)	11.1	0.0	12.5	12.5	7.9
7	HD 4730 (d)	4.0	0.0	0.0	4.0	1.3
8	HI 8750 (d)	4.0	0.0	0.0	4.0	1.3
9	HI 8751 (d)	5.0	0.0	0.0	5.0	1.7
10	HPW 373	55.6	20.0	18.9	55.6	31.5
11	HPW 411	32.5	8.9	21.1	32.5	20.8
12	HS 593	53.3	11.8	44.4	53.3	36.5
13	PBW 677	75.0	16.7	7.7	75.0	33.1
14	PBW 723	65.0	11.7	6.0	65.0	27.6
15	TL 2995 (T)	5.0	0.0	0.0	5.0	1.7
16	TL 2996 (T)	4.5	0.0	0.0	4.5	1.5
17	TL 2999 (T)	4.8	0.0	6.7	6.7	3.8
18	TL 3000 (T)	4.3	0.0	0.0	4.3	1.4
19	UAS 451 (d)	8.3	2.2	0.0	8.3	3.5
20	VL 1003	56.3	2.7	0.0	56.3	19.7
20A	Sonalika (LS)	83.3	24.3	49.2	83.3	52.3
B. Resistant to Stem and Leaf rusts						
Source: AVT II year 2013-14						
21	DBW 110	60.0	24.0	3.2	60.0	29.1
22	HUW 666	55.6	10.6	10.7	55.6	25.6
23	VL 967	30.0	19.6	41.3	41.3	30.3
Source: AVT I year 2013-14						
24	DBW 154	60.0	23.3	2.2	60.0	28.5
25	GW 451	41.3	11.9	22.8	41.3	25.3
26	GW 455	60.0	14.3	3.3	60.0	25.9
27	HD 2933-Lr/Sr 25	70.0	23.0	0.0	70.0	31.0
28	HD 3132	35.0	24.8	27.4	35.0	29.1
29	HD 3133	25.0	34.0	11.5	34.0	23.5
30	HD 3146	20.0	6.3	1.7	20.0	9.3
31	HPW 401	42.5	12.2	52.6	52.6	35.8
32	HS 547	10.0	14.8	19.5	19.5	14.8
33	HS 595	58.1	10.9	22.4	58.1	30.5
34	HUW 675	36.0	19.6	59.8	59.8	38.5
35	HUW 677	35.0	9.2	36.5	36.5	26.9
36	NIAW 2030	54.1	14.7	19.7	54.1	29.5
37	PBW 701	76.0	10.6	18.4	76.0	35.0
38	PBW 704	53.3	0.0	30.3	53.3	27.9

Sr. No.	Entry	Loose smut (% infected tillers)				
		Hisar	Ludhiana	Durgapura	HS	AV.
39	UP 2864	57.4	13.3	39.8	57.4	36.8
40	UP 2891	38.5	5.8	39.2	39.2	27.8
40A	Sonalika (LS)	80.0	5.0	46.6	80.0	43.9
41	VL 1004	25.0	4.7	0.0	25.0	9.9
42	VL 3004	26.7	7.5	57.1	57.1	30.4
43	VL 3005	10.0	13.3	6.5	13.3	9.9
44	VL 977	10.0	0.0	24.2	24.2	11.4
C. Resistant to Leaf and Stripe rusts						
Source: AVT II YEAR 2013-14						
45	UAS 446	5.0	0.0	23.1	23.1	9.4
46	WH 1129	5.0	24.7	0.0	24.7	9.9
Source: AVT I YEAR 2013-14						
47	HI 8755 (d)	20.0	0.0	0.0	20.0	6.7
48	HS 590	41.3	10.6	17.4	41.3	23.1
49	HS 592	10.0	5.2	9.7	10.0	8.3
50	HS 594	5.0	6.2	6.6	6.6	5.9
51	HUW 661	8.3	25.0	30.1	30.1	21.1
52	K 1204	7.6	0.0	14.1	14.1	7.2
53	PBW 695	6.6	9.5	4.8	9.5	7.0
54	PBW 697	20.0	0.0	5.8	20.0	8.6
55	PBW 698	28.6	12.2	27.4	28.6	22.7
56	PBW 703	18.6	13.9	36.5	36.5	23.0
57	PBW 722	10.0	16.5	21.8	21.8	16.1
58	TL 2997 (T)	11.3	0.0	0.0	11.3	3.8
D. Resistant to Stem and Stripe rusts						
Source: AVT II YEAR 2013-14						
59	K 1217	10.0	20.7	21.2	21.2	17.3
60	PBW 692	8.3	11.3	0.0	11.3	6.5
60A	Sonalika (LS)	75.0	11.0	58.2	75.0	48.1
61	VL 3002	10.0	0.0	6.9	10.0	5.6

Table 2.4. Confirmed source of resistance to insect pests in MPSN, 2016-17

Sr. No.	Entry	Foliar Aphid Score (1-5)*				Av	HS	Root Aphid Score (1-5)**
		Ludhiana	Niphad	Karnal	Kharibari			Ludhiana
1	PBW 723	5	5	3	4	4.25	5	5
2	HI 8765 (d)	5	5	4	5	4.75	5	5
3	HPBW 08	5	5	4	4	4.5	5	5
4	HPBW 09	5	5	4	5	4.75	5	5
5	HPW 422	5	5	4	5	4.75	5	4
6	HS 580	5	5	4	5	4.75	5	4
7	HS 596	5	4	5	5	4.75	5	4
8	HS 597	5	5	4	5	4.75	5	4
9	HS 599	5	4	4	5	4.5	5	5
10	K 1312	5	5	5	5	5	5	5
11	K 1314	4	5	4	5	4.5	5	5
12	MACS 4024	4	5	4	5	4.5	5	5
13	MACS 3970 (d)	4	5	5	4	4.5	5	3

Sr. No.	Entry	Foliar Aphid Score (1-5)*				Av	HS	Root Aphid Score (1-5)**
14	MACS 3972 (d)	5	5	5	5	5	5	5
15	PBW 709	5	5	5	4	4.75	5	5
16	PBW 718	5	5	4	5	4.75	5	4
17	TL 3001 (T)	5	4	5	4	4.5	5	3
18	TL 3002 (T)	5	5	5	5	5	5	4
19	TL 3003 (T)	5	5	5	4	4.75	5	4
20	TL 3004 (T)	5	5	5	5	5	5	5
20 A	SONALIKA (C) FOR SF	-	4	-	5	4.5		-
20 B	IWP 72 (C) FOR BWM	-	5	-	5	5	5	-
20 C	A 9-30-1 (C) FOR FA	5	5	5	5	5	5	-
20 D	GW 173 (C) FOR RA	-	4	-	4	4	5	5
21	TL 3005 (T)	5	5	4	5	4.75	5	4
22	UAS 453 (d)	5	5	3	4	4.25	5	4
23	UAS 455 (d)	5	5	4	5	4.75	5	4
24	VL 3007	5	5	4	4	4.5	5	5
25	VL 3008	5	5	4	5	4.75	5	5
26	WB5	5	5	4	5	4.75	5	5
27	DBW 147	5	5	5	5	5	5	4
28	DBW 150	5	5	4	5	4.75	5	4
29	DBW 181	5	5	4	4	4.5	5	4
30	DBW 182	5	5	3	5	4.5	5	4
31	DBW 183	4	5	5	4	4.5	5	4
32	DDK 1048 (dic.)	5	5	5	5	5	5	5
33	DDK 1049 (dic.)	5	5	5	4	4.75	5	3
34	DDW 31	5	5	5	5	5	5	3
35	GW 1315 (d)	5	5	-	3	4.33	5	4
36	GW 463	5	4	4	5	4.5	5	4
37	HD 3164	5	5	4	5	4.75	5	3
38	HPBW 01	5	5	5	5	5	5	3
39	HPBW 02	5	5	4	5	4.75	5	4
40	HPBW 05	5	5	4	4	4.5	5	4
40 A	SONALIKA (C) FOR SF	-	4	-	5	4.5	5	-
40 B	IWP 72 (C) FOR BWM	-	5	-	4	4.5	5	-
40 C	A 9-30-1 (C) FOR FA	5	5	5	5	5	5	-
40 D	GW 173 (C) FOR RA	-	4	-	4	4	4	5
41	HUW 695	4	4	5	5	4.5	5	4
42	HUW 712	4	4	4	4	4	5	4
43	JWS 712	4	4	4	5	4.25	5	4
44	K 1313	4	4	4	4	4	5	3
45	K 1315	5	5	5	4	4.75	5	4
46	KRL 350	5	5	4	4	4.5	5	4
47	KRL 351	5	5	4	5	4.75	5	5
48	MACS 4020 (d)	5	5	3	4	4.25	5	4
49	MACS 5041	5	5	3	5	4.5	5	4
50	MACS 5043	5	5	3	4	4.25	5	5
51	PBW 716	5	5	4	5	4.75	5	5
52	PBW 719	5	5	4	5	4.75	5	4
53	UP 2883	5	5	5	5	5	5	5
54	VL 4001	5	5	4	5	4.75	5	3
55	WB1	5	5	5	4	4.75	5	2
56	WH 1309	5	5	5	5	5	5	5
57	DDW 32	5	5	4	4	4.5	5	4
58	HD 3165	5	5	5	5	5	5	4
59	HS 600	5	5	5	4	4.75	5	3

Sr. No.	Entry	Foliar Aphid Score (1-5)*				Av	HS	Root Aphid Score (1-5)**
60	PBW 721	5	4	5	5	4.75	5	4
60 A	SONALIKA (C) FOR SF	-	5	-	4	4.5	5	-
60 B	IWP 72 (C) FOR BWM	-	5	-	5	5	5	-
60 C	A 9-30-1 (C) FOR FA	5	4	5	4	4.5	5	-
60 D	GW 173 (C) FOR RA	-	5	-	5	5	5	5
61	UAS 428 (d)	5	5	4	5	4.75	5	5
62	DBW 184	4	5	5	5	4.75	5	4
63	HD 3159	5	5	4	5	4.75	5	4
64	HI 1604	5	5	4	5	4.75	5	5
65	HPBW 07	5	5	5	5	5	5	3
66	HS 583	5	5	4	5	4.75	5	4
67	HS 601	5	5	5	5	5	5	3
68	PBW 707	5	5	4	4	4.5	5	4
69	VL 1006	5	5	5	5	5	5	4
70	DBW 129	5	5	5	4	4.75	5	4
71	HI 8750 (d)	4	5	4	5	4.5	5	3
72	GW 451	4	5	5	4	4.5	5	4
73	HD 2932-Lr19/Sr25	5	5	4	5	4.75	5	3
74	HD 3132	4	5	5	4	4.5	5	4
75	HD 3133	4	5	5	5	4.75	5	4
76	WH 1129	5	5	5	4	4.75	5	3
77	PBW 704	5	5	4	5	4.75	5	4
78	HD 4728 (d)	5	5	4	4	4.5	5	4
79	HI 8751 (d)	4	5	4	5	4.5	5	5
80	PBW 723	5	5	4	4	4.5	5	4
80 A	SONALIKA (C) FOR SF	-	4	-	5	4.5	5	-
80 B	IWP 72 (C) FOR BWM	-	5	-	4	4.5	5	-
80 C	A 9-30-1 (C) FOR FA	5	5	5	5	5	5	-
80 D	GW 173 (C) FOR RA	-	4	-	4	4	5	5
81	UAS 451 (d)	4	5	4	4	4.25	5	4
82	DBW 110	5	5	4	5	4.75	5	4
83	HI 8755 (d)	4	5	5	4	4.5	5	5
84	UAS 446	4	5	4	5	4.5	5	5
85	UP 2891	5	5	5	4	4.75	5	4
86	TL 2995 (T)	4	5	4	5	4.5	5	3
87	TL 2999 (T)	5	5	4	5	4.75	5	3

*Due to low infestation of foliar aphid and root aphid screening at SHILLSongani was not carried out;
**Karnal: Infestation of Root aphid was not observed

Annexure Table 2.5. Reaction of AVT entries against leaf blight in Leaf Blight Screening Nursery (LBSN) at different centres at hard dough growth stages during 2016-17

S. No.	Entry	Leaf Blight Score (0-9dd)								
		IIIrd (Hard dough)								
		Pantnagar	Karnal	Faizabad	Hisar	Ludhiana	Varanasi	Kalyani	HS	AV.
AVT IInd Year 2016-17										
I. NORTHERN HILLS ZONE										
1	HPW 251 (C)	89	13	58	45	02	99	57	99	56
2	HS 375 (C)	24	24	37	36	02	68	46	68	35
3	HS 490 (C)	38	35	46	56	38	57	46	57	47
4	HS 507 (C)	12	13	35	46	16	68	35	68	35
5	HS 542 (C)	18	24	35	45	02	68	57	68	36
6	VL 829 (C)	12	13	24	23	01	12	35	35	13
7	VL 892 (C)	99	46	57	35	38	57	79	99	57
8	VL 907 (C)	NS	NS	NS	NS	NS	NS	NS	NS	NS
II. NORTH WESTERN PLAINS ZONE										
9	DBW 173	45	35	46	46	89	99	57	99	57
10	DBW 88 (C)	25	35	46	23	55	57	57	57	45
11	DBW 90 (C)	45	24	57	45	37	57	46	57	46
12	HD 3043 (C)	12	24	47	36	23	68	35	68	35
13	HD 2967 (C)	38	13	12	57	02	12	68	68	25
14	HD 3059 (C)	58	35	57	34	13	68	79	79	46
15	HD 3086 (C)	56	35	57	56	13	57	46	57	46
16	PBW 644 (C)	78	24	56	46	24	47	79	79	46
17	WH 1021 (C)	58	35	68	56	79	36	79	79	57
18	WH 1080 (C)	34	35	57	45	14	57	89	89	46
19	WH 1105 (C)	34	35	57	45	57	68	89	89	56
20	WH 1124 (C)	34	46	68	36	24	57	89	89	46
20A	RAJ 4015 (Check)	78	59	78	78	37	89	68	89	68
21	WH 1142 C)	15	35	58	35	68	57	46	68	46
III. NORTH EASTERN PLAINS ZONE										
22	HI 1612	12	35	47	23	33	34	57	57	34
23	C 306 (C)	34	24	35	34	57	34	46	57	35
24	DBW 39 (C)	34	46	36	45	67	24	57	67	46
25	HD 2733 (C)	67	35	36	57	16	36	57	67	46
26	HD 2888 (C)	34	24	46	23	79	24	79	79	46
27	HD 3171 (I) (C)	45	35	36	45	89	36	46	89	46
28	K 8027 (C)	35	35	56	24	37	47	68	68	46
29	K 0307 (C)	38	35	46	23	46	47	68	68	46
30	K 1006 (C)	48	35	58	35	66	47	79	79	57
31	K 1317 (I) (C)	23	24	46	46	89	57	79	89	56
IV. CENTRAL ZONE										
32	DBW 110 (C)	46	35	47	78	23	68	79	79	57
33	HD 8627 (d) (C)	34	35	58	35	89	57	68	89	57
34	MP 3288 (C)	56	47	68	57	89	47	57	89	57
V. PENINSULAR ZONE										
35	DBW 168	56	57	47	35	89	36	57	89	57
36	HI 8777 (d)	67	24	58	23	89	36	89	89	57
37	MACS 4028 (d)	69	47	67	34	89	47	NG	89	57
38	UAS 375	58	57	58	46	89	57	NG	89	58
39	AKDW 2997-16(d) (C)	67	58	78	57	89	99	89	99	78
40	GW 322 (C)	37	46	58	45	69	47	89	89	57

S. No.	Entry	Leaf Blight Score (0-9dd)								
		IIIrd (Hard dough)								
		Pantnagar	Karnal	Faizabad	Hisar	Ludhiana	Varanasi	Kalyani	HS	AV.
40A	RAJ 4015 (Check)	79	68	78	79	89	89	89	89	79
41	MACS 6222 (C)	45	35	57	37	79	36	89	89	57
42	MACS 6478 (C)	37	46	46	46	44	46	68	68	46
43	NI 5439 (C)	NG	46	57	57	89	36	99	99	67
44	NIAW 1415 (C)	45	68	46	46	77	68	89	89	67
45	UAS 304 (C)	78	57	47	36	44	99	99	99	67
46	UAS 446 (d) (C)	23	46	68	57	79	99	99	99	67
VI. SOUTHERN HILLS ZONE										
47	HW 2044 (C)	59	46	58	23	00	89	89	89	56
48	HW 5216 (C)	67	35	57	35	89	99	79	99	67
49	CoW (W) -1 (C)	NG	68	46	45	89	89	99	99	78
VII. SPECIAL TRIAL (Tritieal,DICOCCUM,Salinity/Alkalinity										
50	DBW 14 (C)	67	68	58	46	68	68	89	89	68
51	DBW 71 (C)	32	35	46	56	89	89	68	89	56
52	DDK 1029 (C)	45	68	58	23	79	68	57	79	57
53	HW 1098 (C)	58	79	58	57	58	99	79	99	68
54	Kharchia 65 (C)	NG	68	46	56	89	89	99	99	78
55	KRL 19 (C)	NG	57	68	45	89	89	99	99	78
56	KRL 210 (C)	15	35	68	34	79	89	99	99	57
57	PBW 550	79	46	46	56	99	68	99	99	68
58	TL 2942 (C)	45	46	58	57	99	68	99	99	67
59	TL 2969 (C)	12	36	57	45	99	89	99	99	67
60	WR 544 (C)	NG	68	58	34	99	68	89	99	68
60A	RAJ 4015 (Check)	79	68	78	78	68	89	57	89	78
AVT Ist Year 2016-17										
I. NORTHERN HILLS ZONE										
61	DBW 179	56	46	24	34	89	69	57	89	56
62	DBW 204	NS	NS	NS	NS	NS	NS	NS	NS	NS
63	HPW 434	NS	NS	NS	NS	NS	NS	NS	NS	NS
64	HPW 438	NS	NS	NS	NS	NS	NS	NS	NS	NS
65	HPW 439	34	35	46	34	89	68	46	89	46
66	HPW 440	25	46	57	46	89	57	68	89	57
67	HPW 448	34	35	46	23	79	99	46	99	56
68	HPW 449	23	24	57	24	45	89	99	99	56
69	HS 629	23	24	58	23	89	36	35	89	45
70	HS 630	34	24	57	23	34	57	46	57	35
71	HS 643	23	24	46	23	13	47	68	68	35
72	HS 644	67	46	57	34	89	89	46	89	57
73	HS 645	12	35	36	12	14	24	35	36	24
74	HS 646	13	24	25	12	33	99	46	99	35
75	HS 647	35	35	35	34	37	57	46	57	36
76	HS 648	23	24	57	36	99	57	68	99	56
77	UP 2992	23	24	47	46	22	24	79	79	35
78	UP 2993	12	13	46	23	44	35	57	57	34
79	VL 1011	12	35	25	23	67	47	79	79	45
80	VL 1012	34	35	36	24	55	99	68	99	46
80A	RAJ 4015 (Check)	78	46	78	78	78	89	46	89	68
81	VL 1013	12	35	35	23	12	12	46	46	24
82	VL 3013	38	46	57	34	56	89	68	89	57
83	VL 3014	14	24	46	12	46	57	89	89	45

S. No.	Entry	Leaf Blight Score (0-9dd)								
		IIIrd (Hard dough)								
		Pantnagar	Karnal	Faizabad	Hisar	Ludhiana	Varanasi	Kalyani	HS	AV.
84	VL 3015	34	35	45	45	16	47	79	79	46
85	VL 4002	34	24	46	23	37	36	46	46	35
86	VL 4003	56	46	24	12	11	99	79	99	45
II. NORTH WESTERN PLAINS ZONE										
87	BRW 3773	13	35	57	NS	99	57	79	99	57
88	CG 1023	56	24	68	34	78	68	79	79	57
89	DBW 189	12	13	36	35	26	36	99	99	35
90	DBW 196	13	24	46	34	47	47	79	79	46
91	HD 3226	34	35	46	35	99	57	68	99	56
92	HD 3237	34	24	47	34	99	57	57	99	46
93	HI 1617	45	35	57	23	99	57	79	99	56
94	HI 1619	45	35	36	36	89	57	79	89	57
95	HI 1620	25	24	47	37	99	89	79	99	57
96	HP1963	23	24	58	23	77	68	68	77	46
97	HS 611	45	35	47	24	67	57	99	99	56
98	MACS 6677	12	24	46	13	89	47	57	89	45
99	MP 1318	13	13	35	24	79	57	57	79	35
100	PBW 750	45	24	45	23	99	57	68	99	56
100A	RAJ 4015 (Check)	69	68	78	78	99	89	99	99	79
101	PBW 752	13	24	36	34	89	68	99	99	56
102	UP 2942	12	13	24	23	56	47	46	56	34
103	WH 1202	35	35	57	13	89	99	57	99	56
III. NORTH ESTERN PLAINS ZONE										
104	DBW 187	34	35	57	45	99	47	68	99	56
105	HD 3219	67	46	35	34	56	68	68	68	56
106	UAS 384	78	46	36	23	79	57	79	79	57
IV. CENTRAL ZONE										
107	BRW 3775	13	35	67	45	89	99	68	99	57
108	HI 8791 (d)	14	46	58	02	58	57	79	79	47
109	UAS 385	45	46	46	12	68	99	68	99	56
110	UAS 462 (d)	12	24	57	02	14	47	68	68	35
V. SOUTHERN HILLS ZONE										
111	UAS 387	56	46	57	02	99	47	99	99	57
VI. SPECIAL TRIAL (DICOCCUM, MABB,SALINITY AND ALKALINITY)										
112	DBW 246	12	35	47	13	55	57	68	68	45
113	DBW 247	13	35	46	12	25	68	68	68	35
114	DBW 248	34	46	35	13	89	68	79	89	56
115	DDK 1052	67	57	67	24	47	99	79	99	67
116	DDK 1053	67	58	67	34	89	99	68	99	67
117	KRL 370	78	46	46	25	89	47	79	89	57
118	KRL 377	57	35	58	23	89	57	79	89	57
119	KRL 384	57	35	67	35	99	47	68	99	57
120	KRL 386	57	24	57	12	89	89	79	89	57
120A	RAJ 4015 (Check)	69	69	78	78	99	89	89	99	79
121	MACS 5047	69	68	78	57	79	57	46	79	68
122	MACS 5049	58	68	78	78	49	47	46	78	58
123	PBW 779	68	35	47	13	89	89	99	99	67
124	PBW 780	45	24	46	23	89	57	57	89	46
125	WH 1316	46	24	47	12	79	68	46	79	46

S. No.	Entry	Leaf Blight Score (0-9dd)								
		IIIrd (Hard dough)								
		Pantnagar	Karnal	Faizabad	Hisar	Ludhiana	Varanasi	Kalyani	HS	AV.
VII. SPECIAL TRIAL (TRITICALE)										
126	TL 3011	59	35	36	12	99	57	99	99	57
127	TL 3012	15	24	36	23	99	47	57	99	46
128	TL 3013	35	24	35	12	99	78	68	99	46
129	TL 3014	56	35	68	23	99	68	99	99	67
130	TL 3015	67	24	68	34	99	68	68	99	57
IX. SPECIAL TRIAL (VERY LATE SOWN)										
131	DBW 249	23	35	68	23	99	57	79	99	56
132	DBW 250	12	24	46	24	89	68	89	89	46
133	DBW 251	12	24	46	25	89	99	68	99	56
134	HD 3271	12	24	57	12	79	57	99	99	46
135	HD 3272	13	24	46	23	79	47	46	79	35
136	HI 1621	46	13	57	34	79	89	79	89	57
137	PBW 757	58	35	57	23	99	89	79	99	67
138	PBW 777	13	35	47	12	99	89	68	99	56
139	PBW 778	13	35	25	23	26	24	89	89	35
140	WH 1232	67	46	58	12	99	57	89	99	57
140A	RAJ 4015 (Check)	69	59	78	79	99	89	79	99	79
141	WH 1233	23	35	57	12	79	24	46	79	35
IX. SPECIAL TRIAL (Very High Altitude)										
142	HS 375 (C)	45	35	56	24	47	35	79	79	46
143	HS 490(C)	79	35	68	12	99	89	57	99	67
A. Resistant : (AV. SCORE RANGE14-35, HIGHEST SCORE UP TO 57)										
Source: AVT Ist Year 2015-16										
144	VL 4001	13	24	24	12	11	24	48	48	24
145	UP 2955	78	46	46	24	46	68	NG	78	56

Annexure Table 2.6. Leaf blight score of AVT entries at three growth stages during 2016-17

S.No.	Entry	Leaf Blight Score (0-9dd)					
		Ist (Flowering)		IInd (Dought)		IIIrd (Hard dought)	
		HS	AV.	HS	AV.	HS	AV.
AVT IInd Year 2016-17							
I. NORTHERN HILLS ZONE							
1	HPW 251 (C)	48	13	89	45	99	56
2	HS 375 (C)	12	01	57	24	68	35
3	HS 490 (C)	27	12	47	25	57	47
4	HS 507 (C)	01	01	57	23	68	35
5	HS 542 (C)	13	02	47	25	68	36
6	VL 829 (C)	12	01	12	12	35	13
7	VL 892 (C)	23	12	46	36	99	57
8	VL 907 (C)	NS	NS	NS	NS	NS	NS
II. NORTH WESTERN PLAINS ZONE							
9	DBW 173	25	12	47	25	99	57
10	DBW 88 (C)	13	01	47	24	57	45
11	DBW 90 (C)	12	01	47	24	57	46
12	HD 3043 (C)	01	01	47	13	68	35

S.No.	Entry	Leaf Blight Score (0-9dd)					
		Ist (Flowering)		IInd (Dought)		IIIrd (Hard dought)	
		HS	AV.	HS	AV.	HS	AV.
13	HD 2967 (C)	37	12	38	14	68	25
14	HD 3059 (C)	27	12	48	35	79	46
15	HD 3086 (C)	24	12	35	23	57	46
16	PBW 644 (C)	46	12	68	34	79	46
17	WH 1021 (C)	38	13	38	25	79	57
18	WH 1080 (C)	13	01	46	24	89	46
19	WH 1105 (C)	13	01	47	25	89	56
20	WH 1124 (C)	23	12	47	24	89	46
20A	RAJ 4015 (Check)	56	22	67	46	89	68
21	WH 1142 C)	03	01	46	24	68	46
III. NORTH EASTERN PLAINS ZONE							
22	HI 1612	12	01	24	13	57	34
23	C 306 (C)	23	12	47	24	57	35
24	DBW 39 (C)	13	01	33	23	67	46
25	HD 2733 (C)	35	12	36	24	67	46
26	HD 2888 (C)	12	01	26	13	79	46
27	HD 3171 (I) (C)	13	01	24	23	89	46
28	K 8027 (C)	23	11	35	23	68	46
29	K 0307 (C)	28	12	38	24	68	46
30	K 1006 (C)	35	12	46	34	79	57
31	K 1317 (I) (C)	22	11	46	24	89	56
IV. CENTRAL ZONE							
32	DBW 110 (C)	23	11	46	34	79	57
33	HD 8627 (d) (C)	12	01	44	34	89	57
34	MP 3288 (C)	12	01	66	34	89	57
V. PENINSULAR ZONE							
35	DBW 168	13	02	35	23	89	57
36	HI 8777 (d)	22	11	46	25	89	57
37	MACS 4028 (d)	58	14	59	47	89	57
38	UAS 375	23	12	57	45	89	58
39	AKDW 2997-16(d) (C)	24	12	68	46	99	78
40	GW 322 (C)	23	12	67	46	89	57
40A	RAJ 4015 (Check)	56	23	69	47	89	79
41	MACS 6222 (C)	13	11	46	34	89	57
42	MACS 6478 (C)	25	12	35	24	68	46
43	NI 5439 (C)	12	02	68	35	99	67
44	NIAW 1415 (C)	22	12	57	46	89	67
45	UAS 304 (C)	23	12	89	45	99	67
46	UAS 446 (d) (C)	12	02	57	24	99	67
VI. SOUTHERN HILLS ZONE							
47	HW 2044 (C)	48	13	68	46	89	56
48	HW 5216 (C)	38	13	69	47	99	67
49	CoW (W) -1 (C)	34	12	68	56	99	78
VII. SPECIAL TRIAL (Tritieal,DICOCCUM,Salinity/Alkalinity							
50	DBW 14 (C)	25	12	67	46	89	68
51	DBW 71 (C)	12	01	68	34	89	56
52	DDK 1029 (C)	24	12	57	35	79	57
53	HW 1098 (C)	45	23	69	47	99	68
54	Kharchia 65 (C)	24	12	78	67	99	78
55	KRL 19 (C)	23	12	79	57	99	78
56	KRL 210 (C)	14	02	68	35	99	57

S.No.	Entry	Leaf Blight Score (0-9dd)					
		Ist (Flowering)		IInd (Dought)		IIIrd (Hard dought)	
		HS	AV.	HS	AV.	HS	AV.
57	PBW 550	24	12	69	46	99	68
58	TL 2942 (C)	24	12	79	46	99	67
59	TL 2969 (C)	35	12	89	46	99	67
60	WR 544 (C)	24	12	88	57	99	68
60A	RAJ 4015 (Check)	56	23	69	45	89	78
AVT Ist Year 2016-17							
I. NORTHERN HILLS ZONE							
61	DBW 179	23	12	36	35	89	56
62	DBW 204	NS	NS	NS	NS	NS	NS
63	HPW 434	NS	NS	NS	NS	NS	NS
64	HPW 438	NS	NS	NS	NS	NS	NS
65	HPW 439	13	01	57	35	89	46
66	HPW 440	14	12	67	35	89	57
67	HPW 448	12	01	89	35	99	56
68	HPW 449	12	01	68	34	99	56
69	HS 629	12	01	57	24	89	45
70	HS 630	12	01	36	24	57	35
71	HS 643	13	02	35	23	68	35
72	HS 644	45	12	57	46	89	57
73	HS 645	02	01	24	12	36	24
74	HS 646	13	01	35	24	99	35
75	HS 647	13	02	34	24	57	36
76	HS 648	02	01	57	24	99	56
77	UP 2992	12	01	24	12	79	35
78	UP 2993	12	01	24	13	57	34
79	VL 1011	24	12	67	34	79	45
80	VL 1012	24	12	68	35	99	46
80A	RAJ 4015 (Check)	56	23	67	46	89	68
81	VL 1013	12	01	24	12	46	24
82	VL 3013	26	12	47	25	89	57
83	VL 3014	13	02	46	24	89	45
84	VL 3015	24	12	25	24	79	46
85	VL 4002	13	01	24	13	46	35
86	VL 4003	12	01	35	24	99	45
II. NORTH WESTERN PLAINS ZONE							
87	BRW 3773	01	01	57	24	99	57
88	CG 1023	35	12	56	34	79	57
89	DBW 189	12	01	24	13	99	35
90	DBW 196	13	02	24	24	79	46
91	HD 3226	12	01	67	35	99	56
92	HD 3237	22	11	68	35	99	46
93	HI 1617	12	02	77	46	99	56
94	HI 1619	13	02	47	35	89	57
95	HI 1620	12	01	67	35	99	57
96	HP1963	12	02	47	25	77	46
97	HS 611	22	11	46	24	99	56
98	MACS 6677	12	01	57	24	89	45
99	MP 1318	13	02	46	24	79	35
100	PBW 750	24	12	79	35	99	56
100A	RAJ 4015 (Check)	56	24	89	57	99	79
101	PBW 752	13	01	57	35	99	56
102	UP 2942	12	01	36	14	56	34
103	WH 1202	22	12	89	57	99	56

S.No.	Entry	Leaf Blight Score (0-9dd)					
		Ist (Flowering)		IInd (Dought)		IIIrd (Hard dought)	
		HS	AV.	HS	AV.	HS	AV.
III. NORTH ESTERN PLAINS ZONE							
104	DBW 187	12	01	78	35	99	56
105	HD 3219	13	01	46	25	68	56
106	UAS 384	14	02	77	46	79	57
IV. CENTRAL ZONE							
107	BRW 3775	13	01	79	35	99	57
108	HI 8791 (d)	12	01	36	25	79	47
109	UAS 385	13	02	57	35	99	56
110	UAS 462 (d)	24	01	35	13	68	35
V. SOUTHERN HILLS ZONE							
111	UAS 387	23	12	79	46	99	57
VI. SPECIAL TRIAL (DICOCCUM, MABB,SALINITY AND ALKALINITY)							
112	DBW 246	12	01	46	24	68	45
113	DBW 247	24	12	46	24	68	35
114	DBW 248	24	12	46	35	89	56
115	DDK 1052	24	02	46	25	99	67
116	DDK 1053	13	01	89	57	99	67
117	KRL 370	34	11	79	46	89	57
118	KRL 377	24	12	57	36	89	57
119	KRL 384	24	13	67	35	99	57
120	KRL 386	12	01	57	25	89	57
120A	RAJ 4015 (Check)	56	23	89	57	99	79
121	MACS 5047	24	12	58	35	79	68
122	MACS 5049	24	12	57	35	78	58
123	PBW 779	48	13	68	46	99	67
124	PBW 780	12	01	38	25	89	46
125	WH 1316	12	01	66	34	79	46
VII. SPECIAL TRIAL (TRITICALE)							
126	TL 3011	24	12	79	47	99	57
127	TL 3012	14	02	79	35	99	46
128	TL 3013	24	12	46	35	99	46
129	TL 3014	24	11	88	46	99	67
130	TL 3015	24	12	88	45	99	57
IX. SPECIAL TRIAL (VERY LATE SOWN)							
131	DBW 249	13	01	57	35	99	56
132	DBW 250	12	01	47	24	89	46
133	DBW 251	35	12	89	46	99	56
134	HD 3271	12	01	55	24	99	46
135	HD 3272	12	01	36	24	79	35
136	HI 1621	12	02	79	46	89	57
137	PBW 757	24	12	79	57	99	67
138	PBW 777	13	01	46	24	99	56
139	PBW 778	12	01	24	13	89	35
140	WH 1232	45	12	79	46	99	57
140A	RAJ 4015 (Check)	56	24	69	57	99	79
141	WH 1233	12	01	36	13	79	35
IX. SPECIAL TRIAL (Very High Altitude)							
142	NH-01-VHA	22	12	55	24	89	56
143	NH-02-VHA	13	02	45	24	79	46
144	NH-03-VHA	12	01	88	34	99	56
145	NH-04-VHA	13	02	79	34	99	56

S.No.	Entry	Leaf Blight Score (0-9dd)					
		Ist (Flowering)		IInd (Dought)		IIIrd (Hard dought)	
		HS	AV.	HS	AV.	HS	AV.
146	NH-05-VHA	13	02	47	24	79	35
147	NH-06-VHA	17	03	69	35	99	56
148	NH-07-VHA	23	12	78	46	99	67
149	NH-08-VHA	14	02	79	35	79	56
150	NH-09-VHA	15	02	89	35	89	56
151	NH-10-VHA	15	12	65	46	89	56
A. Resistant : (AV.SCORE RANGE14-35,HIGHEST SCORE UP TO 57)							
Source: AVT Ist Year 2015-16							
152	VL 4001	12	01	24	13	48	24
153	UP 2955	13	02	36	23	78	56

Annexure Table 2.7. Karnal bunt incidence in KBSN entries evaluated under artificially inoculated conditions at multilocations during 2016-17

Sr. No.	Entries	% Incidence of Karnal bunt				HS	Av.
		Jammu	Ludhiana	Delhi	Hisar		
AVT IInd Year 2016-17							
I. NORTHERN HILLS ZONE							
1	HPW 251 (C)	4.5	1.7	1.5	4.3	4.5	3.0
2	HS 375 (C)	11.8	4.0	3.3	12.5	12.5	7.9
3	HS 490 (C)	4.1	0.3	0.0	11.1	11.1	3.9
4	HS 507 (C)	8.6	2.0	2.3	11.7	11.7	6.2
5	HS 542 (C)	11.3	4.0	7.4	13.3	13.3	9.0
6	VL 829 (C)	6.2	4.0	0.0	10.0	10.0	5.1
7	VL 892 (C)	13.0	0.4	17.6	16.6	17.6	11.9
8	VL 907 (C)	NS	NS	NS	NS	NS	NS
II. NORTH WESTERN PLAINS ZONE							
9	DBW 173	2.1	4.0	2.3	15.0	15.0	5.8
10	DBW 88 (C)	9.5	16.7	8.3	17.3	17.3	12.9
11	DBW 90 (C)	14.4	12.7	1.4	15.5	15.5	11.0
12	HD 3043 (C)	4.0	0.0	2.3	18.3	18.3	6.2
13	HD 2967 (C)	18.2	6.9	6.3	23.3	23.3	13.7
14	HD 3059 (C)	9.1	11.0	9.1	16.6	16.6	11.4
15	HD 3086 (C)	11.3	2.0	3.9	16.3	16.3	8.4
16	PBW 644 (C)	14.2	1.1	0.0	17.5	17.5	8.2
17	WH 1021 (C)	1.5	1.2	1.4	5.6	5.6	2.4
18	WH 1080 (C)	14.2	2.0	9.5	11.1	14.2	9.2
19	WH 1105 (C)	9.2	18.3	33.3	13.3	33.3	18.5
20	WH 1124 (C)	3.3	0.0	15.8	7.3	15.8	6.6
20. A	HD 2967 (C)	18.5	**12.0**	9.1	23.5	23.5	15.8
21	WH 1142 C)	4.2	10.0	22.2	7.1	22.2	10.9
III. NORTH EASTERN PLAINS ZONE							
22	HI 1612	9.2	14.5	0.0	14.2	14.5	9.5
23	C 306 (C)	7.1	8.9	0.0	16.6	16.6	8.1
24	DBW 39 (C)	11.5	20.7	11.6	12.5	20.7	14.1
25	HD 2733 (C)	4.2	4.0	0.0	11.1	11.1	4.8
26	HD 2888 (C)	11.9	12.7	0.0	17.5	17.5	10.5
27	HD 3171 (I) (C)	7.2	13.3	25.3	13.3	25.3	14.8
28	K 8027 (C)	13.3	11.0	17.0	15.5	17.0	14.2
29	K 0307 (C)	3.2	0.0	34.8	14.2	34.8	13.0
30	K 1006 (C)	0.0	6.3	0.0	10.4	10.4	4.2

Sr. No.	Entries	% Incidence of Karnal bunt				HS	Av.
		Jammu	Ludhiana	Delhi	Hisar		
31	K 1317 (I) (C)	7.1	8.2	8.0	13.2	13.2	9.1
IV. CENTRAL ZONE							
32	DBW 110 (C)	5.5	2.6	0.0	5.8	5.8	3.5
33	HI 8627 (d) (C)	0.0	3.9	5.2	9.3	9.3	4.6
34	MP 3288 (C)	4.1	3.0	5.7	7.5	7.5	5.1
V. PENINSULAR ZONE							
35	DBW 168	6.1	2.4	26.7	12.5	26.7	11.9
36	HI 8777 (d)	0.0	0.0	8.3	3.3	8.3	2.9
37	MACS 4028 (d)	2.4	0.0	16.1	2.5	16.1	5.2
38	UAS 375	6.6	0.0	9.1	14.2	14.2	7.5
39	AKDW 2997-16 (d) (C)	0.0	0.0	11.7	8.3	11.7	5.0
40	GW 322 (C)	4.4	0.0	26.7	13.3	26.7	11.1
40. A	HD 2967 (C)	21.5	10.0	10.4	22.2	22.2	16.0
41	MACS 6222 (C)	14.2	4.8	9.9	26.6	26.6	13.9
42	MACS 6478 (C)	8.6	1.0	14.3	18.3	18.3	10.5
43	NI 5439 (C)	14.0	24.0	0.0	17.5	24.0	13.9
44	NIAW 1415 (C)	9.0	2.9	28.3	14.2	28.3	13.6
45	UAS 304 (C)	6.1	1.2	24.5	3.3	24.5	8.8
46	UAS 446 (C)	2.0	1.3	3.5	4.2	4.2	2.7
VI. SOUTHERN HILLS ZONE							
47	HW 2044 (C)	5.3	1.0	13.9	1.1	13.9	5.3
48	HW 5216 (C)	5.0	3.4	14.9	2.5	14.9	6.4
49	CoW (W) -1 (C)	0.0	0.0	5.1	0.0	5.1	1.3
VII. SPECIAL TRIAL (MABB-IR-LS-CZ/PZ/WB)							
50	DBW 14 (C)	2.1	0.6	0.0	5.0	5.0	1.9
51	DBW 71 (C)	8.8	1.3	8.6	8.3	8.8	6.7
52	DDK 1029 (C)	12.6	0.0	7.8	10.0	12.6	7.6
53	HW 1098 (C)	10.3	0.0	6.3	15.3	15.3	8.0
54	Kharchia 65 (C)	4.4	0.0	0.0	16.6	16.6	5.3
55	KRL 19 (C)	13.2	0.0	0.0	11.1	13.2	6.1
56	KRL 210 (C)	4.4	0.0	0.8	12.5	12.5	4.4
57	PBW 550 (C)	8.1	11.5	0.0	13.3	13.3	8.2
58	TL 2942 (C)	0.0	9.0	4.0	0.0	9.0	3.2
59	TL 2969 (C)	0.0	3.0	0.0	0.0	3.0	0.7
60	WR 544 (C)	0.0	1.2	0.0	2.5	2.5	0.9
60. A	HD 2967 (C)	22.3	**15.6**	8.6	25.0	25.0	17.9
AVT Ist Year 2016-17							
I. NORTHERN HILLS ZONE							
61	DBW 179	4.1	7.0	15.7	8.3	15.7	8.8
62	DBW 204	NS	NS	NS	NS	NS	NS
63	HPW 434	NS	NS	NS	NS	NS	NS
64	HPW 438	NS	NS	NS	NS	NS	NS
65	HPW 439	2.1	0.0	0.0	4.6	4.6	1.7
66	HPW 440	5.5	0.0	0.0	5.3	5.5	2.7
67	HPW 448	0.0	0.7	0.0	5.6	5.6	1.6
68	HPW 449	4.1	2.0	0.0	6.3	6.3	3.1
69	HS 629	2.1	2.0	0.0	6.1	6.1	2.6
70	HS 630	0.0	2.2	0.0	5.6	5.6	2.0
71	HS 643	3.5	0.0	0.0	4.5	4.5	2.0
72	HS 644	0.0	0.0	0.0	4.6	4.6	1.2
73	HS 645	2.1	0.0	2.5	5.0	5.0	2.4
74	HS 646	6.1	0.0	0.0	4.2	6.1	2.6
75	HS 647	0.0	0.8	0.0	4.3	4.3	1.3
76	HS 648	4.3	1.1	0.0	5.3	5.3	2.7

Sr. No.	Entries	% Incidence of Karnal bunt				HS	Av.
		Jammu	Ludhiana	Delhi	Hisar		
77	UP 2992	6.5	1.3	23.1	6.6	23.1	9.4
78	UP 2993	9.1	1.4	0.0	7.7	9.1	4.6
79	VL 1011	6.1	0.0	3.9	0.0	6.1	2.5
80	VL 1012	2.1	0.0	27.5	0.0	27.5	7.4
80. A	HD 2967 (C)	20.1	**11.5**	16.7	24.1	24.1	18.1
81	VL 1013	0.0	0.0	1.4	2.5	2.5	1.0
82	VL 3013	1.1	1.4	0.0	0.0	1.4	0.6
83	VL 3014	4.1	0.2	0.0	0.0	4.1	1.1
84	VL 3015	5.0	0.0	0.0	0.0	5.0	1.3
85	VL 4002	0.0	1.7	0.0	1.1	1.7	0.7
86	VL 4003	7.9	2.7	0.0	1.3	7.9	3.0
II. NORTH WESTERN PLAINS ZONE							
87	BRW 3773	6.6	2.7	0.0	5.0	6.6	3.6
88	CG 1023	2.1	2.0	0.0	2.5	2.5	1.7
89	DBW 189	6.1	4.0	0.0	5.6	6.1	3.9
90	DBW 196	8.0	1.1	0.0	4.5	8.0	3.4
91	HD 3226	7.2	1.3	0.0	4.3	7.2	3.2
92	HD 3237	2.1	0.6	0.0	5.0	5.0	1.9
93	HI 1617	9.1	1.0	0.0	5.3	9.1	3.9
94	HI 1619	0.0	1.0	0.0	0.0	1.0	0.3
95	HI 1620	8.2	0.8	0.0	5.0	8.2	3.5
96	HP 1963	6.2	1.3	0.0	4.5	6.2	3.0
97	HS 611	7.2	1.8	0.0	4.2	7.2	3.3
98	MACS 6677	10.3	0.8	0.0	8.3	10.3	4.9
99	MP 1318	2.1	1.9	0.0	2.5	2.5	1.6
100	PBW 750	8.2	1.5	18.3	6.6	18.3	8.7
100. A	HD 2967 (C)	19.6	**9.0**	14.3	25.0	25.0	17.0
101	PBW 752	4.0	5.0	0.0	5.3	5.3	3.6
102	UP 2942	3.3	1.4	0.0	5.0	5.0	2.4
103	WH 1202	0.0	3.0	0.0	2.5	3.0	1.4
III. NORTH EASTERN PLAINS ZONE							
104	DBW 187	1.1	1.3	0.0	3.3	3.3	1.4
105	HD 3219	0.0	2.4	0.0	2.5	2.5	1.2
106	UAS 384	9.1	5.8	0.0	9.3	9.3	6.1
IV. CENTRAL ZONE							
107	BRW 3775	2.2	2.0	0.0	6.5	6.5	2.7
108	HI 8791 (d)	2.3	1.0	19.5	9.5	19.5	8.1
109	UAS 385	4.1	2.3	0.0	5.0	5.0	2.8
110	UAS 462 (d)	1.1	0.0	20.2	1.1	20.2	5.6
V. SOUTHERN HILLS ZONE							
111	UAS 387	4.1	0.0	0.0	6.5	6.5	2.7
VI. SPECIAL TRIAL (Dicoccum, MABB, SALINITY and Alkalinity)							
112	DBW 246	8.3	4.0	0.0	5.3	8.3	4.4
113	DBW 247	4.6	3.0	0.0	3.3	4.6	2.7
114	DBW 248	8.6	3.5	0.0	4.5	8.6	4.2
115	DDK 1052	6.6	0.0	0.0	2.5	6.6	2.3
116	DDK 1053	6.6	2.2	7.1	4.0	7.1	5.0
117	KRL 370	8.2	2.0	0.0	3.3	8.2	3.4
118	KRL 377	0.0	1.1	1.1	4.5	4.5	1.7
119	KRL 384	6.1	1.0	0.0	5.3	6.1	3.1
120	KRL 386	8.4	2.3	0.0	3.5	8.4	3.5
120. A	HD 2967 (C)	18.3	**34.0**	7.7	23.3	34.0	20.8
121	MACS 5047	13.6	0.0	3.0	4.5	13.6	5.3
122	MACS 5049	10.0	0.0	0.0	4.3	10.0	3.6

Sr. No.	Entries	% Incidence of Karnal bunt				HS	Av.
		Jammu	Ludhiana	Delhi	Hisar		
123	PBW 779	6.6	0.0	0.0	4.6	6.6	2.8
124	PBW 780	1.1	2.0	0.0	4.8	4.8	2.0
125	WH 1316	0.0	2.0	0.0	4.3	4.3	1.6
VII. SPECIAL TRIAL (TRITICALE)							
126	TL 3011	0.0	5.0	0.0	0.0	5.0	1.3
127	TL 3012	2.1	1.1	0.0	0.0	2.1	0.8
128	TL 3013	1.1	2.6	9.8	0.0	9.8	3.4
129	TL 3014	0.0	1.3	0.0	0.0	1.3	0.3
130	TL 3015	4.5	0.7	0.0	0.0	4.5	1.3
VIII. SPECIAL TRIAL (Very Late Sown)							
131	DBW 249	9.1	0.0	0.0	5.0	9.1	3.5
132	DBW 250	2.4	0.0	0.0	5.3	5.3	1.9
133	DBW 251	0.0	0.0	0.0	6.6	6.6	1.7
134	HD 3271	0.0	1.7	0.0	5.0	5.0	1.7
135	HD 3272	6.3	2.0	0.8	5.6	6.3	3.7
136	HI 1621	9.1	2.4	0.0	4.6	9.1	4.0
137	PBW 757	4.5	2.0	0.0	5.3	5.3	3.0
138	PBW 777	2.1	2.8	0.0	5.5	5.5	2.6
139	PBW 778	6.6	3.7	0.0	6.6	6.6	4.2
140	WH 1232	2.1	5.3	0.0	4.5	5.3	3.0
140. A	HD 2967 (C)	18.5	**11.5**	**6.9**	24.0	24.0	15.2
141	WH 1233	6.3	0.3	0.0	4.3	6.3	2.7
IX. SPECIAL TRIAL (Very High Altitude)							
142	HS 375 (C)	4.4	0.0	0.0	2.5	4.4	1.7
143	HS 490(C)	6.1	3.3	0.0	4.2	6.1	3.4
143. A	HD 2967 (C)	19.3	**12.0**	**5.7**	22.2	22.2	14.8

Annexture Table 2.8. Per cent infected tillers due to loose smut in the entries of AVT II[nd] year and AVT I[st] year 2015-16 expressed during 2016-17 crop season

S. No.	Entries	Loose Smut incidence (%)					HS	AV.
		Karnal	Ludhiana	Hisar	Durgapura	Almora		
AVT II[nd] Year 2015-16								
I. NORTHERN HILLS ZONE								
1	HPW 251 (C)	16.9	9.6	21.3	2.6	30.0	30.0	16.1
2	HS 375 (C)	0.0	10.0	0.3	2.4	19.7	19.7	6.5
3	HS 490 (C)	14.4	15.4	30.0	15.1	10.5	30.0	17.1
4	HS 507 (C)	0.0	16.1	55.6	9.5	15.2	55.6	19.3
5	HS 542 (C)	7.9	18.8	73.3	13.0	61.9	73.3	35.0
6	VL 829 (C)	0.0	0.0	5.0	0.0	0.0	5.0	1.0
7	VL 892 (C)	9.7	17.1	35.0	3.3	35.6	35.6	20.2
II. NORTH WESTERN PLAINS ZONE								
8	DBW 88 (C)	15.1	26.4	NG	10.3	37.6	37.6	22.3
9	DBW 90 (C)	6.2	10.8	8.3	0.0	0.0	10.8	5.1
10	HD 3043 (C)	12.8	11.7	62.5	3.7	16.9	62.5	21.5
11	HD 2967 (C)	5.9	9.1	60.0	23.1	28.1	60.0	25.2
12	HD 3059 (C)	15.3	14.3	25.0	65.9	33.8	65.9	30.9
13	HD 3086 (C)	0.5	14.6	10.0	0.0	0.0	14.6	5.0
14	PBW 644 (C)	6.9	7.2	55.6	7.7	35.4	55.6	22.6
15	WH 1021 (C)	11.8	14.8	46.7	0.0	48.8	48.8	24.4
16	WH 1080 (C)	6.6	18.2	43.3	22.1	16.8	43.3	21.4

17	WH 1105 (C)	28.7	11.3	45.0	6.7	67.3	67.3	31.8
18	WH 1124 (C)	0.0	0.0	11.1	NG	0.0	11.1	2.8
19	WH 1142 (I) (C)	19.9	10.9	8.3	0.0	16.7	19.9	11.2
III. NORTH EASTERN PLAINS ZONE								
20	HD 3171	8.6	12.7	20.0	27.3	10.4	27.3	15.8
20. A	Sonalika (C)	66.9	32.6	83.3	49.2	36.9	83.3	53.8
21	K 1317	44.3	17.3	81.1	33.4	33.6	81.1	42.0
22	C 306 (C)	2.2	0.0	91.3	5.3	32.2	91.3	26.2
23	DBW 39 (C)	2.8	6.9	31.3	9.1	8.9	31.3	11.8
24	HD 2733 (C)	9.4	11.9	15.0	0.0	5.3	15.0	8.3
25	HD 2888 (C)	8.8	6.7	76.0	2.3	27.1	76.0	24.2
26	K 8027 (C)	0.0	7.3	45.0	0.0	8.8	45.0	12.2
27	K 0307 (C)	19.8	16.2	85.0	22.0	14.4	85.0	31.5
28	K 1006 (C)	18.9	5.6	75.0	9.8	2.1	75.0	22.3
IV. CENTRAL ZONE								
29	HI 8759 (D)	0.0	0.0	NG	0.0	0.0	0.0	0.0
30	HD 4728 (D) (I) (C)	0.0	0.0	NG	NG	0.0	0.0	0.0
31	HI 8498 (D) (C)	0.0	0.0	NG	0.0	0.0	0.0	0.0
32	HI 8737 (D) (C)	0.0	0.0	NG	0.0	4.6	4.6	1.2
33	MPO 1215 (d) (C)	0.0	0.0	42.3	0.0	12.5	42.3	11.0
V. PENINSULAR ZONE								
34	MACS 3949 (d)	0.0	12.5	13.3	0.0	5.5	13.3	6.3
35	HI 1605	22.8	12.6	33.3	41.2	54.6	54.6	32.9
36	AKDW 2997-16 (d) (c)	3.5	0.0	65.0	0.0	0.0	65.0	13.7
37	DBW 93 (C)	NG	15.4	10.0	8.5	35.3	35.3	17.3
38	HD 2932 (C)	4.8	24.2	11.1	7.9	26.8	26.8	15.0
39	MACS 6222 (C)	9.6	16.8	5.0	26.8	7.2	26.8	13.1
40	MACS 6478 (C)	13.4	23.2	32.0	7.0	45.1	45.1	24.2
40. A	Sonalika (C)	72.5	34.9	85.3	53.3	33.9	85.3	56.0
41	NI 5439 (C)	9.5	20.6	31.3	52.4	22.9	52.4	27.3
42	NIAW 1415 (C)	24.0	14.1	41.3	26.5	15.1	41.3	24.2
43	NIAW 34 (C)	35.9	17.3	15.0	26.8	70.8	70.8	33.2
44	NIDW 295 (D) (C)	7.5	4.6	30.0	3.8	1.8	30.0	9.5
45	RAJ 4083 (C)	1.4	13.4	62.5	34.4	52.6	62.5	32.9
46	UAS 428 (d) (C)	0.0	3.0	NG	0.0	0.0	3.0	0.8
47	UAS 446 (d) (C)	0.0	0.0	NG	0.0	0.0	0.0	0.0
VI. SOUTHERN HILLS ZONE								
48	HW 2044 (C)	NS	NS	NS	NS	NS	NS	NS
49	HW 5216 (C)	NS	NS	NS	NS	NS	NS	NS
50	CoW (W) -1 (C)	NS	NS	NS	NS	NS	NS	NS
VII. SPECIAL TRIAL (MABB-IR-LS-CZ/PZ/WB)								
51	HD 3209	8.9	13.9	52.0	0.0	34.5	52.0	21.9
52	PBW 723	20.5	2.2	41.3	5.8	12.5	41.3	16.5
53	WB 2	17.6	11.2	81.1	26.8	36.5	81.1	34.6
54	DBW 14 (C)	15.2	0.0	40.0	13.6	10.9	40.0	15.9
55	DBW 71 (C)	40.7	29.3	41.1	20.2	54.4	54.4	37.1
56	DDK 1029 (C)	0.0	0.0	5.0	0.0	4.3	5.0	1.9
57	DPW 621-50 (C)	22.5	23.9	62.5	26.2	46.9	62.5	36.4
58	GW 322 (C)	14.2	6.7	65.0	5.4	12.4	65.0	20.7
59	HD 2864 (C)	9.5	18.9	85.0	3.0	36.5	85.0	30.6
60	HW 1098 (C)	0.0	0.0	22.2	0.0	0.0	22.2	4.4
60. A	Sonalika (C)	61.6	33.3	85.0	57.6	54.0	85.0	58.3
61	Kharchia 65 (C)	15.3	10.8	8.3	3.9	62.8	62.8	20.2
62	KRL 19 (C)	0.0	6.4	42.3	NG	18.6	42.3	16.8
63	KRL 210 (C)	12.8	0.0	10.0	0.0	0.0	12.8	4.6
64	MP 3336 (C)	8.3	15.5	50.0	6.5	27.5	50.0	21.6
65	PBW 343 (C)	18.9	17.3	62.5	12.5	19.6	62.5	26.2

66	TL 2942 (C)	0.0	0.0	10.0	3.3	0.0	10.0	2.7
67	TL 2969 (C)	0.0	0.0	8.3	0.0	0.0	8.3	1.7
68	WR 544 (C)	16.3	23.9	75.0	3.2	34.6	75.0	30.6
AVT Ist Year 2015-16								
I. NORTHERN HILLS ZONE								
69	HS 623	9.8	20.8	20.0	30.0	21.9	30.0	20.5
70	HS 622	8.6	21.3	30.0	8.0	65.4	65.4	26.7
71	VL 1009	0.0	25.0	10.0	0.0	16.9	25.0	10.4
72	HPW 423	0.0	14.4	25.0	NG	17.1	25.0	14.1
73	HPW 424	3.3	2.3	40.0	0.0	3.3	40.0	9.8
74	HS 628	15.7	16.8	76.0	34.4	26.7	76.0	33.9
75	UP 2954	0.0	5.1	30.0	7.7	4.0	30.0	9.4
76	VL 1008	0.0	10.0	5.0	0.0	15.6	15.6	6.1
77	VL 1010	0.0	25.0	5.0	0.0	38.6	38.6	13.7
78	HS 625	7.3	30.2	30.0	3.6	26.2	30.2	19.5
79	HPW 433	0.0	1.8	12.5	0.0	0.0	12.5	2.9
80	HS 627	6.9	21.7	81.3	13.0	34.0	81.3	31.4
80. A	Sonalika (C)	64.1	32.6	86.7	42.1	32.0	86.7	51.5
81	HPW 432	6.4	1.1	10.0	2.8	0.0	10.0	4.1
82	VL 3010	7.4	13.1	21.1	21.6	68.6	68.6	26.3
83	HS 626	0.0	29.6	80.0	13.5	21.4	80.0	28.9
84	VL 3012	0.0	11.4	8.3	0.0	26.8	26.8	9.3
85	UP 2955	0.0	0.0	5.0	0.0	0.0	5.0	1.0
86	VL 3011	0.0	8.3	8.3	0.0	4.4	8.3	4.2
II. NORTH WESTERN PLAINS ZONE								
87	DBW 172	7.7	9.9	35.0	23.1	26.7	35.0	20.5
88	DBW 173	24.0	28.1	28.6	12.9	26.1	28.6	23.9
89	DBW 179	3.3	18.6	10.0	0.0	25.4	25.4	11.5
90	NW 6046	0.0	20.0	12.5	17.4	25.0	25.0	15.0
91	PBW 725	9.8	20.3	81.3	9.1	51.4	81.3	34.4
92	PBW 737	0.0	12.3	62.5	30.1	32.4	62.5	27.5
93	UP 2903	13.5	14.1	85.0	23.9	42.5	85.0	35.8
94	UP 2907	4.5	13.6	40.0	13.0	10.2	40.0	16.3
95	WH 1184	2.3	0.0	20.0	37.5	19.4	37.5	15.8
III. NORTH EASTERN PLAINS ZONE								
96	HD 3184	1.7	9.2	36.7	8.9	0.0	36.7	11.3
97	HI 1612	2.6	29.7	18.3	7.0	18.2	29.7	15.1
98	WH 1181	11.2	23.7	10.0	3.8	37.4	37.4	17.2
IV. CENTRAL ZONE								
99	HI 8774 (D)	0.0	0.0	56.3	0.0	0.0	56.3	11.3
100	PDW 344 (D)	0.0	1.9	8.3	0.0	0.0	8.3	2.0
100. A	Sonalika (C)	69.2	39.4	86.7	59.4	80.3	86.7	67.0
V. PENINSULAR ZONE								
101	AKAW 4842	22.4	18.1	40.0	14.3	25.3	40.0	24.0
102	DBW 168	2.7	13.9	10.0	10.1	22.3	22.3	11.8
103	GW 477	10.6	10.9	32.5	22.0	42.6	42.6	23.7
104	HI 8777 (D)	0.0	0.0	28.6	0.0	0.0	28.6	5.7
105	KD 1418 (D)	0.0	0.0	31.3	11.0	0.0	31.3	8.5
106	MACS 4028 (D)	0.0	0.0	15.0	0.0	0.0	15.0	3.0
107	MACS 6660	26.1	0.0	42.6	28.6	0.0	42.6	19.5
108	NIAW 2495	7.5	24.0	60.0	10.5	33.5	60.0	27.1
109	RKD 283 (D)	1.1	1.7	8.3	0.0	0.0	8.3	2.2
110	RKD 292 (D)	7.6	0.0	30.0	2.5	10.7	30.0	10.2
111	UAS 375	12.7	16.4	80.0	7.7	74.5	80.0	38.2
112	UAS 459 (D)	0.0	0.0	8.3	0.0	14.4	14.4	4.5
VI. SPECIAL TRIAL (Dicoccum and SALINITY and Alkalinity)								

113	DBW 214	7.0	23.2	16.7	13.0	59.8	59.8	23.9
114	DBW 215	0.0	6.3	20.0	12.3	28.8	28.8	13.5
115	DBW 216	16.4	30.7	40.0	11.5	62.8	62.8	32.3
116	DBW 217	7.1	20.5	35.0	10.4	34.4	35.0	21.5
117	DDK 1050	0.0	0.0	45.0	0.0	0.0	45.0	9.0
118	DDK 1051	0.0	0.0	8.3	0.0	0.0	8.3	1.7
119	KA 1427	13.5	5.7	31.3	2.0	5.7	31.3	11.7
120	MACS 5044	0.0	0.0	25.0	0.0	0.0	25.0	5.0
120. A	Sonalika (C)	61.7	36.4	83.3	63.9	36.0	83.3	56.3
121	MACS 5046	0.0	0.9	12.5	0.0	0.0	12.5	2.7
122	NW 6094	0.0	19.0	16.7	12.5	59.2	59.2	21.5
123	WH 1310	7.4	21.6	40.0	0.0	38.0	40.0	21.4
VII. SPECIAL TRIAL (TRITICALE)								
124	TL 3006	0.0	0.0	30.0	0.0	0.0	30.0	6.0
125	TL 3007	0.0	0.0	5.0	0.0	0.0	5.0	1.0
126	TL 3008	0.0	0.0	14.3	0.0	21.5	21.5	7.2
127	TL 3009	0.0	0.0	4.3	0.0	0.0	4.3	0.9
128	TL 3010	0.0	0.0	4.3	0.0	0.0	4.3	0.9
VIII. SPECIAL TRIAL (MABB/NIL (KB) ENTRIES/Biofortification trial)								
129	HPBW 01	5.2	36.7	41.3	0.0	51.7	51.7	27.0
130	HPBW 02	6.9	24.6	86.7	26.5	20.0	86.7	32.9
131	HPPAU 05	10.9	24.8	83.3	0.0	17.3	83.3	27.3
132	HPPAU 08	0.0	27.1	41.3	23.8	40.7	41.3	26.6
133	HPPAU 10	6.5	0.0	4.3	18.2	71.4	71.4	20.1
134	PBW 760	3.2	26.8	81.6	30.8	68.2	81.6	42.1
IX. SPECIAL TRIAL (Very Late Sown)								
135	DBW 218	0.4	14.7	61.1	20.0	42.3	61.1	27.7
136	DBW 219	8.3	27.1	13.3	5.7	0.0	27.1	10.9
137	DBW 220	1.9	16.4	62.5	6.7	39.2	62.5	25.3
138	HD 3236	5.3	24.6	81.6	15.4	44.1	81.6	34.2
139	HI 1621	4.2	10.3	82.5	4.5	5.4	82.5	21.4
140	PBW 756	11.8	15.1	71.6	41.7	45.9	71.6	37.2
140. A	Sonalika (C)	67.1	30.5	85.0	49.2	22.2	85.0	50.8
141	PBW 757	13.5	17.2	32.5	31.9	51.2	51.2	29.3
142	WH 1215	7.3	20.6	75.0	34.4	31.7	75.0	33.8
143	WH 1216	3.6	30.9	76.0	25.4	13.5	76.0	29.9
X. AVTs for Summer sown (VHA)								
144	HS 580	0.0	0.0	14.3	0.0	19.6	19.6	6.8
145	HS 590	6.4	14.6	45.0	18.9	40.9	45.0	25.1
146	VL 3002	0.0	0.0	5.0	0.0	0.0	5.0	1.0
147	VL 4001	0.0	16.7	5.0	25.6	29.9	29.9	15.4
148	PBW 621	4.3	14.7	83.3	23.0	64.1	83.3	37.9

Annexure Table 2.9. Powdery mildew screening nursery, 2016-17

S. No.	Entries	Powdery Mildew Score (0-9)						
		Pantnagar	Malan	Wellington	Shimla	Bajaura	HS	AV.
AVT IInd Year 2016-17								
I. NORTHERN HILLS ZONE								
1	HPW 251 (C)	1	2	3	5	4	5	3
2	HS 375 (C)	1	4	2	7	4	7	4
3	HS 490 (C)	1	4	1	7	4	7	3
4	HS 507 (C)	3	4	2	7	5	7	4
5	HS 542 (C)	1	4	2	7	4	7	4
6	VL 829 (C)	1	5	1	5	5	5	3

S. No.	Entries	Powdery Mildew Score (0-9)						
		Pantnagar	Malan	Wellington	Shimla	Bajaura	HS	AV.
7	VL 892 (C)	3	4	1	5	6	6	4
8	VL 907 (C)	NS	NS	NS	NS	NS	NS	NS
II. NORTH WESTERN PLAINS ZONE								
9	DBW 173	1	6	1	5	4	6	3
10	DBW 88 (C)	1	6	2	9	5	9	5
11	DBW 90 (C)	1	4	1	9	4	9	4
12	HD 3043 (C)	1	3	2	5	3	5	3
13	HD 2967 (C)	3	5	1	9	5	9	5
14	HD 3059 (C)	1	6	1	9	6	9	5
15	HD 3086 (C)	1	5	1	9	5	9	4
16	PBW 644 (C)	1	6	1	7	5	7	4
17	WH 1021 (C)	1	6	3	7	6	7	5
18	WH 1080 (C)	1	5	4	7	5	7	4
19	WH 1105 (C)	3	5	2	9	6	9	5
20	WH 1124 (C)	1	5	2	9	3	9	4
20A	PBW 343 (Check)	7	8	5	9	8	9	7
21	WH 1142 C)	3	6	3	9	4	9	5
III. NORTH EASTERN PLAINS ZONE								
22	HI 1612	5	5	2	9	4	9	5
23	C 306 (C)	1	6	3	9	6	9	5
24	DBW 39 (C)	1	5	3	9	6	9	5
25	HD 2733 (C)	1	6	5	9	6	9	5
26	HD 2888 (C)	3	6	2	9	5	9	5
27	HD 3171 (I) (C)	1	5	2	9	4	9	4
28	K 8027 (C)	1	5	2	9	6	9	5
29	K 0307 (C)	3	6	3	5	4	6	4
30	K 1006 (C)	4	4	4	7	4	7	5
31	K 1317 (I) (C)	1	6	6	9	4	9	5
IV. CENTRAL ZONE								
32	DBW 110 (C)	1	5	3	9	4	9	4
33	HD 8627 (d) (C)	1	5	3	9	5	9	5
34	MP 3288 (C)	1	3	2	7	5	7	4
V. PENINSULAR ZONE								
35	DBW 168	3	4	4	9	4	9	5
36	HI 8777 (d)	1	4	2	9	5	9	4
37	MACS 4028 (d)	1	4	0	9	4	9	4
38	UAS 375	1	5	2	7	4	7	4
39	AKDW 2997-16(d) (C)	3	6	0	9	5	9	5
40	GW 322 (C)	1	6	2	7	4	7	4
40A	PBW 343 (Check)	5	8	4	9	7	9	7
41	MACS 6222 (C)	3	6	1	7	5	7	4
42	MACS 6478 (C)	1	5	3	9	6	9	5
43	NI 5439 (C)	0	5	3	9	5	9	4
44	NIAW 1415 (C)	0	6	4	9	5	9	5
45	UAS 304 (C)	0	6	5	9	4	9	5
46	UAS 446 (d) (C)	0	4	1	9	5	9	4
VI. SOUTHERN HILLS ZONE								
47	HW 2044 (C)	3	5	1	7	5	7	4
48	HW 5216 (C)	1	5	1	7	5	7	4
49	CoW (W) -1 (C)	1	5	1	9	5	9	4
VII. SPECIAL TRIAL (Triticale , Dicoccum, Salinity/ Alk)								
50	DBW 14 (C)	1	3	2	3	4	4	3
51	DBW 71 (C)	3	6	5	9	4	9	5
52	DDK 1029 (C)	1	2	0	3	4	4	2

S. No.	Entries	Powdery Mildew Score (0-9)						
		Pantnagar	Malan	Wellington	Shimla	Bajaura	HS	AV.
53	HW 1098 (C)	0	3	1	5	6	6	3
54	Kharchia 65 (C)	0	3	4	9	6	9	4
55	KRL 19 (C)	1	6	2	7	6	7	4
56	KRL 210 (C)	1	5	3	9	4	9	4
57	PBW 550	1	6	4	7	4	7	4
58	TL 2942 (C)	1	1	1	0	0	1	1
59	TL 2969 (C)	1	0	2	0	0	2	1
60	WR 544 (C)	3	7	5	9	6	9	6
60A	PBW 343 (Check)	5	8	4	9	8	9	7
AVT Ist Year 2016-17								
I. NORTHERN HILLS ZONE								
61	DBW 179	NG	2	2	5	4	5	3
62	DBW 204	NS	NS	NS	NS	NS	NS	NS
63	HPW 434	NS	NS	NS	NS	NS	NS	NS
64	HPW 438	NS	NS	NS	NS	NS	NS	NS
65	HPW 439	5	4	2	5	4	5	4
66	HPW 440	1	4	2	7	4	7	4
67	HPW 448	1	3	3	5	4	5	3
68	HPW 449	1	4	2	5	4	5	3
69	HS 629	3	4	2	7	4	7	4
70	HS 630	0	3	1	3	5	5	2
71	HS 643	0	4	1	7	4	7	3
72	HS 644	0	4	2	3	4	4	3
73	HS 645	3	3	1	5	4	5	3
74	HS 646	1	3	3	5	4	5	3
75	HS 647	1	3	3	7	4	7	4
76	HS 648	3	4	1	7	4	7	4
77	UP 2992	0	4	3	7	4	7	4
78	UP 2993	0	4	2	9	5	9	4
79	VL 1011	1	3	3	7	4	7	4
80	VL 1012	5	3	3	9	5	9	5
80A	PBW 343 (Check)	5	7	4	9	8	9	7
81	VL 1013	1	4	4	7	4	7	4
82	VL 3013	1	4	2	5	4	5	3
83	VL 3014	1	3	4	5	4	5	3
84	VL 3015	3	3	4	7	3	7	4
85	VL 4002	1	5	3	5	5	5	4
86	VL 4003	1	4	3	9	4	9	4
II. NORTH WESTERN PLAINS ZONE								
87	BRW 3773	0	5	4	9	4	9	4
88	CG 1023	0	3	6	9	5	9	5
89	DBW 189	0	3	2	7	4	7	3
90	DBW 196	0	4	3	9	4	9	4
91	HD 3226	3	6	2	7	4	7	4
92	HD 3237	1	5	3	5	4	5	4
93	HI 1617	1	4	2	7	5	7	4
94	HI 1619	0	4	2	5	5	5	3
95	HI 1620	0	5	2	7	4	7	4
96	HP1963	3	4	3	5	4	5	4
97	HS 611	1	4	2	3	4	4	3
98	MACS 6677	3	4	1	9	4	9	4
99	MP 1318	0	4	1	9	4	9	4
100	PBW 750	0	5	2	9	4	9	4
100A	PBW 343 (Check)	5	7	5	9	7	9	7
101	PBW 752	7	6	3	9	4	9	6
102	UP 2942	3	5	2	7	4	7	4

S. No.	Entries	Powdery Mildew Score (0-9)						
		Pantnagar	Malan	Wellington	Shimla	Bajaura	HS	AV.
103	WH 1202	1	5	2	7	4	7	4
III. NORTH ESTERN PLAINS ZONE								
104	DBW 187	1	5	2	7	4	7	4
105	HD 3219	0	5	3	9	4	9	4
106	UAS 384	0	6	4	7	4	7	4
IV. CENTRAL ZONE								
107	BRW 3775	3	5	5	7	4	7	5
108	HI 8791 (d)	0	5	6	9	4	9	5
109	UAS 385	0	5	4	7	4	7	4
110	UAS 462 (d)	5	3	2	9	4	9	5
V. SOUTHERN HILLS ZONE								
111	UAS 387	1	6	3	7	3	7	4
VI. SPECIAL TRIAL (DICOCCUM, MABB,SALINITY AND ALKALINITY)								
112	DBW 246	1	5	4	7	4	7	4
113	DBW 247	1	5	2	5	3	5	3
114	DBW 248	3	5	5	7	4	7	5
115	DDK 1052	0	5	0	5	5	5	3
116	DDK 1053	5	0	0	1	4	5	2
117	KRL 370	3	4	3	7	4	7	4
118	KRL 377	0	5	3	7	5	7	4
119	KRL 384	0	6	2	9	4	9	4
120	KRL 386	0	5	2	9	4	9	4
120A	PBW 343 (Check)	7	8	6	9	8	9	8
121	MACS 5047	1	0	0	1	4	4	1
122	MACS 5049	3	0	0	1	3	3	1
123	PBW 779	1	5	4	5	4	5	4
124	PBW 780	3	4	2	9	5	9	5
125	WH 1316	0	5	4	9	4	9	4
VII. SPECIAL TRIAL (TRITICALE)								
126	TL 3011	0	0	1	0	0	1	0
127	TL 3012	1	0	0	0	0	1	0
128	TL 3013	1	0	1	0	0	1	0
129	TL 3014	1	0	1	0	0	1	0
130	TL 3015	3	0	1	0	0	3	1
IX. SPECIAL TRIAL (VERY LATE SOWN)								
131	DBW 249	0	5	3	7	4	7	4
132	DBW 250	0	5	3	9	3	9	4
133	DBW 251	0	6	2	7	4	7	4
134	HD 3271	0	5	1	9	3	9	4
135	HD 3272	1	4	2	5	2	5	3
136	HI 1621	3	5	3	9	4	9	5
137	PBW 757	1	5	3	5	4	5	4
138	PBW 777	3	6	4	5	4	6	4
139	PBW 778	0	6	4	7	3	7	4
140	WH 1232	0	6	3	5	4	6	4
140A	PBW 343 (Check)	5	8	5	7	8	8	7
141	WH 1233	5	5	5	7	4	7	5
IX. SPECIAL TRIAL (Very High Altitude)								
142	HS 375 (C)	0	6	4	5	5	6	4
143	HS 490 (C)	1	5	1	7	4	7	4
A. Resistant to (Av.0-3 Score, Highest Score up to 5)								
Source: AVT IInd Year 2007-08								
144	WB 2	3	4	1	1	3	4	2

S. No.	Entries	Powdery Mildew Score (0-9)						
		Pantnagar	Malan	Wellington	Shimla	Bajaura	HS	AV.
Source: AVT Ist Year 2015-16								
145	PBW 737	0	5	1	5	3	5	3
146	DDK 1050	0	0	0	1	2	2	1
147	KA 1427	1	4	2	5	2	5	3
148	MACS 5044	3	3	0	3	3	3	2
149	NW 6094	1	5	1	9	3	9	4
150	TL 3007	0	0	1	0	0	1	0
151	TL 3008	3	0	0	0	0	3	1

Annexure Table.2.10: Performance of AVT 2nd and AVT 1st year material against head scab (% incidence) under multilocational testing during 2016-17

S. No.	Entries	Head scab Incidence (%)				
		Pusa Bihar	Wellington	Dhaulakuan	HS	AV.
AVT IInd Year 2016-17						
I. NORTHERN HILLS ZONE						
1	HPW 251 (C)	1	1	5	5	2
2	HS 375 (C)	0	1	5	5	2
3	HS 490 (C)	0	1	5	5	2
4	HS 507 (C)	0	1	5	5	2
5	HS 542 (C)	0	0	5	5	2
6	VL 829 (C)	2	1	5	5	3
7	VL 892 (C)	1	1	5	5	2
8	VL 907 (C)	NS	NS	NS	NS	NS
II. NORTH WESTERN PLAINS ZONE						
9	DBW 173	1	1	5	5	2
10	DBW 88 (C)	0	0	5	5	2
11	DBW 90 (C)	0	0	5	5	2
12	HD 3043 (C)	0	1	5	5	2
13	HD 2967 (C)	0	1	5	5	2
14	HD 3059 (C)	0	1	5	5	2
15	HD 3086 (C)	0	0	5	5	2
16	PBW 644 (C)	0	0	5	5	2
17	WH 1021 (C)	1	0	5	5	2
18	WH 1080 (C)	2	0	5	5	2
19	WH 1105 (C)	0	1	5	5	2
20	WH 1124 (C)	0	0	5	5	2
20. A	HD 2967 (C)	0	1	5	5	2
21	WH 1142 C)	0	0	5	5	2
III. NORTH EASTERN PLAINS ZONE						
22	HI 1612	0	1	5	5	2
23	C 306 (C)	1	2	5	5	3
24	DBW 39 (C)	0	0	5	5	2
25	HD 2733 (C)	0	1	5	5	2
26	HD 2888 (C)	2	0	5	5	2
27	HD 3171 (I) (C)	1	0	5	5	2
28	K 8027 (C)	0	1	5	5	2
29	K 0307 (C)	1	1	5	5	2
30	K 1006 (C)	2	0	5	5	2
31	K 1317 (I) (C)	0	0	5	5	2
IV. CENTRAL ZONE						
32	DBW 110 (C)	0	1	5	5	2
33	HI 8627 (d) (C)	1	0	5	5	2
34	MP 3288 (C)	0	0	5	5	2

S. No.	Entries	Head scab Incidence (%)				
		Pusa Bihar	Wellington	Dhaulakuan	HS	AV.
V. PENINSULAR ZONE						
35	DBW 168	0	1	4	4	2
36	HI 8777 (d)	0	1	5	5	2
37	MACS 4028 (d)	1	0	5	5	2
38	UAS 375	1	0	5	5	2
39	AKDW 2997-16 (d) (C)	1	2	5	5	3
40	GW 322 (C)	1	0	5	5	2
40. A	HD 2967 (C)	1	2	5	5	3
41	MACS 6222 (C)	0	3	5	5	3
42	MACS 6478 (C)	1	1	5	5	2
43	NI 5439 (C)	1	1	5	5	2
44	NIAW 1415 (C)	0	3	5	5	3
45	UAS 304 (C)	1	4	5	5	3
46	UAS 446 (C)	1	1	4	4	2
VI. SOUTHERN HILLS ZONE						
47	HW 2044 (C)	1	1	5	5	2
48	HW 5216 (C)	0	1	5	5	2
49	CoW (W) -1 (C)	1	3	5	5	3
VII. SPECIAL TRIAL (MABB-IR-LS-CZ/PZ/WB)						
50	DBW 14 (C)	1	0	5	5	2
51	DBW 71 (C)	1	0	5	5	2
52	DDK 1029 (C)	0	0	5	5	2
53	HW 1098 (C)	1	0	5	5	2
54	Kharchia 65 (C)	1	1	5	5	2
55	KRL 19 (C)	2	1	5	5	3
56	KRL 210 (C)	2	0	5	5	2
57	PBW 550 (C)	3	1	5	5	3
58	TL 2942 (C)	1	1	5	5	2
59	TL 2969 (C)	1	1	5	5	2
60	WR 544 (C)	1	2	5	5	3
60. A	HD 2967 (C)	0	1	5	5	2
AVT Ist Year 2016-17						
I. NORTHERN HILLS ZONE						
1	DBW 179	1	1	5	5	2
2	DBW 204	NS	NS	NS	NS	NS
3	HPW 434	NS	NS	NS	NS	NS
4	HPW 438	NS	NS	NS	NS	NS
5	HPW 439	1	0	5	5	2
6	HPW 440	1	1	5	5	2
7	HPW 448	1	0	5	5	2
8	HPW 449	0	1	5	5	2
9	HS 629	0	1	5	5	2
10	HS 630	0	1	5	5	2
11	HS 643	1	2	4	4	2
12	HS 644	0	2	5	5	2
13	HS 645	1	0	5	5	2
14	HS 646	0	2	-	2	1
15	HS 647	0	1	5	5	2
16	HS 648	0	1	5	5	2
17	UP 2992	0	2	5	5	2
18	UP 2993	0	0	4	4	1
19	VL 1011	0	1	5	5	2
20	VL 1012	1	2	5	5	3
20. A	INFECTOR	2	1	5	5	3
21	VL 1013	2	0	-	2	1

S. No.	Entries	Head scab Incidence (%)				
		Pusa Bihar	Wellington	Dhaulakuan	HS	AV.
22	VL 3013	0	1	5	5	2
23	VL 3014	0	3	5	5	3
24	VL 3015	2	1	5	5	3
25	VL 4002	0	0	5	5	2
26	VL 4003	2	0	5	5	2
II. NORTH WESTERN PLAINSS ZONE						
27	BRW 3773	0	0	5	5	2
28	CG 1023	0	1	5	5	2
29	DBW 189	0	3	4	4	2
30	DBW 196	1	0	5	5	2
31	HD 3226	0	0	5	5	2
32	HD 3237	0	0	5	5	2
33	HI 1617	0	0	5	5	2
34	HI 1619	0	0	5	5	2
35	HI 1620	0	0	5	5	2
36	HP 1963	0	0	5	5	2
37	HS 611	1	1	5	5	2
38	MACS 6677	0	1	5	5	2
39	MP 1318	0	0	5	5	2
40	PBW 750	2	3	5	5	3
40. A	INFECTOR	1	1	5	5	2
41	PBW 752	0	3	5	5	3
42	UP 2942	0	2	5	5	2
43	WH 1202	0	1	5	5	2
III. NORTH EASTERN PLAINSS ZONE						
44	DBW 187	0	0	5	5	2
45	HD 3219	0	0	5	5	2
46	UAS 384	0	3	5	5	3
IV. CENTRAL ZONE						
47	BRW 3775	0	1	5	5	2
48	HI 8791 (d)	0	1	5	5	2
49	UAS 385	0	2	4	4	2
50	UAS 462 (d)	0	2	5	5	2
V. SOUTHERN HILLS ZONE						
51	UAS 387	1	0	5	5	2
VI. SPECIAL TRIAL (Dicoccum, MABB, SALINITY and Alkalinity)						
52	DBW 246	1	1	5	5	2
53	DBW 247	0	1	4	4	2
54	DBW 248	2	0	5	5	2
55	DDK 1052	2	0	5	5	2
56	DDK 1053	0	2	5	5	2
57	KRL 370	1	0	5	5	2
58	KRL 377	1	1	5	5	2
59	KRL 384	0	2	4	4	2
60	KRL 386	0	0	5	5	2
60. A	INFECTOR	2	1	5	5	3
61	MACS 5047	0	0	5	5	2
62	MACS 5049	0	0	5	5	2
63	PBW 779	0	2	5	5	2
64	PBW 780	0	3	4	4	2
65	WH 1316	0	0	5	5	2
VII. SPECIAL TRIAL (TRITICALE)						
66	TL 3011	0	0	5	5	2
67	TL 3012	0	1	5	5	2

S. No.	Entries	Head scab Incidence (%)				
		Pusa Bihar	Wellington	Dhaulakuan	HS	AV.
68	TL 3013	0	1	5	5	2
69	TL 3014	0	0	5	5	2
70	TL 3015	0	0	5	5	2
VIII. SPECIAL TRIAL (Very Late Sown)						
71	DBW 249	0	0	4	4	1
72	DBW 250	0	1	5	5	2
73	DBW 251	0	0	5	5	2
74	HD 3271	0	1	5	5	2
75	HD 3272	0	1	5	5	2
76	HI 1621	0	2	5	5	2
77	PBW 757	0	0	5	5	2
78	PBW 777	0	2	5	5	2
79	PBW 778	0	0	5	5	2
80	WH 1232	0	3	5	5	3
80. A	INFECTOR	2	1	5	5	3
81	WH 1233	0	1	5	5	2
IX. SPECIAL TRIAL (Very High Altitude)						
82	HS 375 (C)	1	3	5	5	3
83	HS 490(C)	1	3	5	5	3
83. A	INFECTOR	2	2	5	5	3

Table 2.11. Flag smut score of AVT entries in Flag Smut Screening Nursery during 2016-17

S.No.	Entry	Flag Smut (%)					
		Ludhiana	Hisar	Karnal	Durgapura	HS	AV.
AVT IInd Year 2016-17							
I. NORTHERN HILLS ZONE							
1	HPW 251 (C)	25.0	3.5	0.0	11.1	25.0	9.9
2	HS 375 (C)	25.0	6.6	6.0	NG	25.0	12.5
3	HS 490 (C)	0.0	7.7	3.4	4.5	7.7	3.9
4	HS 507 (C)	6.3	6.2	1.8	15.8	15.8	7.5
5	HS 542 (C)	0.0	2.4	5.0	14.3	14.3	5.4
6	VL 829 (C)	0.0	0.0	0.0	12.5	12.5	3.1
7	VL 892 (C)	0.0	2.1	2.1	13.6	13.6	4.5
8	VL 907 (C)	NS	NS	NS	NS	NS	NS
II. NORTH WESTERN PLAIN ZONE							
9	DBW 173	0.0	3.1	2.4	5.9	5.9	2.9
10	DBW 88 (C)	0.0	4.0	1.8	0.0	4.0	1.5
11	DBW 90 (C)	14.3	3.4	0.0	6.7	14.3	6.1
12	HD 3043 (C)	0.0	7.1	1.3	15.4	15.4	6.0
13	HD 2967 (C)	0.0	6.5	0.0	18.2	18.2	6.2
14	HD 3059 (C)	5.0	8.9	0.0	0.0	8.9	3.5
15	HD 3086 (C)	0.0	1.1	23.5	15.8	23.5	10.1
16	PBW 644 (C)	16.7	5.3	4.6	13.6	16.7	10.0
17	WH 1021 (C)	5.9	3.8	0.0	4.0	5.9	3.4
18	WH 1080 (C)	5.0	1.6	0.0	7.4	7.4	3.5
19	WH 1105 (C)	0.0	0.0	3.2	0.0	3.2	0.8
20	WH 1124 (C)	9.1	1.3	1.3	3.6	9.1	3.8
20A	CHECK	15.0	36.6	23.5	28.6	36.6	25.9
21	WH 1142 C)	0.0	2.8	21.3	20.0	21.3	11.0
III. NORTH EASTERN PLAIN ZONE							
22	HI 1612	11.8	11.1	15.0	0.0	15.0	9.5
23	C 306 (C)	7.7	10.4	7.7	41.7	41.7	16.9
24	DBW 39 (C)	0.0	3.6	8.8	23.1	23.1	8.9
25	HD 2733 (C)	0.0	6.6	32.6	14.3	32.6	13.4

S.No.	Entry	Flag Smut (%)					
		Ludhiana	Hisar	Karnal	Durgapura	HS	AV.
26	HD 2888 (C)	18.2	11.8	1.4	22.2	22.2	13.4
27	HD 3171 (I) (C)	6.3	0.0	1.1	0.0	6.3	1.8
28	K 8027 (C)	14.3	0.0	0.0	11.1	14.3	6.3
29	K 0307 (C)	0.0	0.0	0.0	5.9	5.9	1.5
30	K 1006 (C)	0.0	1.1	0.0	13.3	13.3	3.6
31	K 1317 (I) (C)	0.0	3.1	1.9	0.0	3.1	1.3
IV. CENTRAL ZONE							
32	DBW 110 (C)	0.0	6.2	0.0	0.0	6.2	1.6
33	HD 8627 (d) (C)	0.0	0.0	8.8	0.0	8.8	2.2
34	MP 3288 (C)	7.7	1.1	5.2	0.0	7.7	3.5
V. PENINSULAR ZONE							
35	DBW 168	6.7	2.9	0.0	22.2	22.2	7.9
36	HI 8777 (d)	0.0	0.0	0.0	0.0	0.0	0.0
37	MACS 4028 (d)	17.7	0.0	0.0	0.0	17.7	4.4
38	UAS 375	0.0	1.9	0.0	0.0	1.9	0.5
39	AKDW 2997-16(d) (C)	0.0	0.0	12.8	0.0	12.8	3.2
40	GW 322 (C)	0.0	5.0	1.5	6.3	6.3	3.2
40A	CHECK	25.0	21.1	25.6	-	25.6	23.9
41	MACS 6222 (C)	7.7	4.1	9.3	38.5	38.5	14.9
42	MACS 6478 (C)	0.0	5.2	17.1	37.5	37.5	15.0
43	NI 5439 (C)	10.5	6.8	0.0	12.5	12.5	7.5
44	NIAW 1415 (C)	0.0	3.2	0.0	0.0	3.2	0.8
45	UAS 304 (C)	0.0	0.0	0.0	0.0	0.0	0.0
46	UAS 446 (d) (C)	0.0	0.0	26.9	0.0	26.9	6.7
VI. SOUTHERN HILLS ZONE							
47	HW 2044 (C)	0.0	0.0	0.0	0.0	0.0	0.0
48	HW 5216 (C)	0.0	8.6	33.3	0.0	33.3	10.5
49	CoW (W) -1 (C)	0.0	0.0	0.0	0.0	0.0	0.0
VII. SPECIAL TRIAL (Triticale, Dicoccum, Salinity/Alkalinity)							
50	DBW 14 (C)	0.0	0.0	2.8	3.6	3.6	1.6
51	DBW 71 (C)	0.0	18.1	19.1	8.3	19.1	11.4
52	DDK 1029 (C)	0.0	0.0	0.0	0.0	0.0	0.0
53	HW 1098 (C)	0.0	0.0	0.0	0.0	0.0	0.0
54	Kharchia 65 (C)	0.0	13.2	6.2	50.0	50.0	17.4
55	KRL 19 (C)	0.0	2.1	1.6	26.7	26.7	7.6
56	KRL 210 (C)	0.0	3.6	0.0	0.0	3.6	0.9
57	PBW 550	0.0	2.9	4.6	0.0	4.6	1.9
58	TL 2942 (C)	0.0	0.0	0.0	0.0	0.0	0.0
59	TL 2969 (C)	0.0	0.0	0.0	0.0	0.0	0.0
60	WR 544 (C)	0.0	0.0	0.0	0.0	0.0	0.0
60A	CHECK	33.3	13.8	22.5	39.1	39.1	27.2
AVT Ist Year 2016-17							
I. NORTHERN HILLS ZONE							
1	DBW 179	0.0	3.7	36.8	30.8	36.8	17.8
2	DBW 204	NS	NS	NS	NS	NS	NS
3	HPW 434	NS	NS	NS	NS	NS	NS
4	HPW 438	NS	NS	NS	NS	NS	NS
5	HPW 439	0.0	1.1	1.0	8.3	8.3	2.6
6	HPW 440	0.0	1.8	0.0	10.5	10.5	3.1
7	HPW 448	0.0	3.5	0.9	0.0	3.5	1.1
8	HPW 449	0.0	NS	0.0	17.6	17.6	5.9
9	HS 629	0.0	2.4	0.0	4.2	4.2	1.7
10	HS 630	0.0	2.2	0.0	7.7	7.7	2.5
11	HS 643	0.0	2.4	0.0	15.8	15.8	4.6
12	HS 644	0.0	5.9	0.0	0.0	5.9	1.5
13	HS 645	0.0	4.4	0.0	16.7	16.7	5.3
14	HS 646	0.0	2.0	0.0	4.2	4.2	1.6

S.No.	Entry	Flag Smut (%)					
		Ludhiana	Hisar	Karnal	Durgapura	HS	AV.
15	HS 647	25.0	2.2	14.4	40.0	40.0	20.4
16	HS 648	14.3	2.5	0.0	0.0	14.3	4.2
17	UP 2992	0.0	3.8	0.0	16.7	16.7	5.1
18	UP 2993	0.0	5.2	0.0	13.3	13.3	4.6
19	VL 1011	0.0	4.4	0.0	0.0	4.4	1.1
20	VL 1012	0.0	3.9	0.6	15.4	15.4	5.0
20A	CHECK	22.2	23.4	23.9	56.3	56.3	31.5
21	VL 1013	26.7	2.7	42.1	54.5	54.5	31.5
22	VL 3013	0.0	3.0	37.0	13.3	37.0	13.3
23	VL 3014	0.0	8.8	0.0	0.0	8.8	2.2
24	VL 3015	0.0	5.2	2.4	21.1	21.1	7.2
25	VL 4002	0.0	4.3	0.0	18.2	18.2	5.6
26	VL 4003	0.0	3.9	0.0	7.1	7.1	2.8
II. NORTH WESTERN PLAIN ZONE							
27	BRW 3773	0.0	3.9	0.0	0.0	3.9	1.0
28	CG 1023	0.0	2.0	0.0	0.0	2.0	0.5
29	DBW 189	0.0	2.1	0.0	0.0	2.1	0.5
30	DBW 196	0.0	2.1	0.0	0.0	2.1	0.5
31	HD 3226	0.0	2.2	0.0	11.1	11.1	3.3
32	HD 3237	0.0	3.7	0.0	11.8	11.8	3.9
33	HI 1617	0.0	0.0	0.0	7.7	7.7	1.9
34	HI 1619	0.0	2.0	2.1	10.5	10.5	3.7
35	HI 1620	6.7	2.8	0.0	0.0	6.7	2.4
36	HP1963	0.0	2.8	0.0	20.0	20.0	5.7
37	HS 611	17.7	0.0	6.0	4.5	17.7	7.0
38	MACS 6677	0.0	0.0	0.0	12.5	12.5	3.1
39	MP 1318	0.0	4.4	0.0	6.7	6.7	2.8
40	PBW 750	0.0	3.0	0.0	15.8	15.8	4.7
40A	CHECK	7.7	16.1	25.1	45.5	45.5	23.6
41	PBW 752	0.0	2.5	0.0	10.5	10.5	3.3
42	UP 2942	0.0	3.0	0.0	12.5	12.5	3.9
43	WH 1202	10.5	3.7	3.7	5.9	10.5	6.0
III. NORTH ESTERN PLAIN ZONE							
44	DBW 187	25.0	6.4	5.8	0.0	25.0	9.3
45	HD 3219	0.0	0.0	0.0	5.6	5.6	1.4
46	UAS 384	0.0	2.1	0.6	0.0	2.1	0.7
IV. CENTRAL ZONE							
47	BRW 3775	0.0	2.7	0.0	0.0	2.7	0.7
48	HI 8791 (d)	0.0	0.0	0.0	0.0	0.0	0.0
49	UAS 385	9.1	3.1	8.7	0.0	9.1	5.2
50	UAS 462 (d)	0.0	0.0	0.0	0.0	0.0	0.0
V. SOUTHERN HILL ZONE							
51	UAS 387	0.0	4.0	12.5	10.0	12.5	6.6
VI. SPECIAL TRIAL (DICOCCUM, MAB,SAILINITY AND ALKALINITY)							
52	DBW 246	0.0	3.5	0.0	0.0	3.5	0.9
53	DBW 247	10.0	2.0	8.4	7.7	10.0	7.0
54	DBW 248	0.0	3.8	0.0	0.0	3.8	1.0
55	DDK 1052	0.0	0.0	0.0	0.0	0.0	0.0
56	DDK 1053	0.0	2.3	0.0	0.0	2.3	0.6
57	KRL 370	6.7	2.8	0.0	0.0	6.7	2.4
58	KRL 377	0.0	0.0	0.0	14.3	14.3	3.6
59	KRL 384	0.0	0.0	0.0	0.0	0.0	0.0
60	KRL 386	20.0	2.5	1.8	0.0	20.0	6.1
60A	CHECK	33.3	19.4	23.7	48.1	48.1	31.1
61	MACS 5047	0.0	0.0	0.0	0.0	0.0	0.0
62	MACS 5049	0.0	2.7	0.0	0.0	2.7	0.7
63	PBW 779	16.7	6.2	9.2	7.1	16.7	9.8

S.No.	Entry	Flag Smut (%)					
		Ludhiana	Hisar	Karnal	Durgapura	HS	AV.
64	PBW 780	11.1	2.8	0.0	11.1	11.1	6.3
65	WH 1316	0.0	2.3	0.0	4.8	4.8	1.8
VII. SPECIAL TRIAL (TRITICALE)							
66	TL 3011	0.0	0.0	0.0	0.0	0.0	0.0
67	TL 3012	0.0	0.0	0.0	0.0	0.0	0.0
68	TL 3013	0.0	0.0	0.0	0.0	0.0	0.0
69	TL 3014	0.0	0.0	0.0	0.0	0.0	0.0
70	TL 3015	0.0	0.0	0.0	0.0	0.0	0.0
IX. SPECIAL TRIAL (VERY LATE SOWN)							
71	DBW 249	0.0	0.0	0.0	0.0	0.0	0.0
72	DBW 250	0.0	0.0	0.0	0.0	0.0	0.0
73	DBW 251	8.0	2.1	0.0	0.0	8.0	2.5
74	HD 3271	7.7	1.7	6.0	5.0	7.7	5.1
75	HD 3272	0.0	2.2	0.0	4.3	4.3	1.6
76	HI 1621	0.0	1.3	0.0	0.0	1.3	0.3
77	PBW 757	0.0	2.2	0.0	16.7	16.7	4.7
78	PBW 777	0.0	2.6	0.0	10.0	10.0	3.2
79	PBW 778	10.0	2.9	8.2	7.4	10.0	7.1
80	WH 1232	5.9	3.0	1.9	0.0	5.9	2.7
80A	CHECK	27.3	15.1	23.4	38.9	38.9	26.2
81	WH 1233	0.0	2.7	0.0	0.0	2.7	0.7
IX. SPECIAL TRIAL (Very High Altitude)							
82	HS 375 (c)	8.3	2.9	9.2	30.8	30.8	12.8
83	HS 490(C)	20.0	2.8	3.6	12.5	20.0	9.7
84	DBW 204						
85	HPW 434						
86	HPW 438						

Table 2.12. Reactions of AVT entries against hill bunt (%) at hot spot locations, 2016-17

Sr. No.	Variety	% Incidence of Hill bunt				
		Almora	Bajaura	Malan	HS	AV.
I. NORTHERN HILL ZONE						
AVT IInd Year 2016-17						
1	HPW 251 (C)	22.6	0	0	22.6	7.5
2	HS 375 (C)	54.5	16.9	2.86	54.5	24.8
3	HS 490 (C)	19.9	0	0	19.9	6.6
4	HS 507 (C)	50.9	38.1	9.09	50.9	32.7
5	HS 542 (C)	0	22.2	2.86	22.2	8.4
6	VL 829 (C)	36	37.9	19.35	37.9	31.1
7	VL 892 (C)	39.5	40.8	0	40.8	26.8
8	VL 907 (C)	NS	NS	NS	NS	NS
AVT Ist Year 2016-17						
I. NORTHERN HILLS ZONE						
1	DBW 179	43.1	43.4	37.14	43.4	41.2
2	DBW 204	NS	NS	NS	NS	NS
3	HPW 434	NS	NS	NS	NS	NS
4	HPW 438	NS	NS	NS	NS	NS
5	HPW 439	26.1	24.2	38.1	38.1	29.5
6	HPW 440	21.8	57.9	11.11	57.9	30.3
7	HPW 448	12.7	6.9	NG	12.7	9.8
8	HPW 449	12.9	48.9	30.77	48.9	30.9

Sr. No.	Variety	% Incidence of Hill bunt				
		Almora	Bajaura	Malan	HS	AV.
9	HS 629	37.6	28.5	11.54	37.6	25.9
10	HS 630	7.6	32.5	21.05	32.5	20.4
11	HS 643	36.8	6.1	51.11	51.1	31.3
12	HS 644	11.9	3.5	6.25	11.9	7.2
13	HS 645	44.6	16.7	NG	44.6	30.7
14	HS 646	22.4	37.5	12.12	37.5	24.0
15	HS 647	25.5	55.4	10.53	55.4	30.5
16	HS 648	82	69.1	37.93	82.0	63.0
17	UP 2992	48.7	2.9	NG	48.7	25.8
18	UP 2993	0	0	0	0.0	0.0
19	VL 1011	30.2	27.9	11.11	30.2	23.1
20	VL 1012	0	0	0	0.0	0.0
21	VL 1013	8.8	18.3	NG	18.3	13.6
22	VL 3013	30.8	0	0	30.8	10.3
23	VL 3014	19.6	13	18.18	19.6	16.9
24	VL 3015	45.7	31.5	51.35	51.4	42.9
25	VL 4002	30.4	44.2	7.14	44.2	27.2
26	VL 4003	15.9	49.1	15	49.1	26.7
26. A	INFECTOR	54.8	66.3	6.25	66.3	42.5

ANNEXURE 1.6: Seedling Resistance Test of AVT-I against pathotypes of yellow rust (*Puccinia striiformis* f. sp. *tritici*) at Shimla during 2016-17

S. NO.	Variety/Line	Pathotypes																		Postulated gene	Remarks
		110S119	79S68	111S68	110S84	46S119	110S247	78S84	6S0	79S4	238S119	110S68	T	P	K	L	38A	7S0	31		
Northern Hill Zone																					
1	DBW 179	S	R	R	S	R	Mix	R	R	R	S	R	S	R	R	R	R	R	R	*Yr2+*	
2	DBW 204	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No seed
3	HPW 434	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No seed
4	HPW 438	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No seed
5	HPW 439	S	R	R	R	MS	S	R	R	R	R	MR	S	S	Mix	R	R	R	R	*YrA+*	
6	HPW 440	S	MR	R	Mix	R	S	R	R	R	MS	R	MS	R	MS	R	R	R	R	*YrA+*	
7	HPW 448	S	-	R	R	R	MS	R	-	R	MS	-	R	-	R	R	-	-	R	*Yr9+*	
8	HPW 449	MS	R	R	Mix	R	MS	R	R	R	S	R	R	R	R	R	R	R	R	*Yr9+*	
9	HS 629	S	R	S	R	MS	S	R	R	R	S	S	R	Mix	Mix	MS	-	-	R	*Yr2+*	
10	HS 630	S	R	MS	R	MS	MS	R	R	R	R	MS	S	S	S	MS	R	R	R	*Yr2+*	
11	HS 643	S	R	S	S	MS	S	R	R	R	S	S	S	MS	R	R	R	R	R	*Yr2+*	
12	HS 644	S	R	R	R	R	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr9+A+*	
13	HS 645	R	R	R	R	R	R	R	R	R	R	R	R	-	R	R	R	R	R	*Yr2+*	
14	HS 646	Mix	R	R	R	MS	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr9+A+*	
15	HS 647	S	R	R	R	R	S	R	-	R	S	R	S	R	R	R	R	R	R	*Yr9+*	
16	HS 648	S	R	R	Mix	MS	S	R	R	R	MS	R	S	MS	MS	MR	R	R	R	*Yr2+*	
17	UP 2992	S	R	R	MR	S	S	R	R	R	S	R	MS	S	MS	MR	R	R	R	*YrA+*	
18	UP 2993	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	-	Resistant
19	VL 1011	R	R	R	R	MS	R	R	R	R	R	R	R	R	MS	R	R	R	R	*YrA+*	
20	VL 1012	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-	Resistant
21	VL 1013	S	R	R	R	MS	R	R	R	R	MR	R	R	R	R	R	R	R	R	*YrA+*	
22	VL 3013	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	*YrA+*	
23	VL 3014	S	R	R	R	MS	MS	R	R	R	MS	R	MS	MS	S	MR	R	R	R	*Yr2+*	
24	VL 3015	Mix	R	R	R	R	Mix	R	R	R	MS	R	R	R	R	R	R	R	R	*YrA+*	
25	VL 4002	S	-	-	-	-	R	R	R	R	-	R	-	R	R	R	R	-	R	-	
26	VL 4003	R	R	R	-	R	R	R	R	R	Mix	R	R	R	R	-	R	-	R	-	
North western Plain Zone																					
27	BRW 3773	S	R	MS	R	S	S	MR	R	R	S	R	S	MS	R	MS	R	R	R	*Yr2+*	
28	CG 1023	S	MS	MR	S	R	S	R	R	S	S	R	R	R	S	R	R	R	R	*Yr2+*	
29	DBW 189	S	MS	R	R	R	S	R	R	R	S	MR	R	R	R	MS	R	R	R	*Yr2+*	
30	DBW 196	S	S	R	MS	MS	R	R	R	R	S	R	S	S	S	Mix	R	R	R	*Yr2+*	
31	HD 3226	S	R	R	Mix	MS	S	R	R	R	MS	R	R	MS	MS	R	R	R	R	*Yr2+*	

S. NO.	Variety/Line	Pathotypes																		Postulated gene	Remarks
		110S119	79S68	111S68	110S84	46S119	110S247	78S84	6S0	79S4	238S119	110S68	T	P	K	L	38A	7S0	31		
32	HD 3237	S	R	MS	S	MS	S	R	R	R	MS	MS	MS	S	S	S	R	R	R	*Yr2+*	
33	HI 1617	S	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	*YrA+*	
34	HI 1619	S	R	R	MS	S	S	R	R	R	MS	Mix	S	Mix	S	R	R	R	R	*Yr2+*	
35	HI 1620	S	R	R	R	MS	S	R	R	R	S	R	S	S	S	R	R	R	R	*YrA+*	
36	HP1963	S	R	R	MR	MS	MS	R	R	R	MS	R	S	Mix	S	MS	R	R	R	*YrA+*	
37	HS 611	S	R	MS	R	MS	S	R	R	R	R	R	S	Mix	S	Mix	R	R	R	*Yr2+*	
38	MACS 6677	S	R	R	R	MS	S	R	R	R	S	R	S	S	S	MS	R	R	R	*YrA+*	
39	MP 1318	S	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	*YrA+*	
40	PBW 750	S	R	R	R	MR	S	R	R	R	MS	R	R	MS	R	R	R	R	R	*YrA+*	
41	PBW 752	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-	Resistant
42	UP 2942	S	R	R	R	R	S	R	R	R	S	R	R	R	R	R	R	R	R	*YrA+*	
43	WH 1202	S	R	R	R	MS	S	R	R	R	MS	R	Mix	S	R	R	R	R	R	*Yr2+*	
North East Plain Zone																					
44	DBW 187	S	R	R	R	MS	S	R	R	R	S	R	Mix	S	S	R	R	R	R	*Yr2+*	
45	HD 3219	S	R	S	S	S	S	R	R	S	R	R	MS	MS	MS	R	R	R	R	*Yr2+*	
46	UAS 384	S	R	S	S	S	S	MS	R	R	S	S	R	S	R	MS	R	R	R	*Yr2+*	
Central Zone																					
47	BRW 3775	S	R	R	R	S	MS	R	R	R	R	R	MS	S	MS	R	R	R	R	*Yr2+*	
48	HI 8791 (d)	S	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	*Yr2+*	
49	UAS 385	S	R	MS	Mix	S	S	MS	R	R	S	Mix	S	S	S	Mix	R	R	R	*Yr2+*	
50	UAS 462 (d)	S	MS	S	S	S	S	Mix	S	MS	S	R	S	S	R	Mix	R	R	MS	*Yr2+*	
Central Hill Zone																					
51	UAS 387	S	R	R	R	S	S	S	R	R	S	R	R	R	R	R	R	R	R	*Yr9+*	
South Hill Zone																					
52	DBW 246	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-	Resistant
53	DBW 247	S	MR	MS	R	MS	S	R	R	R	S	MS	S	MR	S	R	R	R	Mix	*Yr2+*	
54	DBW 248	S	R	R	MS	MS	S	R	R	R	S	MS	R	MS	MR	R	R	R	R	*Yr2+*	
55	DDK 1052	S	MS	R	R	R	Mix	R	-	R	MS	R	R	R	MS	R	R	R	R	*Yr2+*	
56	DDK 1053	S	S	S	S	S	S	S	S	S	S	S	MS	S	S	MS	R	S	Mix	-	
57	KRL 370	S	R	MS	MS	S	S	R	R	R	Mix	R	S	S	S	S	R	R	R	*Yr2+*	
58	KRL 377	S	R	R	MS	MS	S	R	R	R	S	R	R	R	MS	R	R	R	R	*Yr2+*	
59	KRL 384	S	R	R	R	S	S	R	R	R	S	R	S	S	S	R	R	R	R	*Yr2+*	
60	KRL 386	S	R	MS	R	S	S	R	R	R	S	S	S	S	S	R	R	R	R	*Yr2+*	
61	MACS 5047	S	MS	MS	Mix	MS	MR	MS	R	R	MS	MS	MS	MS	S	MS	MR	R	R	*Yr2+*	

S. NO.	Variety/Line	Pathotypes																		Postulated gene	Remarks
		110S119	79S68	111S68	110S84	46S119	110S247	78S84	6S0	79S4	238S119	110S68	T	P	K	L	38A	7S0	31		
62	MACS 5049	S	R	MS	MS	MS	MR	R	-	-	MS	MS	MS	MS	MR	MR	R	R	R	*Yr2+*	
63	PBW 779	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+A+*	
64	PBW 780	R	R	R	R	R	R	R	R	R	R	-	MR	R	R	R	R	R	R	-	
65	WH 1316	MR	S	S	R	R	R	R	R	R	R	MS	MS	MS	MS	MS	MS	MS	MS	*Yr2+*	
Special Trials																					
66	TL 3011	MS	R	R	MR	S	MS	R	R	R	R	R	R	R	R	R	R	R	-	*Yr9+*	
67	TL 3012	S	R	R	MS	MR	S	R	R	R	R	R	R	R	R	R	R	R	-	-	
68	TL 3013	S	R	R	R	MS	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr9+*	
69	TL 3014	MS	R	R	MS	MS	R	R	R	R	R	R	R	MR	R	R	R	R	-	*Yr9+*	
70	TL 3015	S	R	R	MS	R	R	R	R	R	S	-	R	R	R	R	R	R	R	-	
Special Trials (Very Late sown)																					
71	DBW 249	S	R	MS	MS	MR	S	R	R	R	S	R	MS	MS	R	MS	R	R	R	*Yr2+*	
72	DBW 250	S	R	MS	MS	S	S	R	R	R	R	MS	S	MS	Mix	MS	R	Mix	Mix	*Yr2+*	
73	DBW 251	S	R	R	MS	S	S	R	R	R	MS	MS	S	S	R	R	R	R	R	*Yr2+*	
74	HD 3271	MS	R	R	R	MS	R	R	R	R	MR	R	R	R	R	R	R	R	R	-	
75	HD 3272	S	R	R	R	MS	S	R	R	R	S	R	S	S	MR	R	R	R	R	*Yr2+*	
76	HI 1621	S	MS	MS	MS	MS	S	MS	R	MS	S	MS	S	S	S	Mix	R	R	R	*Yr2+*	
77	PBW 757	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-	Resistant
78	PBW 777	S	R	R	S	S	S	S	R	R	S	R	R	R	R	R	R	R	R	*Yr9+*	
79	PBW 778	S	MR	R	R	MS	S	R	R	R	S	R	S	S	MS	R	R	R	R	*YrA+*	
80	WH 1232	S	R	R	R	MS	R	R	R	R	MS	R	S	R	R	R	R	R	R	*YrA+*	
81	WH 1233	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-	Resistant
82	VL 4002	S	R	R	R	R	-	R	R	R	MS	R	R	R	R	R	R	R	R	*Yr9+A+*	
83	HS 375 (C)	S	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	*Yr9+A+*	
84	HS 630	MS	R	R	R	R	MR	R	R	R	S	R	S	S	MR	R	R	-	R	*YrA+*	
85	VL 4003	R	R	R	R	R	R	R	R	R	S	R	R	R	MS	R	R	R	R	-	
86	HS 629	S	R	R	S	S	S	R	R	R	S	R	-	S	R	R	R	R	R	*Yr2+*	
87	HPW 434	S	MS	S	S	S	MS	MS	R	R	S	S	S	S	MS	S	R	R	R	*Yr2+*	
88	DBW 179	S	R	R	R	R	R	R	R	R	S	R	MS	R	R	R	R	R	R	*YrA+*	
89	HS 490(C)	S	R	R	Mix	R	MS	R	R	R	S	R	MS	R	R	R	R	R	R	*Yr2+*	
90	DBW 204	S	R	R	MS	MS	S	R	R	R	S	R	R	S	MS	MS	R	R	R	*Yr2+*	
91	HPW 438	S	R	R	R	S	S	R	R	R	MS	-	R	R	R	R	R	R	R	*Yr9+A+*	

WHEAT CROP HEALTH NEWSLETTER

Volume: 22 (2016-17) *Issue: 1-5*

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WHEAT CROP HEALTH NEWSLETTER

ICAR-Indian Institute of Wheat and Barley Research, Karnal-132 001, Haryana, India

November, 2016

Volume: 22 (2016-2017) *Available on website*: ***www.dwr.res.in*** ***Issue: 1***

Wheat crop health was monitored during off season and crop season (October and November) 2016 by different cooperators of All India Coordinated Wheat and Barley Improvement Project for different rusts and seedling diseases as well as early insect pests at the farmers' fields. The post harvest grain analysis of wheat samples collected from different 'mandies' was also done for presence of Karnal bunt, black point and grain discolouration during 2016, and results are given in this newsletter. The Crop Protection Technologies' for different wheat growing zones for 2016-17 crop season were finalized in the 55th All India Wheat & Barley Workers' Meet held at CCS HAU, Hisar from 21-24 August, 2016 alongwith brief strategy planning meetings are also being presented in this issue.

Awareness for stripe rust management

The awareness programmes have been organized regarding diseases and insect pest management in wheat with special emphasis on yellow rust. ICAR-IIBWR organized Scientist – Farmers' interaction on 'Seed Day' on 17 October 2016 in which special lecture has been given on 'Disease management in wheat' followed by question answers session. Posters were also displayed to educate farmers aware on identification of stripe rust disease and its management. More than 800 farmers attended the fair. Stripe rust management cards were also distributed among the farmers. Under "Mera Gaon Mera Gaurav" scheme, teams of scientists comprising of Plant Pathologists and Entomologists visited the adopted villages and created awareness among farmers about identification of different diseases and insect pests of wheat and their management practices.

Post harvest analysis of grains

A total of 8732 grain samples collected from various 'mandies' in different agro ecological zones. These were analyzed for Karnal bunt (KB), seed discolouration and black point. The highest KB incidence (53.3%) was recorded from Jammu region of J & K followed by Punjab (33.7%). The Karnal bunt incidence in 2015-16 crop season was lower than the 2014-15. Karnal bunt was not found in grain samples from Maharashtra (Pune, Niphad) and Karnataka (Dharwad) like previous years, and these states remained free from Karnal bunt. Out of 7494 grain samples analyzed for black point from different zones in the country, 73.9 per cent samples showed varying degrees of black point affected grains. The samples (2506 nos.) were also analyzed for grain discolouration and a total of 46.8 per cent samples were infected. The samples from comparatively drier states like Rajasthan, Karnataka and Maharashtra had clearer grains.

Strategy Planning Meetings

(i) Preparedness to manage wheat blast: Strategy planning meetings was also conducted on "Occurrence of blast disease in wheat" on 28.9.2016 at Kolkata under Chairmanship of Agriculture Commissioner, DAC & FW. Wheat blast caused by *Magnaporthe oryzae*, pathotype *Triticum* so far present in Brazil, Bolivia, Paraguay and other countries of South America was reported in Bangladesh in March, 2016. It has

Karnal bunt situation in the country during 2015-16 crop season

State	Total samples	Infected samples	% infected samples	Range of infection
Punjab	3074	944	30.71	0.249*
Haryana	2078	334	16.07	0.05-1.15
Rajasthan	1312	402	30.64	0.1-12.50
Uttarakhand	72	05	15.85	0-0.5
Jammu	465	248	53.33	1.25-5.00
U.P.	291	44	15.12	0-1.6
M.P.	1023	225	21.99	0-2.05
Maharashtra	231	0	0	--
Karnataka	186	0	0	--
Total	**8732**	**2202**	**25.22**	0-12.50

been observed in 15% of wheat area in Bangladesh mainly in the districts of Kushtia, Meherpur, Chuadanga, Jhenaidah, Jessore, Barisal, and Bhola. Keeping in view of resembling climate conditions there may be chances of spread in West Bengal and Assam areas adjoining to Bangladesh boarders in India. ICAR took note of the disease and teams of scientists conducted extensive survey in West Bengal during 1st week of April, 2016. There was no report of wheat blast from any part of India so far. As an immediate step, 40 Indian released varieties / advance wheat lines were sent for screening to CIMMYT, Mexico, for evaluation against wheat blast in Latin America (Brazil, and Bolivia), the hot spot for this disease. Out of these 7 genotypes have a tolerant genotype 'Milan' in their pedigree. The evaluation of Indian wheat lines in Brazil and resistant lines and varieties identified will help in developing resistant varieties in India against this blast as well as deployment of these in strategic area. Strict quarantine measures have been put to prevent entry of wheat blast fungus through seed especially from those countries where wheat blast is reported. During 2016-17 crop season also, vigorous monitoring of wheat crop along with Indo-Bangladesh borders and other parts of the country is planned and will be done using special teams of Plant Pathologists, planting of disease monitoring nurseries and isolation of pathogens from blighted wheat leaves and spikes (ear heads). Training programmes will be conducted for state government agricultural and extension officers on identification of wheat blast and blast management. The protocol for detection of wheat blast pathogen in seeds, collection of diseased samples and isolation of pathogen have been developed alongwith an adhoc IPM which may be used under any emergency situation.

(ii).Management of yellow rust and Karnal bunt: Different strategy planning meetings were conducted to enhance the wheat production. A meeting on "Evolving strategies for enhancing wheat production with special reference to manage wheat rust and Karnal bunt" was conducted on 5.10.2016 at Krishi Bhawan under the Chairmanship of Secretary, DAC & FW, Govt. of India. Dr. G.P. Singh, Director, Dr. D.P. Singh, Dr. M.S. Saharan and Dr. R.K. Sharma attended the meeting from ICAR-IIWBR. Dr. G.P. Singh made the presentation on "Evolving strategies for enhancing wheat production with special reference to manage wheat rust and Karnal bunt" followed by discussion and strategy planning.

(iii).Expert Working Group Meeting on control of wheat insect pests and pathogens: The meeting on 4 November, 2016 was attended at Minneapolis, USA by Dr. D.P. Singh of ICAR-IIWBR Karnal and strategies were discussed to manage important insect pests and pathogens like wheat-blast (MoT) and stripe rust (*Puccinia striiformis*) on a global scale through international cooperation.

(iv.) **Regional Consultation Meeting in response to Wheat Blast epidemic in Nepal:** The meeting was held from 26-27 July 2016 in Kathmandu, Nepal and was organized by CIMMYT-BARC-BARI-WRC-USAID and ACIAR. It was attended by Dr. M.S. Saharan from ICAR-IIWBR, Karnal. The strategies were discussed for management of disease and initiate durable resistance breeding and evaluation programmes against MoT.

Crop Protection Technologies for 2016-17 crop season

The host resistance is the effective, eco-friendly and cheapest mean to management disease and pests. The disease scenario of different zones varies but the problem of yellow rust disease which is mainly prevalent in North Western Plains Zone (NWPZ) and Northern Hills Zone (NHZ) of the country is a major cause of concern.

Stripe or Yellow Rust

Yellow rust is predominant in the areas of North Western Plains Zone (NWPZ) and Northern Hills Zone (NHZ). Generally, disease appears in the Month of January and February but sometimes its appearance is also reported in December. Usually, it is observed that the early infection of stripe rust begin in wheat fields under the shades like poplar trees, in early sown crop (i.e. October). Hence, strict watch is needed by the farmers and extension officers in such fields.

Management

- Grow the varieties recommended for the zone.
- Discourage growing of decreases under one variety and grow at least 3-4 diverse stripe rust tolerant varieties.
- Use balanced and recommended quantity of fertilisers – avoid high dose of nitrogen.
- Keep strict watch on appearance of the stripe rust and immediately spray the affected crop with recommended fungicides, viz., Propiconazole @ 0.1%.
- For avoiding the losses due to stripe rust of wheat in NWPZ, varieties like DBW 88, WH 1105, HD 3086, HD 2967, DBW 621-50, WH 542, PBW 550, PDW 314 (d) and WHD 943 (d) for timely sown and DBW 16, DBW 90, DBW 71, PBW 590, WH 1021 and HD 3059 for late sown conditions may be preferred. In NHZ, varieties like HPW 349, HS 507, HS 365, HS 375, VL 616, VL 907, VL 829, VL 832, VL 892, HPW 155, SKW 196 etc. should be grown. Since most of the varieties recommended for NWPZ and NHZ do not carry high level of seeding resistance, hence, chemical sprays may be followed especially if rust occurs during second half of December to mid February.

Leaf or brown rust and stem or black rust

Stem and leaf rusts are the major diseases of wheat in Central Zone (CZ), Peninsular Zone (PZ) and Southern Hill Zone (SHZ).

Management:

- Grow the varieties recommended for the zone.
- To avoid large scale cultivation of single variety and grow atleast 3-4 varieties at village level.
- Use balanced and recommended quantity of fertilisers – avoid high dose of Nitrogen.
- Keep strict watch on appearance of the disease and immediate spraying of affected areas with recommended fungicides, viz., Propiconazole @ 0.1 % to avoid its further spread of rust spores from initial infection foci.

Varieties Recommended for the zones
Central Zone (Madhya Pradesh, Chhattisgarh, Gujarat)
Timely sowing: HI 1544, GW 322, DL 803-3, MP 3288, HI 8498(durum) and HD 4672 (durum)
Late sowing: MP 1203, HD 2864, HD 2932 and Raj 4083
Peninsular Zone (Maharashtra, Karnataka)
Timely sowing: MAACS 6222, Raj 4037, GW 322, HUW 510, HD 2189, MACS 2971 (dicoccum) and HD 8663 (durum).
Late sowing: AKAW 4627, HD 2932, HD 2833, Raj 4083 and PBW 533.
Southern Hills Zone (Tamil Nadu)
HW 2044, HW 1085, Co(W)-1

Karnal bunt
The disease mainly occurs in parts of Northern Plains, especially Punjab, Haryana, foot hills of J&K and HP, tarai area of Uttranchal, and in lesser severity in Rajasthan, Bihar and UP. The disease severity is high in situations when ear head (spike) emergence – coincides with rainfall. Karnal bunt is difficult to diagnose in the field and only seen after threshing of grains
Management
- Use of certified or disease free seed will help to check introduction disease in new areas.
- Follow crop rotation and avoid growing wheat for 2-3 years in highly infected fields.
- Zero tillage helps in reducing Karnal bunt incidence.
- In Karnal bunt prone areas, spray Propiconazole @ 0.1% at the time of 50% flowering.
- To minimize losses due to Karnal bunt grow resistant/tolerant varieties in disease prone areas viz. PBW 502 and PDW223, PDW291, PDW314 (Durum) in Northern Western Plains Zones, HPW251, HS490, HS507 in Northern Hills Zone and GW366, HD2864, MP3336 and HI8498 (Durum) in Central Zone.

Powdery mildew
It is mainly present in the cooler areas and hilly regions; foot hills and plains of North - Western India and the Southern hills (Nilgiris).
Management
- Use recommended quantity of seed - avoid dense planting.
- For the control of powdery mildew in disease prone areas, spray of Propiconazole (@ 0.1%) can be given at the appearance of disease.

Foliar blight
Foliar blight is the main problem in humid and warmer areas especially in North Eastern Plains Zone (NEPZ).
Management
- For effective management of the disease, cultivation of recommended (resistant) varieties, like HD 2985, HI 1563, DBW 39, CBW 38, NW 1014, NW 2036, K 9107, HD 2733, DBW 14, HD 2888, K0307, DBW39 and HUW 468 should be encouraged.

Loose smut
It is totally seedborne disease and occurs in cooler states.
Management:
- Use disease free seed.
- Rouge out and destroy the infected tillers.

- Seed treatment with Carboxin 75 WP @ 2.5 g/kg seed or Carbendazim 50 WP @ 2.5 g/kg seed or Tebuconazole 2DS @ 1.25 g/kg seed or a combination of a reduced dosage of Carboxin (75 WP @ 1.25 g/kg seed) and a bioagent fungus *Trichoderma viride* (@ 4 g/kg seed) is recommended.

Flag smut

Flag smut disease also poses problems in isolated fields in Punjab, Haryana, and Rajasthan.

Management

- Use disease free seed.
- Seed treatment with Carboxin 75 WP @ 2.5 g/kg seed or Carbendazim 50 WP @ 2.5 g/kg seed or Tebuconazole 2DS @ 1.25 g/kg.

Foliar Aphids

Present in all wheat growing areas in India but more severe in North Western Plains Zone (NWPZ) and Peninsular India.

Management

- Grow 4 rows of maize/sorghum/bajra around the field as a gourd guard/barrier crop.
- Judicious use of Nitrogenous fertilizers.
- Spray Imidacloprid 17.8 SL 100 ml per ha initially on border rows at the beginning of the aphid colonization. This will help in protecting the bio-agent insect, (lady bird beetle) inside the field which feed on aphid.
- Spray 1000 ml of Quinalphos 25% EC in 500 liters of water per ha. at economic threshold levels of 10-15 aphids per shoot.

Termites

Mainly found in the Northern and Central India, but also in some pockets of Peninsular India.

Management

- Deep ploughing of fields during summer to control of insect pests in the field.
- Apply well rotten FYM only to discourage termite infestation.
- Avoid late sowing of crops.
- Crop planted in FIRBS is more prone to root aphid and termite attack while zero tillage shows less damage.
- Seed treatment with Chloropyriphos 20% EC (3–4 ml/Kg seed) is also very effective.
- Mix Chloropyriphos 20 EC (3 liter) in 50 kg soil per hectare broadcast in field and irrigate.

Pink stem borer

Pink stem borer is a known pest of rice, but due to climate shift, raising of mean temperature during November and December it has also started causing damage to wheat crop and a new emerging pest of wheat.

Management

- Hand picking of infested tillers and their destruction reduces borer attack.
- Bird perches @ 10/ acre should be erected for facilitating field visits of predatory birds.
- To avoid the infestation use of Nitrogen fertilizers in split doses.
- Conservation of beneficial insects like apentalis, mirid bug, bracon and laddybird beelte in the field.

- If infestation is more spray 1300 ml of Quinalphos 25%EC in 500 liters of water per ha.

Status of insect pests, diseases and nematodes on wheat crop during 2016-17 crop season (October – November 2016)

J & K, Punjab, Uttarakhand, Bihar and Tamil Nadu
No report received

H. P.
No incidence of any disease was observed on wheat so far.

Haryana
One day Gehun Gyan Divas and Sutrakrimi Jagriti Diwas was organized by CCSHAU, KVK, Fatehabad in village Dhand (Distt. Fatehabad) on 4/11/2016. Dr R. S. Kanwar delivered expert lecture on management of wheat nematodes. About 70 farmers participated in this Gyan Divas. The crop was observed for diseases and insect pests. No disease or insect pest was observed till end of November, 2016.

Rajasthan
The loose smut and flag smut are major diseases in Rajasthan. To minimize the losses due to smut diseases in wheat, lectures have been delivered by Dr P.S. Shekhawat, Wheat Pathologist to the farmers and extension peoples of the state. Small card related to smut, rust and Karnal bunt have developed and distributed among the farmers and extension workers. The farmer's advisory for the management of smut disease through seed treatment has given through news paper.

Uttar Pradesh
About 60 percent farmers' fields in eastern India have been sown and germination is good. Seedling blight and foot rot were noticed in fields sporadically. In rice-wheat cropping system, yellowing of wheat seedlings was observed in traces. Overall the crop health is in good conditions and no major disease / pest was observed in the month of November 2016.

Gujarat
The sowing of timely sown wheat varieties like GW 496, GW 451, GW 322, GW 366, GW 273, GDW 1255 is almost completed. The sowing of late sown varieties like GW 173 and GW 11 is in progress. More than 500 farmers visited the Vijapur centre through Agricultural Technological Management Agency (ATMA) and they were informed and trained regarding pests and diseases of wheat along with the measures to be taken up for the management of same. No any disease or pest is noticed till date.

Madhya Pradesh
In central India, wheat sowings are going on and crop is good till end of November. In some parts of Harda area of M.P. farmers reported root rot disease in seedlings in low incidence.

Karnataka
Wheat Crop Health Survey was conducted in Dharwad taluk in seven wheat fields Rust and leaf blight was not observed in any of the field. However, low incidence of shoot fly and aphids was observed on Bijaga Yellow and DWR 2006 in rainfed and

DWR 162 under irrigated condition. In Breeding experimental plots at Dharwad, lower incidence of shootfly was observed in few entries.

West Bengal

The sowing is in progress. No disease was observed on crop so far.

Maharashtra

Wheat sowing has been completed in many of farmers' fields in timely sown area. The late sown crop is in progress after sugarcane harvesting in Baramati area. A disease trap plot nursery was planted at Gite Vasti, Songaon, Taluka Baramati on 13/10/2016. Observations will be recorded periodically for natural incidence of diseases. The timely sown crop, rainfed and restricted irrigation crop are in good conditions at Hol farm, Pune. Wheat crop reached at completion of seedling to tillering stage. There was no natural incidence of any rust, blight and other pests at the end of Nov. 2016. Overall crop health status was good. The climate was almost dry and cool.

The information of the climatic parameters (1st Nov. to 30th Nov. 2016) of ARI Pune are given below:

Week	Temperature (°C)		Rains (mm)	Relative Humidity (%)	
	Maximum	Minimum		Maximum	Minimum
44	31.00	13.00	Nil	93.8	24.00
45	30.14	10.71	Nil	94.28	28.85
46	30.14	13.00	Nil	92.00	37.00
47	27.80	12.00	Nil	95.00	35.60
48	31.50	11.20	Nil	95.00	27.00
Average	30.11	11.98	Nil	94.01	30.49

There is no incidence of any disease on wheat crop at farmers field till today in Satara district. The crop condition is good. The wheat crop was sown at ARS, Niphad in the month October under rainfed condition showed the incidence of shoot fly, jassids and termite. The reported incidence was medium. The population of jassids in medium intensity was also reported on timely sown wheat crop of this station during last week of November. The sowing of wheat was in progress in the adjoining area of this Niphad Research Station due to prolonged harvesting of preceding crop. Timely sown crop is now in tillering stage. Incidence of diseases is not observed in the sown crop till date. Overall the climate is suitable for wheat crop.

Status of rusts in 2016

The surveys conducted during of off-season crops in Kinnaur and Lahaul & Spiti in Himachal Pradesh and Nilgiri hills (Tamil Nadu) during 2016 revealed the occurrence of all three wheat rusts. In Kinnaur and Lahaul & Spiti of H.P. only yellow (stripe) rust was observed and brown (leaf rust) was only found in one sample. In South, at Nilgiri hills both brown and black (stem) rusts were observed. So far it is a dry season this year on hills during 2016-17 crop season which may delay spread of inculum of yellow rust in northern plains. However, keeping in view of climatic changes, a vigil for yellow rust of wheat is of high importance beginning from last week of December, 2016 till February, 2017. Increase in the proportion of virulent pathotypes of yellow rust (46S119 and 110S119) in Northern India and high acreages of one variety like HD 2967 coupled with low temperature and high humidity may be favourable situation for spread and development of yellow rust in northern states namely Punjab, Haryana, Jammu & Kashmir, Himachal Pradesh, Uttarakhand and Western Uttar Pradesh. The samples of yellow rust may be sent immediately to ICAR-IIWBR, RS, Flowerdale, Shimla for pathotype analysis by following proper sample collection and delivery protocol with a copy of cover letter to PI (CP), ICAR-IIWBR Karnal. It is advised that initial foci of infection of yellow rust in field may be sprayed with Propiconazole fungicide @ 0.1%.

First report of yellow rust occurrence during last five crop seasons

Crop year	First occurrence	Location	State
2015-16	18 Dec. 2015	Brahampur (Anandpur Sahib)	Punjab
2014-15	24 Dec. 2014	Daroli village	Punjab
2013-14	1 January, 2014	Village-Ratangarh,Yamunanagar	Haryana
2012-13	9 January, 2013	Village –Hehindpur, SBS Nagar	Punjab
2011-12	5 January, 2012	Village-Kalyana, Jammu	J & K

Acknowledgement:
Thanks to different cooperators (Drs. B.C. Game, S.I. Patel, T.L. Prakasha, Virender Rathee, S.P. Singh, N. Savant, S.D. Patil, Satyajit Hembram, Pradeep Singh Shekhawat, P.V. Patil, B. Honrao, M.S. Saharan) and Dr. S.C. Bhardwaj, Incharge IIWBR-Regional Station, Flowerdale who sent the reports for this issue.

Issued by: Crop Protection Programme, ICAR- Indian Institute of Wheat and Barley Research, Karnal- 132001
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	WHEAT CROP HEALTH NEWSLETTER **ICAR-Indian Institute of Wheat and Barley Research, Karnal-132 001, Haryana, India** **December, 2016**	
Volume: 22 (2016-2017)	*Available on website:* ***www.dwr.res.in***	***Issue: 2***

Wheat crop health was monitored during the month of December, 2016 by different cooperators of All India Coordinated Wheat and Barley Improvement Project for different rusts and other diseases as well as insect pests at the farmers' fields. The detailed report is presented in this issue of Newsletter for the use of researchers, extension officers, policy planners and farmers. The data on breeder seed produced and advice for foliar sprays to manage yellow rust are given only after appearance of symptoms in north Indian states. The yellow rust appeared in quite low incidence and late during 2016-17 crop season and major losses are not expected during current crop season. However strict vigil is advised for yellow rust, wheat blast and stem rust keeping in view of any major change in weather during the coming months. Needful advisories will be issued to state government agriculture departments in near future depending on wheat crop health status.

Highlights (December, 2016):

1. **No yellow rust was reported from states of Haryana, Jammu and Kashmir, Uttarakhand, Himachal Pradesh, West Uttar Pradesh, and Rajasthan during current crop season at farmers' fields till 31st Dec. 2016. In Punjab, yellow rust in traces (up to 10 plants) per field in two fields was found on 29th Dec. 2016 in Ropar and Gurdaspur district near river sides. It was well controlled by foliar sprays of propiconazole (0.1%).**
2. **No wheat blast was found in West Bengal and Assam along the Indo-Bangladesh borders.**
3. **No stem rust including Ug99 race was found at farmers' fields in Central and Peninsular zone.**
4. **No major and any exotic insect pest was found so far damaging wheat crop in different agro ecological zones of India.**
5. **The conservation agriculture (rotavator and zero tillage, happy seeder) was largely practiced in Punjab for wheat under rice-wheat cropping system.**
6. **The crop was looking promising.**
7. **About 70% fields were not sown till 15 Dec. 2016 in Jammu due to want of rains.**
8. **In some districts of Punjab (Jalandhar, Ludhiana, Amritsar, Patiala) a sizable acreage was under vegetables (Potato, green pea) and late sown wheat crop may be sown in these districts after harvest of vegetables.**
9. **The farmers were interviewed and were not showing any stress of demonetarization. The crop sowing and agronomy was not affected in Punjab and Haryana.**
10. **Yellow rust is appearing quite late and in only two fields so far in Punjab districts. It is therefore advised not to spray the crop with propiconazole (0.1%) for yellow rust till yellow rust appears in other states and remaining districts of Punjab in north India. A strict vigil may be kept till end of January, 2017 especially on yellow rust susceptible varieties in these states.**

Situation of stripe (yellow) rust in Northern India

Yellow rust of wheat was not found in the states of Haryana, Jammu and Kashmir, Uttarakhand, Himachal Pradesh, West Uttar Pradesh, and Rajasthan during current crop season at farmers' fields till 31st Dec. 2016. In Punjab, yellow rust in traces (up to 10 plants)

per field in two fields was found on 29th Dec. 2016 in Ropar and Gurdaspur district near river sides. It was well controlled by foliar sprays of propiconazole (0.1%).
Following teams were deputed and conducted wheat crop health surveys during the month of Dec. 2016:

Team I (14 Dec. 2016)
Dr. Poonam Jasrotia, Dr. Priyanka Chandra, Mr. Ishwar Singh
Outward: Karnal-Indri-Ladwa-Yamunanagar
Inward: Ambala Road-Mustafabad-Karnal

Team II (12-15 Dec. 2016)
Dr. D. P. Singh, Mr. Pankaj Kumar
Outward journey route: Karnal- Ambala-Khanna- Ludhiana-Phillaur-Jalandhar-Dhilwan-Amristsar-Batala-Gurdaspur-Kathua-Jammu
Inward journey route: Jammu-Kathua-Pathankot-Mukerian-Dasuya-Jalandhar-Phgawara-Ludhiana-Fatehgarhsaheb-Ambala-Kurukshetra-Karnal

Team III (15 Dec. -31 Dec. 2016)
Dr. Jaspal Kaur and scientists of PAU
(Indo- Pakistan Bordering and HP bordering districts)

Team IV (30 Dec. 2016)
Drs. O.P. Gangwar and P.L. Kashyap from IIWBR, R.S. Shimla, Drs. P.P.S. Pannu and Jaspal Kaur from PAU, Ludhiana and Dr. Ashok Kumar from KVK, Anandpur Sahib.
Route: Tandesar, Ajoli, Gardala, Bharatgarh and Anandpur Sahib in Ropar district

Team V (28th-31st Dec. 2016)
Dr. M. K. Pandey and his team of SKUAT Jammu
Udhywalla-Pauni check via Barnai-Sangrampur-Marh-Gajansoo-Gaomanashan and Sai Rakhwalan (Jammu). Chatha-Khandwal-Pirbaba-RS Pura-Arnia-Saikalan (Jammu)-Ramghar-Samba. Kathua district via Hiranagar-Kathua-Rajbag and Khanpur.

Team VI (25-27 Dec. 2016)
Dr. P. V. Patil, Principal Scientist (Wheat Pathology), S.V. Kulkarni, Technical Assistant, Shri Nandeesh gouda, Sr. M.Sc. Student, AICRP on Wheat and Barley, MARS, UAS, Dharwad

Yellow rust in Ropar (L) and Gurdapspur (R) districts of Punjab spotted on 29th Dec. 2016 in only two fields on few plants

High incidence of Foliar aphids at Nasik

Following spots were surveyed by Team II in Punjab, Haryana and J & K states:

1) N-29^{0}49, E-076^{0}56 and 243mt above from sea level, in Tarauri, G.T. Road no yellow rust was observed on 12 December 2016.
2) N-30^{0}04, E-076^{0}52 and 248mt above from sea level, in Tarouri, Near Anjani Dham Temple no yellow rust was observed on 12 December 2016.
3) N-30^{0}24, E-076^{0}43 and 260mt above from sea level, in Mehmodpur village, District Rajpura Punjab state the of-GURUCHARAN SINGH (Farmer) no rust observed on Variety HD2967 & another field the of-PRINCE(Farmer) no rust observed on Variety Berbat on 12 December 2016.
4) N-30^{0}33, E-076^{0}.27 and 251mt above from sea level, in Danumajra village, near Sirhind, Punjab state no yellow rust was observed on 12 December 2016.
5) N-30^{0}44, E-076^{0}.08 and 249mt above from sea level, in Mehandipur village District Ludhiana, Punjab state no yellow rust was observed on 12 December 2016.Crop status was good.
6) N-31^{0} 04, E-075^{0}.46 and 231mt above from sea level, in Gorya village District Jhalandhar, Punjab state no yellow rust was observed on 12 December 2016. Crop status was good.
7) N-31^{0}34, E-075^{0}.03 and 226mt above sea level, in Jundiala village, G.T. Road Amritsar, Punjab state no yellow rust was observed on 12 December 2016.
8) N-31^{0}34, E-075^{0}.00 and 223mt above from sea level, in Meharbanpura village, District Amritsar Punjab state no yellow rust was observed on 12 December 2016.
9) N-31^{0}39, E-074^{0}.57 and 240mt above from sea level, in Ansal town, near Amritsar city (Pathankot G.T. Road), Punjab state no yellow rust was observed on 13 December 2016.
10) N-31^{0}44, E-075^{0}.04 and 225mt above from sea level, in Sahenwali village, District Amritsar, Punjab state no yellow rust was observed on 13 December 2016.
11) N-31^{0}55, E-075^{0}.18 and 247mt above from sea level, in Dhariwal village, District Gurudaspur, Punjab state no yellow rust was observed on 13 December 2016.
12) N-32^{0}26, E-075^{0}.28 and 259mt above from sea level, in Dharbuji Sham Singh village, District Gurudaspur, Punjab state no yellow rust was observed on 13 December 2016.
13) N-32^{0}26, E-075^{0}.25 and 260mt above from sea level, in Sakhta Jatha village, district Kathua, Jammu, no yellow rust was observed on 15 December 2016.
14) N-32^{0}09, E-075^{0}36 and 324mt above from sea level, in Ladi village, District Pathankot, Punjab state the of –GOSI (Farmer) Rainfed area, there was no rust observed on variety-HD3167 on 15 December 2016.
15) N-32^{0}02, E-075^{0}.36 and 283mt above from sea level, in Gindwal village, District Siarpur, Punjab state the of-RAJKUMAR (Farmer) no rust observed on variety-PBW550 on 15 December 2016.
16) N-31^{0}42, E-075^{0}.38 and 240mt above from sea level, in Munak Kalan village, District Jalandhar, Punjab state no rust was observed on 15 December 2016.

Awareness programme on yellow rust:
Dr. D. P. Singh, Principal Scientist (Plant Pathology) and Principal Investigator (Crop Protection Programme) delivered a lead lecture on "Yellow rust of wheat: An overview" on 14 December, 2016 at SAMETI, SKUAST Chatha, Jammu in a brain storming workshop on "Yellow rust of wheat and strategy planning for its management" and interacted with state government agriculture and extension officers of Jammu and Kashmir. The diagnostic cards of yellow rust and management were distributed to about 130 participants of workshop.

Action taken after occurrence of yellow rust in Punjab:
Consequent upon the receipt of report on the occurrence wheat yellow rust in Ropar area of Punjab, survey of the area was undertaken on Dec. 30^{th} , 2016 to assess the disease situation and get on the spot report from Ropar and adjoining areas of Punjab. Drs. O.P. Gangwar and P.L. Kashyap from IIWBR, R.S. Shimla were the team members. Drs. P.P.S. Pannu and Jaspal Kaur from PAU, Ludhiana and Dr. Ashok Kumar from KVK, Anandpur Sahib also joined. The yellow rust was found in a wheat field of Mr. Maya Dass (31^{0} 18' 51" N, 76^{0} 23' 70" E, 320 m AMSL). There was a single focus of yellow rust in an area of about 0.5 sq. m (4-6 wheat hills) on cv. HD2967. This field measuring about one acre is located near a rivulet

of Sutlej, is an isolated wheat area and there are no wheat fields around this spot. The favourable conditions due to the humidity generated by the presence of rivulet must have favoured the onset of the disease. The infected plants have been uprooted and the spray of propiconazole (0.1%) was done in the field same on 30th Dec. 2016. Subsequently other wheat fields in Tandesar, Ajoli, Gardala, Bharatgarh and Anandpur Sahib in Ropar district were also surveyed and yellow rust on wheat was not observed anywhere in these areas. In general, the crop health was very good in these areas. Yellow rust sample from infected wheat plant was picked up for further analysis at ICAR-IIWBR, R.S., Flowerdale, Shimla.

SYMPTOMS

- The first sign : Yellow streaks (pre-pustules), followed by small, bright yellow, elongated uredial pustules arranged in conspicuous rows on the leaves, leaf sheaths, glumes and awns.
- Mature pustules will break open and release yellow-orange masses of urediniospores.
- In some varieties, long, narrow yellow stripes will develop on leaves.
- The infected tissues may become brown and dry as the plant matures or becomes stressed. The urediniospores turn in to teliospores with increase in temperature after mid Feb.
- Severe early infection can result in plant stunting.

Urediniospore stage (L) –infective stage, Telial stage ® non infective stage showing black dotted stripes once temperature goes above 23 ^{0}C

Favourable conditions:

- Urediniospores perpetuate on green host tissue, such as volunteer wheat or off season susceptible wheat growing on higher hills.
- The pathogen is best sustained when night time temperatures are <15ºC.
- Stripe rust can develop on wheat at lower temperatures than other rusts.
- Optimum urediniospore germination occurs between 7-15ºC. Infection and disease development is most rapid between 10-16ºC.
- Urediniospores are spread via wind currents to healthy plants where they can initiate new infections.
- Heavy dew or intermittent rains can accelerate the spread.
- Infection tends to cease when temperatures consistently exceed 23ºC.

Management of yellow rust

- Strict monitoring: Roving Surveys, Trap Plot Nurseries, SMS from Extension officers and farmers for earliest detection.
- Meaningful co-ordination (Govt. of India –ICAR- SAUs -State Dept. of Agriculture -farmers) to keep vigil, sharing of information and issue of need based advisories.

- Creating awareness among farmers for promoting new released varieties resistant to yellow rusts in NHZ and NWPZ.
- Discouragement of cultivation of only single variety over large ha to avoid epidemics.
- Distribution of stripe rust diagnostic cards and other literature among farmers, use of print and electronic media, trainings for proper management of yellow rust.
- Monitoring of yellow rust pathotype distribution, shift in pathotypes and consequences.
- Advisories for need bases fungicide application propiconazole @0.1%).

Protocol for sampling

A good rust sample needs following treatment:

I. Small bits (2-3”) of rust infected fresh leaves/stems should be shade dried/ overnight at room temperature.

II. Shade dried samples should be put in paper envelops separately or wrapped in newspaper and sent immediately by post.

III. Following information may be given on each envelope - Type of rust: brown/black/yellow - Details of host: wheat/barley, variety/line - Place of collection - Date of collection - Name and address of the co-operator

IV. Since samples from lines/varieties having little rust or from rust resistant material are important from analysis point of view, therefore, these should be treated on priority.

Precautions to be taken

I. Samples should be representative of a locality, variety and not repetitive.

II. Samples should not be taken from moist, dried or dead plant parts/plants.

III. Only fresh uredial infection may be sent as old and dried plant parts may not have viable spores.

IV. Samples should be sent at the earliest possible to Incharge, ICAR-IIWBR RS, Flowerdale, Post Bag no.2, Shimla, H. P. PIN: 171002.

Very Important

I. Glossy paper/polythene envelopes should not be used for collecting or mailing samples.

II. Samples should not be taken from the sites of artificial inoculations, otherwise it should be mentioned accordingly.

Status of insect pests, diseases and nematodes on wheat crop during 2016-17 crop season (December, 2016)

J & K

An extensive survey was carried out on 28-31st Dec. 2016 in Jammu and Samba divisions. No yellow or brown rust was spotted on wheat crop in all the surveyed fields of farmers. All the areas, wheat field was also free from diseases and insects. Due to no rain fall received in December, most of the wheat sowing was delayed much and in some fields yellowing of leaf was also observed.

Punjab

The surveys were conducted in the bordering districts of H. P. and Pakistan from 12th Dec. 2016 till 31st Dec. 2016 by teams of ICAR- IIWBR, PAU, KVK, State Department and FASS staff of PAU. The yellow rust was spotted in only two fields in village Bela Dhyani in Rupnagar District on variety HD2967 on 5-6 plants on 29.12.2016 and village Sekha in Gurdaspur on variety HD2967 again on only few plants. At both the locations the crop had been sprayed with recommended fungicides and disease was under control.

Haryana

A survey was conducted on 14th December, 2016 to know the disease and insect-pest situation in three districts of Haryana viz., Yamunanagar, Kurukshetra and Karnal on wheat. In Yamuna Nagar area (Roopnagar, Bhamboli, Bilaspur), there was no incidence of any disease of wheat although the aphid and termite infestation was observed. The population of aphid was recorded to be 2-5 aphids/plant while termite infestation was quite low (1 plant/one meter row).

In Kurukshetra area (Ramnagar, Padlu, Shahbaad) and in Karnal area (Indri, Badheri, Phoosgarh, Baraundi), no incidence of rust was observed and low infestation of aphid was observed which was around 1-3 aphid/plant. No termite infestation was observed in these areas. The farmers interviewed were 1. Shyam Singh (Phoosgarh): 9998452653. 2. Surender Kumar (Bhateri): 9991147046, 3.Rajender Bajaj (Bhamboli):9812084753, 4.Vir Singh (Ramnagar):9467894428. During our survey we met Shri. Shyam Singh, a farmer of Phoosgarh village, Karnal district of Haryana who has a holding of nearly 6 acres. He grows cereal crops like wheat and paddy and vegetables (potato, onion, garlic and other season vegetables). He was impressed with the gains of zero-tillage technology being adopted by fellow farmers in Kaithal area in Haryana. He adopted the technology on his farm in 2012, but its benefits were not felt immediately but now after using this technology for five years, he is seeing its benefits. He is using a happy seeder machine for sowing of wheat in residue and he is getting this machine from his fellow farmers in the area. By using zero tillage he is having less weed problem and he is getting good yield of the crop.

Uttarakhand

No report of yellow rust at farmers' fields has been received. No insect pest has appeared.

H. P.

No incidence of any disease was observed on wheat so far. Crop is healthy in the area. There is no report of yellow rust.

Rajasthan

No report received

Uttar Pradesh

Wheat and barley crop growth is very good. Little termite infestation was observed in rainfed wheat. Foliar aphid, leaf blight, rusts and other diseases were not spotted on wheat in Kanpur area.

Bihar

No yellow rust, wheat blast, and stem rust were found in Sabour area.

West Bengal

Wheat crop health situation Cooch Behar, Jalpaiguri, Darjeeling, South Dinajpur and Malda, districts is good. No rust and spot blotch diseases were found.

Assam

Till December 31, 2016, no insect pest and disease infestation were observed in the wheat crop in farmers' fields and also in RARS, Shillongani, Nagaon fields in Assam.

Gujarat

The wheat crop in Gujarat was free from any major pests except termite at few punctuated pockets with scarce irrigation in light textured soils of North Gujarat. The rusts (brown or black) were not found in the state. The temperatures (Maximum and Minimum) were slightly towards higher side as compared to previous years since last two weeks (December 10 onwards). The maximum temperature was recorded more than 30 ^{o}C while minimum temperature ranged 13-14 ^{o}C.

WEEKLY TEMPERATURES RECORDED AT WRS, VIJAPUR

DATE	MET. WEEK	Maximum Temp. ^{o}C			Minimum Temp. ^{o}C		
		2014-15	2015-16	2016-17	2014-15	2015-16	2016-17
Nov 12-18	46	32.0	33.7	31.9	20.4	17.9	15.1
Nov 19-25	47	31.1	33.0	33.0	15.2	18.5	14.8
Nov 26-Dec 2	48	30.4	30.4	32.7	14.6	16.1	15.1
Dec 3-9	49	29.3	31.4	30.6	14.2	14.4	13.8
Dec10-16	50	26.1	26.8	30.3	11.2	10.5	14.0
Dec 17-23	51	24.6	26.4	30.1	9.7	10.2	13.3

Madhya Pradesh

Wheat health status in Indore area was good.

Karnataka

Wheat Crop Health Survey in Karnataka- Date of Survey: 25.12.2016

S. No.	Village	Taluka	District	Latitude (N)	Longitude (E)	Elevation (m)	Variety	Crop grown condition	Growth stage of the crop (days)	Remarks (Insect pest)
1	Mangalgatti	Dharwad	Dharwad	1532.230	07457.640	698	Bread wheat	RI	Milky	
2	Mangalgatti	Dharwad	Dharwad	1532.833	07457.828	684	Bread wheat	RI	Milky	
3	Kurubgatti	Dharwad	Dharwad	1533.999	07457.858	690	Durum wheat (UAS 2006)	RI	Milky	
4	Lokur	Dharwad	Dharwad	1535.023	07458.156	664	Durum wheat (Amruth)	RF	Milky	
5	Lokur	Dharwad	Dharwad	1536.012	07458.399	651	Durum wheat	RI	Milky	
6	Dodawad	Bailhongal	Belgaum	1538.676	07459.023	650	Bread wheat	RI	Milky	
7	Arvalli	Bailhongal	Belgaum	1544.262	07452.698	663	Bread wheat	RI	Milky	
8	Sampagaon	Bailhongal	Belgaum	1544.394	07452.673	686	Durum wheat	RF	Milky	Severe moisture stress
9	Hirebagewadi	Bailhongal	Belgaum	1546.444	07439.559	669	Bread wheat	RI	Milky	
10	Amminabhavi	Chikkodi	Belgaum	1688.557	07431.960	709	Dicoccum	IR	Flowering	Moderate aphid infestation
11	Rupinal	Chikkodi	Belgaum	1629.913	07438.285	560	Dicoccum	IR	Flowering	Moderate aphid infestation
12	Rupinal	Chikkodi	Belgaum	1631.560	07439.500	542	Bread wheat	IR	Milky	Moderate aphid infestation
13	Ugarkhurd	Athani	Belgaum	1638.448	07449.706	514	Bread wheat	IR	Flowering	
14	Shiraguppi	Athani	Belgaum	1636.692	07442.451	536	Bread wheat	RI	Milky	Moderate aphid infestation

Wheat Crop Health Survey in Karnataka- Date of Survey: 27.12.2016

S. No.	Village	Taluka	District	Latitude (N)	Longitude (E)	Elevation (m)	Variety	Crop grown condition	Growth stage of the crop (days)	Remarks (Insect pest)
1.	Kmalapur	Dharwad	Dharwad	1528.985	07501.437	693	Bread wheat	IR	Milky	
2.	Marewad	Dharwad	Dharwad	1530.503	07502.235	695	Durum Wheat	RF	Milky	
3.	Amminabhavi	Dharwad	Dharwad	1533.824	07503.774	643	Dicoccum	IR	Milky	
4.	Goravanakolla	Saundatti	Belgaum	1547.830	07508131	654	Bread wheat	IR	Anthesis	
5.	Jivapur	Saundatti	Belgaum	1555.525	07503.317	641	Bread wheat	IR	Anthesis	
6.	Jivapur	Saundatti	Belgaum	1555.539	07503.327	643	Dicoccum	IR	Anthesis	

S. No.	Village	Taluka	District	Latitude (N)	Longitude (E)	Elevation (m)	Variety	Crop grown condition	Growth stage of the crop (days)	Remarks (Insect pest)
7.	Rainapur	Saundatti	Belgaum	1557.326	07501.837	667	Dicoccum	IR	Anthesis	
8.	Sidnal cross	Ramdurg	Belgaum	1602.593	07509.223	638	Durum Wheat	RF	Dough	
9.	Salhalli	Ramdurg	Belgaum	1604.259	07512.960	643	Dicoccum	IR	Anthesis	
10.	Panchagaon	Ramdurg	Belgaum	1605.706	07515.389	673	Bread wheat	IR	Milky	
11.	Kajjidoni	Bagalkot	Bagalkot	1610.518	07526.919	549	Bread wheat	IR	Milky	
12.	Kajjidoni	Bagalkot	Bagalkot	1610.941	07527.762	545	Bread wheat	IR	Milky	Aphid infestation
13.	Simikeri	Bagalkot	Bagalkot	1611.466	07534.832	552	Bread wheat	IR	Milky	
14.	Tumarmatti	Bilagi	Bagalkot	1611.214	07537.470	531	Dicoccum	IR	Anthesis	
15.	Badagandi	Bilagi	Bagalkot	1622.434	07539.055	534	Bread wheat	IR	Dough	
16.	Shindogi	Mudhol	Bagalkot	1625.153	07516.656	578	Bread wheat	IR	Anthesis	
17.	Ronihal	Vijaypur	Vijaypur	1630.610	07541.231	670	Bread wheat	RF	Anthesis	
18.	Mulawad	Vijaypur	Vijaypur	1637.359	07543.905	623	Bread wheat	RF	Anthesis	2-3 Loose smut Infected plants
19.	Khanda Tanda	Vijaypur	Vijaypur	1647.380	07541.460	635	Bread wheat	RF	Milky	
20.	Khajiapur	Vijaypur	Vijaypur	1646.182	07540.719	627	Dicoccum	IR	Milky	
21.	Sarwad	Vijaypur	Vijaypur	1643.317	07538.438	617	Bread wheat	RF	Milky	
22.	Sarwad	Vijaypur	Vijaypur	1642.553	07537.528	595	Durum Wheat	RF	Milky	2-3 Loose smut Infected plants
23.	Chikkapadasalgi	Jamakhandi	Vijaypur	1635.506	07526.581	568	Bread wheat	RF	Dough	

Dr. P. V. Patil, Principal Scientist (Wheat Pathology) and Mr. Nandeesh Gouda,M.Sc. (Agri.) student conducted the Wheat crop health survey in Dharwad and Belgaum districts (S. No. 1-14) on 25.12.2016. Dharwad taluk in Dharwad district and Bailhongal, chikkodi and Athani taluks of Belgaum district have been visited. Most of the wheat fields visited were given few irrigations (Restricted Irrigations) and few fields in Belgaum district were given regular irrigations. None of the wheat fields visited in both the districts have shown infection of either leaf or stem rust, and the crop was between flowering to milky (grain filling) stage. However moderate infestation of aphid was observed in few fields.

Leaf blight (*Bipolaris sorokiniana*) was observed in few fields only on lower leaves, hence the score under double digit was 00 in all the fields. Low to moderate aphid infestation was noticed in few fields. During the year in northern parts of Karnataka most of the farmers were under taken the sowing at normal recommended time i.e. Oct.15 to Nov.15th 2016.

Tamil Nadu

No stem or brown rust was reported from farmers' fields in SHZ.

Maharashtra

Higher incidence of foliar aphid was recorded at the Niphad farm during 52nd MW i.e 24/12/2016 to 31/12/2016. The burning of the plants in some varieties were observed due to the heavy attack of aphid. At farmers field in Nasik district the severity of aphid was in medium intensity. Adequate plant protection measures were adopted for the control of wheat aphids. In general crop condition is healthy at this station. Overall the climate remained suitable for the growth of wheat crop in Niphad and adjoining areas during December 2016. Lowest temperature of 6.2 ^{o}C was recorded on 28th Dec. 2016. There was no report of incidence of rust and other diseases in the adjoining areas. The Wheat Disease Monitoring Nursery set up at Pimpalgaon, Baswant remained free from rust and leaf blight. Wheat crop in Pune District is ranging from tillering to stem elongation stage. In trap plot nursery, foliar aphids were observed on varieties viz. HD 2329, Agra local, HD 2161, Lal Bahadur, WL 1562, HW 2021, DL 7843 and HD 2501 with low to high population at Songaon Farm, Taluka Baramati. Foliar blight was observed in crossing blocks on varieties viz. WH 147, Gulab, Bijage yellow, Lal Bahadur on lower leaves at Hol Farm. Overall crop health is good in most of wheat growing areas. No natural incidence of black and brown rust in any location. The climate was almost dry and cool. In the Trap Plot Nursery also there was no natural incidence of rust till 31st Dec. 2016. There is no any disease incidence or insect pest infestation on wheat crop of Satara District of Maharashtra State. The crop health and vigour is good.

Weekly information of the climate parameters (1st to 31st December 2016) has been given below:

Week	Temperature (°C)		Rains	Relative Humidity		Remark
	Max.	Min.		Max.	Min.	
49	29.7	11.9	-	95.0	52.0	Two days cloudy
50	28.8	9.5	Trace	94.5	47.9	One day cloudy
51	29.7	12.4	-	96.0	50.4	-
52	30.3	8.4	-	93.3	40.7	-
Average	**29.6**	**10.5**		**94.7**	**47.8**	

Brain storming workshop on strategy planning for yellow rust at SAMETI, SKUAST Jammu

Status of crop in Haryana and Punjab

Acknowledgement:
Thanks to different cooperators (Drs. R.S. Bisht, M. K. Pandey, Vinod Kumar Garg, Jaspal Kaur, T.L. Prakash**,** Kalyan Kumar Sarma, V. K. Rathee, B.K. Honrao, Satyajit Hembram. B.C. Game, C. S. Azad, S.I. Patel, S. D. Pail, P. Nallathambi, N.V. Savant, Raj Kumar, Amit Sharma, Dr. P. V. Patil, S.V. Kulkarni, Javed Bahar Khan, Dr. S.C. Bhardwaj, Incharge IIWBR-Regional Station, Flowerdale who sent the reports for this issue.

Issued by: Crop Protection Programme, ICAR- Indian Institute of Wheat and Barley Research, Karnal- 132001
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	WHEAT CROP HEALTH NEWSLETTER ICAR-Indian Institute of Wheat and Barley Research, Karnal-132 001, Haryana, India Dr. Subrahmaniam Nagarajan memorial issue January, 2017	
Volume: 22 (2016-2017)	*Available on website: www.dwr.res.in*	*Issue: 3*

Wheat crop health was monitored during the month of January, 2017 by different cooperators of All India Coordinated Research Project on Wheat and Barley for different diseases as well as insect pests at the farmers' fields. The detailed report is presented in this issue of Newsletter. The information may be used freely by the researchers, extension officers, policy planners and farmers by giving acknowledgement to ICAR-IIWBR. The yellow rust incidence remained quite till end of January, 2017. Keeping in view of quite late occurrence and scanty presence of yellow rust in few fields in Punjab and Jammu so far, it is not expected to have any negative impact on wheat production during 2016-17 crop season. No major losses are expected during current crop season due to yellow rust. However strict vigil is advised for rusts and wheat blast, keeping in view of any major change in weather during the months of February-March, 2017. Needful advisories are issued to state government agriculture departments in past and will continue in near future depending on wheat crop health status and weather to minimize losses in wheat yields and grain quality. The Crop Protection Programme is heading towards managing wheat crop health successfully again during current crop season after four decades of no epidemic of any disease or insect pests in India in wheat in spite of changes in weather, cropping system, tillage, pathotypes, disease spectrum and larger areas under one or two popular wheat varieties. In India, the use of large quantity of fungicides or insecticides in wheat for managing biotic stresses are so far avoided and crop health is largely well managed using strategic deployment of wheat varieties in six agro ecological zones. It is a result of a proactive research conducted in wheat, strategies chalked along with strong coordination between ICAR, SAUs, KVKs, DAC & FC, Seed agencies, State Agric. Departments and farmers.

Highlights (January, 2017):

1. **No yellow rust was reported from states of Haryana, Uttarakhand, Himachal Pradesh, Western Uttar Pradesh, and Rajasthan during current crop season at farmers' fields till 31st January, 2017. Yellow rust was in very low incidence in few fields in Punjab (Ropar, Gurdaspur, Pathankot and Jammu and Kathua areas in J & K state. It has been well under control in these fields and foliar sprays of propiconazole (0.1%) have been practiced.**
2. **Yellow rust has been so far tactically managed during 2016-17 crop season by, strategic planning meetings, replacing rust susceptible varieties in targeted areas, early, vigorous and collective survey involving different agencies and surveillance, use of weather data and foliar sprays.**
3. **So far no wheat blast was found in West Bengal and Assam along the Indo-Bangladesh borders. Likewise, no stem rust including Ug99 race was found at farmers' fields in Central and Peninsular zone of India.**
4. **No major and any exotic insect pest was found so far damaging wheat crop in six agro-ecological zones of India.**
5. **The crop was looking perfect in different states without any sign of stress.**

6. **The farmers were interviewed and were so far highly satisfied with their crop condition. So far no reports of damage due to biotic stresses reported by farmers in India.**
7. **The advisories were issued regarding yellow rust and farmers are advised to spray seed crop with propiconazole @0.1% at boot leaf stage to manage Karnal bunt infection in seed crop.**

Situation of stripe (yellow) rust in Northern India

Till 31st January, 2017, yellow rust of wheat was not found in the states of Haryana, Uttarakhand, Himachal Pradesh, Uttar Pradesh, and Rajasthan. In Punjab, yellow rust in traces (up to 10 plants) per field in six fields was found in Ropar, Pathankot and Gurdaspur districts and controlled by foliar sprays of propiconazole (0.1%). The data collected during past surveys were used for identifying districts in J&K, Punjab and Haryana where yellow rust occurred first and farmers were advised to use rust resistant new varieties of wheat during 2016-17 crop season.

Following teams were deputed and conducted wheat crop health surveys during the month of January, 2017:

Team I (4-5 January, 2017)
Dr. Sudheer Kumar, Principal Scientist (Plant Pathology), Dr. Subhash Katare, Senior Scientist (Entomology) IIWBR and Dr. P.L. Kashyap Scientist (Plant Pathology) RS-IIWBR, Flowerdale, Shimla
(Karnal to Rupnagar via Indri, Ladwa, Yamunanagar, Bilaspur, Sadhaura, Naraingarh, Panchkul and Kharar-Garhshankar, Nawanshahar, Machhiwara, Samrala, Khanna, Ambala, Kurukshetra)

Team II (6, 10 January, 2017)
Dr. Anil Kumar and Dr. Kanak Srivastava of GBPUAT Pantnagar
[Dineshpur (Vill. Rambagh, Chand Nagar), Gadarpur (Vill. Kewalganj Bari, Motipura, Dhimerkhera, Dhimerpura), Kashipur (Vill. Jhagarpuri, Kaushalpur, Gurunanak Jagannathpur), and Bajpur (Vill. Banskheri, RaniRajpura, Lalpura) & Kichha (Vill. Shankarpur form, Chacher form, Gurunanak farm, Uttam nagar, Sirsa farm (Bari), Sitarganj (Vill. Katangari, Mukhwara, Chikaghatt and Khatima (Vill. Kumra) in Uttarakhand]

Team III (5, 21-23 January, 2017)
Dr. M. K. Pandey, SKUAST with State Agriculture officer [Mr. Sushil Kumar (AEO) and Mr. Arun Khajuria (JEO)]

Team IV (10-13, 30 January, 2017)
Dr. Jaspal Kaur and other colleagues of PAU, Ludhiana
(Kiratpur Sahib, Morinda, Darouli of Ropar district of Punjab)

Team V (18 January, 2017)
Dr. S. S. Vaish, BHU Varanasi
(Around Varanasi in U. P.)

Team VI (20-21 January, 2017)
Dr. P. S. Sekhawat and his team of RARI Durgapura, Rajasthan

(Lalsot, Deedwan, Ramgarh, Salempura, Bhandana, Bichhya areas of district Dausa and Kalwad, Ramkui, Pachar, Idan ka bas, Bobas, Jobner, Dungari, Karansar, Harsoli, Kanarpura, Tadawas, Raythal & Punana areas of district Jaipur)

Team VII (25 January, 2017)
Dr. D. P. Singh, Dr. Charan Singh and Mr. Pankaj Kumar of ICAR-IIWBR Karnal)
(Karnal-Muzaffarnagar, Western U. P.)

Team VIII (29-31 January, 2017)
Dr. Vaibhav Kumar Singh, ICAR-IARI New Delhi, Dr. O. P. Gangwar, ICAR-IIWBR RS Flowerdale, Shimla Dr. Ritu Bala, PAU, Ludhiana and Dr. Poonam Jasrotia, ICAR-IIWBR Karnal)
(Karnal-Ludhiana-Bhatinda-Mansa-Kaithal-Karnal)

Awareness programme on yellow rust: A short film was shot at ICAR-IIWBR Karnal on "Yellow Rust of Wheat" by Dr. D. P. Singh and Dr. Anuj Kumar. The advisories regarding status, diagnosis and control of yellow rust were issued.

Status of insect pests, diseases and nematodes on wheat crop during 2016-17 crop season (January, 2017)

J & K
Dr. M. K. Pandey with State Agriculture officer (Mr. Sushil Kumar (AEO) and Mr. Arun Khajuria (JEO) were conducted a survey on 5th Jan., 2017 in Kathua district via Pali More, Nagari, Nihalpur and Check Desa. During the survey, first incidence of stripe rust was observed in the field of farmer Baldev Singh, village Barmora, zone Airwan on variety HD 2967 with 60S severity in ½ meter patches. Some pustules of stripe rust on 2-3 plants were also observed on variety HD 2967 in Nihalpur. Yellowing of leaf and termites attack due to scarcity of water was also observed in some fields during survey. No insects were observed on wheat crop during survey.

The surveys were conducted in the Jammu, Kathua and Sambha district bordering areas of Pakistan from 21st to 23rd January, 2017 with State Agriculture Department of J&K. On 21st Jan., 2017, field were surveyed the areas in the route starting from Udhywalla to Pauni check via Barnai, Sangrampur, Marh, Jhiri, Kalyanpur, Kana check, Ladiyal camp, Gajansoo, Gaumanasha and Sai Rakhwalan (Jammu). On 22nd Jan., 2017 survey route via Domana, Chatha, Khandwal, Pirbaba, RS Pura, Dablehar, Quaderpur, Arnia, Saikalan (Jammu), Allah, Nanadpur, Ramghar, Check Salarian and Vijaypur (Sambha). On 23rd Jan., 2017 survey was conducted in the areas of Kathua district via Hiranagar, Kathua, Rajbag Chuck Murli, Jurui and Kharkara.The yellow rust was observed in Saikalan (5S) in HD 2967 on 2 plants, Jurui village of Kathua in WH 1080 (5S) variety on 2-3 plants. Yellowing of leaf in lower water logged field after rainfall and also in long dried spell field. Blight was also observed in some field of Ramghar, Check Salarian and Vijaypur (Sambha), Arnia, Saikalan (Jammu) area. Aphids were also observed in one field of Jurui village of Kathua.

Punjab & Haryana
The farmer's fields were surveyed by Dr. Sudheer Kumar, Principal Scientist (Plant Pathology), Dr. Subhash Katare, Senior Scientist (Entomology) IIWBR and Dr. P.L. Kashyap Scientist (Plant Pathology) RS-IIWBR, Flowerdale, Shimla on 4 - 5th January, 2017 for presence of different diseases and insect pest specially rusts in the route starting from Karnal to Rupnagar via Yamunanagar and in returning surveyed

Garhshankar, Nawanshahar, Machhiwara, Samrala, Khanna, Ambala and Kurukshetra.

On 4th the survey was conducted in route from Karnal to Rupnagar via Indri, Ladwa, Yamunanagar, Bilaspur, Sadhaura, Naraingarh, Panchkul and Kharar. The crop in this area were timely sown and in tillering stage. Overall the crop was good, there was no disease and pest infestation observed. While interaction with farmers it was found that most of area is under HD 2967 followed by HD 3086, WH 1105 and DBW 621-50. On 5th the survey was conducted from Rupnagar to Karnal via Balachaur, Garhshankar, Nawanshahar, Machhiwara, Samrala, Khanna, Ambala and Kurukshetra. In the area of Rupnagar to Balachaur about 50% of wheat is grown under poplar plantation. Some of the fields are late sown in which wheat was in seedling stage.

The detail of spots surveyed is as below:

Stops	**Places surveyed**	**Location**	**Crop details**	**Remarks**
1	Indri, Karnal	N 29.89845 E 77.05112 MSL 224m	Variety HD 2967, Seedling stage	No rust, crop was in good health.
2	Lathi dhanora, Ladwa,	N 29.96387 E 77.04773 MSL 244m	Variety HD 2967, Seedling stage,	No rust, crop was in good health. Interacted with Farmer Sh. Jai Singh, he told occasionally problem of aphid in later stages.
3	Ban, Ladwa,	N 30.00306 E 77.07787 MSL 251m	Variety HD 2967, Seedling stage,	No rust, wheat is grown in Poplar plantation.
4	Rador,	N 30.01506 E 77.11566 MSL 256m	Variety HD 2967, Seedling stage,	No rust, wheat is grown in Poplar plantation.
5	Jadoda, Yamunanagar	N 30.19828 E 77.29298 MSL 275m	Tillering stage	No rust, wheat is grown in Poplar plantation.
6	Bhedthal, Yamunanagar	N 30.24023 E 77.29444 MSL 275m	Tillering stage	No rust, wheat is grown in Poplar plantation. Aphid seen in few plants.
7	Kapuri kala, Bilaspur	N 30.31719 E 77.26876 MSL 296m	Seedling stage	No rust
8	Sadora	N 30.29784 E 77.16869 MSL 290m	Variety HD 2967, Seedling stage,	No rust
9	Barson Majara,	N 30.45168 E 77.13595 MSL 305m	Late sown, Seedling stage	No rust
10	Garhi Kotan, Raipur Rani	N 30.54576 E 77.07590 MSL 319m	Late sown, Seedling stage	No rust
11	Sarakpur, Raipur Rani	N 30.54321 E 76.98251 MSL 308m	Variety HD 2967, Late sown, Seedling stage	No rust
12	Shahoran, Mohali	N 30.78460 E 76.61340	Variety HD 2967,	No rust,

Stops	Places surveyed	Location	Crop details	Remarks
		MSL 304m	Late sown, Seedling stage	
13	Bhago Majara, Rupnagar	N 30.87255 E 76.55679 MSL 282m	Variety HD 2967, Heading stage	No rust, crop is October sown and started heading due to high temperature in these days.
14	Rupnagar	N 30.99156 E 76.54742 MSL 269m	Tillering stage	No rust
15	Raipur, Rupnagar	N 31.00674 E 76.41831 MSL 259m	Variety DPW 621-50, Tillering stage	No rust, wheat is grown in Poplar plantation. Aphis seen in few plants.
16	Kathgar, Balachaur	N 31.01795 E 76.36589 MSL 253m	Variety DPW 621-50, Tillering stage	No rust
17	Kamalpur, Balachaur	N 31.02667 E 76.34478 MSL 264m	Variety HD 2967, Heading stage	No rust, crop is October sown and started heading due to high temperature in these days.
18	Grahi kanungo, Balachaur	N 31.07004 E 76.26946 MSL 260m	Variety HD 2967, Tillering stage	No rust
19	Khanpur Kulewal,	N 31.09837 E 76.26001 MSL 261m	Variety HD 3086, Tillering stage	No rust
20	Bakapur, Nawanshahar	N 31.14080 E 76.21453 MSL 282m	Variety HD 2967, Seedling stage	No rust
21	Chakfulla, Nawashahar	N31.17015 E 76.18146 MSL 252m	Seedling stage	No rust
22	Darapur, Garhshankar	N 31.18919 E 76.13730 MSL 247m	Variety HD 3086 and HD 2967, Seedling stage	No rust, Few plant were infested with stem borer.
23	Jafarpur, Nawashahar	N 31.09571 E 76.11626 MSL 249m	Seedling stage	No rust
24	Rahon	N 31.04376 E 76.11990 MSL 239m	Variety HD 2967, Tillering stage	No rust
25	Niamatpur	N 31.00035 E 76.14349 MSL 245m	Variety WH 1105, HD 3086, HD 2967, Tillering stage	No rust
26	Garhitarkhana	N 30.87734 E 76.19205 MSL 252m	Tillering stage	No rust
27	Samrala	N 30.82247 E 76.19729 MSL 254m	Variety HD 2967, Tillering stage	No rust
28	Kulewal	N 30.79728 E 76.19476 MSL 252m	Tillering stage	No rust,

Stops	Places surveyed	Location	Crop details	Remarks
29	Kodhi	N 30.74064 E 76.20980 MSL 253m	Variety HD 2967, Heading stage	No rust
30	Harwanshpura	N 30.63161 E 76.34776 MSL 253m	Variety HD 2967, Heading stage	No rust
31	Jalveri Gehlan, Ambala	N 30.57975 E 76.43522 MSL 255m	Tillering stage	No rust

Uttarakhand
H. P.
There is no incidence/appearance or report of yellow rust in the farmer's field.
Reported by Dr. Virender Rathee.

Rajasthan
Survey was conducted on 20th and 21st January, 2017 in the area of Lalsot, Deedwan, Ramgarh, Salempura, Bhandana, Bichhya areas of district Dausa and Kalwad, Ramkui, Pachar, Idan ka bas, Bobas, Jobner, Dungari, Karansar, Harsoli, Kanarpura, Tadawas, Raythal & Punana areas of district Jaipur to know the status of wheat and barley diseases on farmers field. None of the rust was observed in both wheat and barley crops of the area surveyed. However, incidence of flag smut was noted *in traces* to 20 percent being maximum was noted at village Samail in variety Raj1482. Loose smut *in traces* was noted at village Shivdaspura in variety Raj 3077. Mild attack of termite was also noticed in some fields. Cereal cyst nematode infestation was also noted in some fields. Overall the wheat crop was healthy in the surveyed areas and the crop has attained the boot leaf to heading stage. Deedwana (N 27° 23.324’ and E 075° 49.157’), Bichhya (N 27° 23.324’ and E 075° 49.157’), Lalsot (N26° 35.884’ and E 076° 19.728’, 336m), Bhandana (N 26° 53.338’ and E 076° 14.832’, 327m) of district Dausa and Bassi (N 27° 51.262’ and E 076° 00.766’,

344m), Champapura (N 26° 51.260' and E 076° 00.765'), Bobas (N 26° 51.260' and E 076° 00.765'), Jobner (N 26° 58.952' and E 075° 25.866', 380 m) Karansar (N 27° 04.521' and E 075° 27.155', 410m), Kanarpura (N 27° 11.050' and E 075° 34.305' 435m) of district Jaipur. village Idan ka bas (N 26° 51.260' and E 076° 00.765') village Tadawas (N 27° 08.099' and E 075° 32.619', 418m). Report submitted by Dr. P. S. Shekhawat.

Uttar Pradesh

The wheat fields around Varanasi were surveyed for the status of the crop and diseases on 18.01.2017 by Dr. S. S. Vaish. The crop is healthy and no occurrence of any of three wheat rusts was observed. The crop age varies from seedling to boot stage as shown in figures given in the attachment. Farmers were also educated about the diseases of wheat and their management at their fields. The TPN nursery planted at the farmers field was also monitored for the occurrence of the rusts and no occurrence of any three of wheat rusts was noticed.

Wheat crop was monitored for rust in farmer's field by Anil Kumar Deptt. of Genetics and Plant Breeding and Dr. Kanak Srivastava, Plant Pathology on 6th January 2017 enroute Dineshpur (Vill. Rambagh, Chand Nagar), Gadarpur (Vill. Kewalganj Bari, Motipura, Dhimerkhera, Dhimerpura), Kashipur (Vill. Jhagarpuri, Kaushalpur, Gurunanak Jagannathpur), and Bajpur (Vill. Banskheri, RaniRajpura, lalpura). The varieties sown in the areas were WH711, HD2967, PBW226, PBW343, PB502 and DBW17.

Second survey was conducted on 10th January 2017 by Dr. Anil Kumar and Dr. Kanak Srivastava in farmers' field enroute Kichha (Vill. Shankarpur form, Chacher form, Gurunanak farm, Uttam nagar, Sirsa farm (Bari), Sitarganj (Vill. Katangari, Mukhwara, Chikaghatt and Khatima (Vill. Kumra).

The varieties sown in these areas were PBW502, PBW343, HD2967 and PBW154. But mostly farmers preferred variety HD2967. The overall crop health was very good due to rain. It was noted that no any type of rust was observed. Only in one field at Gadarpur (Vill. Motipura) aphid infection was found.

Yellow Rust Survey on route Karnal to Muzaffarnagar Via Shamli and Muzaffarnagar to Karnal via Sanouli Panipat, Gharounda

1) N-29^{0}39, E-077^{0}01 and 232mt above from sea level, in Nagla Farm, Meerut Road, Karnal District, Haryana State, no yellow rust was observed on 25 January 2017.
2) N-29^{0}36, E-077^{0}05 and 228mt above from sea level, in Manglor, Near Yamuna River, Karnal District, Haryana State of SONU (Farmer), no yellow rust was observed on Variety HD2967 on 25 January 2017.
3) N-29^{0}34, E-077^{0}08 and 228mt above from sea level, in Kertu village, District Shamli, Uttar Pradesh state of-MOR SINGH & AKASH (Farmer), no rust observed

on Variety HD2967 & another field the of-PYARE SINGH (Farmer), no rust observed on 25 January 2017.

4) N-$29^0$29, E-077^0.14 and 228mt above from sea level, in Kertu village, District Shamli, Uttar Pradesh state, no yellow rust was observed on 25 January 2017.

5) N-$29^0$29, E-077^0.14 and 233mt above from sea level, in Agaripur village District Shamli, Uttar Pradesh state of SHAJID (Farmer), no yellow rust was observed on 25 January 2017. Field under popular.

6) N-$29^0$28, E-077^0.24 and 230mt above from sea level, in Banti Kera village District Shamli, Uttar Pradesh state, no yellow rust was observed on 25 January 2017.

7) N-$29^0$28, E-077^0.26 and 236mt above sea level, in Buthara village, District Shamli, Uttar Pradesh, no yellow rust was observed but flag smut was more present on 25 January 2017.

8) N-$29^0$28, E-077^0.33 and 237mt above from sea level, in Titavi village, District Muzaffarnagar, Uttar Pradesh state, no yellow rust was observed on 25 January 2017.

9) N-$29^0$25, E-077^0.15 and 231mt above from sea level, in Jaganpur village, Panipat Road, no yellow rust was observed on 25 January 2017.

10) N-$29^0$22, E-077^0.10 and 221mt above from sea level, near Jaganpur village, Panipat Road, no yellow rust was observed on 25 January 2017.

11) N-$29^0$33, E-077^0.05 and 224mt above from sea level, in Sanouli Jalalpur village, no yellow rust was observed on Variety WL 57 on 25 January 2017.

12) N-$29^0$28, E-076^0.58 and 227mt above from sea level, in Gandpur village, Panipat Road, no yellow rust was observed on 25 January 2017.




Bihar

No report received

West Bengal

On 20th January, 2017, Drs. A. K. Chowdhury and Prateek surveyed the Bangladesh border areas of Coochbehar and the crop was good without incidence of wheat blast. Only minor infestation of spot blotch was observed.

Assam

No report received

Gujarat

The wheat crop in Gujarat state experiences increasing trend of maximum as well as minimum temperatures compared to previous years as evident from the following daily temperature data. The maximum temperature of 30+ and minimum temperature of 15+ ^{o}C was experienced since last ten days, however the situation is improving since 27th January and hence, the likely ill effect of rising temperature to wheat crop may be compensated. No serious pests or diseases are noticed. Overall condition of the crop is good.

Day	**Maximum Temperature (^{o}C)**		**Minimum Temperature (^{o}C)**	
	2016	**2017**	**2016**	**2017**
15th January	27.7	27.9	10.7	11.4
16th January	27.5	25.9	13.6	10.5
17th January	27.2	24.5	12.8	9.7
18th January	25.6	26.3	14.8	10.6
19th January	25.5	25.7	11.4	12.2
20th January	25.6	26.1	10.9	14.9
21st January	25.2	27.7	9.2	15.8
22nd January	25.2	30.6	8.1	15.5

Day	Maximum Temperature (^{o}C)		Minimum Temperature (^{o}C)	
	2016	**2017**	**2016**	**2017**
23rd January	26.9	31.2	8.0	16.6
24th January	27.4	32.7	8.4	16.2
25th January	27.6	32.3	8.2	16.3

Report submitted by Dr. S. I. Patel

Madhya Pradesh

The overall wheat crop condition in Madhya Pradesh was good in January, 2017. Most of the irrigated wheat grown in Narmadapuram Division, Malwa region and in other adjoining areas as well as in Jabalpur division is either timely shown or late sown condition. In Narsinghpur and Jabalpur districts, substantial area is under late sown condition. Till date there is not any disease nor insect problem is posing any threat to wheat crop in the state. In most of the areas the crop is either in tillering or in early boot stage. In some fields Rhizoctonia root damage was found during survey programme but right now the crop has recovered enough and not requiring any chemical intervention. There is no incidence of rust and any other foliar disease at this stage. The report was submitted by Dr. K. K. Mishra of ICAR-IARI RS Indore.

Karnataka

No report received

Maharashtra

The wheat crop was healthy around Mahabaleshwar area. Crop was between the stages of seedling to flowering on farmers' field. Dr. Manoj A. Gud delivered lecture on pest-disease management in wheat crop in 'Krishi Day'organized in Satara district by State Department of Agriculture on 04/01/2017.

During this period a survey tour was conducted in Pune District covering area Nira and Baramati Taluka and Satara District (Phaltan area) in the first fortnight. Wheat crop was from flowering to milk stage. In most of the wheat growing areas, overall crop was good. No natural incidence of black and brown rust in any location. The trap plot nursery at Songaon farm was also free from natural rust incidence till today.

Foliar blight was observed in few farmers' field only on lower leaves varieties viz. Lok-1 and Aditya near Songaon village. The Foliar blight was recorded on TPN nursery on varieties viz. HW-2021, WH-147, HW-2008, DL-784-3, HW-2022, RNB-1001, rainfed breeding material at Hol farm and SRSN plot no.6158, etc. with severity ranging from 01 % to 35 %. Aphid incidence was also observed on farmer's field, Experimental Hol farm with low to high populations.

The early rainfed / restricted irrigated crop were nearing physiological maturity stage. The climate is almost dry and cool. The temperatures (maximum and minimum) were slightly towards higher side. The maximum temperature was recorded 32°C on 26/01/2017 while minimum temperature ranged from 6.8°C to 12.1°C.

Ten Foliar blight samples were collected from TPN nursery, farmer's fields and Experimental Research Farm, Hol and sent to IIWBR Karnal for pathogen analysis.

Weekly information of the climate parameters (1st to 31st January 2017) has been given below:

Week	Temperature (°C)		Rains	Dew Point		Relative Humidity		Remark
	Max.	Min.		Max.	Min.	Max.	Min.	
1	29.56	08.11	-	12.56	08.78	94.57	36.14	-
2	28.24	07.91	-	14.21	09.41	93.28	44.00	-
3	29.23	12.90	-	16.15	13.14	97.00	47.14	-
4	30.64	11.97	-	13.80	11.65	93.14	36.28	-
Average	**29.42**	**10.22**		**14.18**	**10.75**	**94.50**	**40.89**	

Reported by Dr. Balgonda Honrao, ARI Pune.

Acknowledgement:
Thanks to different cooperators (Drs., M. K. Pandey, Jaspal Kaur, V. K. Rathee, B.K. Honrao, Satyajit Hembram, Manoj A. Gud, A. K. Chowdhury, Prateek, J. P. Jaiswal, Kanak Srivastava, Anil Kumar, S. S. Vaish, K. K. Mishra, P.S. Shekhawat, S.I. Patel, N.V. Savant, Charan Singh, Pankaj Kumar, Sushil Kumar, Arun Khajuria, Ritu Bala, V. K. Singh and O. P. Gangwar, who sent the reports for this issue.

Tributes to Dr. S. Nagarajan: The Crop Protection Programme of ICAR-IIWBR Karnal and All India Cooprdinated Research Project on Wheat and Barley, salute Dr. Nagarajan, former Project Director, for his global contributions in the field of wheat and barley crop protection and pray Almighty to grant peace to the departed soul and give strength to Mrs. Nagarajan and his family bear this difficult time.

Issued by: Crop Protection Programme, ICAR- Indian Institute of Wheat and Barley Research, Karnal- 132001
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	WHEAT CROP HEALTH NEWSLETTER **ICAR-Indian Institute of Wheat and Barley Research, Karnal-132 001, Haryana, India** **February, 2017**	
Volume: 22 (2016-2017)	***Available on website*: *www.dwr.res.in***	***Issue: 4***

Wheat crop health was monitored during the month of February, 2017 by different cooperators of All India Coordinated Research Project on Wheat and Barley for different diseases as well as insect pests at the farmers' fields. The yellow rust incidence remained quite low and sporadic during the month of February, 2017 as compared to last years. It is therefore not causing any negative impact on wheat production during 2016-17 crop season and quite good crop health is expected. However strict vigil is advised for brown and black rusts as well as wheat blast, during the months of March, 2017. Needful advisories were issued to state government agriculture departments and will continue in March, 2017 depending on wheat crop health status and weather to minimize losses in wheat yields and grain quality. The Crop Protection Programme of ICAR-IIWBR Karnal has therefore successfully managed yellow rust of wheat in coordination with DAC & FW, SAUs, KVKs and state agriculture departments. The directions received from Hon. DG and DDG (CS) of ICAR helped a lot in devising the strategies at ICAR-IIWBR Karnal. As a result large quantity of fungicide (propiconazole) has been saved and it benefitted the farmers directly.

Highlights (February, 2017):

1. **No yellow rust was reported from states of Western Uttar Pradesh, and Rajasthan during current crop season at farmers' fields in the month of February 2017. Yellow rust was in very low incidence in few fields in Punjab (Ropar, Gurdaspur, Pathankot and Jammu and Kathua areas in J & K, H. P and Haryana state). The infection in the infected fields was well controlled using foliar sprays of propiconazole (0.1%).**
2. **So far no wheat blast and stem rust including Ug99 race was found at farmers' fields in India. However, spike blight like symptoms were reported from Murshidabad and Nadia districts in West Bengal on local wheat varieties on 4th Feb. 2017 close to Bangladesh borders by a team of scientists of ICAR-IIWBR and BCKVV led by Dr. D. P. Singh PI (CP) which was later confirmed by teams of DAC&FW, Govt. of West Bengal, UBKVV and BCKVV. The crop has been sanitized and sprayed with fungicide (tebuconazole+trifloxystrobin). No wheat zone will be created in affected areas during next few years and wheat and other monocot crops will be replaced with oilseeds and pulses. Strict monitoring and spraying of weed plants will also be done. No spike blight symptoms were observed in any other wheat growing state except 2-3 districts of West Bengal close to Bangladesh borders. The farmers will be compensated and assisted well in these districts in West Bengal by GOI and state Govt.**
3. **HD 2967 variety was found resistant, UP 262 was susceptible, PBW 343 and HD 2985 was moderately susceptible to spike blast like symptoms in Murshidabad district in West Bengal.**
4. **No major and exotic insect pest was found so far damaging wheat crop in six agro-ecological zones of India. The incidence of foliar aphids was quite low.**
5. **The crop was looking perfect in different states without any sign of stress.**
6. **The farmers were interviewed and were so far highly satisfied with their crop condition. No major reports of damage due to biotic stresses reported in India.**
7. **The advisories were issued regarding spray of seed crop with propiconazole @ 0.1% at boot leaf stage to manage Karnal bunt infection.**
8. **Recording of yellow rust was done by teams of Plant Pathologists and Breeders in NWPZ.**

Situation of stripe (yellow) rust in Northern India

Till 28th February, 2017, yellow rust of wheat was not found in the states of Uttar Pradesh, and Rajasthan. In Punjab, yellow rust in traces in few field in Punjab, Haryana, H. P. and Uttarakhand. It was controlled by foliar sprays of propiconazole (0.1%).

Following teams were deputed and conducted wheat crop health surveys during the month of February, 2017:

Team I (30th January to 5th February, 2017)

Dr. Sandeep Manuja, Dr. Anil Kumar Saklani, Project Director, ATMA, Kangra; Dr. Sachin Upmanyu, Scientist (Plant Pathology); Dr. Ashok Kumar, Incharge, State Bio Control Laboratory, Palampur; Dr Rax Paul, Subject Matter Specialist, Dehra and Dr Vinod Sharma, Subject Matter Specialist, Pragpur.

(Thana, Baba Panja, Bhatti, Bhatti Bohan, Padhyada, Kamlota, Lower Ghallour, Chaniara in Dehra Block and Seri, Haar in Pragpur)

Team II (31st January to 2nd February, 2017)

Dr. Sudheer Kumar, Principal Scientist (Plant Pathology), Dr. Subhash Katare, Senior Scientist (Entomology) IIWBR and Dr. Rajender Singh Beniwal (Plant Pathologist) CCS, HAU Hisar

(Karnal to Bathinda via Patiala, Barnala, Sangrur and Bathinda to Sirsa via Abohar Sri Ganganagar, Hanumangarh and in returning surveyed Sirsa, Hisar, Jind) .

Team III (1st February, 2017)

Dr. Prem Lal Kashyap, Scientist (Plant Pathology), and Dr. Satyavir Singh, Principal Scientist, IIWBR, Karnal

(Village Chaoganwa, Karnal)

Team IV (2nd February, 2017)

Dr. Jaspal Kaur, PAU Ludhiana and Dr Ashok Kumar from KVK Ropar)

(Villages- Chandesar, Sh Anandpur Sahib, Hariwal and Midwa, Kiratpur Sahib in Ropar district of Punjab)

Team V (3rd February, 2017)

Dr. Sudheer Kumar, Principal Scientist (Plant Pathology), Dr. Prem Lal Kashyap, Scientist (Plant Pathology), and Mr. Om Prakash, (Technical officer), IIWBR Karnal

(Village Taprapur, Sarswatinagar block, Yamunanagar)

Team VI (4th Feb 2017)

Dr. D. P. Singh, Dr. Raj Kumar and Dr Amit Kumar Shjarma of ICAR-IIWBR Karnal and Dr. Dhiman Mukherjee, Agronomist of BCKVV Kalyani

(Kalyani, Krishnangar, Tihatta, Jalangi, Goshpara in Nadia and Murshidabad districts)

Team VII (4th February, 2017)

Dr. J. B. Khan, Pathologist and Dr. Jitendra Kumar, Entomologist, Kanpur,U.P.

(District Kanpur Nagar (Villages): Udhav Nivada, Man Nidava, Araul, Atin, Harpura and Mohamda.

District Kannauj (Villages): Hazratpur, Patrauli, Disbara and Sultanpur

District Farrukhabad (Villages): Kheranagla, Naglabhuj and Bhattapur.)

Team VIII (4th February, 2017)

Scientists of KVK Damla, Yamunanagar

(Village-Damla, Bloack-Jagadhri)

Team IX (7th February, 2017)

Dr. J. B. Khan, Pathologist and Dr. Jitendra Kumar, Entomologist, Kanpur,U.P.

(District Unnao (Villages): Pariyar, Kulva, Devipurwa, Atwa, Hasanapur, Barikheda, Chakalvanshi, Safipur, Jamaluddinpur, Chandankhera and Utmanpur.

District Hardoi (Villages): Mallawan, Chandipur, Madhouganj, Bilgram, Jarauli, Atrauli, Dhulia, Fardapur).

Team X (7th February, 2017)
Scientists of KVK Damla, Yamunanagar
(Village- Taprapur, Block- Saraswati Nagar, and Damla, Block- Jagadhri,)

Team XI (9th February, 2017)
Dr. J. B. Khan, Pathologist and Dr. Jitendra Kumar, Entomologist, Kanpur, U.P.
(District Fatehpur;Villages: Gopalpur, Abhaypur, Mohar and Korsam)

Team XII (9th February, 2017)
Dr.P.V.Patil,UAS, Dharwad
(Villages in Bagalkot and Belgaum district)

Team XIII (13th February, 2017)
Scientists of KVK Damla, Yamunanagar
(Village- Taprapur, Block- Saraswati Nagar, Damla, Block- Jagadhri, , Village- Sabapur, Block- Jagadhri, Village-Jarodi Block- Jagadhri,Village-Jagdhouli, Block-Saraswati Nagar and Village-Gohra Bani, Block Chhachhrauli)

Team XIV (7th to 14th Febuary, 2017)
Drs.P.M.Bhattacharya, A.K.Chowdhury, Wasim Reza, West Bengal
(Coochbehar, Alipurduar, Malda, Siliguri, Dakshin Dinajpur and Murshidabad districts of West Bengal)

Team XV (22nd -24th Febuary, 2017)
Dr. D. P. Singh, Dr. S. K. Malhotra, Agriculture Commission, Shri .Ashwani Kumar, JS (PP) and Officers of DAC&FW
(Nadia and Murshidabad districts)

Team XVI (22nd to 24th Febuary, 2017)
Dr. M. K. Pandey, SKUAST with State Agriculture officer (Mr. Sushil Kumar (AEO) and Mr. Arun Khajuria (JEO)
(Udheywalla, Marh, Chinor, Lalihal, Kanna Check, Rajpura, Akhnoor, Deyaran, Simbal and Mishriwalla, Chadwall, Banoti, Khanpur, Sajhi More and Marheen, Peerbaba, RS Pura, Dablehar, Arnia, Kalyana, Palli, Bishnah, Ramgrah, Vijaypur, Chadwall, Ghagwal, Marheen, Kotali, Dhanshar and Bari Brahmana)

Team XVII (21st to 27th Febuary, 2017)
Director Agriculture, Himachal Pradesh
(Villages-Rit, Bahal, Kamlah in Block Nadaun, and village Luharda in Block Bhaoranj of district Hamirpur, Vill Bagru and Sarnoo in Block Rait of Kangra district,
and Village-Khad, Ispur and Saloh in Block Horoli of Una district of Himachal Pradesh)

Team XVIII (21st to 27th Febuary, 2017)
Dr. R. S. Kanwar,HAU Hisar
(Villages- Jagaan, Asranwa, Mahalsara, Kholi, Khairampur, Sadalpur, Chuli, Adampur, Sishwal, Bhodiya Bishnoiyan in Hisar district and Dharnia, Mehuwala, Dhingsara, Bhodiya Khera, Sulikhera, Dhabi, Gadli, Bhattu, Kumhariya and Kirdhan villages of Fatehabad)

Team XIX
Drs. V.K. Rathee, Dhirendra Singh and J. S. Thakur ,Project Director, ATMA, Nahan,H.P.
(Villages-Puruwala, Majra, Fatehpur, Pipliwala, Bhagwanpur, Haripur Tohana , Johron ,Jagatpurand Shivpur of Paonta Sahib)

Recording of yellow rust in PPSN:
Following teams consisting of Plant Pathologists and Breeders visited different hot spot locations for recording of yellow rust in the entries of PPSN:
Dates: 21-23rd Feb. 2017
Dr. Sudheer Kumar, Pr. Scientist, ICAR-IIWBR Karnal, Dr. Vaibhav Kumar Singh, Scientist (Pathology) Division of Plant Pathology, ICAR-IARI, New Delhi.
Centres: Karnal, Hisar, Durgapura, Delhi
Dr. P.S. Shekhawat, Wheat Pathologist, RARI, Durgapura (Jaipur)

Dates: 27-28th Feb 2017
Dr. P.L. Kashyap, Scientist, ICAR-IIWB, Karnal. Dr. R. S. Beniwal, Wheat Pathologist, CCS HAU Hisar, Dr. Anil Kumar, Wheat Breeder, GBPUAT Pantnagar

Dates: 2-4th March 2017
Dr. P.L. Kashyap, Scientist, ICAR-IIWB, Karnal. Dr. M.K. Pandey, Wheat Pathologist, SKUAST-J. Main Campus, Chatha,]ammu-180 009 (J&K). Dr. Vikas Gupta, Scientist (Plant Breeding) ICAR- IIWBR Karnal, Dr. Jaspal Kaur, Wheat Pathologist, PAU, Ludhiana, Dr. Indu Bhagat and Dr. R. S. Bal,PAU Rs Gurdaspur

ADHOC INTEGRATED PEST MANAGEMENT FOR WHEAT BLAST DISEASE (2016-17 crop season)

Wheat blast caused by a fungus *Mangaporthe orgyzae* pathotype *Triticum* is an exotic disease in India and was reported from Bangladesh in 2016. It is a seed, soil and airborne disease and humid and warmer climate favours the disease. Keeping in view of possible threat of entry and establishment of wheat in India following adhoc IPM is suggested by D. P. Singh, PI (CP), ICAR-IIWBR Karnal

1. Strict quarantine of seed or grain of wheat from Bangladesh and South American countries where disease occurs.
2. Prevention of smuggling and entry of wheat grains of Bangladesh origin in India through borders. BSF posts at borders may be informed and sensitization of Ministry of Home Affairs, New Delhi may be done regarding it.
3. Prevention and destruction of wheat seed and grains entered in India by any mean.
4. Seed health testing of uncertified seed and farmers' grown self seed of wheat before sowing during 2016-17 crop season in West Bengal and Assam.
5. Use of certified and treated seed for sowing. Compulsory seed treatment of seed with recommended fungicides like carboxin+thiram @2.5 g/kg of seed or tebuconazole @ 1.25 g /kg of seed or carbendazim @2.5 g /kg of seed to eliminate any possible seedborne infection.
6. The wheat leaves and spikes may be monitored for wheat blast like symptoms. The samples of such plants may be sent for proper diagnosis to designated Plant Pathological laboratories in the states and SAUs.
7. The standing crop may be sprayed with recommended fungicides like tebuconazole+ trifloxystrobin @ 0.4g/lit of water or tricyclazole @ 0.6 g /lit of water on initiation of disease and may be repeated after 20 days. A combination of fungicides is preferred since wheat blast pathogen develops resistance to fungicides fast.
8. The burning of crop may also be practiced wherever seed of exotic and susceptible wheat varieties are sown.

Status of insect pests, diseases and nematodes on wheat crop during 2016-17 crop season (January, 2017)

J & K
An extensive survey (Dr. M. K. Pandey with State agriculture officers) was carried out in Jammu, Kathua and Sambha districts (J&K) during 22nd to 24th Feb., 2017. On 22nd Feb., the

farmer's fields were surveyed in the route starting from Udhaywalla, Marh, Chinor, Lalihal, Kanna Check, Rajpura, Akhnoor, Deyaran, Simbal and Mishriwalla. On 23rd Feb., the survey was carried out via Chadwall, Banoti, Khanpur, Sajhi More and Marheen. On 24th Feb., the survey was carried out via Peerbaba, RS Pura, Dablehar, Arnia, Kalyana, Palli, Bishnah, Ramgrah, Vijaypur, Chadwall, Ghagwal, Marheen, Kotali, Dhanshar and Bari Brahmana. During survey, stripe rust was observed in Barnai on PBW 175 (10S), Ghaumanashan on HD 2967 (20S), Arnia on HD2967 (10S) and Quderpur on HD 2967 (5S) in Jammu district. In Sambha district, stripe rust was observed in Ramgrah with 20S severity on HD 2967 in 2 meter patch. In Kathua, stripe rust observed in Rajbag on HD 2967 and PBW 550 with 10S severity in 4-6 plants. Stripe rust was also observed in Nagari on DPW 621-50 (20S) and PBW 175 (20S) in 2 meter patches. No major attack of stripe rust was observed during survey in these three districts.
First symptom of brown rust was observed in field of Chatha upto 60S severity on RAJ 3077 on 12 Feb., 2017. During survey, some pustules (5S) of brown rust were also observed in kalyana village of Jammu district on unknown variety. Aphid was also observed in many fields during survey.

Punjab & Haryana

Monitoring team consisting of Dr. Vaibhav K. Singh, Scientist (Plant Pathology), ICAR-IARI, New Delhi; Dr. (Mrs.) Poonam Jasrotia, Senior Scientist (Entomology), ICAR-IIWBR, Karnal; Dr. O.P. Gangwar, Scientist (Plant Pathology), Regional Station, ICAR-IIWBR, Flowerdale, Shimla and Dr. (Mrs.) Ritu Bala, Scientist (Plant Pathology), Punjab Agricultural University, Ludhiana surveyed different wheat growing farmer's fields in Haryana and Punjab during 29-31st January 2017 for presence of different diseases and insect-pests specially rusts and aphids

On 29th January 2017, the survey was conducted in route from Karnal to Ludhiana via Indri, Ladwa, Radaur, Yamunanagar, Ambala and Khanna. The crop in this area were timely sown and in tillering to booting stage. Overall the crop situation was good, there was no disease but minor infestation of aphid was observed (2-4 aphids/plant) at few locations. While interaction with farmers it was found that most of area is under HD 2967 followed by HD 3086, WH 1105 and DBW 621-50. The detail of spots surveyed is as below:

S.No.	Places surveyed	Location	Crop details	Remarks
1	Indri, Karnal	E 77.0299966 N 29.8494709 MSL 256m	Variety HD 2967, Tillering stage	No rust, crop was in good health.
2	Khanpur, Indri, Karnal	E 77.0486265 N 29.9391243 MSL 260m	Variety HD 2967, Booting stage	No rust, crop was in good health.
3	Ban, Ladwa	E 77.0778072 N 30.0028321 MSL 263m	Variety HD 2967, Booting stage	No rust, crop was in good health.

S.No.	Places surveyed	Location	Crop details	Remarks
4	Kheridav Dalan, Ladwa	E 77.0529867 N 30.0026469 MSL 235m	Variety HD 2967, HD 3086 Booting stage	No rust, crop was in good health. General yellowing of tip of the leaves are seen in HD 3086.
5	Kajnoo, Radaur	E 77.1646032 N 30.0424302 MSL 272m	Variety HD 2967, Booting stage	No rust, crop was in good health. Aphid infestation 2-4 aphids/plant
6	Bakana, Radaur, Yamunanagar	E 77.0495566 N 29.9439906 MSL 262m	Variety HD 2967, Booting stage	No rust, crop was in good health.
7	Ratangarh, Nandpura, Yamunanagar	E 77.1150406 N 30.0446911 MSL 225m	Variety HD 2967, Booting stage	No rust, crop was in good health.
8	Bamboli, Mustafabad, Ambala	E 77.2315291 N 29.1959633 MSL 285m	Variety HD 2967, Booting stage	No rust, crop was in good health. Aphid infestation 4-6 aphids/plant

On the 30th January 2017, Dr. (Mrs.) Ritu Bala, Scientist (Plant Pathology), Punjab Agricultural University, Ludhiana joined the team and the survey was conducted from Ludhiana to Bhatinda via Monga, Ferozpur and Sri Muktsar Sahib (Punjab). Most of the fields are normal sown in which wheat was in booting to heading stage while few of the fields are late sown in which wheat was in seedling to tillering stage. There was no sign of rust but aphid infestation was recorded at all the locations surveyed. The infestation was between 2 to 10 aphids/plant. The detail of spots surveyed is as below:

S.No.	Places surveyed	Location	Crop details	Remarks
1	Chaukiman, Ludhiana	E 75.5692721 N 30.8216145 MSL 238m	Variety HD 2967, PBW 621 Booting to Heading stage	No rust, crop was in good health.
2	Monga Khurd, Monga	E 75.3029182 N 30.8117683 MSL 179m	Variety HD 2967 Heading stage	No rust, crop was in good health.
3	Janera, Monga	E 75.1774760 N 30.8805062 MSL 221m	Variety HD 2967, HD 3086 Booting stage	No rust, crop was in good health.
4	Nevara, Monga	E 75.1774728 N 30.8804620 MSL 220m	Variety HD 3086 Booting stage	No rust, crop was in good health.
5	Talwandi, Ferozpur	E 75.0598931 N 30.9501277 MSL 167m	Variety HD 2967 Booting stage	No rust, crop was in good health.
6	Jalekhan, Ferozpur	-	Variety HD 2967 Heading stage	No rust, crop was in good health.
7	Kulgarhi, Ferozpur	E 74.0762624 N 30.9528284 MSL 201m	Variety HD 2967 Tillering stage	No rust, crop was in good health.

S.No.	Places surveyed	Location	Crop details	Remarks
8	GulamPatra, Sri Muktsar Sahib	E 74.6044928 N 30.8090525 MSL 193m	Variety HD 2967, HD 3086, WH 1105 Heading stage	No rust, crop was in good health.
9	ButtarSirnih, Sri Muktsar Sahib	E 74.6701101 N 30.3650849 MSL 201m	Variety HD 2967, Tillering stage	No rust, crop was in good health.
10	Kothe Chet sing Wale, Bhatinda	E 74.7347848 N 30.3114742 MSL 203m	Variety HD 2967, HD 3086 Heading stage	No rust, crop was in good health. General yellowing of tip of the leaves are seen in HD 3086.

On 31st January 2017, the survey was conducted from Bhatinda to Karnal via Mansa, Bareta, Munak, Sangroorand Kaithal. Most of the fields are normal sown in which wheat was in booting to heading stage while few of the fields are late sown in which wheat was in seedling to tillering stage. The detail of spots surveyed is as below:

S.No.	Places surveyed	Location	Crop details	Remarks
1	ChhotiMansha, Mansha	E 75.4084516 N 30.0143805 MSL 219m	Variety HD 2967 Heading stage	No rust, crop was in good health.
2	MansaKhurd, Mansa	E 75.4111313 N 30.0121804 MSL 218m	Variety HD 2967 Heading stage	No rust, crop was in good health.
3	Lulluana, Mansa	E 75.4574457 N 29.9997494 MSL 220m	Variety HD 2967, HD 3086 Booting to heading stage	No rust, crop was in good health.General yellowing of tip of the leaves are seen in HD 3086.
4	Bappiana, Mansa	E 75.4907242 N 29.9939237 MSL 218m	Variety HD 2967 Tillering to booting stage	No rust, crop was in good health.Aphid seen in few plants.
5	KhudalAkbarpur, Bareta	E 75.7173178 N 29.8629905 MSL 221m	Variety HD 2967, HD 3086 Booting stage	No rust, crop was in good health. General yellowing of tip of the leaves are seen in HD 3086.
6	LehenKalan, Munak	E 75.8807854 N 29.8219182 MSL 228m	Variety HD 2967 Heading stage	No rust, crop was in good health.
7	Chandu, Sangroor	E 76.0115737 N 29.8203001 MSL 227m	Variety HD 2967 Heading stage	No rust, crop was in good health.
8	Nand Singh Wala, Kaithal	E 76.2388016 N 29.8029864 MSL 233m	Variety HD 2967, WH 1105 Heading stage	No rust, crop was in good health.
9	Padala, Kaithal	E 76.3142190 N 29.7990281 MSL 237m	Variety HD 3086, WH 1105 Booting stage	No rust, crop was in good health.
10.	Fatehpur, Pundari, Kaithal	E 76.5382696 N 29.7744085 MSL 244m	Variety HD 2967, HD 3086 Tillering to booting stage	No rust, crop was in good health.

 

The wheat fields of Sh. Satpal were surveyed by Dr. Prem Lal Kashyap, Scientist (Plant Pathology), and Dr. Satyabir Singh, Principal Scientist (Ext) on 1st February, 2017 for presence of yellow rust in village Chaoganwa (Karnal). The disease was extended in approximate two acres wheat field (variety HD 2967). The telial stage of rust was initiated, although some plants of nearby fields also showed initial symptoms of yellow rust. The crop stand was good. While interaction with farmers it was found that most of area is under HD 2967 and the foliar sprays of propiconazole (0.1%) has been done by the farmers to restrict the further spread of the disease.

 

The farmer's fields were surveyed by Dr. Sudheer Kumar, Principal Scientist (Plant Pathology), and Dr. Subhash Katare, Senior Scientist (Entomology), IIWBR, Karnal and Dr. Rajender Singh Beniwal (Plant Pathologist) CCS, HAU Hisar on 31st January to 2th February, 2017 for occurrence of different diseases and insect pest specially rusts in the route starting from Karnal to Bathinda via Patiala, Barnala, Sangrur, 2nd day Bathinda to Sirsa via Abohar Sri Ganganagar, Hanumangarh and in returning surveyed Sirsa, Hisar, Jind .

On 31st January 2017, the survey was conducted in route from Karnal to Bathinda via Pehowa, Patiala, and Sangarur. The crop in this area were timely sown and in flag leaf and heading stage. Overall the crop was good, there was no disease and pest infestation observed. While interaction with farmers it was found that most of area is under HD 2967 followed by HD 3086, WH 1105 and DBW 621-50. From Pehowa to Bathinda road the maximum area under zero-tillage. So some plants in each field showing pink stem bore infestation. On 1st February-2017 the survey was conducted from Bathinda to Malout, Abohar, Sri Ganganagar, Hanumangarh. In the area of Bathinda to Abohar wheat crop was late sown and in tillering and flag leaf stage. Abohar to Sri Ganganagar crop is very late shown seedling or late seedling stage. Crop was late sown because of cotton-wheat cropping system. Sri Ganganagar to Hanumangarh maximum area under mustard, chickpea & wheat. On 2nd February, 2017 the survey was conducted from Sirsa, Hisar, Jind to Karnal. Wheat crop was late to timely sown and in tillering to flag leaf stage. cotton-wheat, cropping system was common. Mustard crop is also seen in some pockets of Hisar. The detail of spots surveyed is as below:

S.No.	Places surveyed	Location	Crop details	Remarks
1	Keorak, Kaithal	N 29.88319 E 76.47801	Variety HD 2967, Heading stage	No rust, crop was in good health.
2	Gumthala Gadda, Pehowa	N 29.93313 E 76.53818	Variety HD 2967, Heading stage	No rust, crop was in good health. pink stem borer damaged plants in traces was observed under zero-tillage field.
3	Jurasi Khurd, Pehowa	N 30.01327 E 76.58155	Variety HD 2967, Flag leaf stage and Heading stage	No rust, crop was in good health.
4	Yodhapur, Patiala	N 30.08495 E 76.57300	Variety HD 2967, Flag leaf stage and Heading stage	No rust, and pink stem borer damaged plants in traces was observed under zero-tillage field. Few plant were infected with loose smut in a field.
5	Devigarh, Patiala	N 30.14684 E 76.52432	Variety HD 2967, Heading stage	No rust, pink stem borer damaged plants in traces was observed under zero-tillage field.
6	Mirpur, Patiala	N 30.20048 E 76.49200	Variety HD 2967, PBW 343 Heading stage	No rust, loose smut and foliar aphid damaged plants in traces was observed in the field.
7	Tudpur, Patiala	N 30.29576 E 76.28145	Variety HD 2967, Flag leaf stage and Heading stage	No rust,
8	Sasarwal, Baharpur, Patiala	N 30.27113 E 76.22500	Variety HD 2967, Flag leaf stage and Heading stage	No rust,
9	Chunno, Patiala	N 30.26323 E 76.13894	Variety HD 2967, Heading stage	No rust,
10	Gurdaspura, Patiala	N 30.25608 E 75.98315	Variety HD 2967, Heading stage	No rust,
11	Kalaudi, Sangrur	N 30.25009 E 75.91354	Variety HD 2967, Flag leaf stage	No rust
12	Upalai, Sangrur	N 30.23074 E 75.81976	Variety HD 2967, Heading stage	No rust
13	Beman Divana, Bathinda	N 30.23368 E 74.86481	Variety HD 2967, Tillering and flag leaf stage	No rust
14	Bulluana, Bathinda	N 30.23135 E 74.80907	Variety HD 2967, Tillering and flag leaf stage	No rust, Few plants infected with blight.
15	Husnara, Bathinda	N 30.22327 E 74.61292	Variety HD 2967, Tillering and flag leaf stage	No rust
16	Theri, Malout	N 30.21309 E 74.55859	Variety HD 2967, Tillering stage	No rust, foliar aphid damaged plants in traces was observed in the field.
17	Karmgarh, Malout	N 30.19671 E 74.43220	Variety HD 2967, Tillering stage	No rust, foliar aphid damaged plants in traces was observed in the field.
18	Alamgarh, Abohar	N 30.12234 E 74.17332	Variety HD 2967, Seedling stage and Tillering stage	No rust
19	Daulatpur, Abohar	N30.09613 E 74.03863	Variety HD 2967, Seedling stage and Tillering stage	No rust

S.No.	Places surveyed	Location	Crop details	Remarks
20	Kallar Khera, Abohar	N 30.05736 E 73.94314	Variety HD 2967, Seedling stage	No rust
21	Gumjal, Abohar	N 29.98591 E 73.90245	Variety Raj 1482, HD 2967 Tillering stage	No rust
22	Kundalwala, Sri Ganganagar	N 29.91771 E 73.92207	Variety Raj 1482, HD 2967 Tillering stage	No rust
23	Mummad, Sri Ganganagar	N 29.79646 E 74.04377	Variety Raj 1482, HD 3086, HD 2967 Tillering stage	No rust
24	Saharana, Hanumangarh	N 29.72287 E 74.15802	Variety Raj 1482, HD 2967 Tillering stage	No rust
25	Jandawali, Hanumangarh	N 29.63900 E 74.23451	Variety Raj 1482, Tillering stage	No rust
26	Ratanpura, Hanumangarh	N 29.72552 E 74.44065	Variety Raj 1482, Tillering stage	No rust
27	Chautala (Sangaria) Hanumangarh	N 29.77001 E 74.48772	Variety Raj 1482/ HD 2967, Tillering stage	No rust
28	Tejakheda, Hanumangarh	N 29.77001 E 74.59338	Variety HD 2967, Tillering stage	No rust
29	Ashakheda, Dababali (Sirsa road)	N 29.80159 E 74.48772	Variety HD 2967, Tillering stage	No rust
30	Gaon-Ganga, Dababali (Sirsa road)	N 29.78206 E 74.69411	Variety HD 2967, Tillering stage	No rust
31	Rampura Vishnoiyan (Sirsa road)	N 29.76227 E 74.78837	Variety HD 2967, Tillering stage	No rust
32	Bhawadeen, Sirsa	N 29.53422 E 75.22079	Variety HD 2967, Tillering stage	No rust, crop was in good health.
33	Maujukheda, Sirsa	N 29.52995 E 75.25044	Variety HD 2967, Tillering stage	No rust, crop was in good health. Some places water lodging conditions in the field
34	Dhani Channawali, Sirsa	N 29.52398 E 75.32236	Variety HD 2967, Tillering stage	No rust, crop was in good health.
35	Dhangar, Fatehabad	N 29.45306 E 75.52713	Variety HD 2967, Tillering stage	No rust, crop was in good health.
36	Badopal , Fatehabad	N 29.43219 E 75.53865	Variety HD 2967, WH 1105 Tillering stage	No rust, yellowing and burning in wheat seen due to high dose of weedicide. (Topic+Algrip+2,4,-D)
37	Agroha, Hisar	N 29.30456 E 75.64404	Variety HD 2967, WH 1105, Tillering stage	No rust
38	Maiyad, Hisar	N 29.11230 E 75.86706	Variety HD 2967, 1105, Tillering stage	No rust
39	Kharad, Hisar	N 29.12729 E 75.87497	Variety HD 2967, WH 1105 Tillering stage	No rust
40	Shekhpura, Hansi	N 29.12604 E 76.00661	Variety HD 2967, Tillering stage	No rust, foliar aphid damaged plants in traces was observed in the field.

S.No.	Places surveyed	Location	Crop details	Remarks
41	Rajpura, Hisar	N 29.19096 E 76.07690	Variety HD 2967, PBW 343 Tillering stage	No rust
42	Narnod, Hisar	N 29.24235 E 76.17318	Variety HD 2967, Tillering stage	No rust
43	Rajpura, Hisar	N 29.29015 E 76.24969	Variety HD 2967, Tillering stage	No rust
44	Jind	N 29.36221 E 76.32854	Variety HD 2967, HD 3086 Tillering stage, flag leaf stage	No rust




A team of Scientists of KVK Damla and Officers of DOA & FW Yamunangar visited farmers' fields of Yamunangar district to survey incidence of yellow rust in wheat crop on 4.2.17. Following wheat fields were affected with yellow rust. The details are given below.

Name/Fathers Name	Village/Block	Area (acre)	Variety	Mobile No.
Satish Kumar	Damla/ Jagadhri	1	HD 2967	9466019070
S. Kumar	Damla/ Jagadhri	1	HD 2967	9812616058

The affected fields have been sprayed with recommended fungicide i.e. Propiconazole @ 200 ml/acre to avoid further spread of disease. Farmers are being awakened regarding symptoms and cotrol measures of yellow rust through kisan gosthi, trainings, farmers meetings, SMS etc.

The incidence of yellow rust in wheat was observed in small patches in four fields in Taprapur village of distt. Yamunanagar. Scientist of KVK alongwith DDA Yamunanagar and his team visited the affected spots. They suggested recommended management practices and affected area was got sprayed in the presence of team to check further spread of disease. KVK and DOA & FW are fully vigilant to awaken the farming community for timely management of disease. The details of affected fields are given below:

Name/Fathers Name	Village/Block	Variety	Mobile No.
Om Parkash	Taprapur	Barbat	9050460439
Rajeev	Taprapur	HD 2967	9466328238
Jaiveer	Taprapur	HD 2967	9050460567
Sunder Lal	Taprapur	HD 2967	967446633

A survey was conducted Dr. Jaspal Kaur, PAU Ludhiana and Dr Ashok Kumar from KVK Ropar in different villages of Ropar districts on 02.02.2017. Most of the wheat fields were free from disease. But in villages namely Chandesar (Variety WL711) near Sh Anandpur Sahib; Hariwal (HD2967 & Barbet) and Midwa (Barbet) near Sh Kiratpur Sahib where 3-4 wheat fields were severely infected with stripe rust (40-60S). All the spots has been sprayed with propiconazole to avoid the further spread of disease.

The wheat fields at village Taprapur, Sarswatinagar block, Yamunanagar were visited by Dr. Sudheer Kumar (Principal Scientist, Plant Pathology), Dr. Prem Lal Kashyap, Scientist (Plant Pathology), and Mr. Om Prakash, (Technical officer) on 3rd February, 2017 to see the incidence of yellow rust. The following fields of villages were affected by yellow rust and details are provided as below:

Farmer Name	Area affected and disease situation	Variety Sown	Geographical locations
Sh. Om Prakash	Rust appeared in foci of infection in large patches of 5-6 sq. meters in two places in the field of 2 acre; initial uredial stage of rust noticed. The infection in foci of infection was of 60 – 80S severity.	Barbat	N30^{O}26656′ E77 ^{O} 155220′
Sh. Nathu Ram	Rust affected three to four plants in one acres area and infection in initial uredial stage. No foci of infection was observed.	HD2967	N30^{O}26867′ E77 ^{O}14824′
Sh. Harbans Singh	Rust affected few plants in the field and infection in initial uredial stage	HD2967	N30^{O}277245′ E77 ^{O} 15014′
Sh. Rajiv	Rust appeared in large foci of 3-4 meters in 2-3 places in an area of 2 acre; the severity was 60 – 80S in foci. Initial uredial stage of rust noticed	Local (25+2)	N30^{O}27780′ E77 ^{O} 15452′
Sh. Jaibir	Rust affected plants were observed in the field, but no foci of infection was observed and infection in initial uredial stage	HD2967	N30^{O}27728′ E77 ^{O} 15312′

The disease was observed maximum in field sown with local wheat varieties Barbat and 25+2. The initial foci of infection were also observed in the field grown with these local cultivars. However rust infection in traces and few plants have been observed in nearby field where HD 2967 variety was sown. The initial uredial stage was recorded in all the surveyed fields. The crop stand was good. As suggested, farmers sprayed propiconazole (0.1%) to restrict the further spread of the disease.

It is also evident that the under favorable weather condition the local varieties (Barbat and 25+2) provided the conducive environment for rust infection as these local varieties are susceptible for rust. The initial foci of infection established on these varieties and from there it was further spread in adjoining fields. The farmers also advised to grow only varieties recommended for the zone.

  

KVK Yamunanagar and KVK Ropar reported the incidence of Yellow Rust in Wheat crop during the visit of KVK team at farmers' field from 2-13rd Feb. 2017. Following wheat fields were affected with yellow rust (1-2 small patches). The affected fields have been sprayed with recommended fungicide i.e. Propiconazole @ 200 ml/acre to avoid further spread of disease. The details are given below:

KVK Yamunanagar

Name/Fathers Name	Village/Block	Area (acre)	Variety	Mobile No.
Om Parkash S/O Phool singh	Taprapur /Mustafabad	1	Barbat	9050460439
Nathi Ram S/O Sunder Lal	Taprapur/Sadhaura	1	HD-2967	9671446633
Harbans S/O Sarwan singh	Taprapur/Mustafabad	1	HD-2967	9466509359
Rajeev S/O Roshan Lal	Taprapur/Sadhaura	1	HD-2967	9466328238
Rajeev S/O Roshan Lal	Taprapur/Sadhaura	1	25+2	9466328238
Jaiveer S/O Ajmer Singh	Taprapur/Mustafabad	1	HD-2967	9050460567
Satish Kumar	Damla/ Jagadhri	1	HD 2967	9466019070
-	Damla/ Jagadhri	1	HD 2967	9812616058
Surender Kumar/Satpal Singh	Judda Sekhan/Bilaspur	2	25+2	-
Rajnish Kumar/Kumer Singh	Sabapur/Jagadhri	1	HD 2967	-
Sanjay Kumar/Amrit Pal	Sabapur/Jagadhri	1	HD 2967	-
Harpreet Singh/Harbhajan Singh	Jarodi/Jagadhri	1	DBW-88	9355402006
Karamjeet Singh/ Mahinder Pal	Gohra Bani/ Chhachhrauli	2	HD 2967	7027325625
Parveen/MahinderPal	Gohra Bani/ Chhachhrauli	2	HD 2967	-
Nirmal/Jaswant Singh	Jagdhouli/Saraswati Nagar	5	HD 2967	7027127327

KVK Ropar

S.No.	Name/Fathers Name	Village/Block	Variety	Date of 1st Incidence
1.	S. Sandeep Singh s/o Malkeet Singh	Shahpur (Near Kiratpur Sahib)/ Anandpursahib	HD 2967	20.01.2017

Wheat nematodes

Survey of wheat crop health was done for nematodes by Dr. R. S. Kanwar and his team in Hisar and Fatehabad districts on 27th & 28th Feb,2017. CCN was found in Jagaan, Asranwa, Mahalsara, Kholi, Khairampur, Sadalpur, Chuli, Adampur, Sishwal, Bhodiya Bishnoiyan in Hisar district and Dharnia, Mehuwala, Dhingsara, Bhodiya Khera, Sulikhera, Dhabi, Gadli, Bhattu, Kumhariya and Kirdhan villages of Fatehabad. Wheat seed gall nematode was not found in any of the fields surveyed.

Uttarakhand

A survey was conducted in the hilly region of Uttarakhand on 21st February 2017. Dr K.K. Mishra, Senior Scientist (Plant Pathology) and Dr Rajashekara, H., Scientist (Plant Pathology) from ICAR-VPKAS, Almora were the members of the team. The following observations were made:

1. At Mallihat, Ranman (N 29°, 45' 11" E 79°37'47.6" amsl 1332 M), Almora, the crop was at tillering stage and no rust incidence was found.
2. At Laiwaz (N 29°52'25.8", E 79° 35' 30.7" amsl 1359 M), Bageshwar, the crop was at tillering stage and no yellow rust was found.
3. At Gagrigol (N 29°53'46.7", E 79°39'24.4" amsl 1078 M), Bageshwar, the crop was in tillering stage and no yellow rust incidence was observed.
4. At Bahuli (N 29°51' 14.7", E 79°44'38.3", amsl 950 M), bageshwar around 75% area has been planted with VL *Gehun* 907 and the crop is at late jointing to early booting stage and the fields of VL *Gehun* 907 were free from yellow rust.

Field view wheat crop at Gagrigol, Bageshwar

Field view VL *Gehun* 907 at Bahuli, Bageshwar

H. P.

The wheat growing villages *i.e* Puruwala, Majra, Fatehpur, Pipliwala, Bhagwanpur, Haripur Tohana , Johron ,Jagatpurand Shivpur of Paonta Sahib, Block were surveyed by the team(Drs. V.K. Rathee , Dhirendra Singh and J. S. Thakur ,Project Director, ATMA, Nahan). The crop was free from Yellow Rust at all the locations.

 

An extensive survey programme was undertaken by a team consisting of scientists from Rice and Wheat Research Centre, Malan along with officers from the department of Agriculture (HP Govt.) to know the current status of yellow rust of wheat in the State. The team included Dr. Anil Kumar Saklani, Project Director, ATMA, Kangra; Dr. Sachin Upmanyu, Scientist (Plant Pathology); Dr. Ashok Kumar, Incharge, State Bio Control Laboratory, Palampur; Dr Rax Paul, Subject Matter Specialist, Dehra and Dr Vinod Sharma, Subject Matter Specialist, Pragpur. The survey was especially conducted for Yellow Rust in wheat at various locations namely Thana, Baba Panja, Bhatti, Bhatti Bohan, Padhyada, Kamlota, Lower Ghallour, Chaniara in Dehra Block and Seri, Haar in Pragpur Block on 04.02.2017 covering approximately 40 ha area under wheat. Yellow rust (upto 10S) was noticed on variety HD 2967 in village Chaniara village (Lower Ghallour) whereas a significantly higher severity (upto 80s) was noticed on the local or susceptible varieties grown by the farmers in Bhatti, Bhatti Bohan in Dehra Block and village Seri & Haar (upto 60S) in Pragpur Block. Around 30 farmers across the blocks surveyed were contacted and sensitized about the symptoms and management of yellow rust of wheat keeping in view the conducive climatic conditions prevailing in these areas. The farmers were advised to spray the wheat crop with recommended fungicide i.e. Propiconazole @ 1 ml per litre of water. The concerned Block Subject Matter Specialists also accompanied the Surveillance Team and advocated the farmers to spray fungicide 'Shine' to control the yellow rust in wheat. It was also informed that recommended fungicide 'Shine' is available in sufficient quantity in the respective blocks. The farmers were advised to go for 2nd spray after 15 days of Ist spray, if required. The prevailing weather is more conducive for yellow rust. In this context, all the Subject Matter Specialists (Agri) of district Kangra have been informed through Mobile SMS Alerts regarding occurrence of yellow rust and its timely management. The detail of farmers contacted during field visit is enclosed on prescribed format.

Director of Agriculture Himachal Pradesh reported yellow rust as below during 25-27.02.2017

Total area under Wheat:-359000 Ha

Name of District	Farmers, Name address/village with mobile no	Variety sown/ Grown	Total area under each variety(Ha)	Approximate Total Area infection ha(with percentage	Degree of infection(s)	Brief Management practices adopted
Hamirpur	Sh Rakesh Pathinia S/o Rattan Chand R/oLuharda, Block BhaoranjPNo 9418692663	DBW 621.50	0.40	0.20, (3%)	3%	Farmers are advised and provided, to spray of Tilt @0.1% solution in the infested wheat crop fields .
	Keshar Singh S/o Sh Banku Ram,Vill. Bahal,Nadaun	-do-	0.16	0.02	2%	-do-

Name of District	Farmers, Name address/village with mobile no	Variety sown/ Grown	Total area under each variety(Ha)	Approximate Total Area infection ha(with percentage	Degree of infection(s)	Brief Management practices adopted
	Pno 9459297325					
	Bhawan Singh S/o Ram Dass R/O Kamlah Block Nadaun PNo9418418411	-do-	0.12	0.01	1%	-do-
	Krishan Kumar S/o Amar Singh R/O Rit Block Nadaun PNo 9805748827	-do-	0.24	0.04	3%	-do-
Kangra	Smt Sunita Devi Vill Bagru, Block Rait	Own seed-50	0.40	0.25ha	Up to 100S	--do-
	Smt Nisha Devi Vill Bagru, Block Rait	-do-	0.48	0.25 ha	Upto 100S	--do-
	Sh Piar Chand Vill Bagru, Block Rait	-do-	0.40	0.25ha	Up to 40S	--do-
	Smt Pawna Devi Vill Bagru, Block Rait	-do-	0.80	In traces/scattered	Up to 5S	--do-
	Sh HemRaj Vill Sarnoo , Block Rait	-do-	0.80	0.25ha	Upto 5S	--do-
Una	Sh Mohan Lal S/o Sh Basant Ram vill. &PO Khad ,Block Horoli	DPW 621.5	0.48	7%	-	Farmers are advised to spray of Propiconazole, 1ml /lit , Brochures on Yellow rust management were distributed to the farmers.
	Sh PrithviS/o Sh Bansi Lal Vill. &PO Khad ,Block Horoli.	-do-	0.60	5%	-	-do-
	Hargopal S/o Shiv Ram V&PO Ispur Block Horoli.	-do-	0.40	5%	-	-do-
	Prakash Chand S/o Sher Singh V & P O Saloh Block Horoli.	-do-	0.56	6%	-	-do-
	Subhash S/o Balbir V&PO Saloh Block Horoli.	-do-	0.44	10%		-do-

Rajasthan

Survey was conducted on 25th February, 2017 in the area of Shapura, Pragpura, Paota, Nareheda, Chimanpura areas of district Jaipur to know the status of wheat and barley diseases on farmer's field by Dr. Pradeep Singh Shekhawat Wheat & Barley Pathologist, Rajasthan Agricultural Research Institute, Durgapura, Jaipur. No rust was observed in wheat in the area surveyed. However, incidence of flag smut was noted *in traces* to 5 per cent at villages Muktawala (N 27° 07.950' and E 075° 32.422'), Nareheda (N 27° 43.305' and E 076° 06.203', 348m). One field at village Bhakri (N 27° 35.060' and E 076° 07.727', 387m) has maximum 25 per cent incidence of flag smut in variety Raj 4120. Incidence of loose smut *in traces* to 2 per cent was noted at villages Bhakri (N 27° 35.060' and E 076° 07.727', 387m), Chimanpura (N 27° 45.278' and E 076° 07.550', 338m) and Dhani daymawali (N 27° 48.445' and E 076° 09.658, 327m'). Infestation of cereal cyst nematode was also noted in some fields. Overall the wheat crop was healthy in the surveyed areas and the crop has attained the grain filling to milking stage.

Uttar Pradesh

The wheat crop health surveys were done by Dr. J.B. Khan and Dr. Jitendra Singh of CSAUAT, Kanpur

04.02.2017

Areas: Kanpur to Farrukhabad,

District Kanpur Nagar (Villages): Udhav Nivada, Man Nidava, Araul, Atin, Harpura and Mohamda.

District Kannauj (Villagaes): Hazratpur, Patrauli, Disbara and Sultanpur

District Farrukhabad (Villages): Kheranagla, Naglabhuj and Bhattapur.

Variety Sown: HD2967, PBW343, PBW502, PBW550, K0402, K0307, HUW234, PBW373 and K7903.

Appearance of disease & severity: Leaf Rust, Stripe Rust, Stem Rust, Leaf Blight, Powdery mildew,Loose smut, Root Aphid: Nil

Foliar Aphid: 1-2%, Termite: 6-10%, Shoot Fly: 5-8%, Stem Borer: 2-3%

07.02.2017

Survey Areas: Kanpur to Hardoi,

District Unnao (Villages): Pariyar, Kulva, Devipurwa, Atwa, Hasanapur, Barikheda, Chakalvanshi, Safipur, Jamaluddinpur, Chandankhera and Utmanpur.

District Hardoi (Villages): Mallawan, Chandipur, Madhouganj, Bilgram, Jarauli, Atrauli, Dhulia, Fardapur.

Variety Sown: PBW343, HD2967, K0307, K7903, DBW17 and K0402.

Appearance of disease & severity:

Termite: Maximum up to 10-15%, Shoot Fly: 8-10% only in few fields

09.02.2017

Survey Area: Kanpur to Fatehpur

District Fatehpur (Villages): Gopalpur, Abhaypur, Mohar and Korsam

Variety Sown: PBW343, HD2967, UP2329, K7903, PBW502.

Appearance of disease & severity:

Termite: 8-12%, Shoot Fly: 8-10%, Army warm: 8-10%, maximum incidence only in few fields.

Bihar

No report received

Jharkhand

I. **Ranchi to Brambe , Dates (1-2 February 2017)**

The surveys were conducted by Mr. Pankaj Kumar Singh of ICAR-IIWBR Karnal and Jagadish Oraon, Shiv Narayan, F.O. & Avinash Kumar Pashwan,Cereal Research Scheme,PBG Department, BAU, Ranchi. The status of wheat crop health was as below:

1) N-23^{0}25, E-085^{0}09 and 693mt above from sea level, in Brambe,Mander,Ranchi District, Jharkhand State, No any Disease and Insect pest was observe in the field (Farmers- Jado oraon,Mobile No-8539872416) on 01 February 2017.The farmers were advised of use of toll free number of IIWBR for further advised.

2) N-23^{0}25, E-085^{0}07 and 683mt above from sea level, in Sursa,near murma, Ranchi District, Jharkhand State, No any Disease and Insect pest was observe in the field (Farmers- Pandey Kajur) on 01 February 2017.

3) N-23^{0}23, E-085^{0}07 and 681mt above from sea level, in Baski village, Ranchi District, Jharkhand state, No any Disease and Insect pest was observe in the field are Zero tillage and Inter cropping (Farmers- Saryu Oraon,Mobile No-9939166299,9006078353) on 01 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

4) N-23^{0}23, E-085^{0}.07 and 686mt above from sea level, in Baski village, Ranchi District, Jharkhand state, Leaf Blight Disease are present in 2-3 leaf and no Insect pest was observe in the field (Farmers- Suka Oraon, Mobile No-9006783973) on 01 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

5) N-23^{0}23, E-085^{0}.06 and 689mt above from sea level, in Totanbi, Village, Block- Mander, Ranchi District, Jharkhand State, No any Disease and Insect pest was observe in the field mix cropping Mustard & Pea (Farmers- Shiban Devi & Panchu Oraon, Mobile No-8809115053) on 01 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

6) N-23^{0}23, E-085^{0}.06 and 687mt above from sea level, in Totambi, Village, Block- Mander, Ranchi District, Jharkhand State, No any Disease and Insect pest was observe in the field (Farmer- Subodh Kesari) on 01 February 2017.

7) N-23^{0}23, E-085^{0}.06 and 687mt above from sea level, in Totambi, Village, Block- Mander, Ranchi District, Jharkhand State, No any Disease and Insect pest was observe in the field, mix crop with Mustard (Farmer- Binod Pathak) on 02 February 2017.

8) N-23^{0}23, E-085^{0}.06 and 685mt above from sea level, in Totambi, Village, Block- Mander, Ranchi District, Jharkhand State, No any Disease and Insect pest was observe in the field, Bathu weeds are present (Farmer- Manga Bek) on 02 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

9) N-23^{0}23, E-085^{0}.06 and 685mt above from sea level, in Totambi, Village, Block- Mander, Ranchi District, Jharkhand State, Steam borer Insect pest was observe in the field, Variety HD-2967 (Farmer- Rampratap Gope) on 02 February 2017.

10) N-23^{0}22, E-085^{0}.07 and 704mt above from sea level, in Sakarpada Village, Block- Mander, Ranchi District, Jharkhand State, Leaf Blight are present in some leaf and No Insect pest was observe in the field on 02 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

11) N-23^{0}22, E-085^{0}.07 and 695mt above from sea level, in Korambi, Village, Block- Mander, Ranchi District, Jharkhand State, No any Disease and Insect pest was observe in the field, mix crop Pea+mustard (Farmer- Renu Kashyap, Mobile No- 9199520526) on 02 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

12)) N-23^{0}22, E-085^{0}.07 and 690mt above from sea level, in Korambi, Village, Block- Mander, Ranchi District, Jharkhand State, Insect pest was observe in the field (Farmer- Etwa oraon) on 02 February 2017.

II. Ranchi to Itki Dates 3-4 February 2017

1) N-23^{0}19, E-085^{0}.07 and 723mt above from sea level, in Simra Village, Block- Itki, Ranchi District, Jharkhand State, No any Disease and Insect pest was observe in the field (Farmer-Sohrai Tigga, Mobile No-7549006933) on 03 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

2) N-23^{0}19, E-085^{0}.07 and 726mt above from sea level, in Simra Village, Block- Itki, Ranchi District, Jharkhand State, Leaf Blight 10s and Termite are present in the field (Farmer- Indru mahto, Mobile No- 7766848929) on 03 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

3) N-23^{0}19, E-085^{0}.07 and 723mt above from sea level, in Simra Village, Block- Itki, Ranchi District, Jharkhand State, Leaf Blight 20sare present and no Insect pest was observe in the field, on 03 February 2017.

4) N-23^{0}21, E-085^{0}.07 and 704mt above from sea level, in Ranikhatnga Village, Block- Itki, Ranchi District, Jharkhand State, No any Disease and Insect pest was observe in the field and Dark green spike emergence are present, mix cropping Mustard+wheat (Farmer- Puspa minz) on 03 February 2017.

5) N-23^{0}21, E-085^{0}.07 and 705mt above from sea level, in Ranikhantanga Village, Block-Itki, Ranchi District, Jharkhand State, No any Disease and Insect pest was observe in the field (Farmer- Madra Bhagat, Mobile No-7549968373) on 03February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

6) N-23^{0}22, E-085^{0}.08 and 687mt above from sea level, in Ranikhantanga Village, Block-Itki, Ranchi District, Jharkhand State, No any Disease and Insect pest was observe in the field, mix cropping Mustard+Wheat (Farmer- Ram Oraon) on 03 February 2017.

7) N-23^{0}21, E-085^{0}.06 and 704mt above from sea level, in Jhakhara Toli Village, Block- Itki, Ranchi District, Jharkhand State, Leaf Blight present, Spike emergence dark green and no Insect pest was observe in the field, (Farmer- Satnarayan Takur, Mobile No-9709083616) on 04 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

8) N-23^{0}19, E-085^{0}.08 and 707mt above from sea level, in Nagri Village, Block- nagri, Ranchi District, Jharkhand State, Leaf Blight 20s present, Spike maturity and no Insect pest was observe in the field, on 04 February 2017.

9) N-23^{0}19, E-085^{0}.08 and 708mt above from sea level, in village -Prem Nagar Village, Block- nagri Ranchi District, Jharkhand State, no Insect pest was observe in the field, crop status good, on 04 February 2017.

10) N-23^{0}19, E-085^{0}.08 and 706mt above from sea level, in village -Pirra , Block- Itki, Ranchi District, Jharkhand State, no Insect pest was observe in the field, crop status good, on 04 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

IIIrd Ranchi to Bankura(West Bengal), Dates: 06-07 Feb. 2017

1) N-23^{0}21.134, E-085^{0}.06.652 and 102mt above from sea level, in Village- khalGarm, Bankura District, West Bangal,Mix cropping(Wheat,mustard,potato,radish,onion,garlic), No any disease and Insect pest seen on farmers fields 06 February 2017.

2) N-23^{0}04.483, E-087^{0}02.440 and 86mt above from sea level, in Khalgarm, Bankura District, West Bengal State, Leaf Blight 20s present, irrigation problem, (Farmers- Hardan Manghi(B.Sc. Ag.) ,Mobile No-9434738825), on 04 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

3) N-23^{0}04.492, E-087^{0}02.448 and 82mt above from sea level, in Village- Khalgarm, Block-Taldangra ,Bankura District, West Bengal, No Wheat, mix cropping mustard, radish onion & garlic, on 06 February 2017.

4) N-23^{0}13.438, E-087^{0}04.508 and 145mt above from sea level, in Village-Khalgarm ,Bankura District, West Bengal , mix cropping(wheat, mustard, radish onion), on 06 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

5) N-23^{0}13.438, E-087^{0}04.508 and 147mt above from sea level, in Village-Biparda ,Bankura District, West Bengal, no insect pest observed in field, mix cropping(mustard, radish onion), on 06 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

6) N-23^{0}13.438, E-087^{0}04.508 and 95mt above from sea level, in Village-Paika ,Bankura District, West Bangal , wheat crop status good, no any disease observed in field, on 07 February 2017.

7) N-23^{0}13.438, E-087^{0}04.508 and 102mt above from sea level, in Village-Raipur ,Bankura District, West Bengal , mix cropping (wheat, mustard, radish, onion), on 07 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

8) N-23^{0}13.438, E-087^{0}04.508 and 102mt above from sea level, in Village-Bhainda ,Bankura District, West Bengal , wheat crop status good, no any disease observed in field, on 07 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

9) N-23^{0}13.438, E-087^{0}04.508 and 101mt above from sea level, in Village-Bhainda, Bankura District, West Bengal , wheat crop status good, no any disease and insect –pest observed in field, on 07 February 2017. The farmers were advised of use of toll free number of IIWBR for further advised.

IV. Birsa Agriculture University, Ranchi, Dates 10-11 Feb. 2017

1) N-23^{0}26.436, E-085^{0}19.194 and 632mt above from sea level, at BAU Field Ranchi, District, Jharkhand , wheat crop status good, leaf blight disease present with 5S-10S and no insect –pest observed in Research field, on 10 February 2017 on variety HD 2967.

2) N-23^{0}26.628, E-085^{0}19.158 and 635mt above from sea level, at BAU Field Ranchi, District, Jharkhand , wheat crop status good, leaf blight disease present with 05-10S and no insect –pest observed in Research field, on 10 February 2017 on variety HD 2967.

3) N-23^{0}26.436, E-085^{0}19.194 and 632mt above from sea level, at BAU Field Ranchi, District, Jharkhand , wheat crop status good, leaf blight disease present with 05-20S and no insect –pest observed in Research field(Different dose of Fertilizers’ 150 Kg N) on 10 February 2017 on variety CBW38.

4) N-23^{0}26.436, E-085^{0}19.194 and 636mt above from sea level, at BAU Field Ranchi, District, Jharkhand , wheat crop status good, leaf blight disease present with 5S-10S and no insect –pest observed in Research field(Different dose of Fertilizers’ 150 Kg N), on 11 February 2017.Unknown variety.

5) N-23^{0}26.436, E-085^{0}19.194 and 637mt above from sea level, at BAU Field Ranchi, District, Jharkhand , wheat crop status good, leaf blight disease present with 5S-20S and no insect –pest observed in Research field(Different dose of Fertilizers’ 150 Kg N), on 11 February 2017 on variety CBW38.

6) N-23^{0}26.436, E-085^{0}19.194 and 630mt above from sea level, at BAU Field Ranchi, District, Jharkhand , wheat crop status good, and no insect –pest observed in Research field, on 11 February 2017 on variety CBW38.

7) N-23^{0}26.436, E-085^{0}19.194 and 628mt above from sea level, at patratoil Village, Farmers Field Ranchi, District, Jharkhand , wheat crop status good, and no insect –pest observed in Research field, on 11 February 2017 unknown variety.

8) N-23^{0}26.436, E-085^{0}19.194 and 630mt above from sea level, at Kanke Village, Farmers Field Ranchi, District, Jharkhand , wheat crop status good, and no insect –pest observed but leaf blight presence with 5-20S, unknown variety on 11 February 2017.

9) N-23^{0}26.436, E-085^{0}19.194 and 630mt above from sea level, another field at Kanke Village, (Farmers: Dale bhagat Field) Ranchi, District, Jharkhand , wheat crop status good, and no insect –pest observed but leaf blight presence with 5S, unknown variety on 11 February 2017

10) N-23^{0}26.436, E-085^{0}19.194 and 634mt above from sea level, another field at Kanke Village, (Farmers: Ajit Oraon Field) Ranchi, District, Jharkhand , wheat crop status good, and no insect –pest observed but leaf blight presence with 10S, unknown variety on 11 February 2017. The all farmers were advised of use of toll free number of IIWBR.


West Bengal

As a consequence of occurrence of wheat blast during 2015-16 crop season in Bangladesh, extensive surveys were undertaken that year and wheat blast was not reported from adjoining states to Bangladesh in India. This year again (2016-17 crop season), extensive surveys have been undertaken by teams of wheat pathologists, breeders and agronomists of ICAR-IIWBR, Karnal, BCKVV, Kalyani West Bengal and UBKV Coochbehar West Bengal. As of now the incidence of wheat blast is not recorded in any district of West Bengal, except in Jalangi area of Murshidabad district of West Bengal where "spike blight like symptoms" were recorded in few fields on a variety 'Shatabdi' and "Pradip" of Bangladesh origin by a team of scientists led by Dr. D. P. Singh, PI (Crop Protection), ICAR-IIWBR Karnal on 4.2.2017. HD 2967 was found resistant to disease, whereas UP 262 was susceptible and PBW 343 and HD 2985 were moderately susceptible. Indian wheat varieties have not shown any such disease symptoms in this area. The wheat crop in West Bengal looks very promising. An adhoc IPM for wheat blast is circulated in case of need and training has been conducted at BCKVV, Kalyani in which farmers and Agriculture officers of WB Govt. participated on 3rd Feb. 2017. The wheat crop of varieties of non Indian origin has been destroyed and adjoining crop has been sprayed with tebuconazole+trifloxystrobin fungicide. The wheat crop will be replaced with legumes and oilseed crops for few years in these areas and improved as well as tolerant varieties will be grown.

Teams of DAC&FW and Govt. of West Bengal and BCKVV also visited these areas and helped in demarcation, spraying and sanitization of areas close to Bangladesh borders in three districts of West Bengal. Agricultural Commissioner, Joint Secretary (PP), ADG (PP &B) and Dr. D. P. Singh, PI (CP) again visited the areas to facilitate the demarcation

Spike blight like symptoms detected first time in west Bengal by Dr. D. P. Singh and team (unpublished) on 4th Feb. 2017) on local variety of wheat


HD 2967 variety of wheat is found resistant to spike blight like symptoms in Jalangi, Murshidabad (Unpublished, D. P. Singh)

Survey of wheat crop health in West Bengal especially near Bangladesh borders was conducted from 13-15Feb. 2017 by a team of scientists, Dr. Sudheer Kumar, Principal Scientist (Plant Pathology), Dr. Charan Singh (Breeder), IIWBR, Karnal and Dr. Satyajit Hembram, Assistant Professor, Plant Pathology, RRS Terai Zone, UBKV, Coochbehar -WB in the area of West Bengal near Bangladesh border. Dr. Satyajit Hembram started the survey from Coochbehar to Bagdogra. Dr. Sudheer Kumar and Dr. Charna Singh join at Bagdogra and started the survey in route Balurghat via Islampur, Kishanganj and Raiganj. From bagdogra to Islampur mainly the tea plantation after that main crop is rice followed by mustard, potato and wheat.

Balurghat to Hilli very few fields of wheat near Balurghat and near to Bangladesh border at Hilli no wheat cultivation enforced by BSF. While returning from Hilli visited Assistant Agriculture Development office, Hilli, Dakshin Dinapur and discuss about the effort make to combat the blast. Officials told that state government has suggested not growing wheat in one Kilometer area near border and also distributed pamphlets but that is not properly being followed by farmers.

From Balurghat to Malda route, in the area of Dazole wheat cultivation, about 50% area in Gazole is under wheat and crop was health, no blast symptoms were observed. Around the Malda mainly the Mango plantation and very few wheat fields were found and there was no blast observed. In the Malda Berhampore route, Faraka onwards near Duliyan in very few fields some symptom of drying of one and two spikelets in few spikes has been observed but blast was not confirmed.

The detail of observation points are given below.

S.No.	Places surveyed	Location	Crop details	Remarks
1	Mevdagachha	N 26.39612 E 88.29819 MSL 89m	Variety Swarna, Heading stage	No blast symptoms were observed.
2	Ramgary, Uttar Dinapur	N 26.32384 E 88.27973 MSL 53m	Anthesis stage	No blast symptoms were observed.
3	Chhatish	N 26.22698 E 88.14633 MSL 50m	Anthesis stage	No blast symptoms were observed.
4	Gachhpora	N 26.18043 E 88.10439 MSL 45m	Variety local, anthesis stage and nearby filed at tillering stage very late sown	No blast symptoms were observed.
5	Dulachauki	N 26.03921 E 88.07245 MSL 40m	Anthesis stage,	No blast symptoms were observed.
6	Talaan	N 25.92562 E 88.08206 MSL 29m	Sonna kanak, Anthesis stage, heavy weed infestation	No blast symptoms were observed.
7	Hilli	N 25.27856 E 89.00137 MSL 42m	Near Bangladesh border, no wheat cultivation enforced by BSF	No blast symptoms were observed.
8	Ferusa, Dakashin Dinapur	N 25.26371 E 88.90494 MSL 13m	Variety HD 2967	No blast symptoms were observed.
9	Teor	N 25.26.32 E 88.88899 MSL 15m	Heading stage	No blast symptoms were observed.
10	Bolla, Balurghat	N 25.34123 E 88.71439	Anthesis stage	No blast symptoms were observed.

S.No.	Places surveyed	Location	Crop details	Remarks
		MSL 23m		
11	Buniadpur, Bhalkushen	N 25.35674 E 88.35346 MSL 27m	Heading stage	No blast symptoms were observed.
12	Bainshab nagar	N 24.84799 E 87.98887 MSL 25m	Variety Local, Heading stage	Some symptom of drying of one and two spikelets in few spikes has been observed but blast was not confirmed.
13	Dhuliyan	N 24.71884 E 87.91758 MSL 17m	Heading stage	Some symptom of drying of one and two spikelets in few spikes has been observed but blast was not confirmed.




A team of scientists, Drs. P. M. Bhattacharya, A. K. Chowdhury, Wasim Reza of Uttar Banga Krishi Viswavidyalaya, Coochbehar, visited several fields of Coochbehar, Alipurduar, Siliguri division of Darjeeling, Malda and Murshidabad districts of West Bengal from 7-14th February, 2017 to monitor the crop health status of wheat. The detail of survey are as below:

Coochbehar- In general the crop health is good except in some fields where outbreak of spot blotch disease is severe. Alipurduar – No major incidence of diseases is recorded. The tillering of the crop is not good probably due to late sowing and high temperature.

Siliguri Division - No major incidence of diseases is recorded. The tillering of the crop is not good probably due to late sowing and high temperature.

Malda- Crop health is moderate and late sowing has affected the tillering. No major incidence of diseases is recorded except some unusual leaf spots in some pockets of Bamangola block.

Dakshin Dinajpur - Crop health is moderate and late sowing has affected the tillering.

Murshidabad – In general, crop health is moderate. In some areas, viz. Jalangi and Domkal spike blight like symptoms were observed. The detail of field is given below:

a) Ghoshpara, Jalangi (Farmer's name: Akkas Mandal, GPS data- 240 8.397min N, 88 0 41.3min)

b) Jaikrishnapur, Jalangi (Farmer's name: Kuran Sekh, GPS data 240 8.415min N, 88 0 41.279minE)

c) Tiktikipara, Jitpur, Domkal (Farmer's name: Anwar Hossain Mullick, GPS data 240 9.783min N, 88 0 32.174minE)

d) Arazimulatpur, Jalangi (Farmer's name: Abdul Hannan Mandal, GPS data 240 8.789min N, 88 0 40.822minE)

Besides the above mentioned fields the adjoining fields also shows similar symptoms. The varieties could not identified as were purchased from local market.

Assam

No rust and wheat blast was found. The spot blotch incidence was mild.

Gujarat

The farmer's fields were surveyed by Dr. A. A. Patel, Research Scientist (Entomology), Dr. S. I. Patel, Associate Research Scientist (Plant Pathology) and Ms. Elengbam Premabati Devi, Assistant Research Scientist (Plant Pathology) of Wheat Research Station, SDAU, Vijapur on 21-23 February and 25th February, 2017 for presence of various diseases and insect pest with special focus on rusts encompassing various areas of Mehsana, Gandhinagar, Sabarkantha and Arvalli districts. The farmers' fields surveyed in a route covered following villages.

District	**Taluka**	**Villages**
Sabarkantha	Prantij	Ghadkan, Tajpur, Vaghrota, Talod
	Himmatnagar	Meharpura
Arvalli	Dhansura	Dhansura, Vadagam
	Bayad	Tenpur, Alvakampa, Choila
Gandhinagar	Dehgam	Sanpa, Kadjodara
	Kalol	Mubarakpur, Serisa
	Mansa	Pundhara, Ambod, Rampura, Golthara
Mehsana	Kadi	Kadi, Karannagar, Meda Adraj, Borisana, Thol
Mehsana	Vadnagar	Valasana
	Vijapur	Ladol, Sardarpur
Sabarkantha	Khedbrahma	Khedbrahma, Laxmipura
	Vadali	Vadoth
	Idar	Umedgadh, Makarpura
	Vijaynagar	Ukhalikampa, Vanaj, Jaleti
	Bhiloda	Chithoda, Lilachha, Badhuli, Rewas
Gandhinagar	Gandhinagar	Lavarpur, Shahpur, Dabhoda, Chiloda, Jakhora

The timely sown wheat crop in these areas was in dough stage while late sown crop in some of the fields was in milking stage. The rust was not observed at any of the field surveyed. Sporadic damage by termite was observed in some fields while stem borer infestation is noticed especially in areas where paddy-wheat crop rotation (Kadi areas of Mehsana district) and Sorghum-Wheat crop rotation (Khedbrahma areas of Sabarkantha district) is practiced. The maximum temperature was experienced comparatively higher (32-35 ^{o}C) since last fortnight which might slightly affect the grain development in wheat crop. Overall the crop was good and there was no serious disease and pest infestation observed.

Madhya Pradesh, Karnataka

During the monitoring of wheat trials at different stations in Karnataka, the team (Dr. P.V. Patil and group) visited 3 to 4 farmers' field in Bagalkot and Belgaum district and no incidence of leaf rust was observed in any of the fields. However at Ugar Khurd, in Trap Nursery Trials no entries have shown any infection of leaf rust, but the border sown susceptible check, Agra local has shown initial infection of leaf rust. During the year, this is the first report on natural incidence of leaf rust in Karnataka. In most of the farmers field, irrigated wheat crop was between grain development to maturity stage.


Border sown susceptible genotype (Agra Local) in TPN trial laid out at Ugar Khurd showing the initial infection of leaf rust. Monitoring team members observed the natural infection of leaf rust on borders sown susceptible genotype (Agra Local) in TPN planted at Ugar Khurd on 09.02.2017.

Maharashtra

Dr. B. C. Game of ARS Niphad surveyed the wheat crop status and did not find natural incidence of rust in Amravati, Akola, Washim and Parbhani. Wheat Disease monitoring nursery at Akola Centre was free from rust and other diseases. Trap plot Nursery (coordinated by RWRS Mahabaleshwar) located at Parbhani Centre was also free from rust etc.

At Niphad Centre increase in temperature is recorded during this month. The maximum temperature is in the range of 31 to 34 ^{o}C while minimum ranged between 12 to 13 ^{o}C. Wheat Disease Monitoring Nursery at Pimpalgaon (B) is free from leaf and stem rust.

Dr. B. K. Honrao, surveyed wheat crop from 15 and 16 February 2017 in the area of Saswad , Jejuri,, Nira, Baramati and Songaon area of Pune district. Wheat crop was good in both timely and late sown crop. Some traces of stem borer and leaf beetles were observed in late sown fields. Early sown crop is ready for harvesting whereas timely sown crop is at maturity stage, overall crop was good. No natural incidence of black and brown rust in any location. The trap plot nursery at Songaon farm was also free and reaches at maturity stage, no natural rust incidence till today.

The climate is almost dry and cool. The temperatures (maximum and minimum) were slightly towards higher side. The maximum temperature was recorded 35.78°C while minimum temperature ranged from 12.1°c to 13.7°C.

Twelve leaf rust samples were collected from PPSN entries showing more than 40S severity and have been dispatched to Shimla for pathogen analysis. Weekly information of the climate parameters (1st to 28th February 2017) has been given below:

Week	Temperature (0°c)		Rains	Relative Humidity		Remark
	Max.	Min.		Max.	Min.	
5	31.7	12.1	-	94.57	37.43	-
6	32.3	13.7	-	97.00	44.04	-
7	31.7	12.7	-	88.71	39.57	-
8	35.8	12.4	-	83.43	26.43	-
Average	**32.9**	**12.7**	**-**	**90.92**	**36.86**	**-**

Tamil Nadu

In Kenthorai area of Nilgiri district, Dr. J. Berliner encountered *Tylenchorhynchous* species @ 50 nematodes per 100cc soil in wheat fields.

Acknowledgement:

Thanks to different cooperators, Drs., Rajender Singh Beniwal, M. K. Pandey, Jaspal Kaur, B.K. Honrao, Satyajit Hembram, A. K. Chowdhury, P.M.Bhattacharya, Wasim Reza, J. P. Jaiswal, Kanak Srivastava, Anil Kumar, K. K. Mishra, P.S. Shekhawat, Rambir Singh Kanwar, Charan Singh, Pankaj Kumar, Sushil Kumar, Arun Khajuria, Ritu Bala, V. K. Singh and O. P. Gangwar, P.V. Patil, B. C. Game, A. A. Patel, S. I. Patel, Ms. Elengbam Premabati Devi, J. B. Khan, Jitendra Kumar, Anil Kumar Saklani, Project Director, ATMA, Kangra; J. Berliner, T. P. Saikia, Sachin Upmanyu, Ashok Kumar Rax Paul, Vinod Sharma, Sandeep Manuja, V.K. Rathee, Dhirendra Singh, J. S. Thakur, Sr. Coordinator, KVK, Damla, Yamunanagar, Scientists of KVK Damla and Officers of DOA & FW Yamunangar, Kamboj, Sr. Coordinator, KVK Yamunanagar Zonal Project Directorate, ICAR- Agricultural Technology Application Research Institute, Zone-I, PAU Campus, Ludhiana, Deputy Director (Agric.) Yamunanagar, Haryana, Agriculture Depart. Officers Jammu Div. who sent the reports for this issue. Thanks to DAC & FW, KVKs and State Agriculture Departments for contributions.

Issued by: Crop Protection Programme, ICAR- Indian Institute of Wheat and Barley Research, Karnal- 132001

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	WHEAT CROP HEALTH NEWSLETTER ICAR-Indian Institute of Wheat and Barley Research, Karnal-132 001, Haryana, India March, 2017	
Volume: 22 (2016-2017)	***Available on website*: *www.dwr.res.in***	***Issue: 5***

Wheat crop health was at flowering to dough stage in cooler regions of India whereas it was towards maturity in warmer zones in the month of March, 2017. The yellow rust spread declined and turned in to non spreading telial stage due to increase in temperature beyond 25 ^{0}C in Northwestern plains zone and farmers were advised in Haryana and Punjab not to use any fungicidal sprays at that stage. There are reports of presence of brown rust around Faizabad on susceptible varieties in Eastern U. P. and Jharkhand in traces in few fields. The survey of crop indicated absence of any spike blight like symptoms in other states except three districts of West Bengal.

Highlights (March, 2017):

1. **So far no wheat blast and stem rust including Ug99 race was found at farmers' fields in India. The spike blight like symptoms were not found in any other state except earlier reports from Murshidabad and Nadia districts in West Bengal, on local wheat varieties.**
2. **Strict restrictions for movement of wheat from Murshidabad and Nadia districts are recommended. The wheat grains will be milled and used locally.**
3. **Wheat holiday will be imposed in these districts for next three years and wheat will be completely replaced with oilseeds and pulses. In rest of the districts, local varieties of wheat will be replaced with high yielding resistant varieties in other districts of West Bengal.**
4. **Strict monitoring of crop at different stages is recommended for presence of spike blight like symptoms in West Bengal during next crop seasons. Prophylactic sprays will be followed using effective fungicides.**
5. **The powdery mildew incidence remained in traces during end of March 2017 with no yield penalties.**
6. **The wheat varieties HD 3086, WB 02, WH 1105 and KRL 210 were found resistant to yellow rust close to plots where yellow rust was up 100S in PPSN block (under artificially create disease epiphytotics using new pathotypes 110S119, 110S84 and old one 46S 119). HD 2967 was found slow ruster type.**
7. **No major and exotic insect pest was found so far damaging wheat crop in six agro-ecological zones of India. The incidence of foliar aphids remained below thresh hold level with increase of predator insects towards end of March 2017.**
8. **The wheat crop health therefore remained excellent during 2016-17 thus contributing maximum towards realization of yield potential of varieties and grain quality is also expected quite good.**
9. **So far no adverse reports of crop health have been reported in Newspapers and by farmers throughout India during crop season except spike blight like symptoms in two districts of West Bengal. The farmers were interviewed and were highly satisfied with their crop condition.**
10. **From crop health point of view, the production of wheat is all set to surpass the present estimates of 98 million tons and all factors (Crop health, growth, comparatively prolonged cool weather at grain filling stage, little lodging and very good performance of late and very late sown crop during current crop season, more acreages under wheat, use of slow releasing N need coated urea, and adoption of high yielding disease resistant varieties etc.) favour a bumper and record production of more than 100 million tons with great quality of grain.**


एच. डी. 3086
डी. बी. डब्ल्यू. 88


डब्ल्यू. एच. 1105
उत्तर पश्चिमी मैदानी क्षेत्र
एच.डी. 2967
उत्तर-पश्चिमी मैदानी क्षेत्र


डब्ल्यू बी 2
उत्तर पश्चिमी मैदानी क्षेत्र
सिंचित, समय से बुआई


के. आर. एल. 210
लवणीय/क्षारीय भूमि
सिंचित समय से बुआई

Production estimates (April 2017)

Production : ('000 tonnes)

State	Wheat	Barley
	Rabi	Rabi
(1)	(5)	(15)
Andhra Pradesh	0.0	
Assam	34.0	
Bihar	4718.5	14.0
Chhattisgarh	200.7	1.7
Gujarat	2879.0	
Haryana	11480.2	150.0
Himachal Pradesh	634.2	32.6
Jammu & Kashmir	463.3	4.4
Jharkhand	400.7	
Karnataka	110.0	
Kerala	0.0	
Madhya Pradesh	17778.4	239.8
Maharashtra	1405.0	**3.0**
Odisha	1.3	
Punjab	16040.5	44.0
Rajasthan	8704.8	865.0
Tamilnadu		
Telengana	5.0	0.0
Uttar Pradesh	29911.8	463.0
Uttarakhand	799.0	25.0
West Bengal	970.0	3.0
Others	**106.8**	**1.3**
All India	96643.2	1846.8

State-wise Second Advance Estimates of Area of FOODGRAINS During 2016-17

Area : ('000 hectares)

State	Wheat	Barley
	Rabi	Rabi
(1)	(5)	(15)
Andhra Pradesh	0.0	
Assam	25.0	
Bihar	2095.2	11.0
Chhattisgarh	150.1	2.2
Gujarat	976.0	
Haryana	2440.0	42.0
Himachal Pradesh	324.0	18.3

Jammu & Kashmir	282.9	6.7
Jharkhand	193.9	
Karnataka	155.0	
Kerala	0.0	
Madhya Pradesh	5940.0	120.0
Maharashtra	913.0	**8.0**
Odisha	0.8	
Punjab	3500.0	12.0
Rajasthan	2790.0	308.8
Tamilnadu		
Telengana	3.0	
Uttar Pradesh	9726.0	176.0
Uttarakhand	348.0	21.0
West Bengal	340.0	2.0
Others	**28.0**	**1.2**
All-India	30231.0	729.1

Source: Agricultural Statistics Division, Directorate of Economics & Statistics, New Delhi

Field days

The field day and farmers school was organized at Nalvi Khurd (Karnal) where participatory seed production of wheat is being undertaken. The farmers were given knowledge on IPM and reducing the use of pesticides. Another field days was organised at wheat FLD sites in village Mugal Majra (District Karnal) on 31.03.2017 and farmers were educating for use of improved and resistant varieties of wheat to minimize crop losses. Higher incidence of diseases was observed in varieties taken from other sources by farmers which were not properly tested in coordinated system.

Preparedness for wheat blast

-Dr. D. P. Singh along with Hon. DDG (CS) and ADG (PP&B) participated in a meeting called by Hon. Secretary, DAC & FW on the topic occurrence of wheat blast in Bangladesh in Krishi Bhavan New Delhi on 4.3.2017 and given IPM and latest update on wheat blast survey report.

-Dr. D. P. Singh also participated in the meeting with hon. AS (Ad), DAC & FW, Krishi Bhavan, New Delhi on label claim of fungicides for wheat blast control on 27.3.2017 and given technical inputs.

Visits of CIMMYT team in PPSN

CIMMYT team (Dr. Hans Braun, Dr. Ravi P. Singh and Dr. Arun K. Joshi) visited the PPSN block of Crop Protection and appreciated the development of disease epiphytotics of yellow rust and performance of AVT and NIVT entries at ICAR-IIWBR Karnal.

Yellow rust in PPSN created artificially for screening of varieties in pipe line

Situation of stripe (yellow) rust in Northern India

Till 30th March, 2017, yellow rust of wheat was not found in the states of Uttar Pradesh, and Rajasthan. In Punjab, Haryana and Uttarakhand the spread of rust ceased due to increase in temperature. The farmers were advised not to spray crop with fungicides like propiconazole (0.1%) once temperature went beyond 25 ^{0}C thus helping them to save money and reduce cost of cultivation which in turns increased their income. The state wise report is given below:

J & K

An extensive surveyed (Dr. M. K. Pandey) was carried out especially in border areas of Jammu Province including Jammu, Samba and Kathua districts of different wheat growing farmer's field during 12 & 13 March, 2017 and 25th & 26th March, 2017. On 12th March, the farmer's fields were surveyed in the route starting from Udhaywalla, Marh, Chinor, Lalihal, Kanna Check, Rajpura, Akhnoor, Deyaran, Simbal and Mishriwalla. On 13th March, the survey was carried out via Miransahab, RS Pura, Saikalan, Devigarh, Trewa, Arnia, Rajgarh, Chack Salaria, Mawa, Rajpura, Mathura chake, Chadwal, Gangayal, Samba. On 25th March, survey was carried Udhyawalla to Anand Nagar via Marh, Kalagi, Bhalwal, Malian Mishriwalla, Jhiri, Kana Check, Ladiyal, Gajansoo, Gho Manashan, Sai Rakhwalan and Pauni Check. On 26th March, survey of Samba and Kathua districts via RS Pura, Dablehar, Suchetghar, Saikalana, Ramgarh, Vijaypur, Chadwal, Hamirpur and Banoti. In first fortnight, yellow rust pustules were found every surveyed field with low incidence and intensity. In 2nd fortnight survey, yellow rust was increased rapidly especially in HD 2967 due cold days in mid march but they change in teliospores in end of March due to high temperature. Brown rust was also observed in many farmers fields. Leaf blight was also observed in some fields of RAJ 3077 and RAJ 3765. Loose smut was also observed in 20% surveyed field. The detail of disease spots surveyed is as below:

S.No.	Place surveyed	Location	Variety	Remarks
1.	Anand Nagar (Marh, Jammu)	32.5542115	HD 2967	20S (Stripe/Yellow rust)

		074.9002227 284	WH 1105	20S (brown rust)
2.	Pauni check	74.7993092 32.7356505 281	HD 2967 HD 3086	60S (stripe rust) 5S (stripe rust)
3.	Sai Rakhawalan	32.7685494 74.8168025 325	HD-2965	40S (stripe rust)
4.	Ghou Manashan	32.7623248 074. 8404072 307	HD-2967 WH 1080	20S (stripe rust) 5S (brown rust)
5.	Ghou Manashan	32.43445 074.43770 291	Barley (unknown)	60S (brown rust)
6.	Marh	32.44082 074.43035 260	Unknown	20S (brown rust)
7.	RS Pura	32.736376 74.8301616 269	DBW 621-50	20S (stripe rust)
8.	Ramgragh	32.5542115 0749006227 296	RAJ 3077 HD 2967	20S (brown rust) 40S (stripe rust)
9.	Arnia	32.5122136 074.7986579 269	Unknown RAJ 3765	40S (stripe rust) 10S (Stripe rust) 10S (brown rust)
10	Chack Salarian	32.5561255 074.0070877 332	Unknown Barley	40S (Stripe rust) 10S (brown rust) 40S (brown rust)

Punjab & Haryana

The survey of wheat crop for incidence of diseases was conducted by Dr. Jaspal Kaur, Plant Pathologist and Dr. Ramanna Kaoulagi, Assistant Nematologist, Deptt. of Plant Breeding and Genetics, PAU Ludhiana on 08.03.2017 on the route, Ludhiana-Phillour-Nagar-Lasara-SBS Nagar-Langroya-Hyatpur-Gharshankar and adjoining areas. The incidence of yellow rust was observed some fields on the route in traces-5S. except in villages, Hyatpur (SBS Nagar) up to 10 S, in Mehatpur (SBS Nagar) on HD 2967 in higher severity. S. Dhyan Singh was immediately contacted and advised to spray his crop with the recommended fungicide. In addition in the SAARC and TRAP nurseries sown at KVK langroya, symptoms of yellow rust were also observed and it was maximum up to 60S on susceptible checks. In village Moron (Phillour) two fields one of HD 3086 (2 acres) and another WH 1105(1 acre) were infected with brown rust.

Nematode status in Haryana: Survey for wheat nematodes was done by DR R S Kanwar in CCN affected blocks of Fatehabad and Hisar districts of Haryana on 27th and -28th Feb, 2017. Dr Sardul Mann from KVK Fatehabad and Dr Pawan Kumar from KVK Hisar also accompanied Dr Kanwar in their respective districts. CCN infection was found in villages Jagaan, Asranwa, Mahalsara, Kohli, Khairampur, Sadalpur, Chuli, Adampur, Siswal, Bhodiya Bishnoiyan of Hisar. In Fatehabad, district Samples from villages Mehuwala, Dharnia, Bhodiya Khera, Sulikhera, Kirdhan, Dhhabi, Bhattu and Kumhariya had CCN . Incidence and intensity of Molya disease caused by CCN has come down due to adoption of management practices, particularly crop rotation with mustard. ECN was not found in any of the fields surveyed.

H. P.

The yellow rust survey indicate sporadic incidence of disease in Una, Hamirpur and Mandi districts only.

Rajasthan

No report received since crop was at harvesting stage

Uttar Pradesh

Wheat and barley late sown crops are generally good. In rainfed crop termite infestation ranged from 12-15% and in irrigated crop about 8% infestations are recorded. Aphid infestation in wheat early & late sown crop was not seen, while in barley crop, it was susceptible to highly susceptible. In timely & late sown wheat crop, shoot fly infestation was ranged from 10-15%. Leaf Blight was observed in different barley varieties. The first incidence of brown rust was observed on 09.03.2017 in Kharchia (TPN) at Araul. The report was submitted by Dr. S. P. Singh.

Uttarakhand

Survey of wheat crop health in Tarai and Plains of Uttarakhand was conducted during Feb 25-27, 2017 by a team of scientists, Dr. J.P. Jaiswal, Professor & Sr. Wheat Breeder, Dr. Swati, Wheat Breeder and Dr. Kanak Srivastava, Sr. Tech. Asstt. (Plant Pathology).

Route on 25th February Pantnagar – Kashipur area was surveyed in route a number of wheat fields with sole cropping and also in agro-forestry system particularly with popular plantations were observed for rust and other diseases. Four farmers with the following details could also be contacted:

-Sri Nabab Singh, Netaji Nagar, Dineshpur, Udham Singh Nagar
Sowing time: November 1st week
Wheat varieties planted: PBW 502- 6 acre, HD 2967- 1.5 acre
Crop health was very good. No disease was observed. It was told that two sprays of propiconozole and one spray of other chemical (name was not told) have been done for the control of aphid (Tela).

-Chaudhary Gavendra Singh, Mukundpur, Dineshpur
Sowing time: November 3rd
Wheat varieties planted: PBW 502- 4 acre, HD 2967- 11 acre

Crop health was very good. No disease was observed. It was told that one spray of propiconozole and one spray of monocrotophos have also been done. Some aphid infestation was seen.

-Sri Dilsher Singh Cheema, Bajpur
Sowing time: November 1st fortnight
Area under wheat: 90 acre (all under seed production)
Wheat varieties planted: PBW 154- 70 acre, PBW 343- 20 acre
Crop health was very good. No disease was observed. It was told that two sprays of propiconozole, one spray of Torpid (for the control of aphid) one spray of mancozeb @0.2% (for the control of powdery mildew) have been done. Besides these he has applied some growth hormones, Hydropro and Hydrocab each @ 300ml/acre.

-Sri Surjit Kumar Dabur, Gadarpur
Sowing time: November 1 & 10
Wheat varieties planted: HD 2967- 21acre, PBW 226- 1 acre, PBW 343- 1acre
Crop health was very good. No disease was observed. It was told that two sprays of propiconozole and one spray of Ameda and Thiomexone each has been done.
Sri Dabur is a progressive farmer and he made the following suggestions:

- Weekly advisory for the farmers in News Paper for the control of disease and pests.
- Farmers should be invited at least for one day in the training programmes organized by Centre of Advanced Studies of Agronomy and Plant Pathology of the University.
- Development of water logging tolerant varieties of wheat.

In this area none of the wheat fields was seen with rust or any other disease. Some powdery mildew infestation was seen in the wheat grown under popular trees in agro-forestry system.

Route on 27th February Pantnagar – Khatima area was surveyed in route a number of wheat fields with sole cropping and also in agro-forestry system were observed for rust and other diseases. Five farmers with the following details were also contacted:

1. Shankar Farm, Kichchha, Udham Singh Nagar
Sowing time: November 2nd week
Wheat varieties planted: HD 2967- 10 acre
Crop health was good. Yellow rust was observed up to 5S. No spray was done till date. No other disease was observed. Farmer was suggested to spray the propiconozole.

2. Sri Bhupendra Singh, Uttam nagar, Udham Singh Nagar
Sowing time: November
Wheat varieties planted: WH 1105- 8 acre, PBW 154- 7 acre, PBW 343- 10 acre.
Crop health was good. No disease was observed. It was told that two sprays of propiconozole and one spray of Thiomexone have been done.

3. Sri Sikander Singh, Basi Farm, Kichchha
Sowing time: November 2nd week
Wheat varieties planted: PBW 343- 14 acre.

Crop health was good. No disease was observed. It was told that two sprays of propiconozole for the control of rust and one spray of Thiomexone for the control of aphid have been done.

4. Vidora, Majhola, Nanakmata
Sowing time: November 1st week
Wheat varieties planted: HD 2967- 5 acre.
Crop health was good. No spray was done. Yellow rust was seen in trace.

5. Sri Hira Singh Dhami, Vill. Sara Sariyca, Nanakmata
Sowing time: November 2nd week
Wheat varieties planted: PBW 343- 1 acre.
Crop growth was medium. Yellow rust was seen from 5S to 15S and powdery mildew was up to 7. No spray was done for the control of disease or pest.

Farmers were suggested not to grow old and susceptible varieties like PBW 343, PBW 154 and also not to apply chemicals in excess doses.

Route on 23rd March, Pantnagar – Gadarpur

At Pantnagar in different trials and germplasm accessions heavy infestation of brown rust was observed and in some entries second flush of yellow rust was also seen. Therefore, a visit was made by Dr. J.P. Jaiswal to Gadarpur area (30 km away from Pantnagar) on 23.3.17 and some wheat fields with late sown and timely sown crops were observed. However, no infestation of brown rust and yellow rust was observed as most of the crops were sprayed with propiconozole.

Photos of visits are attached.


A survey was conducted in the hilly region of Uttarakhand on 8th March 2017. Dr. Lakshmi Kant, Head, Crop Improvement Division and Dr. K.K. Mishra, Senior Scientist (Plant Pathology) from ICAR-VPKAS, Almora were the members of the team. At Baralgaon, Ganai (N 29°52’ 49”, E 79°22’14”, amsl 974 M), Almora, around 70 % area has been planted with VL *Gehun* 907 and the crop was flowering stage. In these fields, yellow rust symptoms upto 10S was observed.

Yellow rust symptoms on VL *Gehun* 907 leaves

Bihar
No report received

West Bengal
No wheat blast like disease reported from any other district except those already mentioned last month.

Assam
The survey and monitoring team did not find any wheat blast like diseases (WBLD).

Madhya Pradesh,
No report received since crop was at harvesting.

Jharkhand
Wheat crop health survey along West Bengal Borders in Jharkhand for wheat blast like diseases (WBLD) was conducted from March 24-26, 2017 by a team comprised of Dr. Prem Lal Kashyap, Scientist (Plant Pathology), ICAR-IIWBR, Karnal, Dr. H. C. Lal, wheat pathologist, BAU, Ranchi and Dr. Javed Bahar Khan, wheat pathologist, CSAUAT, Kanpur. On March 24, 2017, wheat fields located in the route of Ranchi to Shahibganj were visited and monitored for various diseases and insect pest infestation. At most of the visited fields, crop was at maturity or near to harvesting stage. The wheat crop was grown in patches near river beds and infection of leaf rust, stem borer and aphid infestation were recorded in the visited field. No symptoms of wheat blast like diseases (WBLD) were observed in the visited wheat fields.

On March 25, 2017, wheat fields were monitored from Shahibganj to Dumka route. In this region, wheat was grown mostly in river belt regions. The crop was at ear heading/ maturing stage. The diseases like leaf rust, foliar blight disease complex and insect infestation of stem borer and aphid were recorded.

On March 26, 2017, the wheat fields falling in the route of Dumka to Ranchi were monitored for foliar diseases, insect pest infestation and wheat blast like diseases (WBLD). The crop stand was good but at maturity or harvesting stage. The crop was majorly infested with leaf blights, aphids and stem borer infestations. At several places, leaf rust infection in wheat crop was also recorded. No wheat blast like diseases (WBLD) symptoms was observed in the visited wheat fields. The samples of leaf rust collected from various surveyed locations were sent for rust pathotypes analysis at ICAR-IIWBR, Regional station, Flowerdale, Shimla. During the whole survey, no symptoms of wheat blast like diseases (WBLD) were observed in the visited farmers' fields.





Location(s)	Geographical information	Crop health status
Dardog, Aurnmanji	N 30.47325; E 085.47719	No WBLD symptoms, Stem borer infestation
Gola-Baniyatu	N23.49806; E085.66033	No WBLD symptoms, Stem borer infestation (5%)
Kamta	N 23.51490; E 085.69443	No WBLD symptoms
Manpur	N 23.51.520; E 085.69440	No WBLD symptoms, Aphid (10-~15 aphids/ ear), leaf rust (traces)
Kairabari	N 24.12184; E 087.02033	No WBLD symptoms, Stem borer infestation (5%)
Golbazar	N 24.13762; E 087.03289	No WBLD symptoms, Stem borer infestation (5%), leaf rust (10S), leaf blight (02), Powdery mildew
Aluwada	N 24.34323; E087.36261	No WBLD symptoms, leaf rust (40S)
Mahadebganj	N 24.34330; E 087.58371	No WBLD symptoms, leaf blight (36)
Jhagruchauki	N 25.25618; E 087.58371	No WBLD symptoms, stem borer infestation (5%), foliar blight (5%)
Chanan	N 25.24086; E 087.66949	No WBLD symptoms, Foliar blight (03), leaf rust (traces)
Bandjhi	N 25.12413; E 087.65606	No WBLD symptoms, Foliar blight (24)
Machut	N25.06256; E 087.61953	No WBLD symptoms, leaf rust (traces), stem borer infestation (5%)
Tello	N25.00084; E087.58307	No WBLD symptoms
Kalidah	N24.48923; E087.62814	No WBLD symptoms, stem borer infestation (10%), foliar blight (35)
Raulagram	N24.48218; E 087.68970	No WBLD symptoms, leaf rust (60S), stem borer (10%), foliar blight (36)
Nandan Parha	N24.47714; E087.72552	No WBLD symptoms, leaf rust (traces), foliar blight (03), stem borer (5%)
Maheshpur	N24.47538; E087.75800	No WBLD symptoms, Foliar blight (12), Stem borer (5%)
Chanchki	N24.63992; E087.89375	No WBLD symptoms, leaf rust (10S)
New Chandpur, Chanchki	N24.64164; E087.88804	No WBLD symptoms, leaf rust (traces)
Dumka	N24.25412; E087.24390	No WBLD symptoms, leaf rust (traces), stem borer infestation (5%)
Pusabaihar	N24.33785; E087.18729	No WBLD symptoms, leaf rust (traces), stem borer infestation (5%)
Sindeeh	N24.38594; E087.09413	No WBLD symptoms, leaf rust (60S), stem borer infestation (15%)
Austhar	N24.36280; E087.12871	No WBLD symptoms, foliar blight (24), leaf rust (traces), stem borer infestation (5%)
Chandradeeh	N24.21978; E086.98350	No WBLD symptoms, aphid (15-20/ ear), stem borer infestation (5%)
Chitramoud	N24.14104; E086.90968	No WBLD symptoms, foliar blight (13), stem borer (5%)
Baliyapur	N24.10317; E086.91404	No WBLD symptoms, aphid (~10 aphids/ ear); stem borer (5%)
Ledatand	N24.10314; E086.91444	No WBLD symptoms
Madhupur	N23.92123; E086.13404	No WBLD symptoms, leaf rust (traces)

Karnataka

P. V. Patil from Dharwad reported that most of the fields were nearing maturity in Northern parts of Karnataka. However this year leaf rust was not observed in any of the farmers' field.

Maharashtra

Survey was conducted in Satara, Sangli, Kolhapur districts on 3/3/2017 and 4/3/2017, Pune, Ahmednagar, Nashik, Dhule, Jalgaon districts on 16/3/2017 to 18/3/2017 and Solapur, Osmanabad, Latur, Beed, Parbhani, Hingoli, Washim, Buldhana, Aurangabad, Jalgaon on 22/3/2017 to 24/3/2017 in Maharashtra states. Wheat crop was found healthy and free from rust disease. However, leaf rust was observed on off-type wheat plant in trace at few locations.

Gujarat

The wheat crop in Gujarat is free from any major pests. No any report of rusts (brown or black) is noticed till date in the state. The minimum as well as maximum temperatures were remained higher during second fortnight of March. This leads to forced maturity especially of late sown wheat crop. The harvesting of wheat crop in the state is in progress.

WEEKLY WEATHER DATA RECORDED AT WRS, VIJAPUR

DATE	MET WEEK	TEMPERATURE (^oC)			RELATIVE HUMIDITY (%)			RAIN-FALL	BSS
		MAX	MIN	MEAN	RH-I	RH-II	MEAN RH		
Feb 26-March 4	9	34.3	15.8	25.1	83.3	18.4	50.8	0.0	10.3
Mar 5-11	10	31.8	16.1	23.9	73.6	17.3	45.4	0.0	10.3
Mar 12-18	11	34.5	16.8	25.7	51.4	15.7	33.6	0.0	10.5
Mar 19-25	12	38.2	20.1	29.1	68.4	17.0	42.7	0.0	11.0
Mar 26-Apr 1	13	39.9	22.4	31.2	53.7	15.4	34.6	0.0	11.3

Acknowledgement:

Thanks to different cooperators, Drs. Lakshmi Kant, K. K. Mishra, S. P. Singh, M. K. Pandey, Jaspal Kaur, Ramanna Kaoulagi, Wasim Reza, J. P. Jaiswal, Kanak Srivastava, Swati, Sarjerao Sawashe, Charan Singh, V. Rathee, H. C. Lal, R. S. Kanwar, P.V. Patil, Javed Bahar Khan, S. I. Patel, R. Chatrath and R. Sendil. Thanks to Director, Agriculture, HP state Agriculture Department. Thanks to computer section of IIWBR for uploading the newsletter on web page.

Issued by: Crop Protection Programme, ICAR- Indian Institute of Wheat and Barley Research, Karnal- 132001
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