प्रगति प्रतिवेदन
Progress Report
2017-18

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

उन्नत तकनीकियों द्वारा किसानों की अधिक आय
Improved Technologies for Higher Income of Farmers

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
2017-18

CROP PROTECTION

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DPSingh

ICAR-IIWBR, Karnal
Dated: 18.07.2018

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

C O N T E N T S

PROGRAMME OF WORK, 2017-2018

The programme for the crop year 2017-2018 was chalked out in the 56th All India Wheat and Barley Research Workers Meet held at BHU Varanasi during August 25-28, 2017. The various activities to be executed at respective centres are given below:

PROGRAMME 1: STATUS OF DISEASE RESISTANCE IN THE ENTRIES OF PRE COORDINATED AND COORINATED YIELD TRIALS AND RELEASED CHECK VARIETIES, 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: Dharwad, Mahabaleshwar, Wellington, Powarkheda, Niphad and Indore (6)

(b) Leaf Blight: Faizabad, Pusa (Bihar), Varanasi, Kalyani (for Murshidabad) Sabour and Coochbehar (6)

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.

(a) **Rusts:**

North:
Stripe Rust: Dhaulakuan, Gurdaspur, Malan, Bajaura, Karnal, Delhi, Ludhiana, Pantnagar, Durgapura, Jammu, Kudhwani (Kashmir) (11)
Leaf Rust: Delhi, Hisar, Jammu, Kanpur, Karnal, Ludhiana, Pantnagar, Durgapura, Faizabad (for Ghagaraghat) (9)
South:
Leaf and Stem Rusts: Wellington, Mahabaleshwar, Niphad, Vijapur, Pune, Junagarh, Powarkheda, Dharwad and Indore (9)

(b) **Leaf blight (NIVT 1A, 1B, 3A):** Kalyani, Coochbehar, Pusa (Bihar), Faizabad, Varanasi, Sabour, Shillongani (7)

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 rusts have to be recorded every month.

Monitoring of PPSN

The teams of Plant Pathologists and breeders were constituted during the work-planning meeting for effective monitoring and data recording in PPSN at various locations indifferent zones. The team consists of

NWPZ:

- Drs. Sudheer Kumar, Satish Kumar and M. K. Pandey will monitor PPSN at Dahulakuan, Ludhiana, Gurdaspur and Jammu centres.
- Drs. Vaibhav K Singh, Jaspal Kaur, Anil Kumar and P.L. Kashyap will monitor PPSN at Pantnagar.
- Drs.O. P. gangwar, Rajender Singh Beniwal, Vikram Singh and P.S. Shekhawat will monitor, Karnal, Hisar, Durgapura and Delhi centres.

CZ:

- Drs. Sudheer Kumar, K.K. Mishra, Gurvinder Singh Mavi, and I.B. Kapadia will monitor Vijapur, Junagarh, and Powarkhed
- Drs. D. P. Singh, T.L. Prakasha, Dr. S K Goyal, and S.I. Patel will monitor Indore centre

PZ:

- Drs. D. P. Singh, B. C. Game, Ajit Maruti Chavan, and B. K. Honarao will monitor PPSN at Mahabaleshwar, Pune and Niphad
- Drs. Sudheer Kumar, Dnyandeo A. Gadekar, and B.K. Honrao will monitor Dharwad centre

SHZ:

- Drs. Vaibhav K Singh, S. P. Singh, J. Nanjundan and K.K. Mishra (Almora) will monitor Wellington centre
- The Plant Pathologists and Breeders 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
Stripe rust - Ludhiana
Stem and leaf rusts -Mahabaleshwar
Stem rust -Indore

iv. APR: Race specific and slow rusting

1. **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)

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

3. **Stripe rust:** AVT entries of NWPZ and NHZ along with 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, 77-9, 104-2, 12-5
(ii)	Yellow rust:	46S119, 110S119, 47S103, 110S84
(iii)	Stem rust:	40A,11,42 and 117-6

v. Seedling Resistance Tests and postulation of Rust Resistance Genes

1. 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.

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

PROGRAMME 2: RESISTANT SOURCES TO DIFFERENT DISEASES AND THEIR UTILIZATION

i. **Elite Plant Pathological Screening Nursery (EPPSN):** The resources of resistance to three or two rusts identified in PPSN will be retested to confirm their resistance to rusts:

North: New Delhi, Malan, Karnal, Ludhiana, Pantnagar, Durgapura, Hisar, Chattha and Almora (9)

South: Wellington, Mahabaleshwar, Dharwad and Indore, Niphad (5).

ii. **Multiple Disease Screening Nursery (MDSN):** It will have sources of resistance to rusts and other diseases found earlier and will revalidate their status to different diseases:

Diseases

North: 14 Locations

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

Leaf rust: Karnal, Ludhiana, Delhi, Hisar

Karnal Bunt: New Delhi, Karnal, Ludhiana, Dhaulakuan, Pantnagar

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

Foliar blights: Faizabad, Varanasi, Coochbehar, Sabour, Hisar, Murshidabad (W.B.)

Loose smut: Hisar, Durgapura, Ludhiana, Almora

Flag smut: Hisar, Durgapura, Ludhiana

Head scab: Dhaulakuan, New Delhi, Gurdaspur

South: 4 locations

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

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

The confirmed sources of resistance will be multiplied and seed will be shared with breeders along with passport data in NGSN.

iii. LEAF BLIGHT

i. Leaf Blight Screening Nursery (LBSN): No. of Centres: 12

This nursery will consist of earlier identified resistant materials as well as the AVT's and NIVTs. 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 like symproms also.

NWPZ:	Pantnagar, Ludhiana, Karnal and Hisar.
NEPZ:	Varanasi, Faizabad, IARI Pusa, Coochbehar, Shillongani, Ranchi and Murshidabad (W.B.)
PZ:	Dharwad

iv. KARNAL BUNT

Karnal Bunt Screening Nursery (KBSN): This nursery will consist of the earlier identified resistant materials, released varieties alongwith AVT entries under artificially inoculated conditions.

Centres: Dhaulakuan, Ludhiana, New Delhi, Pantnagar, Hisar, Karnal and Jammu (7).

v. LOOSE SMUT

Loose smut Screening Nursery: It will contain resistant materials identified in the past released varieties and AVT Ist year entries of NHZ, NWPZ and NEPZ

Centres: Ludhiana, Almora, Durgapura and Hisar.

vi. 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 (7)

vii. Head Scab Screening Nursery: Gurdaspur, Dhaulakuan and New Delhi (AVT entries).

viii. Flag Smut Screening Nursery: Ludhiana, Hisar, Karnal and Durgapura (AVT entries).

ix. Foot rot: Dharwad, Indore (AVT entries)

x. Hill bunt: Malan, Bajaura and Almora (AVT entries NHZ).

PROGRAMME 3: CROP HEALTH

PRE- HARVEST CROP HEALTH MONITORING

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 2017 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 (last week of Dec. 2017): Drs. Sudheer Kumar, Vaibabh Kumar Singh, Jaspal Kaur, & Ritu Bala

(Punjab and Haryana at strategic locations)

Team II (second week of Jan. 2018): Drs. P.L. Kashyap, O. P. Gangwar, M. K. Pandey

Karnal- Ambala-Khanna- Ludhiana-Phillaur-Jalandhar-Dhilwan-Amristsar-Batala-Gurdaspur-Kathua-Jammu

Team III (last week of January, 2018): Drs. Sudheer Kumar, P. Prasad, R.S. Beniwal

(Karnal to Rupnagar via Indri, Ladwa, Yamunanagar, Bilaspur, Sadhaura, Naraingarh, Panchkul and Kharar-Garhshankar, Nawanshahar, Machhiwara, Samrala, Khanna, Ambala, Kurukshetra)

Team IV (Second week of Feb. 2018): Drs. D. P. Singh and Charan Singh (Karnal-Muzaffarnagar, Western U. P.)

Team V (Fourth week of Feb., 2018): Drs. Poonam Jasrotia, Beant Singh and P.S. Shekhawat (Haryana, West U. P. and Uttarakhand)

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 will be recasted.

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.

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

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. Sudheer Kumar, A. K. Gupta and Dhiman Mukherjee

Team 2: Drs. P.L. Kashyap, Vaibhav Singh, Javed Bahar Khan and Satyajit Hembram

Team 3: Drs. D. P. Singh, S. S. Vaish and Dhiman Mukherjee

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

POST- HARVEST CROP HEALTH MONITORING

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 4: INTEGRATED DISEASE MANGEMENT

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

Chemical control of leaf and spike diseases of wheat: Chemical control of leaf and spike diseases: This will be planted in west Bengal at 4 locations in Nadia, Murshidabad and Malda districts.

Chemical control of stripe rust: New chemicals will be tested at Karnal, Hisar, Ludhiana, Durgapura and Jammu.

PROGRAMME 5. WHEAT NEMATOLOGY

i. Monitoring of Nematodes:
Anguina tritici & Heterodera avenae: Durgapura, Ludhiana and other centres
ii. Evaluation of resistance against nematodes parasitizing wheat
Heterodera avenae: Hisar, Durgapura and Delhi
Heterodera filipjevi: Ludhiana
Meloidogyne graminicola: Ludhiana and Hissar
iii. Eco-friendly management of CCN nematodes in wheat
Centres: Durgapura, Hisar, Ludhiana
(To be coordinated by Hisar centre)
iv) Differentiation of CCN biotypes of Durgapura, Ludhiana, Hissar using molecular techniques Centre: Ludhiana

PROGRAMME 6. WHEAT ENTOMOLOGY

A. HOST PLANT RESISTANCE: Entomological screening nurseries (ESN), Multiple pest screening nurseries (MPSN), National initial varietal trial nurseries (NIVT) and special screening nurseries of promising entries identified during previous season

A1: Entomological screening nurseries (ESN)- In these nurseries, AVT I year, AVT II year along with those found resistant during previous years will be screened for

a) Shoot fly (**Centres**: Dharwad, Ludhiana, Kanpur, Niphad)
b) Brown wheat mite (**Centres**: Durgapura and Ludhiana)
c) Wheat Aphids (**Centres**: Niphad, Ludhiana, Karnal, Shillongani, Pantnagar and Kharibari)
d) Root aphid (**Centres**: Karnal and Ludhiana)

The NIVT entries will also be screened against foliar aphids at Niphad, Ludhiana and Karnal

A2: Multiple pest screening nurseries (MPSN)- In these nurseries, the germplasm having resistance to multiple diseases and insect-pests will be screened for

a) Shoot fly (**Centres**: Dharwad, Ludhiana, Kanpur and Niphad)
b) Brown wheat mite (**Centres**: Durgapura and Ludhiana)
c) Foliar aphids (**Centres**: Niphad, Ludhiana, Karnal, Shillongani, Pantnagar and Kharibari)
d) Root aphid (**Centres**: Karnal and Ludhiana)

B. INTEGRATED PEST MANAGEMENT

B1: Survey and surveillance of insect-pests and their natural enemies in wheat and barley cropping systems *(All centres)*

Roving surveys will be carried out at fortnightly intervals during the cropping season in wheat and barley crops for insect-pests and their natural enemies. Population and damage levels of different insect-pests will be recorded and indicated as grades or percent damage inflicted to crop. The peak period of pest activity and its severity of damage will also be recorded.

B2. Influence of sowing time on the incidence and population build-up of major insect pest of wheat (**Centres**: Karnal, Niphad, Ludhiana, Kharibari)
The effect of sowing time on the population build-up of major insect-pests of wheat will be studied at four geographical locations to better understand the insect-pest behaviour under different climatic conditions

B3. Evaluation of trapping efficiency of different type of insect-traps for aphids (New trial) (**Centres**: Niphad, Ludhiana, Karnal)
Different types of traps viz., tray-traps, sticky-traps and pheromone lures and their placement in the crop will be tested to determine the efficiency of traps to capture aphids in the field. The criterion of trap colour, material and cost of trap will be considered for selection of traps for the experiment. The population of alate (winged) and wingless forms of aphids captured in traps will be recorded during the season.

B4. Effect of varied nitrogen fertilization on aphid and termite infesation in wheat (New trial) (**Centres:** Karnal, Ludhiana, Niphad)
Impact of three different doses (low, medium & high) of nitrogen application on population abundance of foliar aphid and termites will be investigated in wheat. The nitrogen doses for NWPZ locations will be 0, 75,150 and 225 kg/ha while for PZ location, it will be 0, 60,120 and 180 kg/ha. Population of aphids per plant, natural enemies (adult and grubs) per plot, yield per treatment and nitrogen status of plants before the treatment and at the time of harvest will be recorded to determine the individual effect of each dose of Nitrogen application on aphid abundance. To know effect of nitrogen fertilization on termite infestation the observations on plant population per meter row length, per cent damaged shoots and effective tillers in each treatment will be taken at different stages of crop along with yield at harvest.

B5. Basic studies for development of IPM strategies (**Centres**: Karnal, Niphad, Ludhiana, Kharibari)
The study will be conducted to generate region-wise data on population dynamics of major insect-pests of wheat and barley for developing pest-forcasting models. Weather parameters of a location will be correlated with insect population to determine the effect of climatic variations on the pest population dynamics under changing climate scenario.

B6. Zone specific IPM modules (**Centres:** Karnal, Niphad, Kanpur)
The integrated pest module consisting of effective cultural, physical, biological and chemical components of integrated pest management will be formulated and tested against major pests of wheat viz., foliar aphids, shootfly and termites.

B7. Eco friendly management of foliar aphid (**Centres:** Karnal, Ludhiana, Niphad, Kharibari and Pantnagar)
New bio-pesticides and new chemicals at lower doses will be evaluated against foliar aphids in wheat. Insect population counts before and after the treatment will be recorded along with yield in each treatment.

B8. Eco friendly management of termites (**Centres:** Durgapura, Kanpur, Ludhiana and Vijapur)
Few selected new chemicals along with botanicals as seed treatment will be tested against termites. The observations on plant population per meter row length, per cent damaged shoots and effective tillers will be taken at different stages of crop.

C. STORED GRAIN PEST MANAGEMENT

C1. Studies on the insecticidal treatments on seed viability during storage under ambient condition against store grain pests, *Trogoderma granarium* or *Rhizopertha dominica* (**Centres:** Karnal and Niphad)

Plants having toxicity effects on insects will be tested as seed protectant to wheat seed/grains against major stored grain insect pests; *Sitophilus oryzae* or *Rhizopertha dominica*

Summary of trials and nurseries allotted and conducted at different cooperating centres during 2017-18 in Crop Protection Programme (Plant Pathology & Nematology)

S. No.	CENTRE	COOPERATORS	NAME OF NURSERIES & TRIALS	Total trials/nurseries		Data not considered	Data not received
NHZ				**Allotted**	**Conducted**		
1.	Almora	K.K. Mishra	MDSN, EPPSN, PMSN, LSSN, HBSN	5	5	EPPSN, PMSN, MDSN(PM)	
2.	Dhaulakuan	V.K. Rathee	IPPSN, PPSN, MDSN, KBSN, PMSN, FHB	6	5	PPSN, KBSN, MDSN(PM), MPSN, MDSN(KB), IPPSN (YR)	FHB
3.	Malan	Sachin Upmanyu, Akhilesh Singh	IPPSN, PPSN, MDSN, EPPSN, PMSN, HBSN,	6	6	PMSN, IPPSN (YR), EPPSN, PPSN(SR)	
4.	Bajaura	Rakesh Devlash	PPSN, PMSN, HBSN	3	3	PMSM	
5.	Shimla	S.C.Bhardwaj, Pramod Prasad, O.P. Gangwar, Hanif Khan, Subodh Kumar	PMSN, SRT, APR	3	3		
6.	Kudwani (J & K)	M. Najeeb Mughal	PPSN	1	1		
NWPZ							
1.	Chattha (Jammu)	M. K. Pandey	IPPSN, PPSN, MDSN, EPPSN, KBSN, LSSN,CHEMICAL CONTROL OF STRIPE RUST	7	7		
2.	Ludhiana	Jaspal Kaur, Ritu Bala, Ramanna Koulagi	IPPSN, PPSN, LBSN, MDSN, EPPSN, KBSN, LSSN, FSSN, APR, FLAG SMUT CHEMICAL CONTROL, CCNSN, SYSTEM BASED RESEARCH, NEMATODE SURVEY,CHEMICAL CONTROL OF STRIPE RUST	14	14		

S. No.	CENTRE	COOPERATORS	NAME OF NURSERIES & TRIALS	Total trials/nurseries		Data not considered	Data not received
3.	Gurdaspur	Jaspal Kaur	IPPSN, PPSN, FHB, MDSN	4	2		FHB, MDSN(FHB)
4.	Pantnagar	J. Kumar, Deepshikha, K.Srivastava	PPSN, LBSN, MDSN, EPPSN, KBSN, PMSN	6	6		KBSN, MDSN(KB)
5.	Duragupra	P.S. Sekhawat, S.P. Bishnoi	IPPSN, PPSN, MDSN, EPPSN, LSSN, FSSN, FLAG SMUT CHEMICAL CONTROL, NEMATODE SURVEY, CCNSN	9	7		IPPSN,PPSN (LR)
6.	Karnal	D.P.Singh, Sudheer Kumar, Poonam Jasrotia, P.L. Kashyap, G. P. Singh	IPPSN, PPSN, LBSN, MDSN, EPPSN, KBSN, FSSN, CHEMICAL CONTROL OF FLAG SMUT, CHEMICAL CONTROL OF STRIPE RUST	9	8		KBSN
7.	New Delhi	M. S. Saharan, V.K. Singh, Pankaj	IPPSN, PPSN, MDSN,EPPSN, KBSN, APR, FHB, CCNSN	8	8		
8.	Hisar	R.S. Beniwal, R. S. Kanwar, Priyanka	LBSN, EPPSN, IPPSN, PPSN, LSSN, FSSN, MDSN, KBSN, CHEMICAL CONTROL OF FLAG SMUT, ECO FRIENDLY NEMATODE MANAGEMENT, SYSTEM BASED RESEARCH ON NEMATODES, CCNSN, CHEMICAL CONTROL OF STRIPE RUST	13	13	IPPSN (LR), EPPSN(YR), MDSN(LR)	
NEPZ				**Allotted**	**Conducted**		
1.	Faizabad,	S.P. Singh, J. Verma	IPPSN, LBSN, MDSN, PPSN, NIVT	5	5		
2.	Varanasi	S.S. Vaish	IPPSN, LBSN, MDSN, SYSTEM BASED RESEARCH, NIVT	5	5	MDSN(LB)	
3.	Coochbehar	Satyajit Hembram	IPPSN, LBSN, MDSN, NIVT	4	4	LBSN	
4.	Ranchi	H.C. Lal	LBSN	1	1	LBSN	
5.	Shillongani	R. Chakravarty	LBSN, NIVT	2	2	LBSN	
6.	Kalyani	Sunita Mahapatra, Dhiman Mukherjee	IPPSN, LBSN, NIVT, MDSN, Chemical control of spike diseases, survey	5	5	IPPSN, NIVT(LB)	

S. No.	CENTRE	COOPERATORS	NAME OF NURSERIES & TRIALS	Total trials/nurseries		Data not considered	Data not received
7.	IARI, Pusa	T.R. Das	IPPSN, LBSN, NIVT	3	3	LBSN, IPPSN(LB), NIVT(LB)	
8.	Kanpur	Javed Bahar Khan	PPSN	1	1		
9.	Sabour	C.S. Azad	IPPSN, MDSN, LBSN, NIVT	4	4	MDSN(LB)	
CZ							
1.	Indore	T.L. Prakasha	IPPSN, PPSN, MDSN, EPPSN, APR, FRSN	6	6		
2.	Powarkheda	K.K. Mishra	IPPSN, PPSN, APR	3	3	IPPSN(LR)	
3.	Vijapur	S.I. Patel	PPSN	1	1		
4.	Junagarh	I.B. Kapadia	PPSN	1	1	PPSN	
PZ & SHZ							
1.	Dharwad	P. V. Patil	LBSN, EPPSN, FRSN, PPSN	6	6	LBSN	
2.	Wellington	P. Nallathambi, C. Umamaheshwari, J. Berliner	PPSN, EPPSN	4	4	PPSN(SR), EPPSN	
3.	Mahabaleshwar	S.G. Sawashe, N. V. Savant, M. A. Gud, T.K.Narute	IPPSN, PPSN, EPPSN MDSN, SRT, APR	6	6	IPPSN(SR), PPSN(SR), SRT (NIVT)	
4.	Niphad	B.C. Game, P. E. More	IPPSN, PPSN, EPPSN MDSN	4	4		
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								
1	Ludhiana	Beant Singh	ESN, NIVT, MPSN	3	3		8	8
2	Duragupra	A.S. Baloda	ESN, MPSN	2	2		2	2
3	Karnal	Poonam Jasrotia	ESN, NIVT, MPSN	3	2		9	9
NEPZ								
1	Shillongani	K.K. Samra	ESN,MPSN	2	2		1	1
2	Kanpur	J.K. Singh	ESN,MPSN	2	2		5	5
3	Kharibari	Wasim Reza	ESN, MPSN	2	2		3	3
CZ								
1	Vijapur	A.A. Patel	-	-	-		4	4
PZ								
1	Dharwad	P.V. Patil	ESN, MPSN	2	2		1	1
2	Niphad	Sanjay D. Patil	ESN, NIVT, MPSN	3	3		9	9

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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 varieties 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 of promotions 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 2017-18 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 happens 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 (www.iiwbr.org). Likewise, advise was given to farmers on crop health management on Tool free No.18001801891. 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 highlights of achievements of programme for 2017-18 are given 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 and Karnal centre against stripe rust.

Entries and check varieties identified resistant in PPSN:
Rust Resistance materials in AVT entries (2017-18) with ACI upto 10.0 are given below:

Stem, Leaf and Stripe Rusts

HPW 349 (C), HPW 442, HS 662, HS660, HS661, HPW 459, PBW 763, PBW 801, PBW 771, DBW 237, HI 1620*, DBW 187, HD 3171 (C),UAS 465 (d), MPO 1343 (d),DDW 47 (d), MPO 1336 (d), UAS 446 (d) (c), HI 8805 (d), HI 8802 (d) and PBW 757

Stem and Stripe Rusts

HPW 349 (C), HPW 442, HS 662, HPW 459, PBW 763, PBW 801, PBW 771, DBW 237, HI 1620*, DBW 187, HD 3171 (C),UAS 465 (d), MPO 1343 (d),DDW 47 (d), MPO 1336 (d), UAS 446 (d) (c), HI 8805 (d), HI 8802 (d) and PBW 757

Stem and Leaf Rusts

HS 542 (C), HS 664, UP 3016, VL 1014, VL 829 (C), HPW 251 (C), VL 907 (C), HS 507 (C), HPW 442, HS 662, HS 490 (C), VL 892 (C), HS 661, HS 660, DPW 621-50 (C), PBW 763, HD 2967 (C), PBW 801, DBW 88 (C), PBW 771, WH 1021 (C), DBW 173 (I) (C), DBW 237, HI 1620HI 1628,

NIAW 3170, HD 3249, HD 3254, DBW 39 (C), HD 2967 (C), DBW 187, DBW 223, HD 2888 (C), K 1317 (C), K 8027 (C), HI 1628, GW 1339 (d), AKAW 4924, HI 8713 (d) (C) HI 1544 (C), GW 495, UAS 465 (d), MPO 1343 (d), DDW 47 (d), MP 3288 (C), HI 8627 (d) (C), UAS 466 (d), NIAW 3170, AKAW 4924, GW 491, GW 493, HI 1624, MACS 6222 (C), GW 495, MACS 3949 (d) (C), HI 8800 (d), HI 1625, PBW 770, GW 492, GW 1346 (d), MPO 1336 (d), UAS 446 (d) (c), HI 8805 (d), MACS 4059 (d), NIAW 3170, HI 8802 (d), DDK 1029 (C), MACS 6222 (Ae.) (C), MACS 5051, HW 4101, DDK 1054, HW 1098 (C) and PBW 757

Leaf and Stripe rusts
HS 666, HS 665, VL 1015, HPW 450, HPW 451, HPW 349 (C), HPW 442, HS 662, HPW 459, BRW 3792, PBW 763, PBW 766, HD 3226, PBW 801, PBW 800, PBW 771, PBW 752*, DBW 237, WH 1080 (C), HI 1620*, DBW 187, HI 1628, UAS 465 (d), MPO 1343 (d), DDW 47 (d), MPO 1336 (d), UAS 446 (d) (c), HI 8805 (d), HI 8802 (d), PBW 757, HI 1621, PBW 777 and HD 3298

Leaf blight resistance materials in AVT entries (2017-18)

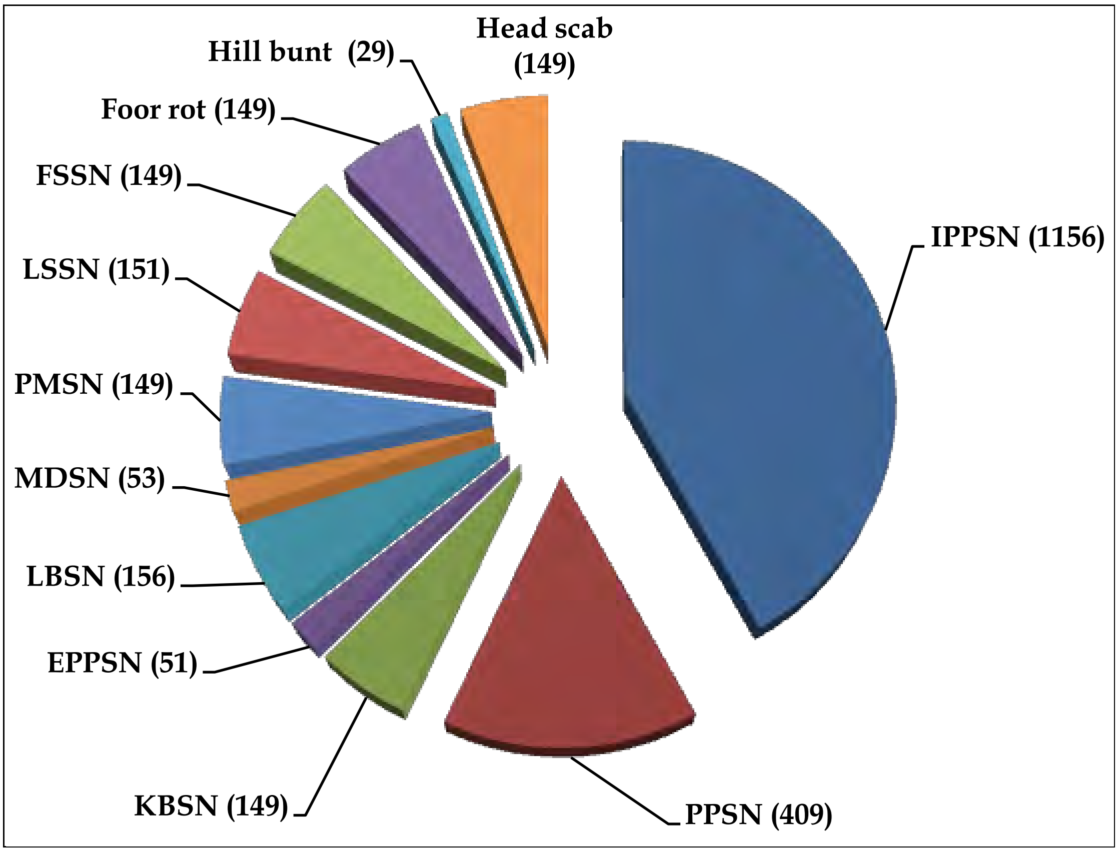
The entries from AVT II year and AVT I year which showed the moderate level of resistance within average score below 35 and the HS of 57 are VL 1015, HS 542 (C), VL 1014, HS 507 (C), UP 3017, PBW 800 and HPW 451. The entries PBW 763, VL 829 (C), HS 666, HS 664, HPW 349 (C), VL 907 (C), HD 2967 (C), HD 2967 (C), HPW 450, VL 1016, UP 3016, and HI 1612 (C), entries also showed moderate resistance to leaf blight with average score upto 35 but the highest score exceeded 57 due to high disease at one locations.

Karnal bunt (KB) resistance materials in AVT entries (2017-18)
KB free: MACS 5051, HW 4101, DDK 1054 and HW 1098 (C)

Resistant (average incidence upto 5%): HS 665, HS 562 (C), VL 3017, UP 3017, VL 3016, HS 490 (C), VL 892 (C), VL 3018, HPW 459, DBW 222 , BRW 3792, DBW 233, HD 3226, PBW 801, DBW 88 (C), PBW 800, DBW 90 (C), DBW 173 (I) (C), PBW 773, DBW 237, WH 1142 (C), WH 1080 (C), HD 3237, PBW 644 (C), HI 1628, DBW 233, HD 3254, K 1006 (C), HD 2733 (C), PBW 769, DBW 39 (C), DBW 187, DBW 223, PBW 762, WH 1218, HI 1628, UAS 465 (d), MPO 1343 (d), DBW 110 (C), DDW 47 (d), MP 1331, MP 3288 (C), HI 8627 (d) (C), UAS 466 (d), NIAW 3170, GW 491, GW 493, MP 1338, HI 8800 (d), MACS 6478 (C), MACS 6709, UAS 428 (d) (C), GW 492, AKDW 2997-16 (d) (C) , UAS 446 (d) (c), HI 8805 (d), MACS 4058 (d), MACS 6696, DBW 93 (c), MACS 6695, HI 8802 (d), DDK 1029 (C), MACS 6222 (Ae.) (C), WR 544 (C), HD 3271, PBW 757, DBW 278, DBW 14 (C) and HD 3298

Powdery mildew (PM) resistance materials in AVT entries (2017-18)
Resistant Entries (Av. score 0-3, highest score upto 5)**:**
HPW 451, VL 1014, HPW 251 (C), HPW 349 (C), HS 634, HS 507 (C), HPW 441, HPW 442, HS 562 (C), HS 662, HS 490 (C), VL 892 (C), HS 661, HS 660, HPW 459, DPW 621-50 (C), BRW 3792 , PBW 766, HD 3086 (C), HD 3226, WH 1124 (C), DBW 90 (C), DBW 252, K 1601, PBW 769, K 0307 (C), DBW 187, WH 1218, BRW 3806, K 1317 (C), DBW 252, HD 3171 (C), GW 322 (C), HI 8713 (d) (C), MPO 1343 (d), DBW 110 (C), MP 1331, MP 3288 (C), DDK 1029 (C), HW 4101, HW 1098 (C), HD 3271, PBW 757 and HD 3298
(C)-*Released check*

Seedling resistance in wheat genotypes
For identification of rust resistant lines of wheat and characterize rust resistance genes, 149 lines of AVT were evaluated at seedling stage using an array of pathotypes of black (*Puccinia graminis* f.sp. *tritici*) (Pgt), brown (*P. triticina*) (Pt) and yellow rust (*P. striiformis* f.sp. *tritici*) (Pst) having varying avirulence/virulence structures. These studies were conducted under controlled conditions of temperature and light. Two lines HS661 and PBW763 were resistant to all the pathotypes of three rust pathogens. Additionally, all the lines having *Sr31* were resistant to black rust of wheat, whereas lines possessing *Lr24*, some with *Lr26* were resistant to brown rust.



Constitution of different plant pathological nurseries during 2017-18

Rust resistance in AVT lines

Rust resistance to all the pathotypes of brown, black and yellow rust pathogens was observed in the two AVT wheat lines HS661 and PBW763. Eight entries *viz.* AKAW4924, GW491, GW492, GW493, GW495, HI1544, HI1625 and MACS6222 possessed resistance to all the pathotypes of brown and black rust pathogens, whereas one entry VL1016 showed resistance to all the pathotypes of black and yellow rust pathogens. Twelve entries *viz.* GW1339, HI1624, HS665, HS666, MACS3949, PBW757*, PBW770, PBW771, PBW777, PBW797, UAS446 and VL3018 expressed resistance to all Pt pathotypes, ten entries *viz.* DBW110, HD3226, HD3237, HI1628, HS542, HS634, K1317, MP1338, MP3288 and PBW769 showed resistance to all the Pgt pathotypes and five entries *viz.* PBW752, PBW762, PBW800, PBW801 and VL1015 were resistance to all Pst pathotypes.

Brown , Black and Yellow rusts:	HS661, PBW763
Brown & Black rust :	AKAW4924, GW491, GW492, GW493, GW495, HI1544, HI1625, MACS6222,
Black &Yellow :	VL1016
Brown rust :	GW1339, HI1624, HS665, HS666, MACS3949, PBW757*, PBW770, PBW771, PBW777, PBW797, UAS446, VL3018
Black rust :	DBW110, HD3226, HD3237, HI1628, HS542, HS634, K1317, MP1338, MP3288, PBW769
Yellow rust :	PBW752, PBW762, PBW800, PBW801, VL1015

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, 2017-18
A. Resistant sources identified

Resistant to all the rusts:
DWR 251, HI 8791(d), HS 611, PBW 777, PBW 778, TL 3011(T), TL 3012(T), TL 3013(T), TL 3014(T), TL 3015(T), UAS 462(d), VL 3014, DBW 246, HS 645.

Resistant to stem and leaf rusts:
DDR 1052(dic.), DDR 1053(dic.), HS 644, HS 646, MACS 5047, MACS 6677

Resistant to leaf and strip rusts:
HD 3271, HI 1619, HPW 439, HS 648, KRL 370, PBW 780, WH 1316

Resistant to stem and stripe rusts:
UP 2993, VL 1011, VL 1012, HI 1620, IWP 5019, LINE 1172

MDSN (2017-18)

A. Resistant to stem, leaf and stripe rusts+

I. **Resistant to all three rust +PM+FS+KB+FHB**: PBW 725, TL 3006 (T), TL 3007 (T), VL 3012
II. **Resistant to all three rust +FS+KB+FHB:** PDW 344 (d), UAS 459 (d)
III. **Resistant to all three rust +PM+FS+KB:** HI 8774 (d), TL 3009 (T)
IV. **Resistant to all three rust +PM+FS+FHB:** HPW 433
V. **Resistant to all three rust +PM+FS:** HS 628, HS 623, HS 622
VI. **Resistant to all three rust +FS+KB**: RKD 283 (d)
VII. **Resistant to all three rust +PM+FS:** TL 3008 (T)
VIII. **Resistant to all three rust +FS+FHB:** WH 1310
IX. **Resistant to all three rust +PM+FHB:** DBW 220
X. **Resistant to all three rust +FS:** HPW 423, HI 8759 (d), HS 626
XI. **Resistant to all three rust +FHB:** PBW 760, HS 627, PBW 757
XII. **Resistant to all three rust**: PBW 756, WH 1216, WH 1184

B. Resistant to stem and leaf rust +

I. **Resistant to Stem and leaf rust +**LB+PM+FS+KB: VL 3011
II. **Resistant to Stem and leaf rust +**PM+FS+KB+FHB: MACS 5044 (dic.)
III. **Resistant to Stem and leaf rust** +PM+FS+KB: DDK 1051 (dic.)
IV. **Resistant to Stem and leaf rust** +FS+KB+FHB: MACS 5046 (dic.), VL 4001
V. **Resistant to Stem and leaf rust** +PM+FS: DBW 217
VI. **Resistant to Stem and leaf rust** +FS+KB: RKD 292 (d)
VII. **Resistant to Stem and leaf rust** +FS: AKAW 4842
VIII. **Resistant to Stem and leaf rust** +KB: WH 1215
IX. **Resistant to Stem and leaf rust**: DBW 179, PBW 621

C. Resistant to leaf and yellow rust +

I. **Resistant to leaf and yellow rust** +PM+FS: HPW 424
II. **Resistant to leaf and yellow rust** +FS+KB+FHB: UP 2954

D. Resistant to LB+

I. **Resistant to LB**+FS+FHB: WH 1184
II. **Resistant to LB**+KB: UP 2955

(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 d: *T. durum*. dic. *T. dicoccum*, C: released check variety, T: Triticale)

Utilization of resistance sources through NGSN
The confirmed sources of multiple disease and insect pest resistance were contributed in the NGSN and were planted at 30 breeding centers across different agro climatic zones of country

for their utilization in breeding for resistance to biotic stresses. All 23 entries were utilized in the range of 3.3 – 43.3% by the breeding centres. The most utilized entries at many centres were HPW 695, K 1315, K 1314, and HS 597. The Pawarkheda centre, utilized maximum 18 entries in their breeding programme followed by Sagar and Udaipur.

Rust resistance genes in AVT materials

Based on gene matching technique, rust resistance genes were characterized in the AVT lines of wheat. These studies were conducted under controlled conditions of temperature and light. Wherever required, the confirmatory and repeated testing was also undertaken to find out the consistency in the observations. Proper reference checks were maintained to ascertain the purity of pathotypes and behaviour of rust resistance genes. Based on the gene matching technique, rust resistance genes characterized in AVT wheat materials are discussed.

***Yr* genes**

Five patterns of *Yr* genes in different combinations or alone were inferred in 90 advance wheat lines. Among these, gene *Yr2* was characterized in 56 lines. Gene *Yr9* which is linked to *Lr26* and *Sr31* was identified in 17 lines. *YrA* was characterized in 12 lines. Gene combinations *Yr9+A*+ and *Yr9+18*+ were inferred in 2 and 3 lines, respectively.

***Lr* genes**

Lr genes were characterized in 83% of AVT lines. Eleven *Lr* genes (*Lr1, 2a, 3, 9, 10, 13, 18, 23, 24, 26* and *34*) were postulated either alone or in different combinations in 124 AVT lines. Among these *Lr13* was observed in 52 lines followed by *Lr23* and *Lr10* in 38 lines each, *Lr26* in 22 lines and *Lr1* in 17 lines. Other *Lr* genes like *Lr2a*, *Lr3*, *Lr9*, *Lr18*, *Lr24* and *Lr34* were postulated in 1-4 lines only.

***Sr* genes**

Stem rust resistance genes (*Sr* genes) were characterized in 78.53% lines of AVT. Twelve *Sr* genes (*Sr2, 5, 7b, 8a, 9b, 9e, 11, 13, 24, 28, 30* and *31*) were characterized in 117 AVT lines. *Sr2*, a known APR gene whose postulation is based on characteristic micro-flecking, was postulated in 36.9 % of the AVT lines. *Sr11* was identified in 40 AVT lines followed by *Sr7b* in 23, *Sr31* in 22 and *Sr28* in14 lines. *Sr9e* and *Sr9b* were characterized in five lines eachwhereas *Sr24* and *Sr30* were identified in 3 lines each. *Sr8a* and *Sr13* were postulated in eleven and seven 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 56th All India Wheat & Barley Workers' Meet held at BHU Varanasi Hisar during 25-28 August, 2017. 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. 23 which was issued during the crop season. This was also put on ICAR-IIWBR website (www.iiwbr.org). 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 so far.

Strategy Planning Meetings

(i). Planning meeting on "Seed Treatment of Wheat" in the office of DG, Agriculture, Govt. of Haryana, Panchkula on 19 July 2017 under chairmanship of Hon. Shri . **Dusmanta Kumar Behera, Director, Agriculture, Govt. of Haryana, Krishi Bhavan, Sector 21, Panchkula on 19**

July 2017: The meeting was attended by senior addl. and deputy directors of Agriculture and MD of Haryana Beej Corporation as well as Dr. R.S. Beniwal of CCS HAU Hisar. The issue of seed treatment of wheat seed produced by public sector units in Haryana was discussed at length and Dr. D. P. Singh PI (CP) supported fungicidal seed treatment keeping in view of presence of loose smut and flag smut in Haryana. It was agreed to treat the seed of wheat with recommended fungicides like tebuconazole 2DS, Carbendazim 50 WP and Carboxin 75 WP and tender the procurement of these using chemical name. Dr. D. P. Singh PI (CP) suggested not mentioning seed treatment for Karnal bunt since it may not work until and unless seed crop is given foliar sprays of fungicides like propiconazole @0.1% at ear emergence stage.

(ii). Preparedness on occurrence of blast disease on wheat: Strategy planning meetings was also conducted on "Preparedness on occurrence of blast disease on wheat" on 07.9.2017 in Kolkata under Chairmanship of Additional Chief Secretary, Govt. of west Bengal. It was attended by Agriculture Commissioner and Joint Secretary (Crops) DAC & FW, ADG (PP&B), Director, IIWBR and other higher officials of Govt of West Bengal, ICAR officials and SAUs. It was decided to keep no wheat zone up to 5 km distance from Border of Bangladesh in Indian states, prevent entry of wheat seed and grains from Bangladesh, wheat holiday in Nadia and Murshidabad districts as well as planting of trap plot nurseries along Indo-Bangladesh borders.

(iii). 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 10 October 2017 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 1500 farmers attended the fair. The seed of rust resistant varieties like WB 02 and HD 3086 was distributed. 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.

(iv). Management of yellow rust and Karnal bunt: Strategy planning meeting was conducted to "Evolving strategies for enhancing wheat production with special reference to management wheat rust and Karnal bunt disease"on 6.10.2017at IISR Lucknow, U. P. under the chairmanship of hon. Secretary (AC &FW). The overview was given by Director, IIWBR and states and SAUs of UP, Bihar, MP, Haryana, H.P and Punjab. The participants were informed about the yellow rust resistant varieties for different states and arranging corrections in the literature prepared by UP Plant Protection department. The meeting was also addressed by ACP, U. P., Secretary Agric. and Director, U. P. Govt. The Secretary AC & FW stressed the need of proper management of wheat diseases and lauded the efforts of IIWBR on evaluation and identification of wheat blast resistant wheat varieties. He stressed the need to increase the productivity in wheat in U.P. and in India so that excess grains may be exported. JS (Crops) of DAC & FW stressed the need to replace older and susceptible varieties of wheat with newly released varieties and exchange of information on diseases for their proper management at farmers' fields. Director, IIWBR Karnal offered help to all the wheat growing states and particularly to Haryana and U. P. in replacing old varieties of wheat and adoption of new technology in wheat production and protection.

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. 23 issues 1-5 in annexure.

The post harvest grain analysis for presence of Karnal bunt in grains of farmers' fields collected from different regions was done by different cooperating centres of All India Coordinated Research Project on Wheat and Barley during April-June 2018. The Karnal bunt incidence was lower as compared to previous years during 2017-18 crop season.

A total of 8079 grain samples collected from various mandies in different zones, and were analyzed at cooperating centers. Among different states samples taken from M.P., Gujarat, Maharashtra and Karnataka were found free from Karnal bunt infection. The overall infection was 21.8%. The samples from Haryana showed maximum infection (49.5%) followed by Rajasthan (49.0%) and Punjab (28.2%)

Pathotype distribution of wheat rusts during 2017-18

There was no major occurrence of wheat and barley rusts during 2017-18 in India. Incidence was far less than the earlier years and practically it was a rust free year. These diseases were kept under check with the help of cooperators, through exhaustive rust surveillance in different wheat growing areas of India and neighboring countries. Five hundred seventy one samples of wheat and barley rust, received from thirteen Indian states, Bhutan and Nepal were analyzed during the crop year.

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

During 2017-18, one hundred thirteen samples of yellow rust were analysed from seven Northern Indian states (Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Punjab, Haryana, Uttar Pradesh and Rajasthan), Bhutan and Nepal. Ten pathotypes were identified on the bases of Indian wheat stripe rust differentials. 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 (46.9%) followed by pt. 110S119 (31.9%). Barring 238S119, which was identified in 4% of the samples, remaining 7 pathotypes were observed in few samples only. It was also true for pt. 78S84 which was predominant up to 2010-11, was not observed in any of the yellow rust sample. *Puccinia striiformis* f. sp. *tritici* (Pst) population was found avirulent on *Yr5, Yr10, Yr15* and *YrSp*. From the analysis of barley yellow rust (*Puccinia striiformis* f. sp. *hordei*) samples, two pathotypes 0S0 (57) and 1S0 (M) were identified and found equally prevalent in India.

ii. Black rust of wheat (*Puccinia graminis* f. sp. *tritici*) (Pgt)

Seven pathotypes of black rust pathogen of wheat were identified from the analysis of 80 samples, received from five different Indian states and Nepal. Like previous years *Sr26, 27, 31, 32,35, 39, 40, 43, Tt3* and *Tmp* were resistant to the field population of black rust in India. Maximum black rust samples were received from Tamil Nadu and Karnataka. Pathotype 11 (79G31) with virulence to *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* and *SrMcN* was the most recurrent pathotype and observed in 60% of the samples analyzed from Gujarat, Karnataka, Maharashtra, and Madhya Pradesh. Pathotype 40A (62G29) was recorded in 24 samples received from Karnataka, Madhya Pradesh and Tamil Nadu. Other pathotypes such as 11A (203G15), 21 (9G5) 21-1(24G5), 117 (37G3), 117-6 (37G19) were observed in few samples only.

iii. Brown rust of wheat (*P. triticina*)

During 2017-18, eighteen pathotypes of wheat brown rust were identified from the analysis of 353 samples, received from eleven different Indian states, Bhutan and Nepal. No virulence was detected for leaf rust resistance genes *Lr9*, *Lr19*, *Lr*24, *Lr*25, *Lr*29, *Lr*32, *Lr*39, *Lr*45 and *Lr*47. More than 100 samples were analysed from Karnataka (146) and Tamil Nadu (102). Pathotypes 77-9 and 77-5 were the most predominant and were identified in 64 and 24% of the samples, respectively. Similar trend was observed during previous year. Remaining 16 pathotypes were confined to 22% of the samples only. Pathotype 77-9 was the most widely distributed than any other pathotypes as it was detected from ten states and Nepal followed by pathotype 77-5, which was spotted in eight Indian states and Bhutan. The reduction in the frequency of pathotypes 104-2 and 104-3 continued this year too. Pathotypes 12-3, 12-9, 104A, 104-3, 106 and 162-4, each was identified only in one sample.

50th wheat disease monitoring nursery (WDMN) 2017-18

Wheat disease monitoring nursery (earlier trap plot nursery/TPN) is an intelligent tool to monitor the occurrence and spreading pattern of wheat diseases especially rusts across different wheat growing zones of India. In addition, it helps to know the seasonal progress of the diseases in all the zones. Samples analyzed from WDMN give an overview of area wise natural distribution and load of different rust races. This nursery also helps in understanding the area wise progress of wheat diseases and the performance of different disease resistance genes/varieties. This is the golden jubilee year of WDMN/TPN as 50th wheat disease monitoring nursery was conducted at more than 40 locations, covering all the major wheat growing areas in the country, especially those situated near the bordering areas to the neighboring countries. The data have been received from 32 locations only.

Disease incidence in WDMN

The occurrence of wheat blast and *Sr31* virulences (Ug99 type of pathotypes) of black rust was not reported from any of the wheat growing zones of India. Yellow rust was noticed at all the locations of NHZ and NWPZ except Shimla, Abohar and Ropar. It was also observed at Kanpur in NEPZ. All the entries of WDMN at other locations of NEPZ, CZ, PZ and SHZ were yellow rust free. Moderate yellow rust severity was observed at locations of NWPZ and NHZ. More than 60S severity of yellow rust was reported from eleven locations of NHZ and NWPZ. More than nine entries of WDMN had more than 40S severity at Almora, Bajaura and Jammu. Barley Local and Kharchia Mutant had 100S yellow rust severity at Bajaura.

Brown rust was reported from nine locations of NHZ and NWPZ *viz*. Kathua, Rajauri & Jammu in J. & K., Almora and Pantnagar in Uttarakhand, Langroya & Gurdaspur in Punjab, Durgapura (Rajasthan) and Hisar (Haryana). It was reported from all the locations of NEPZ except Ranchi. In central zone brown rust appeared at Vijapur, Indore and Powerkheda and in PZ and SHZ at Dharwad, Pune and Wellington. At Wellington (SHZ) brown rust appeared on all the entries of WDMN.

Of the 32 locations of WDMNs, black rust was observed only at Powerkheda in CZ, Dharwad in PZ and Wellington in SHZ. Other zones i.e. NHZ, NWPZ, and NEPZ were black rust free. Leaf blight was reported from WDMNs planted at Almora, Kathua, Rajouri, Jammu (Udhaywalla), Sabour, Ranchi, Faizabad, Kanpur, Varanasi, Pune, and Wellington. Almora, Kathua, Rajauri and Jammu 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 Jammu (22.01.18) followed by Kathua (27.01.18), Pantnagar (02.02.18), Rajouri (16.02.18), Hisar (26.02.18), Ludhiana (27.02.18) and Durgapura (28.02.18). Brown rust was first observed at Pune (02.02.18) followed by Dharwad 03.02.18), Powerkheda (10.02.18), Vijapur (17.02.17), Indore (19.02.18), Varanasi (22.02.18), Sabour (05.03.18), Faizabad (08.03.18) and Kanpur (10.03.18). Black rust was first observed at Powerkheda on 18.02.18.

SAARC Wheat Disease Monitoring Nursery (2017-18)

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 2017-18, SAARC wheat disease monitoring nursery was planted at 29 locations across the six SAARC countries.

Wheat Disease Situation in SAARC countries

Disease situation in India

Rusts

SAARC nursery was planted at 14 locations of NHZ and NWPZ, Faizabad and Wellington (Table 4). Yellow rust was observed at all the SAARC nursery locations in India except at Abohar, Deenanagar, Faizabad and Wellington. Yellow rust was first observed at

Jammu (22.01.18), followed by Kathua (27.01.18), Pantnagar (02.02.18), Rajauri (16.02.18), Delhi (17.02.18) and Durgapura (01.03.18). All the entries of SAARC nursery were infected with yellow rust at Kathua, Jammu and Langroya. Eleven entries at Dhaulakuan & Ropar and ten entries at Langroya and Ludhiana had more than 40S yellow rust severity. At Almora all the entries except PBW660 and Chakwal86 and at Ludhiana all entries except HD2189 and PBW660 were observed to support high incidence of yellow rust. Maximum yellow rust severity (80S) was reported on PBW343 at Ropar, which had more than 20S severity at all the locations where yellow rust appeared except at Durgapura (10S) and Gurdaspur (5S). Yellow rust appeared only on PBW343 (20S), HD2687 (5S), Kohsar (5S) and Susceptible check (60S) at Delhi. Similarly at Durgapura yellow rust was observed on PBW343 (10S), Faisalabad85 (TMS), Inquilab91 (TMS), Rawal87 (TMS), Kohsar (TMR), Gourab (5S) and Check (20S) only. Entry PBW660 was resistance to yellow rust at all the locations except Kathua, Jammu and Langroya, where 5S severity was observed on it. More than 40S yellow rust severity was observed on entries PBW343, HD2687, HP1633, Raj3765, Faisalabad85, Inquilab91 and Gourab.

Brown rust was observed at all the SAARC nursery locations except at Dhaulakuan, Ludhiana, Ropar, Abohar and Deenanagar (Table 8.22). First report of brown rust was from Pantnagar on 19.02.18 followed by Faizabad (08.03.18), Durgapura (10.03.18), Jammu (13.03.18), Delhi (17.03.18) and Kathua (18.03.18). All the entries of SAARC-WDMN were brown rust free at Gurdaspur except HD2204. Similarly at Delhi brown rust appeared only on WL1562 and susceptible check whereas at Durgapura on PBW343 and susceptible check. Other entries were brown rust free at these locations. Brown rust appeared only on five entries (HD2204, Raj3765, Faisalabad85, Inquilab and susceptible check) at Rajouri. Maximum brown rust severity was reported from Wellington, where fifteen entries had more than 40S brown rust severity. HP1633 was brown rust free at all the locations except Faizabad and Wellington, where 5S and 20S severity of brown rust was reported on it, respectively. Similarly on PBW660 brown rust appeared only at Langroya (10S) and Wellington (5S).

Black rust was observed only at Wellington, in all the entries with severity ranged from 5S in Faisalabad83 to 80S on HP1633 (Table 8.21). The check entries, HP1633, Punjab85 and Chakwal86 had more than 40S black rust at Wellington.

Management of diseases 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 Chemical control is needed for the management of diseases in popular cultivars like which have become susceptible to new races of rusts. New molecules were also tested for stripe rust, spike diseases and flag smut management.

Spike diseases

The trial on chemical control was planted at four locations in West Bengal in Nadia and Murshidabad districts.The grain yield in case of Tebuconazole 50% + Trifloxystrobin 25% WG sprays @ 150+75 g a.i/ha, two sprays first at boot leaf and second 15 days thereafter, significantly increased (42.15 q/ha) as compared to unsprayed check (27.74 q/ha), on an average basis. The disease score was also reduced.

Yellow rust

Keeping in view of susceptibility of popular cultivar to new races of yellow rust, two readily available fungicides, Propiconazole and Trifloxystrobin+ Tebuconazole@ 0.6g/l, were applied on the wheat varieties PBW 343 and HD 2967. The first spray was applied at rust initiation and second and thirds at a gap of 15 days. The trial was conducted at Karnal, Jammu, Ludhiana, Hisar and Durgapura. Amongst different treatments (Figs. 9.3-9.4), the foliar sprays of propiconazole (0.1%) (3 sprays) were found best in PBW 343 whereas in HD 2967, three sprays of both propiconazole (0.1%) and Trifloxystrobin+ Tebuconazole@ 0.6g/l,were at par on an average of six locations.

Flag smut

The flag smut was controlled fully by seed treatment of Tebuconazole 2% DS (@0.1%), Difenoconazole 3% (Dividend) @ 0.1%) and Carboxin 75% WP @ 0.25% at Durgapura.
On an average, the incidence of flag smut was 1.2-2.2% in different treatments as compared to untreated control showing 28.0% infection

ENTOMOLOGY

(A) HOST PLANT RESISTANCE

Screening against Shoot fly

Based on the average incidence of shootfly at all locations, 93 AVT entries showed lower level of resistance (infestation < 10%) to shoot fly and remaining showed greater than 10% infestation.

At Niphad location, two entries *viz.* HS 665 & HPW 450 had lowest infestation of 1.66% whereas at Ludhiana, entry HS 490 (C) had lowest infestation of 6.06%. Two entries at Kanpur viz. DBW 278 & BRW 3806were recorded lowest infestation of 2.77% and at Dharwad entry, MPO 1336 (d) had lowest infestation of 1.50%. Amongst 149 tested, entries, the lowest infestation of shootfly i.e 7.32% was recorded in entry MACS 6695, while highest infestation of 14.16% was recorded in entry HS 660.

Screening against brown wheat mite

A total of 149 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, the maximum mite population was observed in BRW 3806 (68/10 cm2 area) while MACS 6709 (8/10 cm2 area) recorded the minimum mite population.

Screening against foliar aphid:

On the basis of average aphid score of five locations, amongst 149 AVT entries, entry NWTS 104 scored lowest (3.25). At Shillongani centre, two entries were found to be resistant (grade 2). These were DBW 222 and WH 1142 (C). Five entries viz. HS 662, VL 3018, DBW 222 HD 2967 (C), and UAS 465 (d) at locations Ludhiana and Karnal showed moderately resistance response to foliar aphid. However, at Kharibari, sixteen entries were found to be moderately resistant category and at location Niphad, all the entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category.

Amongst NIVT entries, three entries, GW 509, RKD 331 and PDW 355 showed the moderately resistance reaction (3.67 average score) to foliar aphid. At Niphad location, all the entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category and none of the entry was found to be in grade 3 or 2.

Screening against Root aphid:

Out of total 149 entries, two entries *viz.*UP 3017and HD 3237 showed the moderately resistance reaction at Ludhiana and rest of them were either susceptible (grade 4) or highly susceptible (grade 5) to root aphid.

Screening against multiple pests

Shoot fly: Out of tested entries, the average maximum score was observed in entry MACS 5044 (dic) and it was 28.35%. However, the minimum score of 6.30% was recorded for HI 8774 (d)

Brown wheat mite: Amongst tested entries, the highest population of 48.00 mites/ 10 cm^2 area was recorded for HPW 433 and lowest population of 4.00 mites/ 10 cm^2 was observed in entry VL 4001. Brown wheat mite population was highest (22.7 mites/ cm^2) on IWP 72(C) and lowest (10 mites/ 10 cm^2) on PBW 621 at Durgapura.

Foliar aphid: Based on average score of five locations, six entries *viz.*PBW 756, WH 1216, PBW 621, VL 4001, UP 2955, IWP 72 (C), VL 3011 scored 4.0 grade.

Root aphid: At Ludhiana, two entries viz. PBW 760, UP 2955 and UP 2954 was found to be moderately resistant (grade 3) to root aphid.Root aphid infestation was not observed on any genotype at Karnal.

(B) INTEGRATED PEST MANAGEMENT

In Punjab, the aphid incidence was above economic threshold level in some places viz. village Mullanpur & Jagraon (Ludhiana), Ajitwal & Dagru (Moga) and Salabatpura (Bhatinda) during the first week of March. The natural enemies viz. grubs and adults of coccinellid beetles, syrphid fly and chrysoperla were observed in some of the fields infested with aphids. The incidence of pink stem borer (PSB) was observed in patches and within patches the PSB damage varied from 1-5 per cent.

Medium to heavy incidence of aphids was recorded in Nasik district. The Coccinellid predator, grubs, beetles and Chrysopa feeding on the aphid infested fields were also observed. The incidence of jassids was recorded in medium intensity.

In Vijapur, the termite and aphid damage in wheat fields remained low to moderate throughout the crop season. The population of *H. armigera*, pink stem borer and surface grasshopper were very low. The sporadic incidence of army worm was reported from some areas of Saurashtra region. While, the other pests like thrips, shoot fly, brown mite, jassids and cut worm were in occasional and in negligible form.

In Rajasthan, survey of wheat and barley fields in Jaipur indicated moderate infestation of termite, mite *H. armigera* and Pink stem borer in wheat fields. While the incidence of other pests like *Spodoptera*, Surface gram hopper, shootfly and jassids was occasional and was in negligible form. The cutworm population was also observed in Tank bed condition of Tonk districts.

Moderate to severe incidence of wheat aphid and pink stemborer was observed in some village Kunjpura, Subhari, Racina and Hajwana etc of Karnal Incidence of foliar aphid, termites and pink stem borer was also recorded in Ladwa, Yamunanagar, Noorpur Bedi, Anandpur Saheb, Banur, Abhiyana Kalan Ropar and Bajrur, some places foliar aphid damage was recorded in some parts of Banur. The grubs and adults of coccinellid beetles were seen frequently in fields infested with aphids.

The early sown crop sown on November 1st had higher infestation of aphids, termites and pink stem borer infestation as compared to timely (November 16th) and late sown crops (December 1st &16th).

Different types of traps viz., sticky-traps and tray-traps and their placement in the crop was tested to determine the efficiency of traps to capture aphids in the field. The observation recorded clearly revealed that the number of aphids trapped more in yellow coloured traps were relatively higher than blue colour traps on all dates of observations. The efficiency of sticky traps was relatively better than tray traps.

Impact of three different doses (low, medium & high) of nitrogen application on population abundance of foliar aphid was investigated in wheat. The incidence of aphids and their natural enemies increased significantly with the increase in dosages of nitrogen level. Yields levels were also higher at higher nitrogen levels.

Population dynamics of foliar studied on wheat and barley crops revealed comparatively higher population of aphid 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.

The integrated pest modules tested against major pests of wheat viz., foliar aphids, shootfly and termites pink stem borer revealed comparatively lower pest popluation in IPM module treatment as compared to Farmer practice (FP). However, in FP treatment the population of natural enemies was little higher than IPM treatment.

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 treatment in reducing termite population.

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 reducing aphid population. The performance of *Azadirahctin* 1500 ppm, *Beauveria bassiana and Metarhizium anisopliae* was comparatively lower than chemical insecticides against aphids.Out of these three, *Azadirahctin* 1500 ppm was better than *Azadirahctin* 1500 ppm.

(C) STORED GRAIN PEST MANAGEMENT

Efficacy of various plant materials as seed protectant to wheat seed was evaluated against grain weevil (*Sitophilus oryzae* L.) and it was found that seed treatment with *Vekhand* powder and its combinations with Neem leaves, Jungli Imli and Gulwel powder proved to be significantly effective in controlling the population of grain weevil (*Sitophilus oryzae* L.) as compared to rest of the treatments.

Crop health monitoring survey for nematodes
Cereal Cyst Nematode (CCN)

Durgapura centre

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.

Hisar

Crop health monitoring survey for nematodes was done in Hisar and Fatehabad, districts. Cereal cyst nematode was reported in 39.5 % (19/48) samples. Number of cysts ranged from 1-26 per 200 cc soil. Other plant parasitic nematodes present in 200 cc soil samples were *Pratylenchus* sp., *Hoplolaimus* sp., *Helicotylenchus* sp. and *Tylenchorhynchus* sp. Wheat seed gall nematode (*Anguina tritici*) was not recorded from the state. Crop health monitoring survey for nematodes was done in the village namely Balsamand, Agroha, Mangali, Ratia, Kohli, Kharakheri, Bhodia Khera, Dhingsara, Bathu, Shekhupura, Dadoli and Dharnia of Hisar and Fatehabad district. Community analysis of plant parasitic nematodes associated with wheat in Hisar and Fatehabad district.

Ludhiana

Heterodera avenae cyst, species of *Meloidogyne, Tylenchorhynchus, Hirschmanniella, Helicotylenchus* and *Hoploloaimus* were recorded. *H* cysts were recorded from Ballowal, Saroya (Nawanshahr District), Gurdaspur, Kharal (Gurdaspur District), Purika, Dasuya (Hoshiarpur District) and Kishangarh (Jalandhar District). The number of cysts recorded was 1-3 cysts/250 cc soil. Root knot nematode was also recorded up to 110 larvae/250cc soil and *Tylenchorhynchus* was recorded from all the collected with the highest of 460 larvae/250cc soil.

Ear Cockle nematode (*Anguina tritici*)

A total of 2380 wheat grain samples were collected from 162 different grain markets of the Punjab State in the months of April, 2018 and were analyzed for ear cockle nematode. None of the samples showed incidence of ear cockle nematode.

Biotypes of *Heterodera avenae* at Durgapura

The pathotypes 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-estanzuellawhile rest showed susceptible reaction. Jaipur Population of CCN is Pathotype Ha 21.

Host resistance to CCN

One hundred forty nine wheat germplasms (AVT) were screened at Durgapura, Hisar and Ludhiana under naturally sick field against cereal cyst nematode.The inoculums level was 7.9 L/gm of soil. Out of 148 germplasm, one has been found resistant (PZ-RI-304), whereas, leleven germplasm showed moderately resistant reaction at Durgapura. None was resistant at other centres. In MDSN, entries WH 1181, HD 3043) were resistant whereas, five showed moderately resistant (Tolerant) reaction viz. PBW 756, TL 3006 (T), VL 3012, DBW 219, MACS 5046 (dic.),at Durgapura. Only eight entries namely HPPAU 05, WH 1216,WB 2,DBW 179,VL 4001,UP 2955, PDW 344 (d) and UP 2954 were moderately resistant at Ludhiana.

Root knot nematode: All entries of AVt were highly susceptible.

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

Hisar

Among all these experiment, minimum number of cysts was observed in neem oil @10 ml/kg seed treatment followed by castor cake @ 10 g/pot, 10 days before sowing. **Durgapura**

The maximum grain yield (35.70 q/ha) was recorded in Neem cake 5 q/ha +half dose of Neem oil with 7.22 cyst/ plant) with increase 92.97% in yield followed by Neem cake 10 q/ha (Grain yield – 32.0 q/ha; 9.22 cysts/plant). 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.

Training Programs

Skill up gradation course entitled "Survey and surveillance, creation of epiphytotics and uniform recording of diseases in wheat and barley from 18 - 20 December 2017 at ICAR-IIWBR Karnal

In total there are 30 officers dealing with crop protection from centres of AICWBIP, IARI, New Delhi and Indore, SAUs, CIPMC (DPP&Q) Kolkata, NSC Hisar, State Agric Departments, U. P., KVK, Saharanpur, U. P and State Agric. department Haryana. We could not accommodate another 20 participants applied this time and may be trained later.

Training course on ""Disease surveillance and wheat seed production" will be conducted for state agriculture departments, SAUs and farmers on 9 January 2018 at Bhola Paswan Shastri College of Agriculture (BAU), Purnea, Bihar: The state government officials of agriculture department and farmers were trained.

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PROGRAMME 1. HOST RESISTANCE: IPPSN AND PPSN

1.1 INITIAL PLANT PATHOLOGICAL SCREENING NURSERY (IPPSN)

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: 1156
No. of breeding centers: 32

TEST LOCATIONS
Rusts:
North:
Leaf Rust:Delhi, Hisar, Karnal, Durgapura and Ludhiana (5)
Yellow Rust: Gurdaspur, Dhaulakuan, Malan, Karnal, Durgapura, Ludhiana and Jammu (7)
South:
Stem Rust + Leaf Rust: Dharwad, Mahabaleshwar, Wellington, Powarkheda, Niphad and Indore (6)

Leaf Blight: Faizabad, Pusa (Bihar), Varanasi, Kalyani (for Murshidabad), Sabour and Coochbehar (6)

Data was not considered due to poor/erratic disease development from the following centres:
Yellow rust: Dhaulakuan and Malan
Stem and Leaf rust: Powarkheda
Leaf blight: Pusa (Bihar)
Data not received:
Leaf rust: Hisar and Durgapura

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)
40A, 11, 42 and 117-6
Mahabaleshwar
40A, 11, 42 and 117-6

LEAF RUST PATHOTYPES
Flowerdale (Shimla)
77-5 (121R63-1), 104-2(21R55), 77-9 and 12-5

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

STRIPE RUST PATHOTYPES
Flowerdale (Shimla)
46S119, 110S119, 110S84 and 47S103

An account of entries exhibiting rust response upto ACI 15 to three rusts is given in Table 1.1. and Figs. 1.1-1.4. The disease data was sent to the concerned breeders in first week of July, 2018 and was also uploaded on IIWBR website.

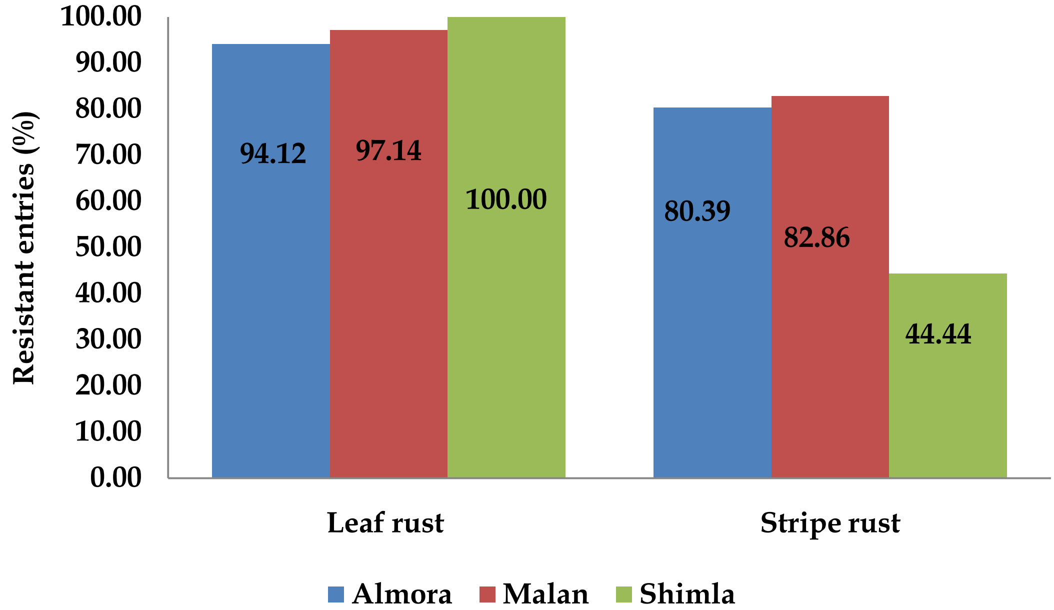

Fig. 1.1. Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of NHZ (Leaf and Stripe rust)

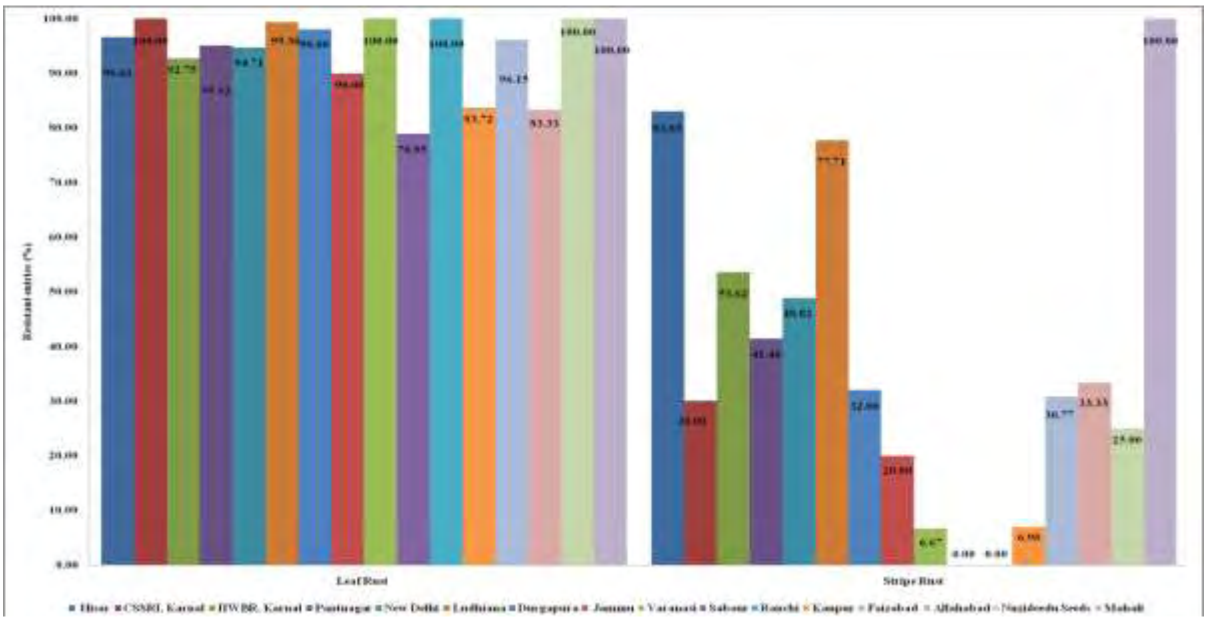

Fig. 1.2 Percent of rust resistant entries in IPPSN slots belonging to cooperating centres of NWPZ (Leaf and Stripe rust)

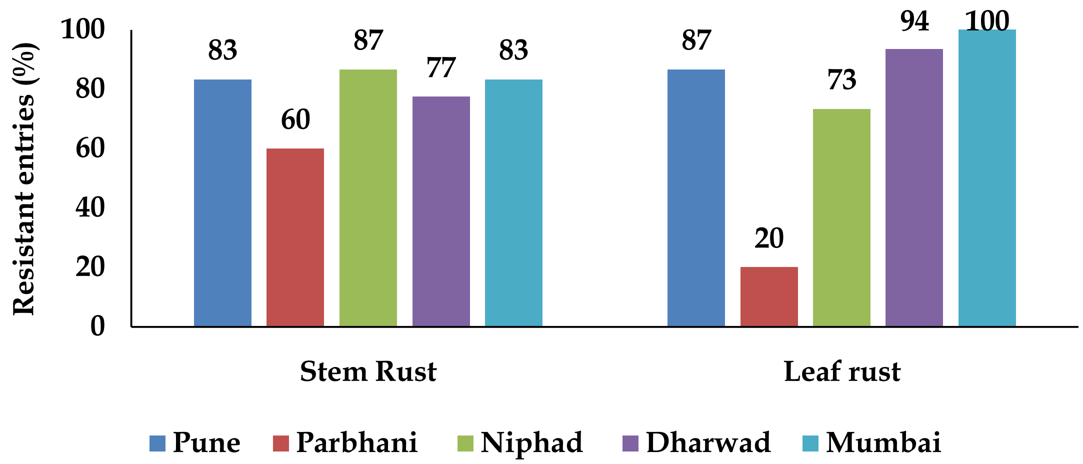

Fig. 1.3. Percent of rust resistant entries in IPPSN slots belonging to cooperating centres of CZ (Stem and Leaf rust)

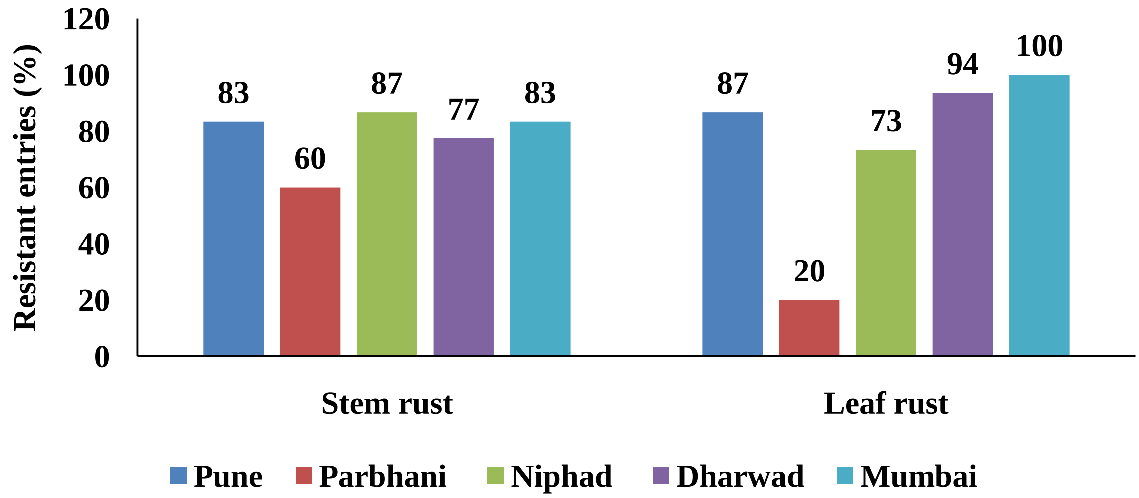

Fig. 1.4. Percent of rust resistant entries in IPPSN slots belonging to cooperating centres of PZ (Stem and Leaf rust)

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

S. No.	Name of Centre	Total	ENTRIES RESISTANT TO (%)			
			SOUTH		NORTH	
			STEM	LEAF	LEAF	STRIPE
I. NORTHERN HILL ZONE						
1	VPKAS, Almora	51	42	40	48	41
2	CSK, HPKVV, Malan	35	34	26	34	29
3	IARI, RS, Shimla	9	9	8	9	4
II. NORTH WESTERN PLAIN ZONE						
4	CCS HAU, Hisar	59	52	48	57	49
5	CSSRI, Karnal	10	10	8	10	3

6	IIWBR, Karnal	207	163	175	192	111
7	GBPUA&T, Pantnagar	41	32	27	39	17
8	IARI, New Delhi.	170	144	131	161	83
9	PAU, Ludhiana	157	123	141	156	122
10	RAU, ARS, Durgapura	50	43	42	49	16
11	SKUAS&T, Chatha, Jammu	10	10	5	9	2
12	B.H.U., Varanasi	30	27	21	30	2
13	BAC, Sabour	19	14	8	15	0
14	BAU, Kanke, Ranchi	7	4	7	7	0
15	CSAUA&T, Kanpur	43	37	16	36	3
16	Kumarganj, Faizabad	26	12	24	25	8
17	SHIAT&S, Allahabad	6	6	3	5	2
18	Nuzideedu Seeds	4	4	4	4	1
19	NABI, Mohali	2	2	2	2	2
III. CENTRAL ZONE						
20	ARS, Ummedganj, Kota	7	7	7	7	5
21	TCB College of Agric. & Res. Stn, Bilaspur (C.G.)	16	11	9	10	1
22	JNKVV, Jabalpur	26	20	17	24	2
23	JNKVV, ZARS, Powarkheda	32	32	25	31	16
24	RARS, Sagar	10	9	5	9	1
25	SDAU, Vijapur	33	32	26	30	8
26	Bhavnagar (Gujrat)	8	8	7	8	0
27	Ronak Seeds, Ahmedabad	1	1	0	1	0
IV. PENINSULAR ZONE						
28	ARI, Pune	30	25	26	28	5
29	MAU, Parbhani	5	3	1	2	2
30	MPKV, ARS, Niphad	15	13	11	14	5
31	UAS, Dharwad	31	24	29	31	10
32	BARC, Mumbai	6	5	6	6	2

1.2 PLANT PATHOLOGICAL SCREENING NURSERY (PPSN)

OBJECTIVES

To help in promotion of entries from one stage to the other in the coordinated trials and identification of varieties after AVT level on the basis of their level of disease resistance.

SIZE AND COMPOSITION

PPSN, 2017-2018 included AVT, NIVT and the special trials (409 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 Bijaga 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. 1.5).

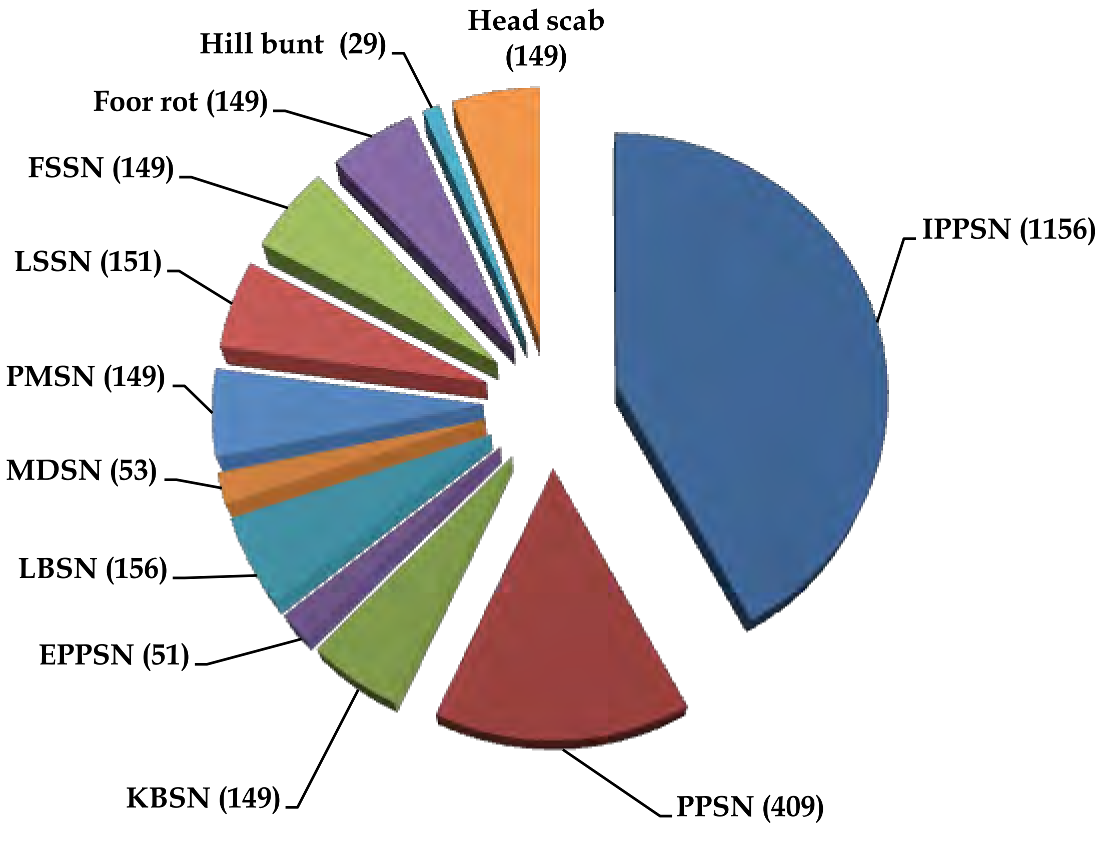

Fig. 1.5. Constitution of different plant pathological nurseries during 2017-18

TEST LOCATIONS

North:
Yellow Rust: Dhaulakuan, Gurdaspur, Malan, Bajaura, Karnal, Delhi, Ludhiana, Pantnagar, Durgapura, Jammu and Kudwani (J & K) (11 locations)
Leaf Rust: Delhi, Hisar, Jammu, Kanpur, Karnal, Ludhiana, Pantnagar, Durgapura and Faizabad (9 locations)

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

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

Leaf rust: Hisar
Stem rust: Wellington, Mahabaleshwarand Junagarh

Yellow rust: Dhaulakuan and Malan

Data not received:
Leaf rust: Durgapura

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.

The data on ryust gene postulation done at IIWBR Regional Station Flowerdale have also been given in the respective in Tables 1.2 and 1.3.Disease data of AVT entries recorded at the hot spot locations is given in Table 1.2 and that of NIVT (three rusts) is presented in Tables 1.4 whereas data on other diseases ares in Table 1.5.

Rust Resistance materials in AVT IInd and Ist Year (2017-18**) with ACI upto 10.0 are given below:**

Stem, Leaf and Stripe Rusts

HPW 349 (C), HPW 442, HS 662, HPW 459, PBW 763, PBW 801, PBW 771, DBW 237, HI 1620*, DBW 187, HD 3171 (C),UAS 465 (d), MPO 1343 (d),DDW 47 (d), MPO 1336 (d), UAS 446 (d) (c), HI 8805 (d), HI 8802 (d), PBW 757

Stem and Stripe Rusts
HPW 349 (C), HPW 442, HS 662, HPW 459, PBW 763, PBW 801, PBW 771, DBW 237, HI 1620*, DBW 187, HD 3171 (C),UAS 465 (d), MPO 1343 (d),DDW 47 (d), MPO 1336 (d), UAS 446 (d) (c), HI 8805 (d), HI 8802 (d), PBW 757

Stem and Leaf Rusts
HS 542 (C), HS 664, UP 3016, VL 1014, VL 829 (C), HPW 251 (C), VL 907 (C), HS 507 (C), HPW 442, HS 662, HS 490 (C), VL 892 (C), HS 661, HS 660, DPW 621-50 (C), PBW 763, HD 2967 (C), PBW 801, DBW 88 (C), PBW 771, WH 1021 (C), DBW 173 (I) (C), DBW 237, HI 1620*HI 1628, NIAW 3170, HD 3249, HD 3254, DBW 39 (C), HD 2967 (C), DBW 187, DBW 223, HD 2888 (C), K 1317 (C), K 8027 (C), HI 1628, GW 1339 (d), AKAW 4924, HI 8713 (d) (C) HI 1544 (C), GW 495, UAS 465 (d), MPO 1343 (d), DDW 47 (d), MP 3288 (C), HI 8627 (d) (C), UAS 466 (d), NIAW 3170, AKAW 4924, GW 491, GW 493, HI 1624, MACS 6222 (C), GW 495, MACS 3949 (d) (C), HI 8800 (d), HI 1625, PBW 770, GW 492, GW 1346 (d), MPO 1336 (d), UAS 446 (d) (c), HI 8805 (d), MACS 4059 (d), NIAW 3170, HI 8802 (d), DDK 1029 (C), MACS 6222 (Ae.) (C), MACS 5051, HW 4101, DDK 1054, HW 1098 (C) and PBW 757

Leaf and Stripe rusts
HS 666, HS 665, VL 1015, HPW 450, HPW 451, HPW 349 (C), HPW 442, HS 662, HPW 459, BRW 3792, PBW 763, PBW 766, HD 3226, PBW 801, PBW 800, PBW 771, PBW 752*, DBW 237, WH 1080 (C), HI 1620*, DBW 187, HI 1628, UAS 465 (d), MPO 1343 (d), DDW 47 (d), MPO 1336 (d), UAS 446 (d) (c), HI 8805 (d), HI 8802 (d), PBW 757, HI 1621, PBW 777 and HD 3298.

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Table 1.2. Adult plant response of AVT entries against three rusts under disease epiphytotic conditions at hot spot locations in field during 2017-18

S. No.	Entry	Rust score								Postulated genes		
		Stem		Leaf				Stripe				
				South		North						
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	*Sr*	*Lr*	*Yr*
I. NORTHERN HILLS ZONE												
1	HS 542 (C)	20MS	5.8	10S	3.0	60S	12.6	60S	38.1	R	13+10+	2+
2	HS 666	40S	20.3	10S	4.3	TR	0.0	20S	5.0	-	R	-
3	HS 665	40S	19.7	20S	6.8	TR	0.1	20S	3.5	*11+*	R	2+
4	VL 1015	40S	18.4	40S	17.3	20S	7.7	5S	1.0	*7b+*	23+10+	*R*
5	HPW 450	30S	15.3	20S	4.9	40S	9.9	20S	6.2	*28+5+*	13+	2+
6	HS 664	30MS	10.0	20S	5.3	40S	11.9	15S	6.1	*28+5+11+*	13+	2+
7	HPW 451	20S	11.0	20MS	2.6	20S	4.3	30S	8.1	*8a+5+*	13+10+	2+
8	VL 1016	20MS	10.0	80S	27.0	40S	22.6	10MR	0.5	R	23+10+	*R*
9	UP 3016	5MR	0.5	40R	1.7	10S	1.7	60S	41.0	*31+2+*	26+9+	*9+*
10	VL 1014	20MS	9.2	20S	5.7	40S	11.6	20S	6.1	*9b+11+*	23+1+	-
11	VL 829 (C)	TR	0.0	20MS	3.7	30S	8.0	60S	17.9	*31+5+2+*	26+34+	*9+18+*
12	HPW 251 (C)	10MR	2.0	20S	6.0	40S	8.4	80S	59.0	*31+2+*	26+23+	*9+*
13	HPW 349 (C)	20MS	8.0	20S	3.5	10S	2.6	10S	4.5	*7b+*	13+10+	2+
14	HS 634	30S	9.5	40S	11.0	20MS	5.5	20S	9.5	R	13+	2+
15	VL 907 (C)	5MR	0.5	10MS	2.1	15S	2.3	40S	20.6	*31+2+*	26+1+	*9+18+*
16	HS 507 (C)	5MR	0.5	20S	3.6	20S	3.0	30S	15.7	*31+*	26+1+	*9+*
17	HPW 441	40S	21.8	20S	7.3	10S	1.5	20S	4.2	-	23+10+	-
18	HPW 442	20X	6.5	20S	8.8	20S	3.6	10S	2.9	*11+*	23+	2+
19	HS 562 (C)	60S	26.3	40S	13.1	20MS	2.5	10S	2.4	*8a+9b+*	23+	*A+*
20	VL 3017	10S	6.3	60S	17.7	20S	4.1	10S	1.8	-	13+	*A+*

S. No.	Entry	Rust score								Postulated genes		
		Stem		Leaf				Stripe				
				South		North						
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	*Sr*	*Lr*	*Yr*
20A	INFECTOR	100S	81.7	100S	76.3	100S	60.0	100S	80.0		-	
21	UP 3017	60S	21.0	40S	22.3	40S	9.3	80S	59.0	*11+*	-	*A+*
22	VL 3016	60S	24.0	40S	10.9	20S	8.6	10S	2.8	*28+5+*	23+	2+
23	HS 662	20MR	2.3	20S	7.8	15S	3.9	10S	3.0	*31+*	26+23+1+	9+
24	HS 490 (C)	20S	9.2	10S	3.2	10S	2.9	60S	19.8	*28+9b+*	23+	*A+*
25	VL 892 (C)	10S	4.4	20S	5.8	10MS	1.3	60S	21.5	2+	13+10+	*A+*
26	HS 661	10MS	3.4	30R	0.8	10MR	1.1	20MS	3.9	2+R	R	*R*
27	HS 660	5MS	1.0	40R	1.6	10MS	1.7	10MS	2.3	*7b+*	23+	-
28	VL 3018	60S	25.3	20S	4.5	10S	1.6	10S	2.7	*7b+*	R	2+
29	HPW 459	10MR	1.0	10S	3.9	20S	3.3	10S	4.0	*31+*	26+23+1+	9+
II. NORTH WESTERN PLAINS ZONE												
30	UP 2981	30S	11.7	60S*	11.8	20S	5.1	20S	6.0	*28+7b+*	23+1+	2+
31	DBW 221	60S	43.3	80S	22.3	10S	3.0	40S	11.6	*7b+*	13+	-
32	DPW 621-50 (C)	20S	10.0	20MS	4.0	20S	4.3	80S	45.5	2+	13+10+	-
33	DBW 222	40S	30.0	10MS	2.0	10MS	1.4	40S	13.7	*31+*	26+23+10+	9+
34	BRW 3792	40S	22.0	20S	8.2	20S	3.7	10S	6.3	*8a+5+*	23+	*A+*
35	PBW 763	20MR	2.4	30S	5.3	10S	1.5	10MR	0.4	2+R	R	*R*
36	PBW 766	20S	10.8	10MS	2.8	10S	2.6	20S	7.4	-	13+10+	*A+*
37	HD 3086 (C)	60S	37.3	40S*	6.1	20S	10.9	10S	2.9	*7b+2+*	13+10+3+	2+
38	DBW 233	60S	36.7	10MS	2.8	10MS	2.4	20S	11.3	*28+8a+5+2+*	13+10+	2+
39	HD 3226	10S	7.6	20S	11.8	10S	3.0	5S	2.9	R	23+10+	2+

S. No.	Entry	Rust score								Postulated genes		
		Stem		Leaf				Stripe				
				South		North						
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	*Sr*	*Lr*	*Yr*
40	HD 2967 (C)	10MS	3.8	10R	0.3	20MS	3.7	80S	39.9	*8a+11+2+*	23+	2+
40A	Infector	100S	81.7	100S	77.5	100S	60.0	100S	75.0			
41	PBW 801	20MS	10.0	10MS	3.2	10S	3.6	10S	2.0	*11+*	10+	*R*
42	DBW 88 (C)	20MR	8.0	20S	5.3	10S	2.6	80S	35.5	*11+2+*	13+10+	*A+*
43	PBW 800	40S	19.0	20MS	4.0	50S	8.7	20 MS	1.6	-	13+	*R*
44	WH 1105	30S	12.3	60S*	11.3	20S	4.3	40 S	27.1	*11+2+*	13+	*2+*
45	PBW 771	10S	5.9	20S	4.1	5R	0.2	40S	7.7	*31+*	26+R	*9+*
46	WH 1124 (C)	40S	26.7	40S	8.5	40S	14.0	10S	1.9	*7b+2+*	13+10+	*2+*
47	DBW 90 (C)	80S	38.3	30S	5.6	40S	14.3	20MS	5.4	*13+2+*	13+10+	*2+*
48	HD 3059 (C)	20S	12.1	20MS	3.9	10S	3.7	80S	40.4	*11+2+*	13+	*2+*
49	WH 1021 (C)	10MR	1.2	40S	9.0	10S	3.8	80S	51.0	*31+2+*	26+1+	*9+*
50	PBW 752*	60S	38.0	40S	8.4	20MS	4.6	10S	2.0	*13+11+*	13+10+	*R*
51	DBW 173 (I) (C)	5S	1.3	5MS	1.0	10S	2.6	80S	23.3	*31+5+2+*	26+10+3+	*9+A+*
52	PBW 773	60S	21.7	40S	12.7	20S	11.5	10S	2.9	-	13+	-
53	DBW 237	20S	9.4	10MS	2.7	20S	6.9	30S	8.5	*2+*	13+10+	*2+*
54	WH 1142 (C)	5S	2.5	60S	15.1	20S	5.6	10S	3.3	*31+2+*	26+23+	*9+*
55	BRW 3806	20MS	11.8	60S	17.9	20S	7.7	40S	17.7	*28+*	13+1+	*A+*
56	WH 1080 (C)	30MS	12.3	40S*	6.1	20S	7.3	10MS	3.1	*9e+2+*	13+	*2+*
57	HD 3237*	20S	14.7	60S	29.0	40S	15.7	10MS	4.1	R	13+3+	*2+*
58	HI 1620*	40MR	7.7	20MS	3.6	10S	2.7	20S	7.8	*11+7b+*	13+10+3+	*A+*
59	PBW 644 (C)	30S	18.0	20MS	4.6	5S	1.6	60S	31.0	*11+2+*	13+1+	*2+*
60	HD 3043 (C)	10 MS	4.0	80S*	17.0	20S	12.9	60S	30.0	*31+*	26+1+*	**9+A +*

S. No.	Entry	Rust score								Postulated genes		
		Stem		Leaf				Stripe				
				South		North						
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	*Sr*	*Lr*	*Yr*
60A	INFECTOR	100S	76.7	100S	72.5	80S	58.6	100S	82.0			
61	DBW 252	30 MS	11.7	30S	4.3	10MR	0.6	60S	25.7	*8a+5+11+2+*	13+10+	*A+*
62	HI 1628	10MS	3.2	20S	6.4	5MR	0.3	40S	13.0	R	13+	*2+*
63	NIAW 3170	5S	1.7	5MS	3.0	5MR	0.3	40S	17.9	2+	13+10+	-
III. NORTH EASTERN PLAINS ZONE												
64	DBW 233	40S	23.7	5MS	0.9	10MS	1.9	20S	11.0	*28+8a+5+*	13+10+	*2+*
65	HD 3249	20MS	7.7	5S	1.0	10S	3.7	40S	14.0	*2+*	13+10+	*2+*
66	HD 3254	20MS	3.3	20S	5.3	50S	10.3	20MS	7.1	*31+*	26+23+	*9+*
67	K 1006 (C)	30S	12.7	60S	16.0	15S	3.0	60S	34.7	*8a+9b+11+*	13+1+	*2+*
68	HD 2733 (C)	20S	4.7	40S	13.6	70S	18.7	80S	48.8	*31+2+*	26+34+	*9+18+*
69	DBW 221	80S	60.0	100S	28.9	20S	9.1	30S	10.5	*7b+*	13+	*2+*
70	K 1601	10MS	2.6	30S	6.9	40S	9.2	20S	13.4	*7b+*	13+	-
71	PBW 769	20S	8.3	40S	15.3	70S	17.6	20MS	7.5	R	13+	-
72	DBW 39 (C)	5MR	0.9	10R	0.3	30MS	6.3	80S	44.0	*31+2+*	26+23+10+	*9+*
73	HD 2967 (C)	20MR	4.2	10MS	1.3	20S	5.1	80S	42.6	*8a+11+2+*	23+	*2+*
74	K 0307 (C)	40S	14.0	40S	10.4	20S	5.7	60S	33.0	*2+*	23+1+	*2+*
75	DBW 187	20S	8.0	5MS	1.6	20S	4.3	20S	8.9	*5+11+*	23+10+*	*2+*
76	DBW 223	20S	7.8	20MS	4.8	70S*	10.1	40S	14.8	*9e+7b+*	23+	*2+*
77	PBW 762	40S	17.0	80S*	16.2	10S	2.9	10MR	0.4	*30+*	23+10+2a+	*R*
78	WH 1218	60S	28.3	20S	6.1	30S	7.2	20MS	5.6	*30+5+*	*23+2a+*	*2+*
79	HD 2888 (C)	10MS	1.7	20R	0.5	10S	1.4	60S	27.1	*24+2+*	24+	*2+*
80	HI 1612 (I) (C)	80S	44.0	20MS	0.0	20MS	3.9	10S	6.1	*7b+2+*	23+	*2+*
80A	INFECTOR	100S	81.7	100S	81.3	100S	60.0	100S	69.6			
81	WH 1235	40S	23.3	40S	10.0	20S	3.3	10MS	5.2	*28+*	23+	*2+*

S. No.	Entry	Rust score								Postulated genes		
		Stem		Leaf				Stripe				
				South		North						
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	*Sr*	*Lr*	*Yr*
82	BRW 3806	40S	23.7	40S	12.9	20S	4.9	40S	17.1	*28+*	13+1+	*A+*
83	K 1317 (C)	40MR	6.2	30S	5.0	10S	3.2	40S	14.0	R	-	**A+*
84	DBW 252	20S	10.4	20S	3.3	10S	1.5	40S	19.6	*8a+5+11+*	13+10+	-
85	K 8027 (C)	10MR	0.7	10R	0.3	10S	2.9	60S	35.0	*11+2+*	13+	2+
86	HD 3171 (C)	40S	22.0	20MS	5.5	20S	5.7	60S	24.0	*11+7b+2+*	23+13+10+	2+
87	HI 1628	10S	5.2	30S	9.9	20MS	4.6	20S	8.9	2+R	13+10+	2+
IV. CENTRAL ZONE												
88	GW 1339 (d)	20MS	5.6	20MS	4.0	10MS	1.4	30S	11.2	*13+11+*	R	-
89	AKAW 4924	5MS	3.3	5S	1.5	10S	2.3	60S	40.6	2+R	R	-
90	GW 322 (C)	30S	14.3	20S	6.4	20MS	3.0	80S	43.6	*11+2+*	13+1+	2+
91	HI 8713 (d) (C)	20MS	5.3	5MS	1.6	5MS	0.7	30MS	17.7	*9e+2+*	13+	-
92	HI 8737 (d) (C)	30S	19.6	30S	4.8	5MR	0.3	20MS	6.6	*9e+2+*	-	2+
93	HI 1544 (C)	5MR	0.7	30R	1.3	10S	1.5	100S	63.0	*24+2+*R	24+R	2+
94	GW 495	10MR	1.2	10MR	1.2	30S	4.9	100S	64.0	R	R	-
95	UAS 465 (d)	20S	9.7	20MS	5.3	20S	4.9	40MS	7.0	*11+7b+*	23+13+	-
96	MPO 1343 (d)	20MS	5.9	20MS	3.8	20S	3.4	40MS	10.0	-	23+	-
97	DBW 110 (C)	20MS	7.3	30MS	4.2	20S	5.5	80S	43.0	R	13+	2+
98	DDW 47 (d)	10MS	3.7	5MS	1.1	10S	2.0	20MS	5.4	*11+7b+*	R	2+
99	MP 1331	30MS	15.0	20MS	2.8	40S	9.2	40S	22.6	*8a+5+*	-	2+
100	MP 3288 (C)	20MR	3.5	40R	1.1	0	0.0	80S	31.6	*24+*R	24+R	2+
100A	INFECTOR	100S	81.7	100S	78.8	80S	60.0	100S	80.0			
101	HI 8627 (d) (C)	20MS	3.6	10S	2.7	0	0.0	40S	14.0	*9e+2+*	13+	-
102	UAS 466 (d)	5MS	2.3	5S	1.2	10S	1.6	40S	17.3	*11+*	13+	-

S. No.	Entry	Rust score								Postulated genes		
		Stem		Leaf				Stripe				
				South		North						
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	*Sr*	*Lr*	*Yr*
103	NIAW 3170	10S	3.4	5MS	1.1	0	0.0	40S	16.7	-	13+10+	-
V. PENINSULAR ZONE												
104	AKAW 4924	10MS	5.7	10MS	2.6	TR	0.0	60S	42.0	*R*	R	-
105	GW 491	10MS	5.3	20MS	5.1	5MR	0.3	100S	72.0	2+R	R	-
106	GW 493	10MR	2.3	5MS	0.6	TMS	0.1	80S	53.6	R	R	-
107	DBW 235	40S	19.7	10S	3.8	15S	2.3	40S	19.2	-	13+10+1+	2+
108	HI 1624	10MR	0.9	20S	3.0	10S	1.4	80S	47.4	*31+2+*	26+R	*9+*
109	MACS 6222 (C)	20MR	2.1	20S	3.5	20MS	2.3	30S	16.6	R	R	-
110	DBW 168 (I) (C)	20MS	5.8	60S*	10.4	70S*	11.9	80S	51.6	*31+2+*	26+	*9+*
111	GW 495	20MR	1.7	10MS	2.3	20S	3.5	100S	60.6	R	R	-
112	MP 1338	40S	14.7	40S	7.0	40S*	6.3	80S	53.0	R	23+	2+
113	MACS 3949 (d) (C)	20MS	7.2	20MS	4.0	TR	0.0	20MS	6.5	*7b+2+*	R	2+
114	HI 8800 (d)	10MR	1.9	15R	1.5	TR	0.1	60S*	10.6	*11+*	-	-
115	MACS 6478 (C)	60S	40.0	40S	7.1	70S*	10.8	80S	65.0	*28+*	23+1+	2+
116	MACS 6709	80S	50.0	20MS	4.5	10S	3.3	100S	67.0	*28+*	13+10+	2+
117	HI 1625	5MS	1.0	15R	1.4	20MS	2.3	100S	63.5	R	R	-
118	UAS 428 (d) (C)	20MS	8.1	60S*	10.3	10MS	1.1	20S	8.0	*7b+*	-	-
119	PBW 770	5MS	1.7	20S	5.0	5MS	1.1	20S	10.5	*31+*	26+	*9+*
120	GW 492	20MR	4.3	5MS	1.6	5MR	0.3	100S	51.8	2+R	R	2+
120A	INFECTOR	100S	80.0	100S	81.3	100S	55.7	100S	81.0			
121	GW 1346 (d)	20MS	3.9	15R	1.9	40S*	5.9	60S	37.2	*11+7b+*	13+10+	-
122	HI 1605 (C)	20MS	7.3	20MS	12.2	20S	3.6	40S	27.0	*5+11+*	13+	2+

S. No.	Entry	Rust score								Postulated genes		
		Stem		Leaf				Stripe				
				South		North						
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	*Sr*	*Lr*	*Yr*
123	AKDW 2997-16 (d)(C)	40S	35.0	20S	7.3	40S	7.6	20S	7.9	*7b*+2+	-	-
124	MPO 1336 (d)	10MS	3.7	20S	4.6	10S	2.1	20MS	2.9	*11+*	23+13+	2+
125	UAS 446 (d) (c)	20S	5.5	20S	6.3	20S	4.9	10S	3.9	*11+2+*	R	-
126	HI 8805 (d)	10S	2.8	10MR	2.0	5S	1.0	20MS	4.2	*13+11+*	13+	-
127	MACS 4058 (d)	40S	17.7	20S	7.8	10MR	0.7	60S	34.4	*13+*	23+	-
128	MACS 6696	40MR	13.3	40S	11.5	60S*	12.7	80S	60.0	-	13+	-
129	MACS 4059 (d)	20S	7.4	30R	2.2	5MS	0.6	40S	16.1	*11+*	13+	-
130	NIAW 3170	10S	4.7	10MS	3.8	10S	3.4	40S	14.5	-	13+10+	-
131	DBW 93 (c)	10MR	1.6	20S	10.8	20S	5.6	80S	45.1	*31+2+*	26+23+	*9+*
132	MACS 6695	20MS	6.7	60S	13.1	60S*	10.7	80S	62.0	*9b+11+7b+*	-	-
133	HI 8802 (d)	20MS	9.6	30MS	7.5	20MS*	2.6	20S	5.5	*13+*	23+	-
VI. SPECIAL TRIAL (Dicoccum)												
134	DDK 1029 (C)	5MR	0.5	40R	1.6	20S*	4.4	80S	34.6	*11+2+*	13+	-
135	MACS 6222 (Ae.) (C)	10MR	1.0	15R	1.7	10MS*	1.2	30S	14.7	R	R*	*-
136	MACS 5051	5S	1.8	20R	0.6	10MS*	1.1	80S	44.6	*11+*	18+	2+
137	HW 4101	5MR	0.7	40R	1.3	0	0.0	60S	26.8	*13+11+7b+*	18+	2+
138	DDK 1054	5MR	0.5	40R	1.3	10S*	2.0	80S	40.0	*11+7b+*	18+	2+
139	HW 1098 (C)	5MR	0.5	30R	1.0	0	0.0	80S	35.7	*11+2+*	18+	-
VII. SPECIAL TRIAL- Very Late Sown												
140	WR 544 (C)	40X	11.3	30S	7.8	0	0.0	100S	60.0	*28+8a+2+*	13+1+	-
140A	INFECTOR	100S	85.0	100S	82.5	100S	58.6	100S	79.0			-
141	HD 3271	20S	11.7	10S	2.3	5S	1.5	30S	8.4	2+	13+10+	*9+*

S. No.	Entry	Rust score								Postulated genes		
		Stem		Leaf				Stripe				
				South		North						
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	*Sr*	*Lr*	*Yr*
143	PBW 797	40S	30.7	10MS	1.8	10S	1.4	40S	8.8	*11+7b+2+*	R	9+
144	PBW 757	40MR	8.3	20S	3.9	10MS	1.4	40S*	4.0	*31+2+*	26+R*	-
145	DBW 278	60S	29.0	30S	5.7	10S	1.5	60S	28.9	*11+2+*	1+	2+
146	HI 1621	40S	14.2	60S	22.4	40S*	7.2	20S	6.1	*28+*	13+	-
147	DBW 14 (C)	40S	16.8	60S	14.0	10S	2.7	40S	20.8	*28+11+2+*	23+	-
148	PBW 777	30MS	12.5	15R	1.5	10S	1.6	15S	3.3	-	R*	2+
149	HD 3298	40S	16.3	20MS	3.0	5S	1.0	20S	6.4	*30+*	23+2a	9+

Table 1.3. Status of disease resistance in AVT (Final year entries) and check varieties at adult stage and rust resistant gene postulation during 2015-16, 2016-17 and 2017-18`

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB
		South				North															
		Stem rust		Leaf rust		Leaf rust		Stripe		DD		0-9		%		%		%		%	0-5
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS
II. NORTH WESTERN PLAINS ZONE																					
1	HD 3226																				
	2015-16	20MR	3.3	40S	8	40S	9.3	20S	2.1												
	2016-17	20MS	5.4	30S	7.1	30S	10.0	TR	0.6												
	2017-18	10S	7.6	20S	11.8	10S	3.0	5S	2.9	78	46	3	2	4.6	3.1	45	31.1	4.3	1.1	5.3	5
	Mean	20MS	5.4	40S	8.967	40S	7.4	20S	1.9	78	46	3	2	4.6	3.1	45	31.1	4.3	1.1	5.3	5
2	PBW 752																				
	2015-16	20S	4.8	10S	3.4	10S	1.3	10MR	0.5												
	2016-17	100S	45.0	40S	18.3	20S	6.6	10MS	0.8												
	2017-18	60S	38.0	40S	8.4	20MS	4.6	10S	2.0	68	46	7	4	25.5	11.3	43.6	26.3	62.5	16.6	5.3	4
	Mean	100S	29.3	40S	10.03	20S	4.2	10S	1.1	68	46	7	4	25.5	11.3	43.6	26.3	62.5	16.6	5.3	4
3	HD 3237																				
	2015-16	20S	9.0	60S	23.8	40S	6.0	10S	1.6												
	2016-17	40S	15.6	40S	16.3	5S	1.4	5MR	0.6												
	2017-18	20S	14.7	60S	29	40S	15.7	10MS	4.1	78	46	7	3	9.5	4.8	46.1	29.6	4.8	1.2	38.9	4
	Mean	40S	13.1	60S	23.03	40S	7.7	10S	2.1	78	46	7	3	9.5	4.8	46.1	29.6	4.8	1.2	38.9	4
4	HI 1620																				
	2015-16	20MS	3.8	20MR	1.8	5S	0.9	40S	4.6												
	2016-17	40MS	14.4	30S	8.1	20S	5.0	10S	5.1												
	2017-18	40MR	7.7	20MS	3.6	10S	2.7	20S	7.8	78	46	8	4	22.9	10.4	73.3	37.9	16.7	6.4	17.7	3

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB
		South				North															
		Stem rust		Leaf rust		Leaf rust		Stripe		DD		0-9		%		%		%		%	0-5
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS
	Mean	40MS	8.6	30S	4.5	20S	2.9	40S	5.8	78	46	8	4	22.9	10.4	73.3	37.9	16.7	6.4	17.7	3
5	HD 2967 (C)																				
	2015-16	60S	20.8	20S	4.8	10S	2.6	80S	40.0	67	35	7	5	31.6	20	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	25.2	18.2	6.2	30	5
	2017-18	10MS	3.8	10R	0.3	20MS	3.7	80S	39.9	67	35	6	3	16.1	6.8	61.9	31.4	42.9	14.1	20.0	4
	Mean	60S	10.0	20S	2.133	20MS	3.4	80S	43.6	79	35	9	4	31.6	14	64.3	31	42.9	9	30	5
6	WH 1105 (C)																				
	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	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
	2017-18	30S	12.3	60S*	11.3	20S	4.3	40 S	27.1	89	56	6	3	26.4	14.1	57.4	25.8	31.6	7.9	27.8	5
	Mean	40S	10.8	60S*	9.467	40S	7.8	80S	23.5	89	56	9	4	33.3	16	82.7	32	31.6	3	27.78	5
7	HD 3086 (C)																				
	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	20	5
	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	23.5	10.1	50	5
	2017-18	60S	37.3	40S*	6.1	20S	10.9	10S	2.9	79	46	5	3	15.2	6.3	31.1	7.8	36.4	11.6	10.0	4
	Mean	70S	34.1	40S*	6.767	30S	9.8	10S	2.8	89	46	9	4	21.3	10	41.3	10	36.4	8	50	5
8	DBW 88 (C)																				
	2015-16	20MS	6.4	10S	2.2	10S	2.3	40S	18.0	78	57	5	4	26.1	13.5	80	32.8	10.5	4.7	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	1.5	35	5
	2017-18	20MR	8.0	20S	5.3	10S	2.6	80S	35.5	89	46	6	3	8.4	4.4	40	35	25.0	7.1	36.8	3
	Mean	20MS	6.8	20S	4.333	10S	2.6	80S	30.3	89	46	9	4	26.1	10	80	30	25	4	36.84	5
9	DPW 621-50 (C)																				
	2015-16																				

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB
		South				North															
		Stem rust		Leaf rust		Leaf rust		Stripe		DD		0-9		%		%		%		%	0-5
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS
	2016-17																				
	2017-18	20S	10.0	20MS	4	20S	4.3	80S	45.5	89	46	5	3	16.7	6.8			10.0	3.3	20.0	3
	Mean		10.0		4		4.3		45.5												
10	HD 3059 (C)																				
	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
	2017-18	20S	12.1	20MS	3.9	10S	3.7	80S	40.4	89	46	7	4	7.4	5.4	35.8	28	22.2	8.3	20.0	3
	Mean	30MS	10.0	20S	4.3	20S	3.6	80S	34.7	89	46	9	5	26.2	11	65.9	28	23.5	8	26.7	5
11	DBW 90 (C)																				
	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	5
	2016-17	60S	33.0	20S	6.5	40S	15.0	5S	1.3	57	46	9	4	15.5	11	10.8	5.1	14.3	6.1	50	5
	2017-18	80S	38.3	30S	5.6	40S	14.3	20MS	5.4	99	47	5	2	6.9	4.4	51.2	12	16.7	4.2	5.9	5
	Mean	80S	30.3	30S	5.5	40S	11.8	40S	5.3	99	47	9	3	18.6	10	71.3	10	16.7	6	50	5
12	WH 1021 (C)																				
	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	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	5
	2017-18	10MR	1.2	40S	9	10S	3.8	80S	51.0	69	46	7	5	12.5	5.9	60	22.9	37.5	10.8	18.8	4
	Mean	20S	4.0	40S	5.7	10S	3.7	80S	44.4	79	57	9	5	12.5	4	77.5	27	37.5	8	18.75	5
13	WH 1124 (C)																				
	2015-16	60S	26.8	20S	4.6	30S	7.2	60S	7.5	89	46	8	5	21.1	8	30.7	8.9	6.7	3.6	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
	2017-18	40S	26.7	40S	8.5	40S	14.0	10S	1.9	79	47	5	3	12.8	5.5	21.2	8.2	27.3	7.6	15.8	5
	Mean	60S	24.5	40S	7.967	40S	8.5	60S	5.7	89	46	9	4	21.1	7	30.7	7	27.3	5	15.79	5

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB
		South				North															
		Stem rust		Leaf rust		Leaf rust		Stripe		DD		0-9		%		%		%		%	0-5
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS
14	DBW 173																				
	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	15	4
	2016-17	80S*	14.3	10MS	2.4	5S	2.0	60MS*	13.8	99	57	6	3	15	5.8	28.6	23.9	5.9	2.9	11.8	5
	2017-18	5S	1.3	5MS	1	10S	2.6	80S	23.3	78	56	6	3	4.6	3.2	71.7	42.2	14.3	7.3	26.3	4
	Mean	80S*	5.8	10MS	1.233	10S	2.0	80S	14.2	99	56	6	3	18.3	6	71.7	33	14.3	4	26.32	5
15	WH 1080 (C)																				
	2015-16	20S	9.4	40S	7	20S	5.9	20S	4.3	89	46	9	5	13.1	6.4	55.5	29.3	3.1	1	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
	2017-18	30MS	12.3	40S*	6.1	20S	7.3	10MS	3.1	89	46	7	4	4.2	2.2	76.6	40.4	20.0	5.0	26.3	3
	Mean	30MS	8.7	40S*	5.433	20S	7.2	20S	3.2	89	46	9	4	14.2	6	76.6	30	20	3	42.1	5
16	PBW 644 (C)																				
	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	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	10	5
	2017-18	30S	18.0	20MS	4.6	5S	1.6	60S	31.0	78	46	7	3	6.5	3.0	60	26.3	71.4	20.7	33.3	4
	Mean	40MS	13.5	20MS	3.9	10S	1.9	60S	19.5	79	46	7	4	36.6	10	60	23	71.4	14	33.33	5
17	HD 3043 (C)																				
	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	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	5
	2017-18	10 MS	4.0	80S*	17	20S	12.9	60S	30.0	78	45	6	2	8.8	5.4			9.1	3.8	0.0	4
	Mean	40S	6.6	80S*	13.93	60S	12.8	60S	22.9	78	35	6	3	23.5	8	62.5	24	15.4	4	20	5
18	WH 1142 (I) C)																				
	2015-16	40S	17.2	60S	25.6	20S	4.6	30S	4.7	79	56	8	5	12.1	6.2	60	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	75	5

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB
		South				North															
		Stem rust		Leaf rust		Leaf rust		Stripe		DD		0-9		%		%		%		%	0-5
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS
	2017-18	5S	2.5	60S	15.1	20S	5.6	10S	3.3	78	46	8	5	6.0	3.4	80.5	42.7	15.4	9.1	17.7	2
	Mean	40S	7.2	60S	16.27	40S*	6.1	30S	3.1	79	46	9	5	22.2	7	80.5	29	21.3	8	75	5
III. NORTH EASTERN PLAINS ZONE																					
19	DBW 187																				
	2015-16	20MS	5.2	30S	4.1	10MS	1.1	20S	3.0												
	2016-17	20MS	9.0	10MS	1.8	TS	0.3	10MS	4.4												
	2017-18	20S	8.0	5MS	1.6	20S	4.3	20S	8.9	89	46	5	3	6.7	4.9	45	34.9	20.0	8.3	35.0	4
	Mean	20S	7.4	30S	2.5	20S	1.9	20S	5.4	89	46	5	3	6.7	4.9	45	34.9	20.0	8.3	35.0	4
20	HD 2733 (C)																				
	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	5
	2016-17	10MR	0.8	60S	14.1	5S	2.0	80S	53.6	67	46	9	5	11.1	4.8	15	8.3	32.6	13.4	63.2	5
	2017-18	20S	4.7	40S	13.6	70S	18.7	80S	48.8	78	46	9	6	6.0	3.0	65.4	37.8	20.0	10.7	0.0	3
	Mean	20S	3.9	60S	15.33	70S	7.6	80S	55.5	78	46	9	6	11.2	5	65.4	23	32.6	10	63.2	5
21	K 0307 (C)																				
	2015-16	40S	20.0	40S	23	40S	6.5	80S	26.4	68	36	6	3	26.3	8.4	-	-	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	85	31.5	5.9	1.5	7.1	5
	2017-18	40S	14.0	40S	10.4	20S	5.7	60S	33.0	89	36	4	3	8.0	5.1	71.4	42.4	9.1	3.3	20.0	5
	Mean	80S	17.6	40S	13.73	40S	5.0	80S	33.1	89	36	6	3	34.8	9	85	37	9.1	2	20	5
22	DBW39(C)																				
	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
	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	5
	2017-18	5MR	0.9	10R	0.3	30MS	6.3	80S	44.0	78	45	5	4	5.0	3.3	61.7	47.1	40.0	11.3	11.1	5
	Mean	10MS	1.9	10MS	1.567	30MS	3.1	80S	38.0	78	45	9	5	20.7	10	61.7	29	40	9	21.1	5

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB
		South				North															
		Stem rust		Leaf rust		Leaf rust		Stripe		DD		0-9		%		%		%		%	0-5
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS
23	K 1006 (C)																				
	2015-16	20S	13.0	40S	25.5	5S	1.2	60S	22.5	68	46	6	4	11.1	4.4	-	-	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	22.3	13.3	3.6	0	5
	2017-18	30S	12.7	60S	16	15S	3.0	60S	34.7	89	46	6	4	7.0	3.7	69.3	44.4	3.3	1.7	11.1	4
	Mean	70S	14.5	60S	19.4	15S	2.4	60S	32.3	89	46	7	4	11.1	4	75	33	13.3	2	15.8	5
24	HD 2967 (C)																				
	2015-16	60S	20.8	20S	4.8	10S	2.6	80S	40.0	67	35	7	5	31.6	20	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	25.2	18.2	6.2	30	5
	2017-18	10MS	3.8	10R	0.3	20MS	3.7	80S	39.9	67	35	6	3	16.1	6.8	61.9	31.4	42.9	14.1	20.0	4
	Mean	60S	10.0	20S	2.133	20MS	3.4	80S	43.6	79	35	9	4	31.6	14	64.3	31	42.9	9	30	5
VII. SPECIAL TRIAL-VERY LATE SOWN (JANUARY) TRIAL																					
25	PBW 757																				
	2015-16	20S	8.8	10S	1.4	0	0.0	5S	0.5												
	2016-17	80S	33.2	20S	5.8	10S	2.2	5MS	0.5												
	2017-18	40MR	8.3	20S	3.9	10MS	1.4	40S*	4.0	89	56	5	3	9.5	5.0	95.3	50.6	11.1	5.2	31.6	4
	Mean	80S	16.8	20S	3.7	10S	1.2	40S*	1.7	89	56	5	3	9.5	5.0	95.3	50.6	11.1	5.2	31.6	4
26	WR544(C)																				
	2015-16	40S	23.2	50S	9.6	5S	0.8	80S	39.8	78	46	7	6	6	3.2	-	-	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	30.6	0	0	31.6	5
	2017-18	40X	11.3	30S	7.8	0	0.0	100S	60.0	89	57	9	5	11.4	4.5	55.7	27.4	37.5	10.8	11.1	5
	Mean	80S	19.9	50S	11.2	30S	2.3	100S	52.8	99	57	9	6	11.4	3	75	29	0	4	31.6	5
27	DBW 14 (C)																				

S. No.	Entries	Rusts								LB (dd)		PM 0-9		KB		LS		FS		FR	FHB
		South				North															
		Stem rust		Leaf rust		Leaf rust		Stripe		DD		0-9		%		%		%		%	0-5
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	AV.	HS	HS
	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	5
	2016-17	60S	22.7	40S	12.3	10S	3.2	60S	22.6	89	68	4	3	5	1.9	40	15.9	3.6	1.6	40	5
	2017-18	40S	16.8	60S	14	10S	2.7	40S	20.8	89	46	7	3	9.2	4.5	57.5	29.8	25.0	7.3	33.3	3
	Mean	60S	17.2	60S	11.33	20S	3.733	80S	21.8	89	57	7	3	9.7	4	57.5	26	8.7	4	40	5
28	DBW 71 (C)																				
	2015-16	10S	4.2	60S	11.3	TR	0	20S	7.0	78	56	7	6	13.4	8.1	-	-	50	30.4	27.8	5
	2016-17	20MS	7.0	30S	6.1	5S	1	10S	5.0	89	56	9	5	8.8	6.7	54.4	37.1	19.1	11.4	60	5
	2017-18	10MR	1.7	40S	11.3	5S	0.8	40S	9.9	88	46	8	4	41.3	14.8	81.3	35.7	54.6	14.4	27.8	4
	Mean	20MS	4.3	60S	9.567	5S	0.6	40S	7.3	89	56	9	5	41.3	10	81.3	36	50	19	60	5

Table 1.4. Adult plant response of NIVT entries against three rusts under disease epiphytotic conditions at hot spot locations in field during 2017-18

S. No.	Entry	Stem rust		Leaf rust				Stripe rust	
		South		South		North		North	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI
1	WH 1240	40S	18.4	10S	2.8	40S	11.9	20S	13.1
2	PBW 782	60S	21.3	5MS	1.8	TR	0.1	40S*	4.5
3	RAJ 4528	60S	31.7	60S*	9.0	60S	15.2	20S	11.5
4	PBW 783	30MS	12.3	40S	8.8	10S	1.7	10S	1.0
5	UP 3002	20MR	1.4	5S	0.9	0	0.0	10MR	2.3
6	HD 3279	30MS	8.0	10MS	1.9	10S	3.0	10S	3.6
7	UP 3003	40S	16.3	10MS	1.3	20S	3.6	20S	4.4
8	K 1701	40MS	14.0	80S	30.8	20S	9.3	80S	51.0
9	UP 3004	40S	18.0	10S	2.2	5MS	0.9	20MS	3.7
10	DBW 257	60S	25.7	40S	14.0	TR	0.2	10S	2.7
11	RAJ 4527	5MS	1.7	10S	2.8	TR	0.0	20S	8.6
12	WH 1239	60S	44.7	20S	6.9	5S	1.1	20S	4.6
13	DBW 88 (C)	20S	10.7	30S	5.0	0	0.0	80S	42.0
14	PBW 781	60S	26.4	20MR	2.5	50S*	8.0	10MR	0.8
15	HUW 826	20X	8.3	10S	1.6	10S	1.4	5S	2.1
16	DBW 253	40MR	10.3	20S	5.8	20MS	5.7	40S	14.5
17	RAJ 4529	40S	24.0	40S	9.5	40S*	12.1	40S	14.2
18	PBW 784	60S*	10.2	10R	0.3	40S*	5.8	10S	5.3
19	HD 3280	60S	46.7	20S	5.3	10S	3.2	60S*	13.5
20	HD 3086 (C)	60S	44.0	30S	6.2	20S	5.7	20S	6.2
20A	INFECTOR	100S	81.7	100S	81.3	80S	57.1	100S	82.0
21	HD 3281	40S	19.3	40S	7.3	40S	8.4	40S	24.8
22	K 1702	40MS	16.3	40S	9.5	40S	10.0	20S	8.5
23	DBW 254	10MS	2.3	20S	7.3	10S	1.5	40S	13.8
24	HD 3277	40X	8.9	40S	13.8	20S	2.9	15S	5.6
25	DBW 255	40S	14.0	60S	14.9	50S	8.7	10S	5.2
26	HD 3278	20MS	6.7	20S	5.3	10MS	2.0	10S	4.6
27	WH 1237	20S	6.7	20MS	3.9	10S	1.5	10S	1.5
28	NW 7041	10MS	2.2	20S	6.3	20S	4.6	15S	3.8
29	DBW 256	60S	50.0	60S	22.3	20S	5.7	10S	3.0
30	K 1006 (C)	40MS	18.0	60S	16.8	30S	6.9	60S	33.6
31	WH 1238	20S	12.7	30S	6.5	20S	3.6	20S	4.8
32	UP 3001	5MS	1.0	40MR	3.8	10S	4.3	10S	4.2
33	NW 7037	40MS	14.3	30S	5.8	20S	8.6	60S*	12.8
34	PBW 785	20S	6.5	30S	5.2	20S	4.3	5S	0.6
35	HD 2967 (C)	20MR	2.8	20S	3.2	30S	7.3	60S	40.4
36	HD 3276	20MS	4.9	5MS	0.8	10S	2.9	20S	6.3

S. No.	Entry	Stem rust		Leaf rust				Stripe rust	
		South		South		North		North	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI
NIVT-1B									
37	PBW 787	20S	4.9	10S	3.3	20MS	3.7	10S	3.0
38	HD 3286	60S	43.3	20S	7.8	10MS	1.9	20S	7.3
39	PBW 786	40S	23.3	5S	1.8	10MS	1.1	40S	6.2
40	HD 3285	40S	13.1	5S	1.8	30S	7.2	20MS	4.1
40A	INFECTOR	100S	81.7	100S	82.5	80S	55.7	100S	76.0
41	DBW 259	20S	8.8	40S	12.4	40S	13.2	10MS	2.6
42	K 1703	20S	13.7	30S	6.8	50S*	9.6	80S	47.5
43	PBW 788	10MR	0.7	20S	8.8	5MR	0.3	5S	0.9
44	K 1006 (C)	40MS	15.7	40S	16.8	10S	2.9	40S	31.0
45	K 1704	20MS	8.3	20S	8.8	40S	11.5	80S	46.5
46	UP 3005	40S*	8.0	20S	3.9	5S	0.7	20S	3.6
47	HD 3282	40S	20.3	30MS	7.3	20S	3.3	10S	5.9
48	WH 1243	40S	18.5	30MS	5.6	50S*	10.3	40S	11.8
49	NW 7028	30S	18.3	40S	9.9	20S	5.6	10S	4.4
50	HUW 828	40S	15.7	30S	8.9	5MS	0.6	80S	36.0
51	HUW 827	20MR	4.0	60S	11.7	40S	10.8	60S	36.0
52	DBW 258	40S	28.0	40S	12.8	30S	4.4	20S	3.3
53	HD 2967 (C)	20MS	5.2	20MS	2.2	50S	7.9	80S	45.0
54	UP 3006	20MS	10.2	20MS	3.0	30S	5.4	20S	4.7
55	UP 3007	30MR	9.0	40S	6.5	10S	2.6	40S	12.5
56	BRW 3814	40S	12.2	40S	10.0	20S	5.0	20S	14.1
57	DBW 260	60S	43.3	5S	1.8	50S*	9.6	20S	2.6
58	WH 1242	40S	16.0	20S	6.6	30S	12.0	10S	1.5
59	K 1705	40S	22.7	60S	27.8	60S	15.7	80S	60.0
60	HUW 829	60S	30.7	30MS	9.5	15S	4.4	40MS	13.4
60A	INFECTOR	100S	81.7	100S	81.3	80S	57.1	100S	80.0
61	HD 3086 (C)	60S	36.7	40S	8.1	30S	10.6	40S	8.8
62	WH 1241	10S	7.0	10MR	1.1	5S	0.7	20S	5.0
63	DBW 261	30S	15.7	40S*	5.9	50S*	7.7	60S	33.1
64	HD 3283	60S	40.7	10MS	1.8	20S	5.3	40S*	12.1
65	HD 3284	10S	4.0	10R	0.3	20S	2.9	40S	9.5
66	NW 7047	30S	14.3	30MS	3.4	30S	6.5	20S	9.6
67	RAJ 4531	5MS	1.7	10MS	1.5	10S	1.4	20MS	9.0
68	DBW 262	10MR	1.3	10R	0.3	20MS	3.7	20S	10.1
69	RAJ 4536	5MR	0.4	5S	1.2	20S	4.3	15MS	6.0
70	DBW 88 (C)	20MS	6.2	20S	5.0	10S	2.9	70S	34.6
71	RAJ 4530	20S	8.4	10MS	1.4	20S	4.3	20S	8.3
72	NW 7049	20MS	8.1	20S	7.7	30S	5.0	20S	7.6
NIVT-2									

S. No.	Entry	Stem rust		Leaf rust				Stripe rust	
		South		South		North		North	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI
73	NIAW 3390	30S	16.0	30S	6.0	20S	3.5	20S	11.2
74	GW 322 (C)	40S	20.3	20MS	7.0	10S	1.6	60S	37.4
75	GW 508	30MR	4.4	20S	8.5	20MS	3.9	80S	42.4
76	HP 1968	40S	17.0	20MS	3.0	30S	6.4	40S	29.0
77	PBW 789	40S	16.7	40S	10.6	20S	4.0	20S	6.1
78	MACS 6727	10MS	3.7	80S	28.6	40S	14.5	80S	62.0
79	GW 505	10MR	1.0	5S	1.0	40S*	5.8	80S	63.0
80	MACS 6222 (C)	20MS	4.7	5S	1.4	10S	2.6	40S	21.0
80A	INFECTOR	100S	78.3	100S	82.5	80S	58.6	100S	78.0
81	MACS 6478 (C)	60S	39.7	40S	7.6	60S*	11.2	100S	64.0
82	MACS 6729	10MR	1.9	10S	1.5	20S	4.3	100S	70.0
83	WH 1244	40S	12.3	30S	7.6	50S*	8.6	20MS	5.8
84	HI 1544 (C)	5MS	1.7	10MR	1.0	10S	2.2	80S	66.0
85	CG 1028	20MR	2.2	60S	29.0	50S	21.7	60S	45.0
86	MP 1350	30S	14.0	10MR	0.9	30S	6.0	20S	7.6
87	GW 506	5S	2.5	40S	9.3	10S	2.2	70S	45.0
88	AKAW 5077	10MR	0.8	10MR	0.8	30S	8.6	60S	35.4
89	DBW 263	10MS	2.3	80S	14.5	10S	1.5	80S	51.0
90	RAJ 4532	40S	15.3	20MS	5.4	10S	1.4	40MR	6.2
91	HI 1632	20MR	1.8	20S	2.8	30S	5.7	100S	61.0
92	UAS 398	40S	25.7	10S	2.7	10S	2.0	40S	13.1
93	MP 1348	60S	7.2	60S	17.2	50S	15.6	100S	55.8
94	MP 1349	40S	18.7	20MS	6.5	30S	4.4	10S	3.7
95	AKAW 5078	10MR	1.8	10S	2.5	20S	4.9	80S	43.5
96	MACS 6722	20MR	2.7	20S	7.8	20S	6.3	80S	66.0
97	NIAW 3270	10MR	1.7	5MS	1.4	20S	5.7	80S	50.0
98	UP 3008	5MS	1.0	5MS	0.6	10S	1.4	20S	5.2
99	HI 1631	20MR	3.9	10MS	1.5	30S	4.4	100S	71.0
100	UAS 3001	20MR	3.7	10MS	1.9	50S	10.1	90S	41.0
100A	INFECTOR	100S	80.0	100S	77.5	100S	60.0	100S	84.0
101	DBW 264	10MS	4.1	40S	11.8	40S	7.3	80S	53.0
102	MP 3493	30S	11.0	30S	4.8	20S	5.5	80S	43.0
103	GW 507	30MR	5.3	20MR	2.4	50S*	7.3	80S	64.0
104	UAS 399	20MR	4.8	20MS	4.1	10S	1.4	60S	34.0
105	HI 1629	20MR	1.7	10R	0.4	30S	5.7	100S	67.0
106	HI 1630	10MR	1.0	10R	0.3	50S	10.4	100S	65.6
107	JW 5154	10MS	3.4	20S	6.7	10S	3.3	40S	10.1
108	MP 3495	20MR	2.0	30S	9.5	20S	3.0	60S	38.0
NIVT-3A									

S. No.	Entry	Stem rust		Leaf rust				Stripe rust	
		South		South		North		North	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI
109	RAJ 4535	10MR	1.1	10MS	1.3	20S	6.0	40S	17.9
110	WH 1247	40S	25.0	20MS	4.4	10S	2.9	30S	6.2
111	HI 1563 (C)	5MR	0.7	5MR	0.5	20S	3.5	100S	57.0
112	DBW 90 (C)	60S	42.0	20S	4.9	20S	8.8	20S	3.5
113	WH 1248	40MS	15.7	40S	11.0	50S	15.1	10S	3.1
114	HD 3290	80S	35.3	40S	12.9	60S*	8.6	10MS	2.9
115	NW 7033	20S	12.0	40S*	5.3	50S	12.9	10S	2.6
116	PBW 793	30MS	12.4	10MS	1.3	10S	1.8	15S	5.4
117	HD 3291	40S	17.7	20MS	3.8	40S	7.1	10S	4.2
118	PBW 792	20MR	3.1	80S	22.6	40S	9.4	20S	3.7
119	K 1707	30MS	10.7	40S*	6.5	50S	12.0	60S	21.5
120	DBW 267	40S	29.3	20S	5.8	50S	10.1	10S	4.8
120A	INFECTOR	100S	76.7	100S	82.5	80S	57.1	100S	82.0
121	UP 3010	60S	38.3	10MS	2.3	30S	4.3	10MS	2.1
122	PBW 790	60S	36.7	20R	0.6	10S	2.2	20S	5.8
123	HP 1969	40MR	8.3	20MS	5.4	30S	7.0	80S	49.9
124	UP 3011	5MR	0.5	10R	0.3	10MS	1.9	40S*	9.1
125	HUW 830	20MS	8.7	20MS	5.1	10S	3.0	20S	6.5
126	PBW 791	20S	3.3	20S	4.8	50S	10.6	10S	1.9
127	DBW 107 (C)	20MR	2.2	40S	14.0	20S	4.6	20MS	6.6
128	HD 3288	20MS	7.0	10MS	1.4	10S	3.9	20S	11.5
129	DBW 269	20MS	5.1	40S	5.3	50S	10.2	10S	4.9
130	K 1708	10MS	2.3	10MS	1.3	20S	4.3	20S	5.8
131	PBW 799	60S	28.0	5MS	1.8	20S	4.3	10S	4.7
132	HD 3059 (C)	20S	6.3	10S	2.9	30S	5.3	80S	39.4
133	DBW 265	60S	28.0	40MS	8.0	5S	1.0	40S*	7.2
134	DBW 266	40S	23.7	10S	3.1	20S	3.2	40S*	6.1
135	RAJ 4534	10MR	1.0	20MR	1.5	40S*	8.3	10S	1.7
136	WH 1245	40S	25.3	5S	1.4	10S	2.6	40S	12.1
137	NW 7034	40S	20.0	20MS	3.8	10S	2.9	20MS	7.0
138	WH 1246	40S	17.7	20R	0.6	5MR	0.3	10MS	1.2
139	DBW 268	20MR	6.2	40S*	5.8	10MS	1.1	40S	14.9
140	HD 3289	10MS	2.2	5S	1.4	TR	0.0	40S	9.1
140A	INFECTOR	100S	75.7	100S	78.8	100S	61.4	100S	86.0
141	HD 3287	10MR	1.7	20S	7.3	10S	1.7	5S	0.7
142	HUW 831	10S	3.7	5S	1.9	20S	3.1	10S	1.5
143	RAJ 4533	10MR	1.0	5MS	1.0	5MS	0.7	20MS	5.5
144	UP 3009	20MR	2.7	20MS	2.2	10S	1.5	10S	4.0
NIVT-3B									
145	GW 510	20MR	2.0	40S	6.1	20S	4.6	100S	63.0

S. No.	Entry	Stem rust		Leaf rust				Stripe rust	
		South		South		North		North	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI
146	NIAW 3523	40S	25.7	30S	13.5	40S	7.7	60S	38.0
147	MP 3503	30S	10.7	40S	14.5	50S	13.3	80S	56.0
148	GW 511	10MR	1.2	20S	3.8	20S	4.1	90S	68.0
149	MACS 6732	5MR	0.7	5R	0.2	10MR	0.6	40S	15.9
150	PBW 794	5MR	0.5	40MS	7.3	10S	2.9	20MS	4.9
151	MP 1352	30MS	12.7	20S	9.5	20S	5.3	80S	43.4
152	HI 1633	5MS	1.9	5MS	0.8	50S	11.4	60S	46.0
153	NIAW 3354	20S	8.5	40S*	6.2	5MR	0.3	40S	15.0
154	MP 3497	40MS	16.0	60S	13.4	30S	6.4	70S	43.0
155	UAS 3002	10MS	2.7	5MS	0.7	30S	5.2	80S	46.0
156	MP 1351	10S	4.9	20S	4.7	30S	8.6	40S*	7.3
157	GW 509	10MR	1.2	5MS	1.0	20S	2.9	70S	46.6
158	AKAW 5023	20MR	4.0	20MS	4.0	20S	4.5	80S	52.6
159	HD 2932 (C)	30MR	6.3	80S	15.1	70S	21.0	90S	58.0
160	HI 1634	10MR	1.5	10R	0.4	30S	6.5	70S	47.6
160A	INFECTOR	100S	81.7	100S	80.0	100S	60.0	100S	77.8
161	DBW 270	60S	27.7	30S	4.9	40S	6.3	40S	20.1
162	HD 2864 (C)	5MR	0.9	5MS	1.3	30S	4.9	80S	59.0
163	HI 8807	10MS	2.5	10MS	1.5	TR	0.0	10S	3.4
164	MACS 6726	40S	15.7	30S	4.2	50S*	8.5	20MS	4.3
165	HI 8808	30S	12.3	20MS	3.0	30S	4.3	10S	3.5
166	DBW 271	20MS	10.3	30S	8.5	20S	3.6	60S	29.4
167	NIAW 3525	10S	4.6	10S	2.6	20S	3.1	60S	35.4
168	HD 3300	30S	10.5	10MS	3.0	50S*	8.7	80S	44.1
169	CG 1029	10S	3.9	10MS	1.3	20S	4.3	90S	70.0
NIVT-4									
170	DDW 48	30S	12.3	40S	8.6	20S	2.9	10S	3.3
171	HI 8813	30S	14.3	30S	3.9	20S	2.9	20MS	2.1
172	HI 8737 (C)	30S	13.7	20S	2.7	10MS	1.7	20MS	3.3
173	MACS 4085	30S	9.3	10MS	3.2	20MS	2.3	40S	19.1
174	MPO 1355	10S	4.0	10S	1.8	50S*	9.2	80S	41.4
175	HI 8812	TMS	0.2	20MS	3.0	5MR	0.3	10MS	3.8
176	HI 8811	30S	7.7	5MS	1.3	TR	0.1	10S	4.4
177	HI 8810	5MR	0.9	10MR	0.8	TMR	0.1	30S	9.5
178	AKDW 5079	30S	8.5	30MS	5.0	10S	1.4	5S	1.3
179	HI 8809	10S	2.0	20MS	3.3	10S	1.4	20MS	2.9
180	WHD 963	40S*	10.8	20MS	4.0	5MS	0.6	20MS	4.3
180A	INFECTOR	100S	78.3	100S	81.3	100S	60.0	100S	82.0
181	RKD 331	20MS	11.0	20S	8.6	10S	1.4	40S	7.6
182	MACS 4083	60S	23.7	20S	3.7	10S	1.4	40S	13.9

S. No.	Entry	Stem rust		Leaf rust				Stripe rust	
		South		South		North		North	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI
183	GW 1348	10MS	3.7	40MS	4.6	10S	3.1	40S	13.9
184	NIDW 1171	10MS	2.7	40MS	4.8	20S	2.9	10S	2.4
185	UAS 468	20MS	3.7	5MS	1.0	10S	1.5	10S	3.1
186	MPO 1353	20S	9.1	40S	12.5	10S	2.0	80S	52.0
187	MPO 1354	20S	9.1	20S	4.9	5MS	0.6	80S	53.5
188	UAS 469	10MS	2.5	30S	6.4	5MS	0.6	40S	8.8
189	PDW 355	10MS	2.4	30MS	3.3	TR	0.0	20MS	4.7
190	HI 8713 (C)	5MS	2.3	10MS	1.7	TR	0.0	20S	9.2
191	DDW 49	20S	17.5	40S	9.8	10MS	2.0	20S	8.0
192	NIDW 1158	10MS	3.4	40S*	5.5	0	0.0	20MS	3.6
193	MACS 3949 (C)	20MS	4.8	10S	2.8	5MS	0.6	20MS	5.1
194	GW 1349	5S	1.2	40S	6.6	0	0.0	20S	5.4
NIVT-5A									
195	UP 3012	100S	44.0	40S	8.3	20S	4.6	40S	16.8
196	PBW 644 (C)	40S	19.3	30S	5.3	10S	1.5	40S	22.5
197	WH 1250	30S	11.7	20S	3.9	10S	2.0	20S	5.9
198	K 1710	30S	10.0	40S	8.4	TR	0.0	20S	9.2
199	DBW 274	60S	27.4	40S	11.1	10S	1.5	10S	1.6
200	HD 3295	10MR	1.0	20S	4.8	30S	4.3	10S	4.1
200A	INFECTOR	100S	85.0	100S	80.0	100S	64.3	100S	78.0
201	HD 3294	10MR	1.0	10S	2.6	20S	4.0	20S	5.0
202	HS 649	80S	37.3	30S	5.9	TS	0.1	10S	2.8
203	NW 7030	10MS	2.2	5S	0.9	0	0.0	20S	11.7
204	WH 1142 (C)	20MS	3.9	60S	21.8	10S	2.0	40S*	4.5
205	K 1317 (C)	10S	5.0	30S	4.5	20S	3.4	30S	13.4
206	UP 3013	40S	16.3	10MS	1.9	30S	4.3	80S	32.1
207	DBW 275	60S	29.0	10S	4.5	20S	5.0	80S	40.0
208	BRW 3823	60S	27.3	30S	8.0	20S	6.4	60S	23.0
209	PBW 795	5X	0.8	10S	2.5	20MS	3.0	10S	3.3
210	DBW 273	60S	38.3	20S	8.3	50S	9.7	30S	7.1
211	HD 3292	30S	16.0	10S	4.3	30S	5.7	90S	56.5
212	HD 2888 (C)	5MR	0.4	5S	0.7	20S	4.3	60S	37.0
213	UP 3018	20MS	6.0	20S	4.3	60S*	8.6	40S	19.9
214	HUW 832	5MR	0.5	20S	5.8	10S	3.7	10S	3.1
215	PBW 796	20S	10.0	20S	3.3	20S	8.3	10S	2.4
216	K 1711	10S	3.9	30S	3.9	50S	12.4	10S	5.3
217	WH 1251	40S	22.3	20S	4.8	60S*	8.6	10S	3.1
218	DBW 272	20X	6.0	40S	11.8	30S	5.9	20S	6.1
219	HD 3293	30S	14.3	40S*	5.6	50S*	9.1	20S	10.4

S. No.	Entry	Stem rust		Leaf rust				Stripe rust	
		South		South		North		North	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI
NIVT-5B									
220	GW 1350 (d)	20MS	6.5	20S	5.0	50S	10.6	80S	63.0
220A	INFECTOR	100S	80.0	100S	75.0	100S	61.4	100S	83.0
221	DBW 110 (C)	20MS	5.6	10MS	2.4	10S	4.0	80S	53.0
222	NIDW 1149 (d)	10MS	3.5	20S	2.8	40S*	5.7	15S	4.1
223	MP 3507	5MS	1.5	60S	17.5	50S*	8.6	60S	42.0
224	HI 8815 (d)	10MR	1.2	20MS	2.6	50S*	7.2	30S	9.9
225	UAS 470 (d)	10S	5.0	20MS	2.9	TR	0.1	10S	4.7
226	HI 8814 (d)	10MS	2.5	20R	0.9	TMR	0.1	40S	11.5
227	DBW 280	20MR	3.0	TR	0.0	20S	5.7	60S	45.5
228	DBW 276	60S	24.7	40S	5.8	20S	5.9	40S	18.3
229	MP 1346	5S	2.6	20MS	2.8	10S	2.9	60S	24.7
230	GW 512	5MR	0.9	10MS	1.9	30S	5.7	80S	65.0
231	HD 3297	10MR	3.7	60S	16.0	50S*	8.4	60S	33.6
232	MP 1345	30S	10.4	10S	2.8	50S	9.4	10S	3.8
233	HI 1605 (C)	20MS	4.7	40S	10.5	70S	15.7	40S	22.6
234	MPO 1347 (d)	5S	1.9	10MS	1.4	30S	7.2	90S	66.0
235	UAS 466 (d) (C)	10S	4.0	5MR	0.5	30S	7.3	10S	2.7
236	MACS 4075 (d)	5S	2.5	20S	5.5	10MS	2.9	40S	26.0
237	NIAW 3386	30MS	12.7	10MR	0.8	20MS	2.3	30S	15.5
238	CG 1030	10MS	5.7	40S*	6.5	10S	10.3	90S	56.0
239	HD 3296	40MR	4.7	60S	24.0	20S	6.3	60S	38.7
240	AKAW 5082	20MR	2.7	5MR	0.5	10S	1.5	80S	52.6
240A	INFECTOR	100S	85.0	100S	77.5	100S	61.4	100S	83.0
241	MACS 6719	10MR	2.2	20R	1.1	5MR	0.3	80S	50.0
242	DBW 277	10MS	5.0	10MR	0.7	TR	0.1	60S	31.5
243	HI 8627 (d) (C)	10MR	1.1	20MR	1.8	5R	0.1	30S	7.4
244	HP 1970	30MS	8.7	60S	22.6	40S*	5.8	10S	4.4
IVT (NHZ)									
245	HPW 454	5MS	2.2	20S	5.1	20S	3.0	20MS	5.2
246	VL 2034	10MS	3.2	40S	12.9	30S	7.2	0	0.0
247	VL 2031	40MS	11.7	10MR	0.8	10S	1.5	10S	4.3
248	HS 650	30MS	8.3	10MS	1.6	20S	2.9	10S	2.3
249	VL 2033	40S	22.0	20S	7.3	10S	3.3	10S	2.5
250	HPW 455	30S	8.7	20S	3.0	10S	2.3	15S	4.7
251	HPW 453	30S	6.7	40S	7.6	20S	4.3	20MS	5.1
252	UP 3014	40S	21.5	40S	6.0	5S	0.7	40S	18.4

S. No.	Entry	Stem rust		Leaf rust				Stripe rust	
		South		South		North		North	
		HS	ACI	HS	ACI	HS	ACI	HS	ACI
253	HS 652	40S	11.0	20S	8.3	30S	6.4	20MS	3.2
254	HS 507 (C)	20S	5.3	20S	4.8	10S	1.9	20S	11.3
255	HS 562 (C)	30S	15.0	20S	7.5	10S	2.6	10S	3.3
256	DBW 279	10MR	1.0	40S	7.7	20MS	2.3	5S	2.4
257	VL 2032	10S	7.7	40S	10.8	10S	1.4	10S	1.9
258	HS 651	10MR	0.7	10R	0.3	30S	4.3	15S	1.9
259	HS 653	20S	14.7	20S	8.8	40S	10.0	10MS	2.4
260	UP 3015	20MR	2.9	10S	1.9	10S	4.6	80S	44.4
260A	INFECTOR	100S	80.0	100S	77.5	100S	61.4	100S	79.0

Table 1.5.Performance of AVTs entries against different diseases under multilocation testing during 2017-18

S. No.	Entry	LB(dd)		PM (0-9)		KB %		LS %		FS		FR	FHB	HB %	
		HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	Av.	%	(0-5)	HS	Av.
I. Northern Hills Zone															
1	HS 542 (C)	56	35	8	3	10.0	6.0	71.8	37.2	25.0	6.3	6.7	3	46	26
2	HS 666	67	35	8	4	14.0	8.1			25.0	8.1	5.9	5	31	26
3	HS 665	78	35	6	3	10.7	4.2			4.3	1.5	15.4	5	31	19
4	VL 1015	47	34	7	4	21.4	9.3			28.6	9.2	27.8	4	34	21
5	HPW 450	78	35	7	3	12.0	7.2			7.1	3.2	12.5	5	15	11
6	HS 664	67	35	8	6	17.5	8.7			0.0	0.0	20.0	5	44	30
7	HPW 451	57	35	5	3	10.1	5.4			16.7	5.8	35.3	3	44	36
8	VL 1016	78	35	7	4	15.6	7.2			50.0	21.2	26.7	4	41	29
9	UP 3016	78	35	6	3	13.8	10.7			42.9	19.2	0.0	4	23	10
10	VL 1014	56	35	5	3	12.5	7.7			58.3	19.6	0.0	3	16	7.5
11	VL 829 (C)	59	35	6	4	12.4	8.7			7.7	1.9	5.6	3	15	6.6
12	HPW 251 (C)	78	45	4	2	17.5	8.1	27.2	22	5.6	2.4	0.0	3	15	11
13	HPW 349 (C)	67	35	5	3	10.5	7.5			44.4	17.2	11.8	4	48	30
14	HS 634	68	46	4	3	25.2	11.6			9.1	2.3	33.3	5	31	16
15	VL 907 (C)	67	35	6	4	16.8	8.1			14.2	6.6	22.2	3	28	13
16	HS 507 (C)	56	35	5	3	7.5	6.1	52.5	28.8	10.0	4.4	0.0	3	37	25
17	HPW 441	78	46	3	2	13.2	6.7			6.9	3.0	5.6	4	26	16
18	HPW 442	79	46	5	3	12.4	7.1			10.0	5.3	35.0	4	47	38
19	HS 562 (C)	78	35	5	3	12.3	4.7			15.4	4.8	10.5	3	42	31
20	VL 3017	78	57	6	3	8.4	3.2			3.2	0.8	27.8	5	15	8.8
20A	INFECTOR	88	78	8	7	28.2	16.3	85	65.3	69.8	44.4	23.5	3		
21	UP 3017	56	35	6	4	5.6	3.8			33.3	15.7	0.0	4	15	8
22	VL 3016	78	46	6	4	6.4	4.0			16.2	5.7	22.2	5	24	14
23	HS 662	78	45	4	2	13.1	6.4			11.1	3.8	27.8	3	36	31

S. No.	Entry	LB(dd)		PM (0-9)		KB %		LS %		FS		FR	FHB	HB %	
		HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	Av.	%	(0-5)	HS	Av.
24	HS 490 (C)	78	36	4	2	7.3	2.6	63.3	32.4	54.6	20.0	22.2	3	22	11
25	VL 892 (C)	78	46	5	2	10.0	4.3	51.7	25.2	3.7	0.9	6.3	5	20	13
26	HS 661	79	46	5	3	15.4	6.1			27.3	10.9	10.5	3	33	20
27	HS 660	78	46	4	2	13.5	6.0			7.1	1.8	16.7	4	30	22
28	VL 3018	78	46	6	3	2.8	0.7			0.0	0.0	5.9	5	11	7
29	HPW 459	78	46	4	2	7.1	3.1			26.7	13.1	0.0	5	54	25
II. NORTH WESTERN PLAINS ZONE															
30	UP 2981	67	34	6	4	12.2	5.8			66.7	24.1	0.0	4		
31	DBW 221	68	35	7	5	10.7	5.5			100.0	47.1	5.0	4		
32	DPW 621-50 (C)	35	24	5	3	16.7	6.8			10.0	3.3	20.0	3		
33	DBW 222	57	24	7	3	6.0	2.7			21.4	6.6	11.1	4		
34	BRW 3792	68	24	5	3	5.0	2.8			33.3	10.7	16.7	4		
35	PBW 763	58	24	9	6	15.1	5.6			55.6	25.3	5.6	5		
36	PBW 766	57	24	5	3	20.8	8.0			25.0	11.6	5.0	4		
37	HD 3086 (C)	58	34	5	3	15.2	6.3	31.3	7.8	36.4	11.6	10.0	4		
38	DBW 233	67	34	6	2	4.5	3.2			7.4	2.2	11.1	5		
39	HD 3226	56	24	3	2	4.6	3.1	45	31.3	4.3	1.1	5.3	5		
40	HD 2967 (C)	24	13	6	3	16.1	6.8	61.9	31.4	42.9	14.1	20.0	4		
40A	INFECTOR	68	46	9	7	28.0	18.8	81.1	61.2	87.5	50.6	30.0	4		
41	PBW 801	46	34	6	3	8.2	3.5			40.0	10.7	35.0	5		
42	DBW 88 (C)	46	24	6	3	8.4	4.4	40	35	25.0	7.1	36.8	3		
43	PBW 800	45	13	6	3	6.7	4.1			50.0	14.4	20.0	4		
44	WH 1105	68	35	6	3	26.4	14.1	57.4	25.8	31.6	7.9	27.8	5		
45	PBW 771	68	34	9	7	14.3	5.9			62.5	23.5	15.0	5		
46	WH 1124 (C)	68	35	5	3	12.8	5.5	21.2	8.2	27.3	7.6	15.8	5		
47	DBW 90 (C)	79	35	5	2	6.9	4.4	51.2	12.8	16.7	4.2	5.9	5		
48	HD 3059 (C)	45	24	7	4	7.4	5.4	35.8	28	22.2	8.3	20.0	3		
49	WH 1021 (C)	56	24	7	5	12.5	5.9	60	22.9	37.5	10.8	18.8	4		
50	PBW 752*	46	23	7	4	25.5	11.3	43.6	26.3	62.5	16.6	5.3	4		
51	DBW 173 (I) (C)	58	35	6	3	4.6	3.2	71.7	42.2	14.3	7.3	26.3	4		
52	PBW 773	68	35	6	3	4.0	2.4			5.9	1.5	20.0	5		
53	DBW 237	56	35	6	3	7.0	4.1			20.0	6.8	23.5	2		
54	WH 1142 (C)	57	24	8	5	6.0	3.4	80.5	42.7	15.4	9.1	17.7	2		
55	BRW 3806	46	24	8	4	9.1	5.8			52.7	13.2	17.7	3		
56	WH 1080 (C)	45	24	7	4	4.2	2.2	76.6	40.4	20.0	5.0	26.3	3		
57	HD 3237*	35	24	7	3	9.5	4.8	46.1	29.9	4.8	1.2	38.9	4		
58	HI 1620*	56	24	8	4	22.9	10.4	73.3	37.9	16.7	6.4	17.7	3		
59	PBW 644 (C)	35	24	7	3	6.5	3.0	60	26.3	71.4	20.7	33.3	4		
60	HD 3043 (C)	35	23	6	2	8.8	5.4	56.3	27.6	9.1	3.8	0.0	4		
60A	INFECTOR	68	46	8	7	15.2	12.8	83.3	60.4	100.0	58.0	25.0	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.	%	(0-5)	HS	Av.
61	DBW 252	46	24	2	1	8.2	5.3			25.0	13.2	10.0	4		
62	HI 1628	67	35	9	4	6.7	4.3			2.1	0.5	45.0	4		
63	NIAW 3170	68	35	7	3	21.7	7.8			2.9	0.7	30.0	4		
III. NORTH EASTERN PLAINS ZONE															
64	DBW 233	45	24	7	3	10.0	3.6			14.3	4.4	23.5	4		
65	HD 3249	45	34	8	4	25.7	10.7			33.3	10.2	15.0	4		
66	HD 3254	35	24	8	4	8.0	4.4			10.0	3.2	0.0	3		
67	K 1006 (C)	45	24	6	4	7.0	3.7	69.3	44.4	3.3	1.7	11.1	4		
68	HD 2733 (C)	35	24	9	6	6.0	3.0	65.4	37.8	20.0	10.7	0.0	3		
69	DBW 221	56	24	9	5	23.3	12.9			58.3	18.3	11.1	4		
70	K 1601	45	24	5	3	18.1	8.3			62.5	18.5	15.8	4		
71	PBW 769	55	24	4	3	7.1	3.4			6.3	1.6	22.2	5		
72	DBW 39 (C)	25	23	5	4	5.0	3.3	61.7	39.7	40.0	11.3	11.1	5		
73	HD 2967 (C)	26	13	6	4	18.1	8.4	61.9	31.4	14.3	5.7	26.3	3		
74	K 0307 (C)	45	24	4	3	8.0	5.1	71.4	42.4	9.1	3.3	20.0	5		
75	DBW 187	46	24	5	3	6.7	4.9	45	34.9	20.0	8.3	35.0	4		
76	DBW 223	34	24	7	4	10.8	4.1			30.0	12.6	23.5	4		
77	PBW 762	56	23	7	5	5.0	2.6			37.5	12.3	37.5	5		
78	WH 1218	57	24	2	1	5.7	2.8			5.9	3.6	31.6	4		
79	HD 2888 (C)	36	24	7	4	7.7	5.1	61.7	37.3	72.7	19.4	5.3	5		
80	HI 1612 (I) (C)	35	13	7	4	22.7	8.8	55	38.3	87.5	36.6	31.6	4		
80A	INFECTOR	78	57	7	7	27.5	18.0	84	68.5	80.0	48.7	0.0	4		
81	WH 1235	78	34	8	4	11.0	5.8			3.4	0.9	20.0	4		
82	BRW 3806	47	24	5	3	11.9	8.1			9.1	5.3	29.4	3		
83	K 1317 (C)	56	24	4	3	10.4	8.1	62.5	49	4.2	1.0	37.5	3		
84	DBW 252	57	34	5	3	9.1	6.0			85.7	24.9	0.0	4		
85	K 8027 (C)	68	24	6	4	14.1	6.8	67.3	44.6	50.0	15.5	0.0	4		
86	HD 3171 (C)	45	23	5	3	33.3	10.1	55	31.7	21.4	6.7	15.0	4		
87	HI 1628	58	23	7	4	6.9	3.0			4.0	1.0	5.9	4		
IV. CENTRAL ZONE															
88	GW 1339 (d)	57	35	6	3	9.1	6.0			3.6	1.3	33.3	3		
89	AKAW 4924	78	35	7	4	28.7	11.6			7.1	1.8	0.0	2		
90	GW 322 (C)	67	34	5	3	9.0	7.0	68.3	43.4	30.8	12.9	22.2	3		
91	HI 8713 (d) (C)	68	35	4	3	10.7	6.4			4.0	1.0	15.0	3		
92	HI 8737 (d) (C)	58	35	7	4	22.3	8.3			5.5	1.4	20.0	3		
93	HI 1544 (C)	78	46	6	4	9.2	6.0			85.7	46.5	22.2	3		
94	GW 495	68	46	6	4	16.5	7.9			83.3	42.5	0.0	3		
95	UAS 465 (d)	79	45	7	4	6.6	2.7			19.3	6.1	27.8	2		
96	MPO 1343 (d)	78	35	3	2	11.0	4.0			4.2	1.0	10.0	3		
97	DBW 110 (C)	57	24	5	3	8.6	3.9	45	29.1	5.3	2.0	33.3	3		
98	DDW 47 (d)	67	34	7	3	8.3	2.8			3.1	0.8	33.3	3		

S. No.	Entry	LB(dd)		PM (0-9)		KB %		LS %		FS		FR	FHB	HB %	
		HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	Av.	%	(0-5)	HS	Av.
99	MP 1331	57	34	5	3	10.9	4.0			14.3	5.6	6.3	3		
100	MP 3288 (C)	58	36	5	3	6.2	3.3	55	30.2	10.0	6.4	0.0	4		
100A	Infector	68	56	9	7	82.9	31.6	90	65.3	68.4	43.8	26.7	3		
101	HI 8627 (d) (C)	79	35	7	4	8.2	3.5	50	13.5	3.8	1.0	17.7	4		
102	UAS 466 (d)	68	35	6	4	6.1	3.1			5.4	1.9	15.0	4		
103	NIAW 3170	68	35	6	3	8.5	3.8			3.7	1.4	11.8	4		
V. PENINSULAR ZONE															
104	AKAW 4924	57	35	8	4	8.6	6.1			6.9	2.5	20.0	5		
105	GW 491	56	34	9	6	6.6	3.8			6.6	1.7	45.0	5		
106	GW 493	57	35	9	6	8.2	3.9			40.0	12.1	29.4	5		
107	DBW 235	67	34	6	3	20.0	6.5			37.5	9.4	5.9	4		
108	HI 1624	68	46	9	5	8.3	5.2			33.3	11.1	22.2	4		
109	MACS 6222 (C)	67	35	7	4	13.7	6.7	43.9	30	27.3	7.9	10.5	5		
110	DBW 168 (I) (C)	68	34	6	3	14.3	6.6	48.8	29.8	28.6	10.0	20.0	3		
111	GW 495	57	35	8	5	9.2	5.1			50.0	22.8	47.4	5		
112	MP 1338	68	35	6	3	6.6	4.3			2.2	0.6	27.8	5		
113	MACS 3949 (d) (C)	68	35	8	3	11.8	5.7			8.1	2.8	26.3	3		
114	HI 8800 (d)	68	34	8	5	8.6	4.5			8.3	2.1	28.6	3		
115	MACS 6478 (C)	57	24	8	5	9.0	4.9	60.7	30.8	54.6	16.5	5.3	4		
116	MACS 6709	45	24	8	4	4.3	2.5			8.9	4.3	21.1	3		
117	HI 1625	67	34	9	4	8.1	5.5			70.0	18.7	29.4	4		
118	UAS 428 (d) (C)	68	24	8	4	6.8	3.2			19.6	4.9	23.5	3		
119	PBW 770	67	35	7	3	18.5	7.6			30.8	8.0	38.9	4		
120	GW 492	78	35	7	4	8.0	4.1			7.7	3.4	35.0	4		
120A	Infector	68	46	9	6	30.0	18.1	86.7	60.7	56.9	41.4	22.2	3		
121	GW 1346 (d)	78	46	7	4	10.8	5.3			6.7	1.7	35.7	5		
122	HI 1605 (C)	78	35	7	4	10.0	5.8			5.6	1.4	45.0	3		
123	AKDW 2997-16 (d)(C)	78	46	9	6	4.4	1.8	51	12.8	25.9	7.5	21.1	5		
124	MPO 1336 (d)	78	46	7	3	13.6	5.5			2.9	0.7	11.8	3		
125	UAS 446 (d) (c)	67	24	7	5	5.6	2.2	65	25.3	5.3	1.3	25.0	5		
126	HI 8805 (d)	67	35	7	4	6.1	4.0			0.0	0.0	33.3	4		
127	MACS 4058 (d)	78	46	9	5	5.9	2.7			0.0	0.0	6.3	5		
128	MACS 6696	89	35	8	4	7.4	3.7			33.3	10.2	20.0	3		
129	MACS 4059 (d)	89	46	9	5	17.0	5.4			0.0	0.0	26.3	4		
130	NIAW 3170	79	35	7	4	11.1	5.9			0.0	0.0	21.1	3		
131	DBW 93 (c)	46	35	8	4	5.0	3.5			44.4	17.8	5.6	3		
132	MACS 6695	78	35	9	4	9.3	4.6			33.3	14.8	16.7	3		
133	HI 8802 (d)	78	35	7	4	4.0	1.8			23.5	5.9	16.7	3		
VI. SPECIAL TRIAL (Dicoccum)															
134	DDK 1029 (C)	46	34	4	2	2.9	0.7	35.0	9.0	25.0	6.3	25.0	3		

S. No.	Entry	LB(dd)		PM (0-9)		KB %		LS %		FS		FR	FHB	HB %	
		HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	Av.	%	(0-5)	HS	Av.
135	MACS 6222 (Ae.) (C)	68	35	7	4	3.3	0.8	43.9	30	33.3	13.6	5.6	3		
136	MACS 5051	68	35	6	2	0.0	0.0			7.1	1.8	7.1	3		
137	HW 4101	45	24	4	2	0.0	0.0			5.5	1.4	6.7	3		
138	DDK 1054	56	34	6	2	0.0	0.0			6.7	1.7	30.0	3		
139	HW 1098 (C)	46	24	3	1	0.0	0.0	25	7.5	6.5	1.6	21.1	3		
VII. SPECIAL TRIAL- Very Late Sown															
140	WR 544 (C)	68	45	9	5	11.4	4.5	55.7	27.4	37.5	10.8	11.1	5		
140A	Infector	68	57	9	6	26.0	16.7	83.3	58.6	65.8	41.2	26.3	3		
141	HD 3271	35	24	5	3	7.0	2.7			44.4	14.3	5.3	4		
142	DBW 71 (C)	68	35	8	4	41.3	14.8	81.3	35.7	54.6	14.4	27.8	4		
143	PBW 797	35	24	7	3	20.3	10.1			50.0	25.4	26.3	3		
144	PBW 757	68	35	5	3	9.5	5.0	95.3	50.6	11.1	5.2	31.6	4		
145	DBW 278	78	45	6	3	7.1	4.0			5.7	1.4	21.1	5		
146	HI 1621	78	35	7	4	10.9	5.3			9.5	4.0	35.0	4		
147	DBW 14 (C)	57	35	7	3	9.2	4.5	57.5	29.8	25.0	7.3	33.3	3		
148	PBW 777	45	34	8	4	14.0	8.6	57.5	29.8	28.6	11.1	11.1	4		
149	HD 3298	57	24	5	3	6.8	3.8			4.7	1.2	15.8	4		
Abbr: LB-Leaf blight, PM-Powdery mildew, KB-Karnal bunt, LS-Loose smut, FS-Flag smut, FR-Foot rot, FHB-Fusarium head blight, HB-Hill bunt															

PROGRAMME 2. RUSTS: BROWN, YELLOW AND BLACK

RACE SPECIFIC APR

AVT entries were evaluated at specific locations for Race Specific Adult Plant Resistance (APR) to three rusts (brown, black and yellow).
Locations:
Yellow rust and brown rust (under controlled conditions): Flowerdale, Shimla (Table 2.1 and Table 2.2)
Black rust (under controlled conditions): Mahabaleshwar (Table 2.3)
Yellow rust – Ludhiana and New Delhi (Table 2.4)
Black rust- Indore, Pune and Powarkheda (Table 2.5)
Brown rust - New Delhi and Ludhiana (Table 2.6)

Race specific Adult Plant Resistance (APR) in AVT material to rusts under controlled conditions at Flowerdale, Shimla
AVT entries were evaluated for identifying adult plant resistance (Table 2.1 & 2.2). Optimum conditions for infection of rust and growth of wheat material were provided.

Table 2.1. Adult plant resistance in AVT material to yellow rust

APR to Pathotype	No. of lines	Detail of entries
110S119	28	BRW3806, DBW221, DBW237, DBW71 (C), DDW47 (D), HD3080 (C), HD3237, HD3298, HI1620, HI1621, HI8800 (D), HPW349 (C), HPW441, HPW450, HPW451, HPW459, HS562 (C), K1601, MPO1336 (D), PBW766, PBW769, PBW773, UP2981, VL3016, VL3017, VL3018, VL892 (C), WH1124 (C)
110S84	15	AKAW4924, DBW168 (I) (C), DBW88 (C), GW1339 (D), GW492, HD3271, HI1628, HI8627 (D) (C), HS660, K0307 (C), K1006 (C), MACS4058 (D), MACS4059 (D), MPO1343 (D), PBW757
110S119 and 110S84	28	AKDW2997-16 (D) (C), DBW14 (C), DBW222, DBW233, DBW235, DBW90 (C), GW1346 (D), HD3226, HD3254, HI1612 (I) (C), HI8737 (D) (C), HI8805 (D), HPW442, HS634, HS662, HS665, HS666, MACS6222 (C), NIAW3170, PBW757, PBW770, PBW777, UAS428 (D) (C), UAS446 (D) (C), WH1080 (C), WH1142 (C), WH1218, WH1235
Total	**71**	

Table 2.2 Adult plant resistance in AVT material to brown rust

APR to pathotypes	Number of entries	Detail of entries
77-9	26	BRW3806, DBW110, DBW223, DBW233, DBW235, DBW252, DPW621-50, GW322, HD2967, HD3059, HD3226, HD3249, HI1628, HPW442, HPW450, HS542, HS660, MACS6478, NIAW3170, PBW752, PBW800,

		PBW801, VL907, VL1014, VL3017, WH1080,
104-2	18	DBW90, DDK1029, DDK1054, HD3043, HD3086, HD3237, HI1612, HI1615, HI8737, HI8805, HS664, HW1098, MACS6695, MP1331, PBW644, VL1016, WH1124, WH1218
77-9 and 104-2	11	HD2733, HPW349, HS490, HS634, K1317, K1601, PBW769, UAS428, VL892, VL1015, VL3016
Total	**55**	

Table 2.3: Race Specific Adult Plant Resistance Test of wheat genotypes from AVT materials (CZ and PZ) against selective pathotypes of stem rust at Mahabaleshwar Centre

S. No.	Genotytpe	Pathotype	
		40A	**117-6**
I. CENTRAL ZONE			
1	GW 1339 (d)	20S	TR
2	AKAW 4924	10MR	TMS
3	GW 322 (C)	10MS	TS
4	HI 8713 (d) (C)	5MR	TR
5	HI 8737 (d) (C)	10MR	TR
6	HI 1544 (C)	5MR	TR
7	GW 495	10MS	TR
8	UAS 465 (d)	5MS	TR
9	MPO 1343 (d)	TR	TR
10	DBW 110 (C)	TMS	10MS
11	DDW 47 (d)	TMR	TR
12	MP 1331	TR	TR
13	MP 3288 (C)	TR	TR
14	HI 8627 (d) (C)	10MR	TMR
15	UAS 466 (d)	TR	TS
16	NIAW 3170	TMS	5MS
II. PENINSULAR ZONE			
17	AKAW 4924	5MS	TR
18	GW 491	TR	TR
19	GW 493	TMR	5MS
20	DBW 235	TR	TR
21	HI 1624	TR	TR
22	MACS 6222 (C)	5MR	TR
23	DBW 168 (I) (C)	TR	TR
24	GW 495	TR	TR
25	MP 1338	10MS	5MS
26	MACS 3949 (d) (C)	TR	TMS
27	HI 8800 (d)	TMR	TR

S. No.	Genotytpe	Pathotype	
28	MACS 6478 (C)	20S	5MS
29	MACS 6709	TR	TR
30	HI 1625	TMR	TR
31	UAS 428 (d) (C)	10MS	5MS
32	PBW 770	TMR	TR
33	GW 492	10MS	10MS
34	GW 1346 (d)	TMR	TMR
35	HI 1605 (C)	TR	5S
36	AKDW 2997-16 (d) (C)	20S	5S
37	MPO 1336 (d)	TR	TR
38	UAS 446 (d) (c)	TR	TR
39	HI 8805 (d)	5MR	TMS
40	MACS 4058 (d)	10MS	10MS
41	MACS 6696	20S	5MS
42	MACS 4059 (d)	TR	5MR
43	NIAW 3170	5MS	TMR
44	DBW 93 (c)	TR	TR
45	MACS 6695	5MS	10MS
46	HI 8802 (d)	5MS	5R

COOPERATORS

NAME	**CENTRES**
PRAMOD PRASAD, OP GANGWAR, SC BHARDWAJ	FLOWERDALE, SHIMLA
SG SAWASHE, NV SAVANT, MA GUD	MAHABALESHWAR

Table 2.4. APR response of AVT materials against individual races of *Puccinia striiformis tritici*

S. No.	Variety	RUSTS PATHOTYPES			
		STRIPE RUST			
		46S119		110S119	
		Delhi	Ludhiana	Delhi	Ludhiana
I. NORTHERN HILL ZONE					
1	HS 542 (C)	0	40S	30S	80S
2	HS 666	5MR	0	5S	0
3	HS 665	TR	0	TR	0
4	VL 1015	0	5S	0	0
5	HPW 450	0	5MS	0	10S
6	HS 664	0	5MS	0	10S
7	HPW 451	10S	5MS	20S	20S
8	VL 1016	0	0	0	0

S. No.	Variety	RUSTS PATHOTYPES			
		STRIPE RUST			
		46S119		110S119	
		Delhi	Ludhiana	Delhi	Ludhiana
9	UP 3016	10S	40S	40S	80S
10	VL 1014	0	5MS	0	0
11	VL 829 (C)	0	40S	20S	40S
12	HPW 251 (C)	20S	40S	60S	80S
13	HPW 349 (C)	10S	10S	10S	10MS
14	HS 634	0	5MS	5S	10S
15	VL 907 (C)	10S	20S	15S	40S
16	HS 507 (C)	0	40S	10S	40S
17	HPW 441	15S	0	0	0
18	HPW 442	10S	0	0	0
19	HS 562 (C)	15S	0	0	0
20	VL 3017	10S	5S	0	0
21	UP 3017	60S	40S	80S	80S
22	VL 3016	10S	0	10S	0
23	HS 662	TR	0	TR	0
24	HS 490 (C)	10S	10S	20S	40S
25	VL 892 (C)	20MS	40S	30S	80S
26	HS 661	0	0	0	0
27	HS 660	10MS	0	10S	0
28	VL 3018	10S	TS	10S	0
29	HPW 459	20S	10S	10S	0
II. NORTH WESTERN PLAIN ZONE					
30	UP 2981	10S	TS	TR	10MS
31	DBW 221	30S	5S	20S	10MS
32	DPW 621-50 (C)	40S	40S	60S	80S
33	DBW 222	5S	5S	10S	10MS
34	BRW 3792	10MS	5S	10S	20MS
35	PBW 763	0	0	0	0
36	PBW 766	10S	0	15S	20S
37	HD 3086 (C)	5S	0	0	0
38	DBW 233	10S	5S	20S	20S
39	HD 3226	0	0	0	0
40	HD 2967 (C)	40S	40S	60S	60S

S. No.	Variety	RUSTS PATHOTYPES			
		STRIPE RUST			
		46S119		110S119	
		Delhi	Ludhiana	Delhi	Ludhiana
41	PBW 801	0	0	0	0
42	DBW 88 (C)	20S	40S	50S	80S
43	PBW 800	0	0	0	0
44	WH 1105	20S	20S	30S	80S
45	PBW 771	0	0	0	0
46	WH 1124 (C)	10S	5S	0	0
47	DBW 90 (C)	10S	5S	0	0
48	HD 3059 (C)	10S	40S	60S	80S
49	WH 1021 (C)	10S	60S	60S	80S
50	PBW 752*	0	0	0	0
51	DBW 173 (I) (C)	5S	40S	30S	60S
52	PBW 773	TMR	5S	5S	0
53	DBW 237	10S	5S	15S	10MS
54	WH 1142 (C)	20S	10S	0	0
55	BRW 3806	5S	40S	20S	40S
56	WH 1080 (C)	20S	5S	0	0
57	HD 3237*	0	5MS	10S	5S
58	HI 1620*	20S	10S	20S	10MS
59	PBW 644 (C)	10S	20S	40S	60S
60	HD 3043 (C)	0	40S	50S	60S
61	DBW 252	20S	40S	50S	60S
62	HI 1628	5S	40S	10S	5S
63	NIAW 3170	20S	10S	20S	40S
III. NORTH EASTERN PLAIN ZONE					
64	DBW 233	5S	20S	20S	20MS
65	HD 3249	5S	20S	20S	40S
66	HD 3254	5S	5S	10S	10MS
67	K 1006 (C)	10S	60S	40S	60S
68	HD 2733 (C)	40S	60S	60S	60S
69	DBW 221	20S	5S	20S	5MS
70	K 1601	10S	10S	20S	60S
71	PBW 769	5MR	5S	10S	5S
72	DBW 39 (C)	10S	40S	40S	80S

S. No.	Variety	RUSTS PATHOTYPES			
		STRIPE RUST			
		46S119		110S119	
		Delhi	Ludhiana	Delhi	Ludhiana
73	HD 2967 (C)	40S	60S	60S	60S
74	K 0307 (C)	40S	40S	50S	40S
75	DBW 187	TMR	5S	10S	5MS
76	DBW 223	20S	10MS	30S	40S
77	PBW 762	0	0	0	0
78	WH 1218	TR	TS	TR	0
79	HD 2888 (C)	10S	40S	30S	60S
80	HI 1612 (I) (C)	10S	TS	10S	0
81	WH 1235	0	0	10S	5MS
82	BRW 3806	10S	10S	20S	40S
83	K 1317 (C)	10S	10S	30S	40S
84	DBW 252	20S	40S	40S	60S
85	K 8027 (C)	40S	40S	50S	80S
86	HD 3171 (C)	40S	40S	40S	40S
87	HI 1628	10S	40S	10S	0
VII. SPECIAL TRIAL- Very Late Sown					
88	DDK 1029 (C)	40S	60S	80S	80S
89	MACS 6222 (Ae.) (C)	5S	10S	10S	5MS
90	MACS 5051	10S	10S	15S	10MS
91	HW 4101	0	TS	5S	0
92	DDK 1054	0	0	0	0
93	HW 1098 (C)	20S	20S	40S	60S
94	DDK 1029 (C)	TR	0	0	5MR
95	MACS 6222 (Ae.) (C)	10S	40S	20S	60S
96	MACS 5051	10S	10S	10S	0
97	HW 4101	0	10S	10S	5MS

Table 2.5. APR response of AVT materials against individual races of *Puccinia graminis tritici*

S. No.	Variety	117-6			40A		
		Indore	Mahabaleshwar	Pune	Indore	Mahabaleshwar	Pune
I. CENTRAL ZONE							
1	GW 1339 (d)	5MS	TR	30S	5R	20S	5MR
2	AKAW 4924	20MR	TMS	10MR	40MR	10MR	5MR
3	GW 322 (C)	20S	TS	20MR	10S	10MS	TR
4	HI 8713 (d) (C)	5S	TR	30S	10MR	5MR	5MR
5	HI 8737 (d) (C)	20S	TR	30S	5S	10MR	TR
6	HI 1544 (C)	20MR	TR	TR	10R	5MR	TR
7	GW 495	20MR	TR	TR	10R	10MS	5MR
8	UAS 465 (d)	40S	TR	20S	40MS	5MS	20MR
9	MPO 1343 (d)	20S	TR	20MS	10MR	TR	5MR
10	DBW 110 (C)	40MR	10MS	10MR	20MR	TMS	20MR
11	DDW 47 (d)	20S	TR	20MR	5R	TMR	40MR
12	MP 1331	40S	TR	30MS	5S	TR	20MR
13	MP 3288 (C)	20MR	TR	5MR	20R	TR	TR
14	HI 8627 (d) (C)	20S	TMR	TR	0	10MR	10MR
15	UAS 466 (d)	10S	TS	30S	TS	TR	10MR
16	NIAW 3170		5MS	5MR	5R	TMS	5MR
II. PENINSULAR ZONE							
17	AKAW 4924	20MR	TR	10MR	40MR	5MS	20MR
18	GW 491	10R	TR	20MR	10R	TR	5MR
19	GW 493	5MR	5MS	TR	5R	TMR	5MR
20	DBW 235	20S	TR	20MS	10S	TR	TR
21	HI 1624	5MR	TR	5MR	10MR	TR	20MR
22	MACS 6222 (C)	5MR	TR	5MR	10MR	5MR	5MR
23	DBW 168 (I) (C)	10MR	TR	10MR	0	TR	20MR
24	GW 495	20MR	TR	10MR	20MR	TR	5MR
25	MP 1338	20S	5MS	5MR	20MR	10MS	TR
26	MACS 3949 (C)	10S	TMS	TR	10S	TR	5MR
27	HI 8800 (d)	5MS	TR	30S	0	TMR	40S
28	MACS 6478 (C)	40S	5MS	40S	20S	20S	10MR
29	MACS 6709	40S	TR	40S	20S	TR	TR
30	HI 1625	10R	TR	10MR	10R	TMR	TR
31	UAS 428 (d) (C)	20S	5MS	10MR	10MS	10MS	10MR
32	PBW 770	20MR	TR	10MR	20MR	TMR	20S
33	GW 492	20MR	10MS	TR	20MR	10MS	TR
34	GW 1346 (d)	20S	TMR	5MR	5S	TMR	5MR
35	HI 1605 (C)	5S	5S	20MS	20S	TR	5MR

S. No.	Variety	117-6			40A		
		Indore	Mahabaleshwar	Pune	Indore	Mahabaleshwar	Pune
36	AKDW 2997-16 (d) (C)	40S	5S	40S	20S	20S	10MR
37	MPO 1336 (d)	10S	TR	40S	5MR	TR	30S
38	UAS 446 (d) (c)	20S	TR	20MS	0	TR	5MR
39	HI 8805 (d)	TMS	TMS	20MS	TMR	5MR	10MR
40	MACS 4058 (d)	5S	10MS	40S	5MS	10MS	TR
41	MACS 6696	10S	5MS	20MS	40MR	20S	20MR
42	MACS 4059 (d)	5S	5MR	10MR	10MR	TR	20MR
43	NIAW 3170	5R	TMR	5MR	20R	5MS	TR
44	DBW 93 (c)	5MR	TR	TR	5R	TR	5MR
45	MACS 6695	10S	10MS	5MR	40MR	5MS	10MR
46	HI 8802 (d)	5S	5R	20MS	10MR	5MS	TR
III. SPECIAL TRIAL (Dicoceum)							
47	DDK 1029 (C)	TMS	-	10MR	10R	-	5MR
48	MACS 6222 (Ae.) (C)	5MR	-	10MR	5MR	-	10MR
49	MACS 5051	5R	-	5MR	5MR	-	5MR
50	HW 4101	5S	-	10MR	5MR	-	10MR
51	DDK 1054	10S	-	10MR	10R	-	20MR
52	HW 1098 (C)	10S	-	10MR	10R	-	20MR

Table 2.6 APR response of AVT materials against individual races of *Puccinia triticina*

S. No.	Variety	77-5		77-9
		Delhi	Ludhiana	Ludhiana
I. NORTHERN HILL ZONE				
1	HS 542 (C)	0	5S	40S
2	HS 666	0	TS	0
3	HS 665	5MR	0	0
4	VL 1015	TR	20S	20S
5	HPW 450	0	0	60S
6	HS 664	0	5S	60S
7	HPW 451	0	0	0
8	VL 1016	5S	10S	20S
9	UP 3016	5MR	0	0
10	VL 1014	0	0	40S
11	VL 829 (C)	0	5S	40S
12	HPW 251 (C)	0	0	0
13	HPW 349 (C)	0	0	0
14	HS 634	0	0	0
15	VL 907 (C)	0	0	40S

S. No.	Variety	77-5		77-9
		Delhi	Ludhiana	Ludhiana
16	HS 507 (C)	5MR	0	40S
17	HPW 441	10S	0	0
18	HPW 442	5MR	0	0
19	HS 562 (C)	0	0	0
20	VL 3017	TR	5S	40S
21	UP 3017	0	TS	40S
22	VL 3016	0	10S	20S
23	HS 662	0	0	0
24	HS 490 (C)	0	0	0
25	VL 892 (C)	0	0	0
26	HS 661	0	0	0
27	HS 660	0	0	0
28	VL 3018	5MR	0	0
29	HPW 459	5MR	0	10S
II. NORTH WESTERN PLAIN ZONE				
30	UP 2981	0	0	40S
31	DBW 221	0	0	0
32	DPW 621-50 (C)	TR	5S	20S
33	DBW 222	5MR	0	0
34	BRW 3792	TMR	0	0
35	PBW 763	0	0	0
36	PBW 766	0	0	0
37	HD 3086 (C)	0	20S	60S
38	DBW 233	5S	0	0
39	HD 3226	10S	0	0
40	HD 2967 (C)	0	0	0
41	PBW 801	0	5S	40S
42	DBW 88 (C)	0	0	5S
43	PBW 800	0	0	0
44	WH 1105	0	20S	40S
45	PBW 771	TR	0	0
46	WH 1124 (C)	5MR	0	40S
47	DBW 90 (C)	0	0	40S
48	HD 3059 (C)	0	0	10S
49	WH 1021 (C)	TR	0	40S
50	PBW 752*	0	0	40S
51	DBW 173 (I) (C)	0	0	0
52	PBW 773	0	0	40S
53	DBW 237	TR	0	0
54	WH 1142 (C)	TR	0	0
55	BRW 3806	0	5S	5S
56	WH 1080 (C)	0	5S	5S
57	HD 3237*	0	20S	40S
58	HI 1620*	0	0	5S
59	PBW 644 (C)	0	0	5S

S. No.	Variety	77-5		77-9
		Delhi	Ludhiana	Ludhiana
60	HD 3043 (C)	0	5S	60S
61	DBW 252	0	0	0
62	HI 1628	TR	0	0
63	NIAW 3170	5MR	0	0
III. NORTH EASTERN PLAIN ZONE				
64	DBW 233	5MR	0	0
65	HD 3249	0	0	5S
66	HD 3254	5MR	0	5S
67	K 1006 (C)	5MR	0	0
68	HD 2733 (C)	5MR	0	40S
69	DBW 221	5S	0	0
70	K 1601	5MR	0	0
71	PBW 769	5S	5S	40S
72	DBW 39 (C)	TR	0	0
73	HD 2967 (C)	0	0	0
74	K 0307 (C)	0	0	0
75	DBW 187	0	0	0
76	DBW 223	0	0	0
77	PBW 762	10S	0	0
78	WH 1218	0	0	40S
79	HD 2888 (C)	0	0	40S
80	HI 1612 (I) (C)	0	0	40S
81	WH 1235	5MR	0	5S
82	BRW 3806	TR	0	20S
83	K 1317 (C)	0	0	20S
84	DBW 252	5MR	0	0
85	K 8027 (C)	TR	0	0
86	HD 3171 (C)	5MR	0	10S
87	HI 1628	10MR	0	5S
VII. SPECIAL TRIAL- Very Late Sown				
88	DDK 1029 (C)	TR	0	0
89	MACS 6222 (Ae.) (C)	0	0	0
90	MACS 5051	0	0	0
91	HW 4101	0	0	0
92	DDK 1054	0	0	0
93	HW 1098 (C)	5MR	0	0
94	DDK 1029 (C)	0	0	40S
95	MACS 6222 (Ae.) (C)	TR	0	0
96	MACS 5051	0	0	0
97	HW 4101	0	0	0

2.2 IDENTIFICATION OF SLOW RUSTER LINES IN AVT MATERIAL 2017-18

Yellow rust

The delay in progress of epiphytotic development is attributed to several factors including latent period, number of uredosori per unit area, size of uredosori, rate of sporulation, etc. Chances of new variants or pathotypes are minimized due to reduced selection pressure. A convenient option of identifying slow ruster lines is the estimation of the Area Under Disease Progress Curve (AUDPC) which takes into account all the factors collectively leading to manifestation of slow rusting in a genotype. AVT entries were sown in single rows, each of 1 meter length with an interception of the spreader row after every 20th line for identifying the slow ruster lines at Karnal and Mahabaleshwar. For creating a load of inoculum pressure, four rows of mixture of susceptible genotypes were sown as border rows (infector/spreader). The infector/spreader rows were syringe inoculated at growth stage 37 (Zadoks growth scale for cereals) when flag leaf was just emerging out of boot. On appearance of rust pustules on flag leaf, the high humidity was maintained for rust development. AUDPC was calculated for yellow rust data of Karnal centre and brown rust and stem rust data of Mahabaleshwar centres.

0: It represents high level of resistance controlled by major genes. This type of resistance exerts a strong selection pressure on pathogen, compelling it to mutate, resulting in short field life of a cultivar. Genotypes possessing this kind of resistance should be particularly avoided in inoculum source areas, however, they can be satisfactorily grown in target areas to seek protection against specified pathotypes.

1 – 10: This type of resistance also represents strong vertical resistance as described in group 0. This category includes those entries on which disease initiated as traces of resistant pustules (TR infection type) not exceeding 10R as terminal reaction. It may also not impart a durable protection and is likely to be lost owing to adaptations in the pathogen.

11 – 100: The incipient reaction appears as pustules of moderately susceptible (MS) infection type. Subsequent progression of disease occurs at a quite slower rate as compared to the fast ruster check genotype. Such genotypes possess adult plant resistance (APR) genes in addition to the vertical resistance genes. Such genotypes may exhibit a better field durability than those possessing the vertical resistance genes only.

101 – 200: Genotypes falling in this range of AUDPC truly represent the slow rusters. Disease initiates in the form of susceptible (S) type pustules on these genotypes but subsequent progression remains slower than the fast ruster check. The terminal severity in these genotypes does not exceed 20S as compared to 80 – 100S in fast rusting genotypes. Genotypes belonging to this category carry a long lasting field resistance and must be preferred while breeding to develop cultivars possessing durable resistance.

Entries showing various ranges of AUDPC are shown below:

Stripe Rust

A. Karnal

0	VL 1016, PBW 801, DBW 90 (C), PBW 752*, PBW 762, HI 8802 (d), PBW 757
1-100	HS 666, HS 665, VL 1015, HPW 450, VL 1014, HPW 349 (C), HPW 441, HPW 442, HS 562 (C), VL 3017, HS 662, HS 661, VL 3018, HPW 459, DBW 222, PBW 763, HD 3086 (C), HD 3226, PBW 800, PBW 771, WH 1124 (C), PBW

	773, WH 1142 (C), HD 3237*, WH 1218, HI 8737 (d) (C), UAS 465 (d), MACS 3949 (d) (C), HI 8800 (d), AKDW 2997-16 (d)(C), MPO 1336 (d), UAS 446 (d) (c), HI 8805 (d), MACS 4059 (d), HD 3271, DBW 71 (C), PBW 777, HD 3298
101-200	HS 664, HS 660, UP 2981, BRW 3792, DBW 237, WH 1080 (C), HI 1612 (I) (C), MPO 1343 (d), DDW 47 (d), PBW 797

B. Ludhiana

0	HS 665, VL 3017, PBW 763, PBW 800, PBW 752*, PBW 757
1-100	VL 1015, VL 1016, VL 1014, HPW 441, HPW 442, HS 562 (C), VL 3016, HS 661, HS 660, VL 3018, UP 2981, HD 3226, PBW 801, WH 1124 (C), PBW 773, PBW 762, WH 1218, GW 1339 (d), UAS 465 (d), MPO 1343 (d), DDW 47 (d), HI 8800 (d), UAS 428 (d) (C), AKDW 2997-16 (d)(C), UAS 446 (d) (c), HI 8802 (d), PBW 797, HI 1621
101-200	HS 666, HS 664, HPW 451, HPW 459, HD 3086 (C), PBW 771, DBW 90 (C), HD 3237*, DBW 221, PBW 769, DBW 187, HI 1612 (I) (C), WH 1235, HI 8713 (d) (C), HI 8737 (d) (C), MP 3288 (C), HI 8627 (d) (C), UAS 466 (d), DBW 235, MACS 3949 (d) (C), PBW 770, MPO 1336 (d), HI 8805 (d), MACS 4059 (d), HW 4101, DBW 71 (C), PBW 777

Stem Rust

A. Indore

0	UP 3016, VL 829 (C), DBW 88 (C), DBW 39 (C), K 8027 (C), HI 8713 (d) (C), HI 1625, PBW 770, MACS 6695
1-100	HS 664, HPW 251 (C), HPW 349 (C), HS 634, VL 907 (C), HS 507 (C), HPW 442, VL 3017, HS 662, HS 661, HS 660, HPW 459, PBW 763, HD 2967 (C), PBW 801, PBW 800, PBW 771, WH 1021 (C), DBW 173 (I) (C), DBW 237, WH 1142 (C), HD 3043 (C), DBW 252, HD 3254, HD 2733 (C), K 1601, DBW 187, DBW 223, HD 2888 (C), K 1317 (C), GW 1339 (d), AKAW 4924, GW 322 (C), HI 8737 (d) (C), HI 1544 (C), GW 495, UAS 465 (d), MPO 1343 (d), DBW 110 (C), DDW 47 (d), MP 1331, MP 3288 (C), HI 8627 (d) (C), UAS 466 (d), GW 491, GW 493, DBW 235, HI 1624, MACS 6222 (C), DBW 168 (I) (C), MP 1338, HI 8800 (d), UAS 428 (d) (C), GW 492, GW 1346 (d), HI 1605 (C), AKDW 2997-16 (d)(C), MPO 1336 (d), UAS 446 (d) (c), HI 8805 (d), MACS 4058 (d), MACS 6696, MACS 4059 (d), DBW 93 (c), HI 8802 (d), DDK 1029 (C), MACS 6222 (Ae.) (C), MACS 5051, HW 4101, DDK 1054, HW 1098 (C), HD 3271, DBW 71 (C), HI 1621, DBW 14 (C)
101-200	HS 542 (C), HS 666, HPW 451, VL 1016, VL 1014, UP 3017, VL 3016, HS 490 (C), VL 892 (C), UP 2981, DPW 621-50 (C) , PBW 766, HD 3226, WH 1105, BRW 3806, WH 1080 (C), HI 1620*, HD 3249, K 1006 (C), PBW 769, K 0307 (C), WH 1218, WH 1235, HD 3171 (C), HI 1628, MACS 3949 (d) (C), NIAW 3170, PBW 797, PBW 757, HD 3298

B. Mahabaleshwar

0	NIL
1-100	HS 542 (C), HS 666, HS 665, VL 1015, HPW 450, HS 664, HPW 451, UP 3016, VL 1014, VL 829 (C), HPW 251 (C), HPW 349 (C), HS 507 (C), HPW 441, HPW 442, VL 3017, HS 662, VL 892 (C), HS 661, VL 3018, HPW 459, DPW 621-50 (C) , DBW 222, BRW 3792, PBW 763, PBW 766, HD 3086 (C), DBW

	233, HD 3226, PBW 801, DBW 88 (C), PBW 800, WH 1105, PBW 771, WH 1124 (C), DBW 90 (C), HD 3059 (C), WH 1021 (C), PBW 752*, DBW 173 (I) (C), PBW 773, DBW 237, WH 1080 (C), HI 1620*, PBW 644 (C), HD 3043 (C), HD 3249, HD 3254, K 1006 (C), HD 2733 (C), K 1601, DBW 39 (C), HD 2967 (C), DBW 187, DBW 223, PBW 762, WH 1218, HD 2888 (C), HI 1612 (I) (C), BRW 3806, K 1317 (C), DBW 252, K 8027 (C), HD 3171 (C), HI 1628, HI 8713 (d) (C), HI 8737 (d) (C), HI 1544 (C), UAS 465 (d), MPO 1343 (d), DBW 110 (C), DDW 47 (d), MP 1331, HI 8627 (d) (C), UAS 466 (d), AKAW 4924, GW 491, GW 493, DBW 235, HI 1624, MACS 6222 (C), DBW 168 (I) (C), GW 495, MP 1338, MACS 3949 (d) (C), HI 8800 (d), MACS 6478 (C), MACS 6709, HI 1625, UAS 428 (d) (C), PBW 770, GW 492, GW 1346 (d), HI 1605 (C), AKDW 2997-16 (d)(C), MPO 1336 (d), UAS 446 (d) (c), HI 8805 (d), MACS 4058 (d), MACS 6696, MACS 4059 (d), NIAW 3170, DBW 93 (c), MACS 6695, HI 8802 (d), DDK 1029 (C), MACS 6222 (Ae.) (C), MACS 5051, HW 4101, DDK 1054, HW 1098 (C), WR 544 (C), HD 3271, PBW 797, PBW 757, DBW 278, DBW 14 (C), PBW 777, HD 3298
101-200	HS 542 (C), HS 666, HPW 451, VL 1016, VL 1014, UP 3017, VL 3016, HS 490 (C), VL 892 (C), UP 2981, DPW 621-50 (C) , PBW 766, HD 3226, WH 1105, BRW 3806, WH 1080 (C), HI 1620*, HD 3249, K 1006 (C), PBW 769, K 0307 (C), WH 1218, WH 1235, HD 3171 (C), HI 1628, MACS 3949 (d) (C), NIAW 3170, PBW 797, PBW 757, HD 3298

Leaf Rust (South)

A. Mahabaleshwar

0	UP 3016, VL 829 (C), DBW 88 (C), DBW 39 (C), K 8027 (C), HI 8713 (d) (C), HI 1625, PBW 770, MACS 6695
1-100	HS 664, HPW 251 (C), HPW 349 (C), HS 634, VL 907 (C), HS 507 (C), HPW 442, VL 3017, HS 662, HS 661, HS 660, HPW 459, PBW 763, HD 2967 (C), PBW 801, PBW 800, PBW 771, WH 1021 (C), DBW 173 (I) (C), DBW 237, WH 1142 (C), HD 3043 (C), DBW 252, HD 3254, HD 2733 (C), K 1601, DBW 187, DBW 223, HD 2888 (C), K 1317 (C), GW 1339 (d), AKAW 4924, GW 322 (C), HI 8737 (d) (C), HI 1544 (C), GW 495, UAS 465 (d), MPO 1343 (d), DBW 110 (C), DDW 47 (d), MP 1331, MP 3288 (C), HI 8627 (d) (C), UAS 466 (d), GW 491, GW 493, DBW 235, HI 1624, MACS 6222 (C), DBW 168 (I) (C), MP 1338, HI 8800 (d), UAS 428 (d) (C), GW 492, GW 1346 (d), HI 1605 (C), AKDW 2997-16 (d)(C), MPO 1336 (d), UAS 446 (d) (c), HI 8805 (d), MACS 4058 (d), MACS 6696, MACS 4059 (d), DBW 93 (c), HI 8802 (d), DDK 1029 (C), MACS 6222 (Ae.) (C), MACS 5051, HW 4101, DDK 1054, HW 1098 (C), HD 3271, DBW 71 (C), HI 1621, DBW 14 (C)
101-200	HS 542 (C), HS 666, HS 665, VL 1015, HPW 450, HS 664, HPW 451, UP 3016, VL 1014, VL 829 (C), HPW 251 (C), HPW 349 (C), HS 507 (C), HPW 441, HPW 442, VL 3017, HS 662, VL 892 (C), HS 661, VL 3018, HPW 459, DPW 621-50 (C) , DBW 222, BRW 3792, PBW 763, PBW 766, HD 3086 (C), DBW 233, HD 3226, PBW 801, DBW 88 (C), PBW 800, WH 1105, PBW 771, WH 1124 (C), DBW 90 (C), HD 3059 (C), WH 1021 (C), PBW 752*, DBW 173 (I) (C), PBW 773, DBW 237, WH 1080 (C), HI 1620*, PBW 644 (C), HD 3043 (C), HD 3249, HD 3254, K 1006 (C), HD 2733 (C), K 1601, DBW 39 (C), HD 2967

	(C), DBW 187, DBW 223, PBW 762, WH 1218, HD 2888 (C), HI 1612 (I) (C), BRW 3806, K 1317 (C), DBW 252, K 8027 (C), HD 3171 (C), HI 1628, HI 8713 (d) (C), HI 8737 (d) (C), HI 1544 (C), UAS 465 (d), MPO 1343 (d), DBW 110 (C), DDW 47 (d), MP 1331, HI 8627 (d) (C), UAS 466 (d), AKAW 4924, GW 491, GW 493, DBW 235, HI 1624, MACS 6222 (C), DBW 168 (I) (C), GW 495, MP 1338, MACS 3949 (d) (C), HI 8800 (d), MACS 6478 (C), MACS 6709, HI 1625, UAS 428 (d) (C), PBW 770, GW 492, GW 1346 (d), HI 1605 (C), AKDW 2997-16 (d)(C), MPO 1336 (d), UAS 446 (d) (c), HI 8805 (d), MACS 4058 (d), MACS 6696, MACS 4059 (d), NIAW 3170, DBW 93 (c), MACS 6695, HI 8802 (d), DDK 1029 (C), MACS 6222 (Ae.) (C), MACS 5051, HW 4101, DDK 1054, HW 1098 (C), WR 544 (C), HD 3271, PBW 797, PBW 757, DBW 278, DBW 14 (C), PBW 777, HD 3298

COOPERATORS

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2.3 SEEDLING RESISTANCE TEST AGAINST PATHOTYPES OF WHEAT RUSTS

A. Flowerdale, Shimla

a. Rust resistance

For identification of rust resistant lines of wheat and characterize rust resistance genes, 149 lines of AVT were evaluated at seedling stage using an array of pathotypes of black (*Puccinia graminis* f.sp. *tritici*) (Pgt), brown (*P. triticina*) (Pt) and yellow rust (*P. striiformis* f.sp. *tritici*) (Pst) having varying avirulence/virulence structures. These studies were conducted under controlled conditions of temperature and light. Two lines HS661 and PBW763 were resistant to all the pathotypes of three rust pathogens. Additionally, all the lines having *Sr31* were resistant to black rust of wheat, whereas lines possessing *Lr24*, some with *Lr26* were resistant to brown rust.

Rust resistance in AVT lines

Rust resistance to all the pathotypes of brown, black and yellow rust pathogens was observed in the two AVT wheat lines HS661 and PBW763. Eight entries *viz.* AKAW4924, GW491, GW492, GW493, GW495, HI1544, HI1625 and MACS6222 possessed resistance to all the pathotypes of brown and black rust pathogens, whereas one entry VL1016 showed resistance to all the pathotypes of black and yellow rust pathogens. Twelve entries *viz.* GW1339, HI1624, HS665, HS666, MACS3949, PBW757*, PBW770, PBW771, PBW777, PBW797, UAS446 and VL3018 expressed resistance to all Pt pathotypes, ten entries *viz.* DBW110, HD3226, HD3237, HI1628, HS542, HS634, K1317, MP1338, MP3288 and PBW769 showed resistance to all the Pgt pathotypes and five entries *viz.* PBW752, PBW762, PBW800, PBW801 and VL1015 were resistance to all Pst pathotypes.

Resistant to	No. of lines	Wheat lines
Brown , Black and Yellow	2	HS661, PBW763
Brown & Black	8	AKAW4924, GW491, GW492, GW493, GW495, HI1544, HI1625, MACS6222,
Black &Yellow	1	VL1016
Brown	12	GW1339, HI1624, HS665, HS666, MACS3949, PBW757*, PBW770, PBW771, PBW777, PBW797, UAS446, VL3018
Black	10	DBW110, HD3226, HD3237, HI1628, HS542, HS634, K1317, MP1338, MP3288, PBW769
Yellow	5	PBW752, PBW762, PBW800, PBW801, VL1015

Rust resistance genes in AVT lines (Gene postulation)

Based on gene matching technique, rust resistance genes were characterized in the AVT lines of wheat. These studies were conducted under controlled conditions of temperature and light. Wherever required, the confirmatory and repeated testing was also undertaken to find out the consistency in the observations. Proper reference checks were maintained to ascertain the purity of pathotypes and behaviour of rust resistance genes. Based on the gene matching technique, rust resistance genes characterized in AVT wheat materials are discussed below.

***Yr* genes**

Five patterns of *Yr* genes in different combinations or alone were inferred in 90 advance wheat lines. Among these, gene *Yr2* was characterized in 56 lines. Gene *Yr9* which is linked to *Lr26* and *Sr31* was identified in 17 lines. *YrA* was characterized in 12 lines. Gene combinations *Yr9+A*+ and *Yr9+18*+ were inferred in 2 and 3 lines, respectively (Table 2.7).

***Lr* genes**

Lr genes were characterized in 83% of AVT lines. Eleven *Lr* genes (*Lr1, 2a, 3, 9, 10, 13, 18, 23, 24, 26* and *34*) were postulated either alone or in different combinations in 124 AVT lines. Among these *Lr13* was observed in 52 lines followed by *Lr23* and *Lr10* in 38 lines each, *Lr26* in 22 lines and *Lr1* in 17 lines. Other *Lr* genes like *Lr2a*, *Lr3*, *Lr9*, *Lr18*, *Lr24* and *Lr34* were postulated in 1-4 lines (Table 2.8) only.

***Sr* genes**

Stem rust resistance genes (*Sr* genes) were characterized in 78.53% lines of AVT. Twelve *Sr* genes (*Sr2, 5, 7b, 8a, 9b, 9e, 11, 13, 24, 28, 30* and *31*) were characterized in 117 AVT lines. *Sr2*, a known APR gene whose postulation is based on characteristic micro-flecking, was postulated in 36.9 % of the AVT lines. *Sr11* was identified in 40 AVT lines followed by *Sr7b* in 23, *Sr31* in 22 and *Sr28* in14 lines. *Sr9e* and *Sr9b* were characterized in five lines eachwhereas *Sr24* and *Sr30* were identified in 3 lines each. *Sr8a* and *Sr13* were postulated in eleven and seven lines, respectively (Table 2.9).

Table 2.7.*Yr* genes in AVT lines during 2017-18

Postulated genes	Number of lines	Detail of lines
2+	56	DBW110 (C), DBW187, DBW221, DBW223, DBW233, DBW235, DBW237, DBW90 (C), DDK1054, DDW47 (D), GW322, GW492, HD2888, HD2967 (C), HD3059 (C), HD3080, HD3171 (C), HD3226, HD3237, HD3249, HD3298, HI1544 (C), HI1605 (C), HI1612, HI1621, HI1628, HI8737 (D) (C), HPW349 (C), HPW442, HPW450, HPW451, HS542 (C), HS634, HS664, HS665, HW4101, K0307, K1006 (C), K8027 (C), MACS3949 (D) (C), MACS5051, MACS6478, MACS6709, MP1331, MP1338, MP3288 (C), MPO1336 (D), PBW644 (C), UP2981, VL3016, VL3018, WH1080, WH1105, WH1124 (C), WH1135, WH1218
9+	17	DBW168 (I) (C), DBW222, DBW39 (C), DBW71 (C), DBW93 (C), HD3254, HI1624, HPW251 (C), HPW459, HS507 (C), HS662, PBW757, PBW770, PBW771, UP3016, WH1021 (C), WH1142 (C)
9+*A*+	02	DBW173 (I) (C), HD3043 (C)*
9+*18*+	03	HD2733 (C), VL829 (C), VL907 (C)
A+	12	BRW3792, BRW3806, DBW252, DBW88 (C), HI1620, HS490 (C), HS562 (C), K1317*, PBW766, UP3017, VL3017, VL892 (C)
Total	90	

Table 2.8*Lr* gene/s in AVT lines during 2017-18

Postulated genes	Number of lines	Detail of lines
*Lr*1+	1	DBW278
*Lr*10+	1	PBW801
*Lr*13+	24	DBW110, DBW221, DDK1029, HD3059, HI8627, HI8713, HI8805, HI1605, HI1620, HI1621, HPW450, HS634, HS664, K1601, K8027, MACS4059, MACS6696, PBW769, PBW773, PBW800, UAS466, VL3017, WH1080, WH1105
*Lr*13+1+	5	BRW3806, GW322, K1006, PBW644, WR544
*Lr*13+3+	1	HD3237
*Lr*13+10+	17	DBW233, DBW237, DBW252, DPW621-50, GW1346, HD3249, HD3271, HI1628, HS542, HPW349, HPW451, MACS6709, NIAW3170, PBW752, PBW766, VL892, WH1124
*Lr*13+10+1+	1	DBW235
*Lr*13+10+3+	4	DBW88, DBW90, HD3086, HI1620
*Lr*18+	4	DDK1054, MACS5051, HI4101, HW1098
*Lr*23+	16	BRW3792, DBW14, DBW223, HD2967, HI1612, HPW442, HS490, HS562, HS660, MACS4058, MACS8802, MP1336, MPO1336, MPO1343, VL3016, WH1235

*Lr*23+1+	4	K0307, MACS6478, UP2981, VL1014
*Lr*23+2a+	2	HD3298, WH1218
*Lr*23+10+	5	DBW187*, HD3226, HPW441, VL1015, VL1016
*Lr*23+10+2a	1	PBW762
*Lr*23+13+	1	UAS465
*Lr*23+13+10+	1	HD3171
*Lr*24+	3	HD2888, HI1544, MP3288
*Lr*26+	6	DBW71, DBW168, HI1624, PBW770, PBW757*, PBW771
*Lr*26+1+	4	HD3043*, HS507, VL907, WH1021
*Lr*26+9+	1	UP3016
*Lr*26+10+3+	1	DBW173
*Lr*26+23+	4	DBW93, HD3254, HPW251, WH1142
*Lr*26+23+1+	2	HPW459, HS662
*Lr*26+23+10+	2	DBW39, DBW222
*Lr*26+34+	2	HD2733, VL829
Total	113	

Table 2.9.*Sr* gene/sin AVT lines during 2017-18

Postulated genes	**Number of lines**	**Detail of lines**
Sr31+5+2+	02	DBW173(I)(C), VL829(C)
Sr31+5+	01	DBW71(C)
Sr31+2+	11	DBW168(I)(C), DBW39(C), DBW93(C), HD2733(C), HI1624, HPW251(C), PBW757, UP3016, VL907(C), WH1021(C), WH1142(C)
Sr31+	08	DBW222, HD3043(C), HD3254, HPW459, HS507(C), HS662, PBW770, PBW771
Sr24+2+	02	HD2888(C), HI1544(C)
Sr24+	01	MP3288(C)
Sr30+5+	01	WH1218
Sr30+	02	HD3298, PBW762
Sr28+8a+5+2+	01	DBW233
Sr28+8a+5+	01	DBW233
Sr28+8a+2+	01	WR544(C)
Sr28+5+11+	01	HS664
Sr28+5+	02	HPW450, VL3016
Sr28+9b+	01	HS490(C)
Sr28+11+2+	01	DBW14(C)
Sr28+7b+	01	UP2981
Sr28+	05	BRW3806, HI1621, MACS6478(C), MACS6709, WH1235
Sr8a+5+11+2+	01	DBW252
Sr8a+5+11+	01	DBW252
Sr8a+5+	03	BRW3792, HPW451, MP1331
Sr8a+9b+11+	01	K1006(C)
Sr8a+9b+	01	HS562(C)
Sr8a+11+2+	01	HD2967(C)
Sr5+11+	02	DBW187, HI1605(C)

Sr9e+7b+	01	DBW223
Sr9e+2+	04	HI8627(d)(C), HI8713(d)(C), HI8737(d)(C), WH1080(C)
Sr9b+11+7b+	01	MACS6695
Sr9b+11+	01	VL1014
Sr13+11+7b+	01	HW4101
Sr13+11+	03	GW1339(d), HI8805(d), PBW752
Sr13+2+	01	DBW90(C)
Sr13+	02	HI8802 (d), MACS4058(d)
Sr11+7b+2+	02	HD3171(C), PBW797
Sr11+7b+	05	DDK1054, DDW47(d), GW1346(d), HI1620, UAS465(d)
Sr11+2+	10	DBW278, DBW88(C), DDK1029(C), GW322(C), HD3059(C), HW1098(C), K8027(C), PBW644(C), UAS446(d)(C), WH1105
Sr11+	09	HI8800(d), HPW442, HS665 , MACS4059(d), MACS5051, MPO1336(d), PBW801, UAS466(d), UP3017
Sr7b+2+	05	AKDW2997-16(d)(C), HD3086(C), HI1612(I)(C), MACS3949(d)(C), WH1124(C)
Sr7b+	07	DBW221, HPW349(C), HS660, K1601 , UAS428(d)(C), VL1015, VL3018
Sr2+	13	AKAW4924, DBW237, DPW621-50(C), GW491, GW492, HD3249, HD3271, HI1628, HS661, K0307(C), NIAW3170, PBW763, VL892(C)
Total	**117**	

*= Different seed lot

B. MAHABALESHWAR

AVT genotypes of CZ & PZ were tested against selective pathotypes of stem and leaf rusts under glass house condition. These were tested at seedling stage against 13 pathotypes of stem rust and 14 pathotypes of leaf rust as detailed below.

Pathotypes used:
Stem Rust: 11, 21-1, 34-1, 40A, 42, 42-B, 117, 117A, 117-2, 117-3, 117-6, 122 and 184.

Leaf Rust: 77, 77A1, 77-4, 77-5, 77-9, 104A, 104-1, 104-2, 12A, 12-2, 12-3, 12-5, 162A and 108.

Wheat genotypes found resistant are depicted in Table 2.10

Table 2.10. Resistant genotypes of wheat from AVT trial against selective pathotypes at seedling stage under glass house condition

Resistant genotypes		
Stem rust	**Leaf rust**	**Both the rusts**
HI 1544 (C), GW 495, DBW 110 (C), DDW 47 (d), MP 3288 (C), GW 491, GW 493, DBW 235, HI 1624, MACS 6222 (C), DBW 168 (I) (C), GW 495, HI 1625, PBW 770, GW 492, MPO 1336 (d), MACS 6695	HI 1544 (C), GW 495, MP 3288 (C), AKAW 4924, GW 491, GW 493, HI 1624, MACS 6222 (C), HI 1625, UAS 428 (d) (C), GW 492, GW 1346 (d), DBW 93 (c)	HI 1544 (C), GW 495, MP 3288 (C), GW 491, GW 493, HI 1624, MACS 6222 (C), HI 1625, GW 492

PROGRAMME 3. LEAF BLIGHT

3.1. LEAF BLIGHT SCREENING NURSERY (LBSN), 2017-18

The disease is causing leaf spot on foliar parts and mainly prevalent in north eastern plains zone (NEPZ) and Peninsular zone (PZ). In recent years, the incidence in NWPZ is increasing as the temperature during crop season rises above 25 ^{o}C. The grain yield losses may vary from 10-50%. In addition to yield losses, the quality also deteriorates depending on the level of susceptibility of a cultivar against the pathogen. Since leaf blight occurs in all the wheat growing agro-climatic zones, deployment of resistant cultivars remains the most effective strategy for the management of disease.

This nursery was planted at 13 centres listed below:

Zone	**Test locations**
NEPZ	Faizabad, Varanasi, Pusa (IARI), Coochbehar, Shillongani, Kalyani, Ranchi, Sabour (8)
NWPZ	Karnal, Pantnagar, Ludhiana, Hisar, (4)
PZ	Dharwad (1)

The nursery was planted at 13 centers cited as above, the disease severity remained very low at five centers viz. Pusa (IARI), and Dharwar hence not included.

The entries were planted in one row each of 1m length and a row of a highly susceptible entry Raj 4015 was repeatedly planted after every 20 test entries. The inoculations of pathogens were done right from the month of January at 15 days intervals with frequent irrigations till development of disease. The recording of disease was done on 0-9 double digit scale at three stages, flowering, dough and hard dough stages to observe response of each entry against leaf blight at various stages. The first digit indicates the score of blight on flag leaf (F) and second digit represents the score of flag-1 leaf (F-1) and the disease score scale (0-9) was as follows:

0-No blight, **1**-Up to 10% leaf area blighted, **2**-11-20% leaf area blighted, **3**-21-30% leaf area blighted, **4**-31-40% leaf area blighted, **5**-41-50% leaf area blighted, **6**-51-60% leaf area blighted, **7**-61-70% leaf area blighted, **8**-71-80% leaf area blighted, **9**->80% leaf area blighted.

Amongst three stages, blight record at hard dough stage was most distinct in terms of giving clear comparison between resistant and susceptible stage and therefore data at hard dough stage was used for final categorization of resistance of test entries including AVT II year and data is also presented in Table 1.5 of chapter 1.

Center wise data of leaf blight score of different entries at hard dough growth stage is given in Table 3.1a and data of all the three stages in Table 3.1b.

Source of resistance

The entries from AVT II year and AVT I year which showed the moderate level of resistance within average score below 35 and the HS of 57 are VL 1015, HS 542 (C), VL 1014, HS 507 (C), UP 3017, PBW 800 and HPW 451. The entries PBW 763, VL 829 (C),

HS 666, HS 664, HPW 349 (C), VL 907 (C), HD 2967 (C), HD 2967 (C), HPW 450, VL 1016, UP 3016, and HI 1612 (I) (C), entries also showed moderate resistance to leaf blight with average score upto 35 but the highest score exceeded 57 due to high disease at one locations.

Among entries previously identified moderately resistant, HI 1612, UP 2942 and VL 1013 showed moderate resistance to leaf blight with average score up to 35 but highest score exceeded more than 57 due to high score at one location.

Table 3.1a Center wise data of leaf blight score of different entries at dough growth stage 2017-18

S. No.	Entry	Leaf Blight Score (0-9dd)												
		IIIrd (Hard dough)												
		Karnal	Pantnagar	Hisar	Sabour	Shillongani	Kalyani	Varanasi	Coochbhear	Ranchi	Ludhiana	Faizabad	HS	AV.
AVTs 2017-18														
I. NORTHERN HILL ZONE														
1	HS 542 (C)	24	45	35	36	24	46	47	56	14	01	35	56	35
2	HS 666	46	35	24	37	12	57	57	67	14	12	47	67	35
3	HS 665	35	35	35	46	25	68	57	78	13	01	46	78	35
4	VL 1015	35	23	24	46	12	36	47	45	24	01	35	47	34
5	HPW 450	46	26	35	36	13	47	46	78	24	11	36	78	35
6	HS 664	57	35	24	45	12	48	47	67	24	11	46	67	35
7	HPW 451	36	12	25	36	25	35	46	45	13	01	57	57	35
8	VL 1016	24	12	23	46	24	36	35	78	24	13	46	78	35
9	UP 3016	35	56	46	57	25	35	35	78	13	11	46	78	35
10	VL 1014	46	12	35	56	25	46	47	45	25	01	45	56	35
11	VL 829 (C)	24	12	46	36	12	59	47	45	25	02	35	59	35
12	HPW 251 (C)	58	DR	45	36	13	78	46	78	13	11	46	78	45
13	HPW 349 (C)	57	23	24	47	25	56	46	67	13	11	57	67	35
14	HS 634	46	23	24	57	13	57	47	67	13	68	57	68	46
15	VL 907 (C)	46	56	23	57	12	46	47	67	24	13	45	67	35
16	HS 507 (C)	35	35	35	46	13	45	47	56	35	01	36	56	35
17	HPW 441	58	23	45	46	24	67	47	78	13	57	46	78	46
18	HPW 442	79	35	35	36	25	79	36	78	24	24	36	79	46
19	HS 562 (C)	68	13	34	36	24	57	47	78	13	11	45	78	35
20	VL 3017	68	46	46	57	25	78	47	78	24	78	68	78	57
20A	Infector	68	78	78	67	78	79	68	78	68	88	78	88	78
21	UP 3017	35	56	35	36	24	56	35	56	13	22	46	56	35
22	VL 3016	57	13	23	37	25	78	47	78	24	57	35	78	46
23	HS 662	57	12	24	56	24	45	24	78	35	57	35	78	45
24	HS 490 (C)	35	26	36	46	25	57	24	78	13	67	36	78	36
25	VL 892 (C)	57	24	24	57	36	78	58	78	14	78	57	78	46
26	HS 661	35	12	23	36	47	79	35	67	13	77	57	79	46

S. No.	Entry	Leaf Blight Score (0-9dd)												
		IIIrd (Hard dough)												
		Karnal	Pantnagar	Hisar	Sabour	Shillongani	Kalyani	Varanasi	Coochbhear	Ranchi	Ludhiana	Faizabad	HS	AV.
27	HS 660	68	13	24	36	24	35	47	67	24	78	67	78	46
28	VL 3018	68	35	25	46	25	56	46	78	24	78	67	78	46
29	HPW 459	68	23	24	46	47	69	35	78	13	67	35	78	46
II. NORTH WESTERN PLAIN ZONE														
30	UP 2981	79	34	12	37	24	78	46	78	24	89	36	89	46
31	DBW 221	58	12	24	36	36	79	35	78	24	89	57	89	46
32	DPW 621-50 (C)	46	DR	34	36	35	45	46	67	13	89	46	89	46
33	DBW 222	68	23	35	36	24	67	47	78	03	67	47	78	46
34	BRW 3792	68	23	36	36	25	89	58	78	24	12	57	89	46
35	PBW 763	35	23	24	36	25	35	58	45	25	57	57	58	35
36	PBW 766	46	23	25	46	26	79	24	78	14	67	58	79	46
37	HD 3086 (C)	46	37	35	46	24	79	35	78	26	67	57	79	46
38	DBW 233	46	13	24	57	24	56	35	78	14	78	46	78	46
39	HD 3226	68	24	35	57	25	67	24	78	24	67	35	78	46
40	HD 2967 (C)	13	23	46	46	24	45	13	34	35	67	36	67	35
40A	Infector	46	56	78	67	78	89	68	78	68	89	78	89	68
41	PBW 801	35	23	45	57	24	67	57	56	26	89	67	89	46
42	DBW 88 (C)	46	45	23	47	25	46	46	67	24	89	35	89	46
43	PBW 800	24	13	24	47	24	56	45	45	14	15	46	56	35
44	WH 1105	68	56	23	46	36	79	35	78	35	89	46	89	56
45	PBW 771	35	23	34	57	25	78	35	78	24	89	57	89	46
46	WH 1124 (C)	58	26	37	57	25	79	46	78	13	47	57	79	47
47	DBW 90 (C)	36	28	46	56	25	99	35	78	24	89	46	99	47
48	HD 3059 (C)	36	DR	56	57	24	58	35	56	24	89	35	89	46
49	WH 1021 (C)	68	DR	45	46	25	69	36	67	13	23	46	69	46
50	PBW 752*	35	12	57	46	25	68	46	67	24	37	46	68	46
51	DBW 173 (I) (C)	68	45	23	56	47	78	57	67	24	78	35	78	56
52	PBW 773	68	23	24	56	46	78	35	78	26	89	46	89	56
53	DBW 237	46	23	23	57	47	68	46	67	24	89	57	89	46
54	WH 1142 (C)	68	12	45	56	24	68	24	67	13	78	46	78	46
55	BRW 3806	68	38	46	56	25	67	24	56	13	89	45	89	46
56	WH 1080 (C)	46	23	24	57	24	58	35	67	26	89	46	89	46
57	HD 3237*	46	27	23	67	24	57	24	78	24	78	67	78	46
58	HI 1620*	68	26	24	67	24	68	24	78	24	78	46	78	46
59	PBW 644 (C)	46	25	25	67	25	46	24	78	23	78	35	78	46
60	HD 3043 (C)	46	13	23	56	24	57	35	67	35	78	36	78	45
60A	Infector	79	56	78	67	78	78	89	78	68	89	78	89	78

S. No.	Entry	Leaf Blight Score (0-9dd)												
		IIIrd (Hard dough)												
		Karnal	**Pantnagar**	**Hisar**	**Sabour**	**Shillongani**	**Kalyani**	**Varanasi**	**Coochbhear**	**Ranchi**	**Ludhiana**	**Faizabad**	**HS**	**AV.**
61	DBW 252	35	56	67	67	24	35	24	56	26	78	36	78	46
62	HI 1628	46	23	45	67	25	78	35	67	35	89	46	89	46
63	NIAW 3170	46	25	46	46	25	79	24	78	14	78	46	79	46
III. NORTH EASTERN PLAIN ZONE														
64	DBW 233	46	27	45	36	24	57	35	78	13	78	35	78	46
65	HD 3249	57	45	34	36	25	57	35	78	14	89	35	89	46
66	HD 3254	35	27	23	36	25	46	24	78	13	89	46	89	36
67	K 1006 (C)	68	34	35	24	25	46	24	67	26	89	57	89	46
68	HD 2733 (C)	68	DR	45	24	24	35	24	56	25	78	46	78	46
69	DBW 221	68	34	35	24	36	68	12	78	13	78	57	78	46
70	K 1601	46	27	36	36	36	67	24	78	25	89	46	89	46
71	PBW 769	68	23	34	36	36	46	24	78	35	89	35	89	46
72	DBW 39 (C)	35	DR	46	24	47	45	24	56	24	78	24	78	45
73	HD 2967 (C)	24	37	45	24	24	35	12	34	13	77	24	77	34
74	K 0307 (C)	46	39	35	24	25	56	24	56	24	89	24	89	36
75	DBW 187	68	38	34	36	36	56	24	78	13	89	35	89	46
76	DBW 223	35	26	23	47	25	45	24	67	23	89	24	89	35
77	PBW 762	35	23	24	36	35	67	24	78	24	78	46	78	45
78	WH 1218	68	49	36	36	25	68	24	78	24	89	35	89	47
79	HD 2888 (C)	68	36	23	46	24	45	24	56	35	89	57	89	46
80	HI 1612 (I) (C)	35	23	23	56	35	45	12	45	24	89	35	89	35
80A	Infector	68	78	78	67	78	89	68	78	68	89	78	89	78
81	WH 1235	68	23	45	36	35	89	24	78	35	68	35	89	46
82	BRW 3806	46	23	67	36	24	46	47	67	24	89	46	89	46
83	K 1317 (C)	46	23	24	46	25	67	58	67	13	89	35	89	46
84	DBW 252	46	56	57	57	25	68	34	67	26	77	35	77	46
85	K 8027 (C)	35	48	36	36	24	79	46	78	35	78	46	79	46
86	HD 3171 (C)	35	13	24	24	36	58	24	67	13	89	35	89	35
87	HI 1628	46	23	23	36	36	69	35	67	24	89	45	89	46
IV. CENTRAL ZONE														
88	GW 1339 (d)	68	56	57	36	24	68	68	78	13	89	78	89	57
89	AKAW 4924	68	49	46	24	46	89	46	56	26	67	46	89	47
90	GW 322 (C)	68	67	34	24	25	67	24	78	35	78	57	78	46
91	HI 8713 (d) (C)	58	12	57	36	35	78	68	67	25	78	68	78	57
92	HI 8737 (d) (C)	68	23	68	57	36	79	46	78	13	67	78	79	57
93	HI 1544 (C)	79	DR	56	56	47	79	47	78	35	89	78	89	67
94	GW 495	68	DR	25	56	46	78	57	78	35	89	67	89	57

S. No.	Entry	Leaf Blight Score (0-9dd)												
		IIIrd (Hard dough)												
		Karnal	Pantnagar	Hisar	Sabour	Shillongani	Kalyani	Varanasi	Coochbhear	Ranchi	Ludhiana	Faizabad	HS	AV.
95	UAS 465 (d)	35	23	24	46	47	99	35	78	24	89	78	99	56
96	MPO 1343 (d)	46	23	45	57	46	67	24	67	24	89	78	89	56
97	DBW 110 (C)	68	34	23	67	36	46	24	67	13	89	46	89	46
98	DDW 47 (d)	35	23	24	67	25	67	35	56	24	89	78	89	46
99	MP 1331	46	23	56	67	36	67	36	56	24	67	67	67	46
100	MP 3288 (C)	68	34	57	56	46	68	47	78	35	78	46	78	57
100A	Infector	79	67	78	67	78	79	68	78	68	89	78	89	78
101	HI 8627 (d) (C)	68	23	23	46	35	79	89	78	26	88	78	89	57
102	UAS 466 (d)	68	12	24	36	35	69	79	67	13	89	78	89	56
103	NIAW 3170	68	67	35	36	36	68	57	78	24	89	57	89	57
V. PENINSULAR ZONE														
104	AKAW 4924	68	57	57	47	25	68	34	78	03	89	57	89	57
105	GW 491	46	DR	45	36	36	68	35	78	14	89	46	89	46
106	GW 493	57	47	46	46	36	79	35	78	24	89	46	89	57
107	DBW 235	57	67	24	47	24	68	35	67	26	78	35	78	46
108	HI 1624	68	58	35	46	24	79	47	78	35	78	57	79	57
109	MACS 6222 (C)	57	45	34	47	36	78	57	67	14	89	46	89	56
110	DBW 168 (I) (C)	57	68	45	56	24	46	57	34	13	78	35	78	46
111	GW 495	79	DR	57	56	46	45	35	78	24	89	47	89	57
112	MP 1338	68	26	58	36	35	79	35	78	24	89	58	89	57
113	MACS 3949 (d) (C)	46	23	35	36	36	79	68	67	24	79	68	79	46
114	HI 8800 (d)	46	23	57	36	24	79	79	56	13	78	78	79	56
115	MACS 6478 (C)	35	DR	56	47	24	48	57	56	35	89	46	89	46
116	MACS 6709	68	DR	57	36	24	57	35	45	14	89	57	89	46
117	HI 1625	46	DR	23	36	24	79	34	67	14	78	57	79	46
118	UAS 428 (d) (C)	46	12	24	36	25	79	57	56	25	78	68	79	46
119	PBW 770	35	58	57	47	36	69	35	78	24	89	45	89	57
120	GW 492	35	DR	58	56	46	69	46	78	35	89	57	89	57
120A	Infector	79	67	79	67	78	78	78	78	58	89	78	89	78
121	GW 1346 (d)	46	47	57	78	46	79	68	78	26	89	78	89	67
122	HI 1605 (C)	46	38	23	46	24	89	24	56	24	89	67	89	46
123	AKDW 2997-16 (d) (C)	79	35	34	67	46	99	57	67	13	89	78	99	57
124	MPO 1336 (d)	68	56	24	78	36	99	45	78	23	89	78	99	57
125	UAS 446 (d) (c)	24	23	23	36	46	58	45	78	24	89	78	89	46
126	HI 8805 (d)	46	23	23	36	25	69	57	78	14	89	78	89	46
127	MACS 4058 (d)	68	78	46	48	24	68	68	67	13	89	68	89	57
128	MACS 6696	46	89	56	46	36	68	35	78	24	67	78	89	57

S. No.	Entry	Leaf Blight Score (0-9dd)												
		IIIrd (Hard dough)												
		Karnal	Pantnagar	Hisar	Sabour	Shillongani	Kalyani	Varanasi	Coochbhear	Ranchi	Ludhiana	Faizabad	HS	AV.
129	MACS 4059 (d)	68	89	57	57	35	79	24	78	36	89	68	89	57
130	NIAW 3170	35	79	23	46	24	57	35	67	35	89	57	89	46
131	DBW 93 (c)	46	27	46	56	24	57	46	67	23	89	46	89	46
132	MACS 6695	58	38	57	46	35	68	24	78	13	89	57	89	47
133	HI 8802 (d)	35	25	24	36	25	69	57	78	24	89	67	89	46
VI. SPECIAL TRIAL (Dicoccum)														
134	DDK 1029 (C)	68	34	23	37	24	57	68	56	24	78		78	46
135	MACS 6222 (Ae.) (C)	57	25	23	36	25	79	57	67	35	89	67	89	46
136	MACS 5051	68	46	56	47	24	79	57	67	24	89	57	89	57
137	HW 4101	68	23	57	36	25	56	45	56	26	78	67	78	46
138	DDK 1054	58	23	57	36	25	79	57	67	13	89	57	89	46
139	HW 1098 (C)	68	34	56	36	35	46	57	67	25	89	46	89	46
VII. SPECIAL TRIAL- Very Late Sown														
140	WR 544 (C)	68	DR	46	47	25	68	47	78	14	89	67	89	57
140A	Infector	79	67	79	67	78	79	68	78	68	89	78	89	78
141	HD 3271	35	47	35	56	36	46	35	67	35	57	46	67	46
142	DBW 71 (C)	46	23	25	47	47	57	35	78	24	88	57	88	46
143	PBW 797	46	23	35	56	46	46	24	56	25	78	46	78	46
144	PBW 757	68	34	24	56	24	79	57	78	14	89	57	89	56
145	DBW 278	35	67	23	46	46	79	57	78	35	89	46	89	56
146	HI 1621	68	12	25	46	45	68	56	78	13	89	45	89	46
147	DBW 14 (C)	46	37	24	46	24	69	47	78	24	89	46	89	46
148	PBW 777	46	23	12	46	25	68	47	78	14	78	46	78	46
149	HD 3298	46	23	13	36	13	57	35	67	35	89	57	89	46
A. Resistant : (Av. score 14-35, HS up to 57)														
AVT -2016-17														
150	HI 1612	35	13	12	24	24	46	35	56	24	89	46	89	35
151	HS 630	46	12	13	24	25	58	47	56	13	78	35	78	35
152	HS 645	46	12	12	24	24	59	57	45	24	78	24	78	35
153	HS 647	46	34	24	36	24	78	34	67	26	89	35	89	46
154	UP 2993	35	23	12	24	24	46	24	67	35	89	46	89	35
155	UP 2942	35	12	13	24	25	35	35	45	25	89	35	89	35
156	VL 1013	46	23	12	24	13	36	24	45	13	89	36	89	35

Table 3.1b Leaf Blight average score of different entries at three different growth stage 2017-18

S. No.	Entry	Leaf Blight Score (0-9dd)					
		Ist (Flowering)		IInd (Dought)		IIIrd (Hard dought)	
		HS	Av.	HS	Av.	HS	Av.
AVT 2017-18							
I. NORTHERN HILL ZONE							
1	HS 542 (C)	12	01	47	13	56	35
2	HS 666	12	01	57	23	67	35
3	HS 665	24	12	57	24	78	35
4	VL 1015	12	01	47	13	47	34
5	HPW 450	13	01	35	23	78	35
6	HS 664	24	11	47	23	67	35
7	HPW 451	12	01	36	13	57	35
8	VL 1016	12	01	35	23	78	35
9	UP 3016	34	01	45	23	78	35
10	VL 1014	12	01	47	23	56	35
11	VL 829 (C)	34	01	47	13	59	35
12	HPW 251 (C)	45	11	67	24	78	45
13	HPW 349 (C)	12	12	46	24	67	35
14	HS 634	24	12	46	23	68	46
15	VL 907 (C)	23	11	35	24	67	35
16	HS 507 (C)	24	12	47	23	56	35
17	HPW 441	35	12	56	24	78	46
18	HPW 442	45	11	67	24	79	46
19	HS 562 (C)	24	12	47	24	78	35
20	VL 3017	36	12	57	24	78	57
20A	Infector	46	24	68	46	88	78
21	UP 3017	24	01	45	23	56	35
22	VL 3016	35	12	56	24	78	46
23	HS 662	24	12	35	23	78	45
24	HS 490 (C)	24	12	45	24	78	36
25	VL 892 (C)	45	23	67	35	78	46
26	HS 661	45	12	56	24	79	46
27	HS 660	24	12	47	24	78	46
28	VL 3018	24	12	46	25	78	46
29	HPW 459	35	12	57	24	78	46
II. NORTH WESTERN PLAIN ZONE							
30	UP 2981	45	12	67	34	89	46
31	DBW 221	46	12	68	35	89	46
32	DPW 621-50 (C)	24	12	35	24	89	46
33	DBW 222	12	01	57	24	78	46

S. No.	Entry	Leaf Blight Score (0-9dd)					
		Ist (Flowering)		IInd (Dought)		IIIrd (Hard dought)	
		HS	Av.	HS	Av.	HS	Av.
34	BRW 3792	45	12	68	24	89	46
35	PBW 763	13	01	58	24	58	35
36	PBW 766	45	12	57	24	79	46
37	HD 3086 (C)	45	12	58	34	79	46
38	DBW 233	24	12	67	34	78	46
39	HD 3226	35	12	56	24	78	46
40	HD 2967 (C)	23	11	24	13	67	35
40A	Infector	46	24	68	46	89	68
41	PBW 801	24	12	46	34	89	46
42	DBW 88 (C)	23	12	46	24	89	46
43	PBW 800	12	01	45	13	56	35
44	WH 1105	47	12	68	35	89	56
45	PBW 771	45	12	68	34	89	46
46	WH 1124 (C)	45	12	68	35	79	47
47	DBW 90 (C)	36	12	79	35	99	47
48	HD 3059 (C)	24	02	45	24	89	46
49	WH 1021 (C)	35	12	56	24	69	46
50	PBW 752*	24	02	46	23	68	46
51	DBW 173 (I) (C)	45	13	58	35	78	56
52	PBW 773	47	13	68	35	89	56
53	DBW 237	46	13	56	35	89	46
54	WH 1142 (C)	35	12	57	24	78	46
55	BRW 3806	35	12	46	24	89	46
56	WH 1080 (C)	46	12	45	24	89	46
57	HD 3237*	24	12	35	24	78	46
58	HI 1620*	45	12	56	24	78	46
59	PBW 644 (C)	24	12	35	24	78	46
60	HD 3043 (C)	12	11	35	23	78	45
60A	Infector	46	24	68	46	89	78
61	DBW 252	34	12	46	24	78	46
62	HI 1628	35	12	67	35	89	46
63	NIAW 3170	45	13	68	35	79	46
III. NORTH EASTERN PLAIN ZONE							
64	DBW 233	24	12	45	24	78	46
65	HD 3249	34	12	45	34	89	46
66	HD 3254	13	01	35	24	89	36
67	K 1006 (C)	23	12	45	24	89	46
68	HD 2733 (C)	13	02	35	24	78	46
69	DBW 221	35	12	56	24	78	46
70	K 1601	35	12	45	24	89	46

S. No.	Entry	Leaf Blight Score (0-9dd)					
		Ist (Flowering)		IInd (Dought)		IIIrd (Hard dought)	
		HS	Av.	HS	Av.	HS	Av.
71	PBW 769	24	12	55	24	89	46
72	DBW 39 (C)	13	01	25	23	78	45
73	HD 2967 (C)	12	01	26	13	77	34
74	K 0307 (C)	24	01	45	24	89	36
75	DBW 187	12	02	46	24	89	46
76	DBW 223	12	02	34	24	89	35
77	PBW 762	35	12	56	23	78	45
78	WH 1218	35	12	57	24	89	47
79	HD 2888 (C)	23	12	36	24	89	46
80	HI 1612 (I) (C)	24	01	35	13	89	35
80A	Infector	45	24	78	57	89	78
81	WH 1235	45	12	78	34	89	46
82	BRW 3806	12	01	47	24	89	46
83	K 1317 (C)	45	12	56	24	89	46
84	DBW 252	46	12	57	34	77	46
85	K 8027 (C)	45	12	68	24	79	46
86	HD 3171 (C)	34	12	45	23	89	35
87	HI 1628	45	12	58	23	89	46
IV. CENTRAL ZONE							
88	GW 1339 (d)	46	13	57	35	89	57
89	AKAW 4924	67	23	78	35	89	47
90	GW 322 (C)	36	12	67	34	78	46
91	HI 8713 (d) (C)	36	12	68	35	78	57
92	HI 8737 (d) (C)	35	12	58	35	79	57
93	HI 1544 (C)	47	24	78	46	89	67
94	GW 495	47	23	68	46	89	57
95	UAS 465 (d)	56	23	79	45	99	56
96	MPO 1343 (d)	46	13	78	35	89	56
97	DBW 110 (C)	24	12	57	24	89	46
98	DDW 47 (d)	36	12	67	34	89	46
99	MP 1331	24	12	57	34	67	46
100	MP 3288 (C)	46	23	58	36	78	57
100A	Infector	47	24	68	56	89	78
101	HI 8627 (d) (C)	57	23	79	35	89	57
102	UAS 466 (d)	36	12	68	35	89	56
103	NIAW 3170	24	12	68	35	89	57
V. PENINSULAR ZONE							
104	AKAW 4924	35	13	57	35	89	57
105	GW 491	35	12	56	34	89	46
106	GW 493	45	12	57	35	89	57

S. No.	Entry	Leaf Blight Score (0-9dd)					
		Ist (Flowering)		IInd (Dought)		IIIrd (Hard dought)	
		HS	Av.	HS	Av.	HS	Av.
107	DBW 235	25	12	67	34	78	46
108	HI 1624	35	13	68	46	79	57
109	MACS 6222 (C)	45	12	67	35	89	56
110	DBW 168 (I) (C)	24	12	68	34	78	46
111	GW 495	35	13	57	35	89	57
112	MP 1338	45	23	68	35	89	57
113	MACS 3949 (d) (C)	57	13	68	35	79	46
114	HI 8800 (d)	57	12	68	34	79	56
115	MACS 6478 (C)	24	11	57	24	89	46
116	MACS 6709	24	12	45	24	89	46
117	HI 1625	45	12	67	34	79	46
118	UAS 428 (d) (C)	45	12	68	24	79	46
119	PBW 770	45	13	67	35	89	57
120	GW 492	35	23	78	35	89	57
120A	Infector	57	24	68	46	89	78
121	GW 1346 (d)	47	23	78	46	89	67
122	HI 1605 (C)	46	12	78	35	89	46
123	AKDW 2997-16 (d) (C)	58	23	78	46	99	57
124	MPO 1336 (d)	56	23	78	46	99	57
125	UAS 446 (d) (c)	35	12	67	24	89	46
126	HI 8805 (d)	46	12	67	35	89	46
127	MACS 4058 (d)	47	23	78	46	89	57
128	MACS 6696	35	13	89	35	89	57
129	MACS 4059 (d)	46	23	89	46	89	57
130	NIAW 3170	34	12	79	35	89	46
131	DBW 93 (c)	24	12	46	35	89	46
132	MACS 6695	24	12	78	35	89	47
133	HI 8802 (d)	35	12	78	35	89	46
VI. SPECIAL TRIAL (Dicoccum)							
134	DDK 1029 (C)	24	12	46	34	78	46
135	MACS 6222 (Ae.) (C)	45	12	68	35	89	46
136	MACS 5051	46	12	68	35	89	57
137	HW 4101	24	12	45	24	78	46
138	DDK 1054	35	12	56	34	89	46
139	HW 1098 (C)	13	12	46	24	89	46
VII. SPECIAL TRIAL- Very Late Sown							
140	WR 544 (C)	45	23	68	45	89	57
140A	Infector	57	24	68	57	89	78
141	HD 3271	24	12	35	24	67	46

S. No.	Entry	Leaf Blight Score (0-9dd)					
		Ist (Flowering)		IInd (Dought)		IIIrd (Hard dought)	
		HS	Av.	HS	Av.	HS	Av.
142	DBW 71 (C)	24	13	68	35	88	46
143	PBW 797	24	12	35	24	78	46
144	PBW 757	35	12	68	35	89	56
145	DBW 278	35	23	78	45	89	56
146	HI 1621	34	12	78	35	89	46
147	DBW 14 (C)	35	12	57	35	89	46
148	PBW 777	34	12	45	34	78	46
149	HD 3298	35	12	57	24	89	46
A. Resistant: (Av. SCORE RANGE14-35, HIGHEST SCORE UP TO 57)							
AVT -2016-17							
150	HI 1612	12	01	35	23	89	35
151	HS 630	35	12	45	23	78	35
152	HS 645	45	11	58	13	78	35
153	HS 647	45	12	57	34	89	46
154	UP 2993	13	12	57	24	89	35
155	UP 2942	12	01	24	13	89	35
156	VL 1013	23	01	35	13	89	35

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PROGRAMME 4. KARNAL BUNT

4.1 KARNAL BUNT SCREENING NURSERY (KBSN) 2017-2018

Wheat entries along with checks were evaluated for resistance to Karnal bunt under Karnal Bunt Screening Nursery (KBSN) at multilocations (Pantnagar, Ludhiana, New Delhi, Hisar, Jammu and Dhaulakuan) during 2017-18 crop season under artificially inoculated conditions. The disease intensity was very low at Dhaulakuan and Pantnagar hence data were not included.

To determine the response of genotypes to Karnal bunt, earheads were injected with hypodermic syringe with adequate amount of inoculum (10,000 allantoids/ml water) at crop growth stage 49. The local isolates were used at all the test centres. Five earheads were inoculated in each entry during evening hours. After inoculation, high humidity was maintained for proper development of disease. The disease incidence in the earheads was recorded at crop maturity and was calculated by reckoning the infected and the total number of grains (both diseased and healthy) of 5 earheads per entry. Entries showing response of upto 5 per cent coefficient of infection (average) were rated as resistant. KB incidence of AVT entries and checks of all centres is given in Table 4.1 and average KB incidence of all centres is given in Table 1.5. The resistant entries identified are listed below:

AVTs 2017-18
Free from infection:
MACS 5051, HW 4101, DDK 1054 and HW 1098 (C)

Resistant (average incidence upto 5%):
HS 665, HS 562 (C), VL 3017, UP 3017, VL 3016, HS 490 (C), VL 892 (C), VL 3018, HPW 459, DBW 222 , BRW 3792, DBW 233, HD 3226, PBW 801, DBW 88 (C), PBW 800, DBW 90 (C), DBW 173 (I) (C), PBW 773, DBW 237, WH 1142 (C), WH 1080 (C), HD 3237, PBW 644 (C), HI 1628, DBW 233, HD 3254, K 1006 (C), HD 2733 (C), PBW 769, DBW 39 (C), DBW 187, DBW 223, PBW 762, WH 1218, HI 1628, UAS 465 (d), MPO 1343 (d), DBW 110 (C), DDW 47 (d), MP 1331, MP 3288 (C), HI 8627 (d) (C), UAS 466 (d), NIAW 3170, GW 491, GW 493, MP 1338, HI 8800 (d), MACS 6478 (C), MACS 6709, UAS 428 (d) (C), GW 492, AKDW 2997-16 (d) (C) , UAS 446 (d) (c), HI 8805 (d), MACS 4058 (d), MACS 6696, DBW 93 (c), MACS 6695, HI 8802 (d), DDK 1029 (C), MACS 6222 (Ae.) (C), WR 544 (C), HD 3271, PBW 757, DBW 278, DBW 14 (C) and HD 3298

Table 4.1: Karnal bunt incidence in KBSN entries evaluated under artificially inoculated conditions at multilocations during 2017-18

S. No.	Entry	% incidence of Karnal bunt					
		Ludhiana	Delhi	Hisar	Jammu	HS	AV
I. NORTHERN HILLS ZONE							
1	HS 542 (C)	10.0	3.2	4.2	6.4	10.0	6.0
2	HS 666	8.9	14.0	7.1	2.5	14.0	8.1

S. No.	Entry	% incidence of Karnal bunt					
		Ludhiana	Delhi	Hisar	Jammu	HS	AV
3	HS 665	10.7	0.0	2.0	4.2	10.7	4.2
4	VL 1015	21.4	2.7	6.9	6.2	21.4	9.3
5	HPW 450	12.0	2.7	7.6	6.7	12.0	7.2
6	HS 664	17.5	5.0	7.3	5.2	17.5	8.7
7	HPW 451	10.1	0.0	6.3	5.4	10.1	5.4
8	VL 1016	15.6	1.0	7.1	5.2	15.6	7.2
9	UP 3016	13.8	12.5	6.0	10.5	13.8	10.7
10	VL 1014	12.5	0.0	11.1	7.3	12.5	7.7
11	VL 829 (C)	11.4	2.8	8.3	12.4	12.4	8.7
12	HPW 251 (C)	17.5	0.0	6.5	8.2	17.5	8.1
13	HPW 349 (C)	10.5	2.0	8.0	9.3	10.5	7.5
14	HS 634	25.2	7.0	12.7	1.5	25.2	11.6
15	VL 907 (C)	16.8	6.7	5.5	3.3	16.8	8.1
16	HS 507 (C)	NI	5.0	5.9	7.5	7.5	6.1
17	HPW 441	13.2	5.5	7.7	0.5	13.2	6.7
18	HPW 442	10.6	0.0	5.4	12.4	12.4	7.1
19	HS 562 (C)	12.3	0.0	2.4	4.2	12.3	4.7
20	VL 3017	0.0	0.0	4.4	8.4	8.4	3.2
20A	Infector	28.2	10.0	12.9	14.0	28.2	16.3
21	UP 3017	0.0	5.6	5.1	4.7	5.6	3.8
22	VL 3016	0.0	5.0	6.4	4.7	6.4	4.0
23	HS 662	13.1	0.0	3.7	8.6	13.1	6.4
24	HS 490 (C)	0.0	0.0	3.2	7.3	7.3	2.6
25	VL 892 (C)	0.0	10.0	2.8	4.3	10.0	4.3
26	HS 661	15.4	0.0	8.5	0.5	15.4	6.1
27	HS 660	8.0	0.0	13.5	2.4	13.5	6.0
28	VL 3018	0.0	0.0	2.8	0.0	2.8	0.7
29	HPW 459	0.0	1.0	4.2	7.1	7.1	3.1
II. NORTH WESTERN PLAINS ZONE							
30	UP 2981	3.8	5.0	12.2	2.1	12.2	5.8
31	DBW 221	0.0	4.0	10.7	7.3	10.7	5.5
32	DPW 621-50 (C)	1.6	2.7	16.7	6.3	16.7	6.8
33	DBW 222	0.0	3.3	6.0	1.5	6.0	2.7
34	BRW 3792	0.0	5.0	4.9	1.2	5.0	2.8
35	PBW 763	0.5	6.7	15.1	0.0	15.1	5.6

S. No.	Entry	% incidence of Karnal bunt					
		Ludhiana	Delhi	Hisar	Jammu	HS	AV
36	PBW 766	0.0	11.4	20.8	0.0	20.8	8.0
37	HD 3086 (C)	3.9	4.0	15.2	2.1	15.2	6.3
38	DBW 233	0.4	3.6	4.4	4.5	4.5	3.2
39	HD 3226	4.6	4.5	3.4	0.0	4.6	3.1
40	HD 2967 (C)	0.0	4.0	16.1	7.1	16.1	6.8
40A	Infector	28.0	11.8	24.7	10.7	28.0	18.8
41	PBW 801	8.2	1.7	4.0	0.0	8.2	3.5
42	DBW 88 (C)	5.8	3.3	8.4	0.0	8.4	4.4
43	PBW 800	6.1	3.0	6.7	0.6	6.7	4.1
44	WH 1105	26.4	2.7	22.7	4.5	26.4	14.1
45	PBW 771	0.0	2.7	14.3	6.6	14.3	5.9
46	WH 1124 (C)	6.0	1.0	12.8	2.1	12.8	5.5
47	DBW 90 (C)	1.9	6.7	6.9	2.1	6.9	4.4
48	HD 3059 (C)	2.9	5.0	7.4	6.2	7.4	5.4
49	WH 1021 (C)	4.0	2.0	12.5	5.1	12.5	5.9
50	PBW 752*	17.3	2.5	25.5	0.0	25.5	11.3
51	DBW 173 (I) (C)	1.3	2.9	4.0	4.6	4.6	3.2
52	PBW 773	0.0	3.3	4.0	2.1	4.0	2.4
53	DBW 237	2.0	4.0	7.0	3.5	7.0	4.1
54	WH 1142 (C)	2.0	6.0	4.2	1.3	6.0	3.4
55	BRW 3806	2.1	8.5	3.4	9.1	9.1	5.8
56	WH 1080 (C)	0.0	2.0	2.5	4.2	4.2	2.2
57	HD 3237*	4.3	0.0	5.6	9.5	9.5	4.8
58	HI 1620*	4.5	22.9	13.0	1.3	22.9	10.4
59	PBW 644 (C)	0.0	0.0	5.5	6.5	6.5	3.0
60	HD 3043 (C)	NI	0.0	8.8	7.5	8.8	5.4
60A	Infector	12.2	11.3	15.2	12.6	15.2	12.8
61	DBW 252	6.3	8.2	5.4	1.2	8.2	5.3
62	HI 1628	2.8	6.7	5.5	2.1	6.7	4.3
63	NIAW 3170	4.6	21.7	3.5	1.5	21.7	7.8
III. NORTH EASTERN PLAINS ZONE							
64	DBW 233	10.0	0.0	2.3	2.1	10.0	3.6
65	HD 3249	9.3	25.7	2.8	5.0	25.7	10.7
66	HD 3254	8.0	0.0	4.8	4.6	8.0	4.4
67	K 1006 (C)	7.0	0.0	5.6	2.1	7.0	3.7

S. No.	Entry	% incidence of Karnal bunt					
		Ludhiana	Delhi	Hisar	Jammu	HS	AV
68	HD 2733 (C)	6.0	0.0	2.5	3.5	6.0	3.0
69	DBW 221	16.3	23.3	4.6	7.3	23.3	12.9
70	K 1601	18.1	3.6	2.2	9.1	18.1	8.3
71	PBW 769	0.0	2.4	7.1	4.2	7.1	3.4
72	DBW 39 (C)	5.0	1.7	2.8	3.5	5.0	3.3
73	HD 2967 (C)	18.1	5.7	2.4	7.5	18.1	8.4
74	K 0307 (C)	8.0	2.5	7.2	2.6	8.0	5.1
75	DBW 187	6.7	5.0	6.7	1.2	6.7	4.9
76	DBW 223	0.8	2.9	10.8	2.1	10.8	4.1
77	PBW 762	0.0	5.0	4.0	1.5	5.0	2.6
78	WH 1218	5.7	0.0	4.0	1.3	5.7	2.8
79	HD 2888 (C)	6.2	0.0	7.7	6.5	7.7	5.1
80	HI 1612 (I) (C)	4.9	0.0	22.7	7.5	22.7	8.8
80A	Infector	27.5	15.0	16.9	12.6	27.5	18.0
81	WH 1235	7.1	4.0	11.0	1.2	11.0	5.8
82	BRW 3806	10.0	3.3	11.9	7.3	11.9	8.1
83	K 1317 (C)	10.0	6.0	6.0	10.4	10.4	8.1
84	DBW 252	9.1	0.0	6.7	8.2	9.1	6.0
85	K 8027 (C)	14.1	0.0	3.7	9.3	14.1	6.8
86	HD 3171 (C)	33.3	0.0	5.5	1.5	33.3	10.1
87	HI 1628	0.0	2.0	6.9	3.3	6.9	3.0
IV. CENTRAL ZONE							
88	GW 1339 (d)	9.1	0.0	8.2	6.7	9.1	6.0
89	AKAW 4924	28.7	0.0	10.5	7.3	28.7	11.6
90	GW 322 (C)	9.0	7.1	4.5	7.3	9.0	7.0
91	HI 8713 (d) (C)	8.0	7.0	10.7	0.0	10.7	6.4
92	HI 8737 (d) (C)	22.3	4.0	7.0	0.0	22.3	8.3
93	HI 1544 (C)	9.1	0.0	5.8	9.2	9.2	6.0
94	GW 495	16.5	0.0	8.1	7.1	16.5	7.9
95	UAS 465 (d)	4.4	0.0	6.6	0.0	6.6	2.7
96	MPO 1343 (d)	5.0	0.0	11.0	0.0	11.0	4.0
97	DBW 110 (C)	5.8	0.0	8.6	1.3	8.6	3.9
98	DDW 47 (d)	2.9	0.0	8.3	0.0	8.3	2.8
99	MP 1331	0.0	10.9	3.4	1.5	10.9	4.0
100	MP 3288 (C)	1.0	0.0	6.2	6.0	6.2	3.3

S. No.	Entry	% incidence of Karnal bunt					
		Ludhiana	Delhi	Hisar	Jammu	HS	AV
100 A	Infector	82.9	14.3	14.5	14.6	82.9	31.6
101	HI 8627 (d) (C)	8.2	2.0	3.9	0.0	8.2	3.5
102	UAS 466 (d)	3.0	3.3	6.1	0.0	6.1	3.1
103	NIAW 3170	3.5	1.7	8.5	1.6	8.5	3.8
V. PENINSULAR ZONE							
104	AKAW 4924	6.0	2.0	8.6	7.6	8.6	6.1
105	GW 491	2.5	0.0	6.6	6.2	6.6	3.8
106	GW 493	3.6	0.0	3.8	8.2	8.2	3.9
107	DBW 235	20.0	0.0	3.7	2.1	20.0	6.5
108	HI 1624	5.6	8.3	5.5	1.5	8.3	5.2
109	MACS 6222 (C)	13.7	0.0	8.5	4.5	13.7	6.7
110	DBW 168 (I) (C)	5.3	14.3	1.1	5.6	14.3	6.6
111	GW 495	2.0	9.2	2.1	7.1	9.2	5.1
112	MP 1338	4.7	2.0	4.1	6.6	6.6	4.3
113	MACS 3949 (d) (C)	11.8	2.0	4.9	4.2	11.8	5.7
114	HI 8800 (d)	2.2	8.6	7.1	0.2	8.6	4.5
115	MACS 6478 (C)	2.0	8.0	9.0	0.5	9.0	4.9
116	MACS 6709	3.8	2.0	4.3	0.0	4.3	2.5
117	HI 1625	8.1	4.3	5.4	4.3	8.1	5.5
118	UAS 428 (d) (C)	0.0	6.0	6.8	0.0	6.8	3.2
119	PBW 770	3.5	18.5	6.4	2.1	18.5	7.6
120	GW 492	0.0	8.0	6.8	1.5	8.0	4.1
120 A	Infector	30.0	13.3	15.8	13.3	30.0	18.1
121	GW 1346 (d)	5.6	10.8	4.8	0.0	10.8	5.3
122	HI 1605 (C)	3.7	10.0	5.2	4.2	10.0	5.8
123	AKDW 2997-16 (d) (C)	4.4	0.0	2.4	0.5	4.4	1.8
124	MPO 1336 (d)	2.9	13.6	5.5	0.0	13.6	5.5
125	UAS 446 (d) (c)	3.0	0.0	5.6	0.0	5.6	2.2
126	HI 8805 (d)	4.0	6.0	6.1	0.0	6.1	4.0
127	MACS 4058 (d)	0.0	0.0	4.8	5.9	5.9	2.7
128	MACS 6696	7.4	0.0	1.7	5.5	7.4	3.7
129	MACS 4059 (d)	17.0	0.0	4.4	0.0	17.0	5.4
130	NIAW 3170	5.0	5.6	11.1	2.1	11.1	5.9
131	DBW 93 (c)	5.0	0.0	4.9	4.1	5.0	3.5

S. No.	Entry	% incidence of Karnal bunt					
		Ludhiana	Delhi	Hisar	Jammu	HS	AV
132	MACS 6695	2.7	0.0	9.3	6.6	9.3	4.6
133	HI 8802 (d)	4.0	0.0	3.2	0.0	4.0	1.8
VI. SPECIAL TRIAL (Dicoccum)							
134	DDK 1029 (C)	0.0	0.0	0.0	2.9	2.9	0.7
135	MACS 6222 (Ae.) (C)	0.0	0.0	0.0	3.3	3.3	0.8
136	MACS 5051	0.0	0.0	0.0	0.0	0.0	0.0
137	HW 4101	0.0	0.0	0.0	0.0	0.0	0.0
138	DDK 1054	0.0	0.0	0.0	0.0	0.0	0.0
139	HW 1098 (C)	0.0	0.0	0.0	0.0	0.0	0.0
VII. SPECIAL TRIAL- Very Late Sown							
140	WR 544 (C)	0.0	No seed	11.4	2.1	11.4	4.5
140 A	Infector	26.0	12.0	14.8	13.9	26.0	16.7
141	HD 3271	0.0	0.0	7.0	3.8	7.0	2.7
142	DBW 71 (C)	41.3	0.0	9.8	8.2	41.3	14.8
143	PBW 797	0.0	20.3	11.4	8.7	20.3	10.1
144	PBW 757	9.5	0.0	5.7	5.0	9.5	5.0
145	DBW 278	2.0	0.0	6.9	7.1	7.1	4.0
146	HI 1621	10.9	0.0	7.4	2.9	10.9	5.3
147	DBW 14 (C)	9.2	0.0	5.5	3.3	9.2	4.5
148	PBW 777	14.0	2.5	11.1	6.6	14.0	8.6
149	HD 3298	4.0	0.0	6.8	4.3	6.8	3.8

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PROGRAMME 5. LOOSE SMUT

5.1 Evaluation of AVT material (2016-17) against *Ustilago segetum tritici*

Loose smut is an internally seed borne disease caused by *Ustilago segetum tritici* and mainly prevalent in northern hills and plains zone. Though the disease can be managed my seed treatment but resistant varieties are always liked by the farmers to manage loose smut as it is economical and convenient. Keeping in view of higher preference of host resistance, the entries of AVT I & II year (2016-17), were inoculated with local isolates of loose smut pathogen using 'Go go' method at hot spot locations like Hisar, Ludhiana, Durgapura, and Almora. The inoculated seeds were sown again during 2017-18 crop season at these locations of NWPZ and NHZ for expression of disease. The data from Hisar center have not been included as it is showing deviation from other centers. A total of 141 entries out of which 60 from AVT II year 2016-17 and 81 from AVT I year 2016-17 were screened. Both healthy as well as smutted tillers were counted and per cent infected tillers were calculated.

The variations were also observed amongst different genotypes at different locations under artificially inoculated conditions. The highest and average disease score was taken for each entry. The detailed data of AVT II year and AVT I year of 2016-17 are presented in Table 5.1. The promising entries in AVTs are:

AVT IInd year, 2016-17

Free (No infection at any location):
DBW 90 (C), HD 3086 (C), HI 8777 (d), MACS 4028 (d), AKDW 2997-16(d) (C) and TL 2942 (C)

Resistant (Average score: 0.1-5.0 % infection):
VL 829 (C), HD 8627 (d) (C), DDK 1029 (C), HW 1098 (C), KRL 210 (C) and TL 2969 (C)

AVT Ist Year, 2016-17

Free (No infection at any location):
UAS 462 (d), DDK 1052, MACS 5047, MACS 5049, TL 3013 and TL 3014

Resistant (Average score: 0.1-5.0% infection):
HI 8791 (d), DDK 1053, TL 3011, TL 3012 and TL 3015

Table 5.1. Per cent infected tillers due to loose smut in the entries of AVT IInd year and AVT Ist year 2016-17 expressed during 2017-18 crop season

S. No.	Entry	Loose smut (%)				
		Ludhiana	Almora	Durgapura	HS	AV.
AVT Ist Year 2016-17						
I. NORTHERN HILLS ZONE						
1	DBW 179	20.0	34.0	34.5	34.5	29.5

S. No.	Entry	Loose smut (%)				
		Ludhiana	Almora	Durgapura	HS	AV.
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	16.3	9.6	16.9	16.9	14.3
6	HPW 440	22.6	52.0	17.2	52.0	30.6
7	HPW 448	21.4	21.7	27.9	27.9	23.7
8	HPW 449	24.6	73.4	41.1	73.4	46.4
9	HS 629	23.1	42.0	46.3	46.3	37.1
10	HS 630	31.0	38.5	26.7	38.5	32.1
11	HS 643	25.0	24.0	21.3	25.0	23.4
12	HS 644	33.3	9.8	16.7	33.3	19.9
13	HS 645	33.8	12.0	28.3	33.8	24.7
14	HS 646	15.7	21.7	23.5	23.5	20.3
15	HS 647	22.5	42.0	33.8	42.0	32.8
16	HS 648	13.4	72.9	28.7	72.9	38.3
17	UP 2992	26.7	42.9	18.4	42.9	29.3
18	UP 2993	0.0	66.7	37.7	66.7	34.8
19	VL 1011	26.9	70.0	37.9	70.0	44.9
20	VL 1012	30.1	26.5	3.8	30.1	20.1
20A	Sonalika (Check)	41.1	61.5	73.6	73.6	58.7
21	VL 1013	46.8	0.0	6.7	46.8	17.8
22	VL 3013	22.1	65.7	0.0	65.7	29.3
23	VL 3014	6.0	66.0	31.1	66.0	34.4
24	VL 3015	7.5	35.7	-	35.7	21.6
25	VL 4002	15.3	61.7	36.7	61.7	37.9
26	VL 4003	15.3	31.5	17.1	31.5	21.3
II. NORTH WESTERN PLAIN ZONE						
27	BRW 3773	15.8	36.0	33.3	36.0	28.4
28	CG 1023	32.2	54.8	53.3	54.8	46.8
29	DBW 189	18.2	59.4	9.9	59.4	29.2
30	DBW 196	15.7	53.9	40.0	53.9	36.5
31	HD 3226	6.8	43.7	29.6	43.7	26.7

S. No.	Entry	Loose smut (%)				
		Ludhiana	Almora	Durgapura	HS	AV.
32	HD 3237	0.0	37.6	36.0	37.6	24.5
33	HI 1617	39.7	13.4	0.0	39.7	17.7
34	HI 1619	12.4	74.8	13.6	74.8	33.6
35	HI 1620	0.0	50.0	28.4	50.0	26.1
36	HP1963	18.5	43.5	42.4	43.5	34.8
37	HS 611	13.6	32.0	40.8	40.8	28.8
38	MACS 6677	13.8	74.1	27.6	74.1	38.5
39	MP 1318	17.4	57.9	47.3	57.9	40.9
40	PBW 750	2.3	61.9	22.2	61.9	28.8
40A	Sonalika (Check)	40.9	65.6	57.1	65.6	54.5
41	PBW 752	5.0	43.6	25.3	43.6	24.6
42	UP 2942	0.0	23.0	35.7	35.7	19.6
43	WH 1202	16.8	0.0	0.0	16.8	5.6
III. NORTH ESTERN PLAIN ZONE						
44	DBW 187	27.8	38.2	28.8	38.2	31.6
45	HD 3219	14.5	45.2	25.5	45.2	28.4
46	UAS 384	14.0	45.4	48.3	48.3	35.9
IV. CENTRAL ZONE						
47	BRW 3775	14.2	24.4	18.2	24.4	18.9
48	HI 8791 (d)	0.0	0.0	2.0	2.0	0.7
49	UAS 385	23.1	72.0	20.0	72.0	38.4
50	UAS 462 (d)	0.0	0.0	0.0	0.0	0.0
V. SOUTHERN HILL ZONE						
51	UAS 387	42.9	56.7	20.3	56.7	40.0
VI. SPECIAL TRIAL (DICOCCUM, MABB, SAILINITY AND ALKALINITY)						
52	DBW 246	16.3	64.1	20.0	64.1	33.5
53	DBW 247	0.0	79.3	30.8	79.3	36.7
54	DBW 248	0.0	24.1	21.0	24.1	15.0
55	DDK 1052	0.0	0.0	0.0	0.0	0.0
56	DDK 1053	0.8	0.0	0.0	0.8	0.3
57	KRL 370	9.3	8.6	20.0	20.0	12.6
58	KRL 377	8.8	30.0	37.3	37.3	25.4

S. No.	Entry	Loose smut (%)				
		Ludhiana	Almora	Durgapura	HS	AV.
59	KRL 384	28.2	54.3	38.2	54.3	40.2
60	KRL 386	16.0	58.5	27.3	58.5	33.9
60A	Sonalika (Check)	45.6	46.9	65.9	65.9	52.8
61	MACS 5047	0.0	0.0	0.0	0.0	0.0
62	MACS 5049	0.0	0.0	0.0	0.0	0.0
63	PBW 779	10.7	78.6	41.3	78.6	43.5
64	PBW 780	10.1	30.4	80.0	80.0	40.2
65	WH 1316	13.3	47.5	32.9	47.5	31.2
VII. SPECIAL TRIAL (TRITICALE)						
66	TL 3011	0.0	0.5	0.0	0.5	0.2
67	TL 3012	0.0	0.4	0.0	0.4	0.1
68	TL 3013	0.0	0.0	0.0	0.0	0.0
69	TL 3014	0.0	0.0	0.0	0.0	0.0
70	TL 3015	1.3	0.0	0.0	1.3	0.4
IX. SPECIAL TRIAL (VERY LATE SOWN)						
71	DBW 249	10.1	33.0	0.0	33.0	14.4
72	DBW 250	7.8	64.7	19.0	64.7	30.5
73	DBW 251	38.1	35.5	57.1	57.1	43.6
74	HD 3271	15.8	71.0	30.3	71.0	39.0
75	HD 3272	13.1	75.0	22.2	75.0	36.8
76	HI 1621	0.0	24.0	16.0	24.0	13.3
77	PBW 757	30.6	66.4	95.3	95.3	64.1
78	PBW 777	9.0	51.5	41.8	51.5	34.1
79	PBW 778	11.7	61.8	33.3	61.8	35.6
80	WH 1232	13.8	50.0	51.3	51.3	38.4
80A	Sonalika (Check)	43.7	78.0	68.2	78.0	63.3
81	WH 1233	1.0	66.3	40.0	66.3	35.8
AVT IInd Year 2016-17						
I. NORTHERN HILLS ZONE						
82	HPW 251 (C)	26.0	27.2	22.2	27.2	25.1
83	HS 375 (C)	2.1	12.3	3.3	12.3	5.9
84	HS 490 (C)	13.3	53.0	0.0	53.0	22.1

S. No.	Entry	Loose smut (%)				
		Ludhiana	Almora	Durgapura	HS	AV.
85	HS 507 (C)	32.3	30.6	0.0	32.3	21.0
86	HS 542 (C)	23.0	71.8	12.9	71.8	35.9
87	VL 829 (C)	0.0	12.8	0.0	12.8	4.3
88	VL 892 (C)	1.4	30.7	16.9	30.7	16.3
89	VL 907 (C)	NS	NS	NS	NS	NS
II. NORTH WESTERN PLAIN ZONE						
90	DBW 173	23.0	54.2	71.7	71.7	49.6
91	DBW 88 (C)	31.1	38.5	30.4	38.5	33.3
92	DBW 90 (C)	0.0	0.0	0.0	0.0	0.0
93	HD 3043 (C)	56.3	24.5	8.5	56.3	29.8
94	HD 2967 (C)	25.6	61.9	6.7	61.9	31.4
95	HD 3059 (C)	28.0	35.8	26.9	35.8	30.2
96	HD 3086 (C)	0.0	0.0	0.0	0.0	0.0
97	PBW 644 (C)	23.6	60.0	0.0	60.0	27.9
98	WH 1021 (C)	11.2	60.0	9.3	60.0	26.8
99	WH 1080 (C)	24.2	76.6	48.4	76.6	49.7
100	WH 1105 (C)	4.9	57.4	27.5	57.4	29.9
100A	Sonalika (Check)	32.5	67.3	71.2	71.2	57.0
101	WH 1124 (C)	21.2	0.0	0.0	21.2	7.1
102	WH 1142 C)	14.0	65.8	80.5	80.5	53.4
III. NORTH EASTERN PLAIN ZONE						
103	HI 1612	40.2	55.0	17.3	55.0	37.5
104	C 306 (C)	21.8	76.4	34.5	76.4	44.2
105	DBW 39 (C)	39.1	40.3	17.9	40.3	32.4
106	HD 2733 (C)	21.7	65.4	8.5	65.4	31.9
107	HD 2888 (C)	17.0	59.6	10.8	59.6	29.1
108	HD 3171 (I) (C)	9.0	50.0	12.9	50.0	24.0
109	K 8027 (C)	36.3	67.3	20.0	67.3	41.2
110	K 0307 (C)	3.1	33.9	71.4	71.4	36.1
111	K 1006 (C)	20.0	44.8	69.3	69.3	44.7
112	K 1317 (I) (C)	25.0	55.8	62.5	62.5	47.8
IV. CENTRAL ZONE						

S. No.	Entry	Loose smut (%)				
		Ludhiana	Almora	Durgapura	HS	AV.
113	DBW 110 (C)	25.9	28.9	16.5	28.9	23.8
114	HD 8627 (d) (C)	4.0	0.0	0.0	4.0	1.3
115	MP 3288 (C)	11.1	38.1	16.4	38.1	21.9
V. PENINSULAR ZONE						
116	DBW 168	15.5	20.0	48.8	48.8	28.1
117	HI 8777 (d)	0.0	0.0	0.0	0.0	0.0
118	MACS 4028 (d)	0.0	0.0	0.0	0.0	0.0
119	UAS 375	21.4	63.8	30.0	63.8	38.4
120	AKDW 2997-16(d) (C)	0.0	0.0	0.0	0.0	0.0
120A	Sonalika (Check)	37.8	55.0	63.3	63.3	52.0
121	GW 322 (C)	0.0	68.3	53.8	68.3	40.7
122	MACS 6222 (C)	5.6	43.9	27.9	43.9	25.8
123	MACS 6478 (C)	8.1	60.7	17.8	60.7	28.9
124	NI 5439 (C)	21.7	84.7	48.3	84.7	51.6
125	NIAW 1415 (C)	12.7	44.9	12.7	44.9	23.4
126	UAS 304 (C)	10.4	71.4	7.6	71.4	29.8
127	UAS 446 (d) (C)	32.0	0.0	4.0	32.0	12.0
VI. SOUTHERN HILLS ZONE						
128	HW 2044 (C)	3.3	22.4	0.0	22.4	8.6
129	HW 5216 (C)	4.0	42.5	30.3	42.5	25.6
130	CoW (W) -1 (C)	13.3	22.0	82.9	82.9	39.4
VII. SPECIAL TRIAL (Triticale,Dicoccum,Salinity/Alk						
131	DBW 14 (C)	15.0	57.5	0.0	57.5	24.2
132	DBW 71 (C)	17.0	81.3	0.0	81.3	32.8
133	DDK 1029 (C)	0.0	0.8	0.0	0.8	0.3
134	HW 1098 (C)	5.0	0.0	0.0	5.0	1.7
135	Kharchia 65 (C)	10.0	71.0	25.0	71.0	35.3
136	KRL 19 (C)	16.0	25.0	10.5	25.0	17.2
137	KRL 210 (C)	11.1	0.7	0.0	11.1	3.9
138	PBW 550	0.0	78.4	36.8	78.4	38.4
139	TL 2942 (C)	0.0	0.0	0.0	0.0	0.0
140	TL 2969 (C)	0.0	1.7	3.7	3.7	1.8

S. No.	Entry	Loose smut (%)				
		Ludhiana	Almora	Durgapura	HS	AV.
140A	Sonalika (Check)	36.7	49.0	65.3	65.3	50.3
141	WR 544 (C)	9.1	55.7	0.0	55.7	21.6

COOPERATORS:

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PROGRAMME 6. POWDERY MILDEW

6.1: POWDERY MILDEW SCREENING NURSERY (PMSN)

Powdery mildew caused by *Blumeria graminis* (DC.) Speer f. sp. *tritici* is emerging as an important disease of wheat in NWPZ and NHZ during cool years and may cause heavy losses in susceptible varieties. During favourable environment, the varieties are prone to powdery mildew and may suffer heavily if infected at early stage of their growth. Keeping in view the importance of powdery mildew, during 2017-18 crop season, 149 entries of AVTs were screened against powdery mildew at 6 hot spot locations in NHZ and NWPZ. The data of five locations, viz., Almora, Dhaulakuan, Shimla, Pantnagar, and Malan were taken into consideration. The data from Bajaura was not considered due to very less disease intensity. Inoculations were done with the local isolate by dusting the inoculum on the test entries. Scoring was done at dough stage on 0-9 scale representing incidence of disease vertically in height of plants. The disease scores of AVT entries along with check varieties have been presented in Table 6.1. The entries found promising against powdery mildew are:

AVTs 2016-17
Resistant Entries (Av. score 0-3, highest score up to 5)**:**
HPW 451, VL 1014, HPW 251 (C), HPW 349 (C), HS 634, HS 507 (C), HPW 441, HPW 442, HS 562 (C), HS 662, HS 490 (C), VL 892 (C), HS 661, HS 660, HPW 459, DPW 621-50 (C), BRW 3792, PBW 766, HD 3086 (C), HD 3226, WH 1124 (C), DBW 90 (C), DBW 252, K 1601, PBW 769, K 0307 (C), DBW 187, WH 1218, BRW 3806, K 1317 (C), DBW 252, HD 3171 (C), GW 322 (C), HI 8713 (d) (C), MPO 1343 (d), DBW 110 (C), MP 1331, MP 3288 (C), DDK 1029 (C), HW 4101, HW 1098 (C), HD 3271, PBW 757 and HD 3298

Table 6.1 Powdery Mildew Screening Nursery, 2017-18

S. No.	Entry	Powdery Mildew Score (0-9)						
		Pantnagar	Almora	Shimla	Dhaulakuan	Malan	HS	AV.
I. NORTHERN HILL ZONE								
1	HS 542 (C)	0	1	0	1	8	8	3
2	HS 666	0	1	3	2	8	8	4
3	HS 665	1	1	3	1	6	6	3
4	VL 1015	1	0	5	4	7	7	4
5	HPW 450	0	0	1	1	7	7	3
6	HS 664	5	3	5	6	8	8	6
7	HPW 451	0	1	3	4	5	5	3
8	VL 1016	0	3	5	2	7	7	4
9	UP 3016	0	1	1	1	6	6	3
10	VL 1014	1	3	1	2	5	5	3
11	VL 829 (C)	0	3	1	6	5	6	4
12	HPW 251 (C)	0	1	0	1	4	4	2
13	HPW 349 (C)	0	3	5	3	4	5	3
14	HS 634	0	3	3	1	4	4	3

S. No.	Entry	Powdery Mildew Score (0-9)						
		Pantnagar	Almora	Shimla	Dhaulakuan	Malan	HS	AV.
15	VL 907 (C)	0	3	3	4	6	6	4
16	HS 507 (C)	0	5		2	4	5	3
17	HPW 441	0	1	3	2	2	3	2
18	HPW 442	0	3	3	4	5	5	3
19	HS 562 (C)	0	1	3	2	5	5	3
20	VL 3017	0	3	3	2	6	6	3
20A	Infector	8	5	7	8	8	8	7
21	UP 3017	0	3	3	4	6	6	4
22	VL 3016	1	5	5	1	6	6	4
23	HS 662	0	1	1	1	4	4	2
24	HS 490 (C)	1	1	0	1	4	4	2
25	VL 892 (C)	0	1	0	2	5	5	2
26	HS 661	0	3	3	4	5	5	3
27	HS 660	0	1	3	1	4	4	2
28	VL 3018	0	1	3	1	6	6	3
29	HPW 459	0	0	3	1	4	4	2
II. NORTH WESTERN PLAIN ZONE								
30	UP 2981	0	3	3	4	6	6	4
31	DBW 221	0	5	5	6	7	7	5
32	DPW 621-50 (C)	0	0	5	2	5	5	3
33	DBW 222	0	1	3	1	7	7	3
34	BRW 3792	0	1	5	2	5	5	3
35	PBW 763	0	3	9	6	6	9	6
36	PBW 766	0	1	5	1	4	5	3
37	HD 3086 (C)	0	1	3	1	5	5	3
38	DBW 233	0	1	0	1	6	6	2
39	HD 3226	0	1	1	1	3	3	2
40	HD 2967 (C)	1	0	1	4	6	6	3
40A	Infector	7	3	9	4	7	9	7
41	PBW 801	1	1	3	1	6	6	3
42	DBW 88 (C)	3	1	3	1	6	6	3
43	PBW 800	0	1	5	2	6	6	3
44	WH 1105	0	1	5	1	6	6	3
45	PBW 771	5	5	7	4	9	9	7
46	WH 1124 (C)	1	1	3	2	5	5	3
47	DBW 90 (C)	1	1	1	1	5	5	2
48	HD 3059 (C)	7	0	3	4	5	7	4
49	WH 1021 (C)	5	1	3	4	7	7	5

S. No.	Entry	Powdery Mildew Score (0-9)						
		Pantnagar	Almora	Shimla	Dhaulakuan	Malan	HS	AV.
50	PBW 752*	0	3	3	6	7	7	4
51	DBW 173 (I) (C)	0	1	1	2	6	6	3
52	PBW 773	1	3	3	1	6	6	3
53	DBW 237	0	1	5	1	6	6	3
54	WH 1142 (C)	1	3	5	4	8	8	5
55	BRW 3806	0	1	5	4	8	8	4
56	WH 1080 (C)	0	3	3	2	7	7	4
57	HD 3237*	0	1	3	2	7	7	3
58	HI 1620*	0	1	5	4	8	8	4
59	PBW 644 (C)	0	0	3	2	7	7	3
60	HD 3043 (C)	0	1	0	1	6	6	2
60A	Infector	7	3	7	6	8	8	7
61	DBW 252	1	1	0	1	2	2	1
62	HI 1628	0	0	3	4	9	9	4
63	NIAW 3170	0	1	3	2	7	7	3
III. NORTH EASTERN PLAIN ZONE								
64	DBW 233	1	0	1	4	7	7	3
65	HD 3249	0	1	3	4	8	8	4
66	HD 3254	1	1	1	4	8	8	4
67	K 1006 (C)	6	1	1	4	4	6	4
68	HD 2733 (C)	5	5	3	6	9	9	6
69	DBW 221	0	3	5	4	9	9	5
70	K 1601	0	1	1	3	5	5	3
71	PBW 769	0	3	3	2	4	4	3
72	DBW 39 (C)	5	3	3	2	5	5	4
73	HD 2967 (C)	2	1	5	6	5	6	4
74	K 0307 (C)	3	1	3	4	2	4	3
75	DBW 187	0	1	5	4	3	5	3
76	DBW 223	0	3	3	6	7	7	4
77	PBW 762	1	3	5	7	6	7	5
78	WH 1218	1	1	1	1	2	2	1
79	HD 2888 (C)	0	1	5	2	7	7	4
80	HI 1612 (I) (C)	0	7	3	3	4	7	4
80A	Infector	7	7	7	6	6	7	7
81	WH 1235	0	1	8	1	3	8	4
82	BRW 3806	0	3	3	4	5	5	3
83	K 1317 (C)	1	3	3	4	4	4	3
84	DBW 252	0	3	1	4	5	5	3

S. No.	Entry	Powdery Mildew Score (0-9)						
		Pantnagar	Almora	Shimla	Dhaulakuan	Malan	HS	AV.
85	K 8027 (C)	1	3	5	1	6	6	4
86	HD 3171 (C)	0	1	5	2	5	5	3
87	HI 1628	0	1	7	2	6	7	4
IV. CENTRAL ZONE								
88	GW 1339 (d)	2	1		2	6	6	3
89	AKAW 4924	0	3	5	2	7	7	4
90	GW 322 (C)	2	3	3	1	5	5	3
91	HI 8713 (d) (C)	1	3	3	2	4	4	3
92	HI 8737 (d) (C)	0	3	7	1	4	7	4
93	HI 1544 (C)	5	3	3	1	6	6	4
94	GW 495	5	3	1	2	6	6	4
95	UAS 465 (d)	3	1	7	1	4	7	4
96	MPO 1343 (d)	2	1	3	1	3	3	2
97	DBW 110 (C)	5	3	1	1	4	5	3
98	DDW 47 (d)	2	1	7	1	1	7	3
99	MP 1331	0	1	3	2	5	5	3
100	MP 3288 (C)	1	1	1	2	5	5	3
100A	Infector	7	3	9	4	8	9	7
101	HI 8627 (d) (C)	0	1	7	1	5	7	4
102	UAS 466 (d)	5	1	-	1	6	6	4
103	NIAW 3170	2	1	3	0	6	6	3
V. PENINSULAR ZONE								
104	AKAW 4924	1	1	3	1	8	8	4
105	GW 491	7	3	7	2	9	9	6
106	GW 493	3	5	7	2	9	9	6
107	DBW 235	0	1	3	1	6	6	3
108	HI 1624	5	1	3	1	9	9	5
109	MACS 6222 (C)	0	3	5	1	7	7	4
110	DBW 168 (I) (C)	0	1	3	2	6	6	3
111	GW 495	2	5	3	1	8	8	5
112	MP 1338	1	1	3	1	6	6	3
113	MACS 3949 (d) (C)	0	1	3	0	8	8	3
114	HI 8800 (d)	3	1	7	1	8	8	5
115	MACS 6478 (C)	5	3	-	2	8	8	5
116	MACS 6709	3	1	1	1	8	8	4
117	HI 1625	3	1	3	0	9	9	4
118	UAS 428 (d) (C)	0	1	5	0	8	8	4
119	PBW 770	0	1	5	0	7	7	3

S. No.	Entry	Powdery Mildew Score (0-9)						
		Pantnagar	**Almora**	**Shimla**	**Dhaulakuan**	**Malan**	**HS**	**AV.**
120	GW 492	7	1	1	0	6	7	4
120A	Infector	7	3	9	1	8	9	6
121	GW 1346 (d)	2	1	7	1	7	7	4
122	HI 1605 (C)	0	3	5	0	7	7	4
123	AKDW 2997-16 (d) (C)	5	3	7	0	9	9	6
124	MPO 1336 (d)	0	1	7	0	5	7	3
125	UAS 446 (d) (c)	4	5	5	0	7	7	5
126	HI 8805 (d)	1	3	7	0	6	7	4
127	MACS 4058 (d)	1	1	9	0	8	9	5
128	MACS 6696	0	3	3	1	8	8	4
129	MACS 4059 (d)	0	1	9	0	8	9	5
130	NIAW 3170	0	3	3	1	7	7	4
131	DBW 93 (c)	0	1	5	4	8	8	4
132	MACS 6695	0	1	3	0	9	9	4
133	HI 8802 (d)	0	1	7	0	7	7	4
VI. SPECIAL TRIAL (Dicoccum)								
134	DDK 1029 (C)	0	1	0	0	4	4	2
135	MACS 6222 (Ae.) (C)	0	1	5	2	7	7	4
136	MACS 5051	0	1	0	0	6	6	2
137	HW 4101	0	1	0	0	4	4	2
138	DDK 1054	1	1	0	0	6	6	2
139	HW 1098 (C)	0	0	0	0	3	3	1
VII. SPECIAL TRIAL- Very Late Sown								
140	WR 544 (C)	2	1	7	0	9	9	5
140A	Infector	5	3	9	4	8	9	6
141	HD 3271	0	1	5	0	5	5	3
142	DBW 71 (C)	0	1	7	1	8	8	4
143	PBW 797	0	1	5	0	7	7	3
144	PBW 757	1	1	3	0	5	5	3
145	DBW 278	0	0	5	0	6	6	3
146	HI 1621	1	1	7	0	7	7	4
147	DBW 14 (C)	3	0	1	0	7	7	3
148	PBW 777	1	1	5	2	8	8	4
149	HD 3298	0	1	5	1	4	5	3

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PROGRAMME 7. REGION SPECIFIC DISEASES OF LIMITED IMPORTANCE

7.1 FUSARIUM HEAD BLIGHT (FHB) OR HEAD SCAB

Fusarium graminearum Schwabe **(*Gibberella zeae* (Schwein) Petch.)**
Evaluation of AVT materials

Test Locations: Gurdaspur, Delhi and Dhaulakuan

AVT entries along with checks were evaluated under artificially inoculated conditions. The data from Dhaulakaun and Delhi has been considered. The data from Gurdaspur have not been received. Disease scoring scale (0-5) has been used. A total 149 entries were evaluated and entry-wise reaction of AVTs entries (2017-2018) has been given in Tables 7.1. On the basis of highest score, none of the genotype was found resistant or moderately resistant.

Table7.1. Performance of AVTs material against head scab (% incidence) under multilocational testing during 2017-18

S. No.	Entry	Head scab incidence (%)			
		Dhaulakuan	**Delhi**	**HS**	**Av.**
I. NORTHERN HILL ZONE					
1	HS 542 (C)	3	3	3	3
2	HS 666	5	2	5	3.5
3	HS 665	5	3	5	4
4	VL 1015	4	3	4	3.5
5	HPW 450	5	3	5	4
6	HS 664	5	3	5	4
7	HPW 451	3	4	3	3.5
8	VL 1016	4	2	4	3
9	UP 3016	4	3	4	3.5
10	VL 1014	3	2	3	2.5
11	VL 829 (C)	3	3	3	3
12	HPW 251 (C)	3	3	3	3
13	HPW 349 (C)	4	4	4	4
14	HS 634	5	3	5	4
15	VL 907 (C)	3	4	3	3.5
16	HS 507 (C)	3	1	3	2
17	HPW 441	4	3	4	3.5
18	HPW 442	4	4	4	4
19	HS 562 (C)	3	3	3	3
20	VL 3017	5	4	5	4.5
20A	Infector	3	4	3	3.5
21	UP 3017	4	3	4	3.5

S. No.	Entry	Head scab incidence (%)			
		Dhaulakuan	Delhi	HS	Av.
22	VL 3016	5	3	5	4
23	HS 662	3	4	3	3.5
24	HS 490 (C)	3	3	3	3
25	VL 892 (C)	5	4	5	4.5
26	HS 661	3	3	3	3
27	HS 660	4	4	4	4
28	VL 3018	5	5	5	5
29	HPW 459	5	5	5	5
II. NORTH WESTERN PLAIN ZONE					
30	UP 2981	4	5	4	4.5
31	DBW 221	4	4	4	4
32	DPW 621-50 (C)	3	4	3	3.5
33	DBW 222	4	3	4	3.5
34	BRW 3792	4	3	4	3.5
35	PBW 763	5	4	5	4.5
36	PBW 766	4	4	4	4
37	HD 3086 (C)	4	5	4	4.5
38	DBW 233	5	5	5	5
39	HD 3226	5	4	5	4.5
40	HD 2967 (C)	4	3	4	3.5
40A	Infector	4	5	4	4.5
41	PBW 801	5	4	5	4.5
42	DBW 88 (C)	3	3	3	3
43	PBW 800	4	2	4	3
44	WH 1105	5	3	5	4
45	PBW 771	5	5	5	5
46	WH 1124 (C)	5	4	5	4.5
47	DBW 90 (C)	5	5	5	5
48	HD 3059 (C)	3	4	3	3.5
49	WH 1021 (C)	4	5	4	4.5
50	PBW 752*	4	3	4	3.5
51	DBW 173 (I) (C)	4	3	4	3.5
52	PBW 773	5	4	5	4.5
53	DBW 237	2	5	2	3.5
54	WH 1142 (C)	2	3	2	2.5
55	BRW 3806	3	4	3	3.5
56	WH 1080 (C)	3	3	3	3

S. No.	Entry	Head scab incidence (%)			
		Dhaulakuan	Delhi	HS	Av.
57	HD 3237*	4	5	4	4.5
58	HI 1620*	3	4	3	3.5
59	PBW 644 (C)	4	1	4	2.5
60	HD 3043 (C)	4	1	4	2.5
60A	Infector	2	4	2	3
61	DBW 252	4	2	4	3
62	HI 1628	4	3	4	3.5
63	NIAW 3170	4	2	4	3
III. NORTH EASTERN PLAIN ZONE					
64	DBW 233	4	3	4	3.5
65	HD 3249	4	4	4	4
66	HD 3254	3	2	3	2.5
67	K 1006 (C)	4	4	4	4
68	HD 2733 (C)	3	5	3	4
69	DBW 221	4	4	4	4
70	K 1601	4	4	4	4
71	PBW 769	5	3	5	4
72	DBW 39 (C)	5	3	5	4
73	HD 2967 (C)	3	2	3	2.5
74	K 0307 (C)	5	3	5	4
75	DBW 187	4	3	4	3.5
76	DBW 223	4	3	4	3.5
77	PBW 762	5	2	5	3.5
78	WH 1218	4	3	4	3.5
79	HD 2888 (C)	5	2	5	3.5
80	HI 1612 (I) (C)	4	2	4	3
80A	Infector	4	5	4	4.5
81	WH 1235	4	5	4	4.5
82	BRW 3806	3	5	3	4
83	K 1317 (C)	3	5	3	4
84	DBW 252	4	3	4	3.5
85	K 8027 (C)	4	3	4	3.5
86	HD 3171 (C)	4	3	4	3.5
87	HI 1628	4	3	4	3.5
IV. CENTRAL ZONE					
88	GW 1339 (d)	3	4	3	3.5
89	AKAW 4924	2	2	2	2

S. No.	Entry	Head scab incidence (%)			
		Dhaulakuan	Delhi	HS	Av.
90	GW 322 (C)	3	5	3	4
91	HI 8713 (d) (C)	3	5	3	4
92	HI 8737 (d) (C)	3	3	3	3
93	HI 1544 (C)	3	3	3	3
94	GW 495	3	3	3	3
95	UAS 465 (d)	2		2	2
96	MPO 1343 (d)	3	3	3	3
97	DBW 110 (C)	3	3	3	3
98	DDW 47 (d)	3	3	3	3
99	MP 1331	3	3	3	3
100	MP 3288 (C)	4	3	4	3.5
100 A	Infector	3	4	3	3.5
101	HI 8627 (d) (C)	4	4	4	4
102	UAS 466 (d)	4	4	4	4
103	NIAW 3170	4	4	4	4
V. PENINSULAR ZONE					
104	AKAW 4924	5	4	5	4.5
105	GW 491	5	5	5	5
106	GW 493	5	2	5	3.5
107	DBW 235	4	5	4	4.5
108	HI 1624	4	5	4	4.5
109	MACS 6222 (C)	5	3	5	4
110	DBW 168 (I) (C)	3	2	3	2.5
111	GW 495	5	4	5	4.5
112	MP 1338	5	4	5	4.5
113	MACS 3949 (d) (C)	3	4	3	3.5
114	HI 8800 (d)	3	5	3	4
115	MACS 6478 (C)	4	5	4	4.5
116	MACS 6709	3	5	3	4
117	HI 1625	4	5	4	4.5
118	UAS 428 (d) (C)	3		3	3
119	PBW 770	4	5	4	4.5
120	GW 492	4		4	4
120 A	Infector	3	4	3	3.5
121	GW 1346 (d)	5	5	5	5
122	HI 1605 (C)	3	4	3	3.5

S. No.	Entry	Head scab incidence (%)			
		Dhaulakuan	Delhi	HS	Av.
123	AKDW 2997-16 (d) (C)	5	3	5	4
124	MPO 1336 (d)	3	4	3	3.5
125	UAS 446 (d) (c)	5	5	5	5
126	HI 8805 (d)	4	4	4	4
127	MACS 4058 (d)	5	4	5	4.5
128	MACS 6696	3	5	3	4
129	MACS 4059 (d)	4	5	4	4.5
130	NIAW 3170	3	4	3	3.5
131	DBW 93 (c)	3	4	3	3.5
132	MACS 6695	3	3	3	3
133	HI 8802 (d)	3	3	3	3
VI. SPECIAL TRIAL (Dicoccum)					
134	DDK 1029 (C)	3	2	3	2.5
135	MACS 6222 (Ae.) (C)	3	2	3	2.5
136	MACS 5051	3	4	3	3.5
137	HW 4101	3	4	3	3.5
138	DDK 1054	3	3	3	3
139	HW 1098 (C)	3	3	3	3
VII. SPECIAL TRIAL- Very Late Sown					
140	WR 544 (C)	5	-	5	5
140 A	Infector	3	4	3	3.5
141	HD 3271	4	5	4	4.5
142	DBW 71 (C)	4	5	4	4.5
143	PBW 797	3	3	3	3
144	PBW 757	4	4	4	4
145	DBW 278	5	2	5	3.5
146	HI 1621	4	4	4	4
147	DBW 14 (C)	3	5	3	4
148	PBW 777	4	4	4	4
149	HD 3298	4	4	4	4

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7.2. FLAG SMUT, *Urocystis agropyri* (Preuss) Sch.

Test Locations: Hisar, Ludhiana, Karnal and Durgapura

Flag smut is soil and externally seed bone disease caused by *Urocyctis agropyri*. The spore of the pathogen can survive for longer period in the soil. Disease development was good at all the centres. A total 149 entries were screened and entry-wise reaction of AVTs (2017-18) has been given in Tables 7.2.Data for 2nd year entries has also been given in Table 1.5. The entries mentioned below were found resistant (upto 10 % average disease incidence).

AVTs 2017-18

Free:

HS 664, VL 3018, HI 8805 (d), MACS 4058 (d), MACS 4059 (d) and NIAW 3170

Resistant (upto 10% infection):

HS 542 (C), HS 666, HS 665, VL 1015, HPW 450, HPW 451, VL 829 (C), HPW 251 (C), HS 634, VL 907 (C), HS 507 (C), HPW 441, HPW 442, HS 562 (C), VL 3017, VL 3016, HS 662, VL 892 (C), HS 660, DPW 621-50 (C), DBW 222, DBW 233, HD 3226, DBW 88 (C), WH 1105, WH 1124 (C), DBW 90 (C), HD 3059 (C), DBW 173 (I) (C), PBW 773, DBW 237, WH 1142 (C) , WH 1080 (C), HD 3237*, HI 1620* ,HD 3043 (C) HI 1628, NIAW 3170, DBW 233, HD 3254, K 1006 (C), PBW 769, HD 2967 (C), K 0307 (C), DBW 187, WH 1218, WH 1235, BRW 3806, K 1317 (C), HD 3171 (C), HI 1628, GW 1339 (d), AKAW 4924, HI 8713 (d) (C), HI 8737 (d) (C), UAS 465 (d), MPO 1343 (d), DBW 110 (C), DDW 47 (d), MP 1331, MP 3288 (C), HI 8627 (d) (C), UAS 466 (d), NIAW 3170, AKAW 4924, GW 491, DBW 235, MACS 6222 (C), DBW 168 (I) (C), MP 1338, MACS 3949 (d) (C), HI 8800 (d), MACS 6709, UAS 428 (d) (C), PBW 770, GW 492, GW 1346 (d), HI 1605 (C), AKDW 2997-16 (d) (C), MPO 1336 (d), UAS 446 (d) (c), HI 8802 (d), DDK 1029 (C), MACS 5051, HW 4101, DDK 1054, HW 1098 (C), PBW 757, DBW 278, HI 1621, DBW 14 (C) and HD 3298

Table 7.2. Performance of AVTs material against flag smut (% incidence) under multilocational testing during 2017-18

S. No.	Entry	Flag smut incidence (%)					
		Ludhiana	Karnal	Hisar	Durgapura	HS	AV.
I. NORTHERN HILL ZONE							
1	HS 542 (C)	25.0	0.0	0.0	0.0	25.0	6.3
2	HS 666	25.0	3.7	3.7	0.0	25.0	8.1
3	HS 665	0.0	1.5	4.3	0.0	4.3	1.5
4	VL 1015	28.6	0.0	8.3	0.0	28.6	9.2
5	HPW 450	0.0	5.7	7.1	0.0	7.1	3.2
6	HS 664	0.0	0.0	0.0	0.0	0.0	0.0
7	HPW 451	16.7	0.0	0.0	6.7	16.7	5.8
8	VL 1016	50.0	13.3	0.0	21.4	50.0	21.2
9	UP 3016	42.9	16.5	0.0	17.5	42.9	19.2
10	VL 1014	58.3	1.6	13.3	5.3	58.3	19.6
11	VL 829 (C)	0.0	0.0	7.7	0.0	7.7	1.9

S. No.	Entry	Flag smut incidence (%)					
		Ludhiana	Karnal	Hisar	Durgapura	HS	AV.
12	HPW 251 (C)	0.0	5.6	3.8	0.0	5.6	2.4
13	HPW 349 (C)	44.4	8.0	8.8	7.5	44.4	17.2
14	HS 634	0.0	0.0	9.1	0.0	9.1	2.3
15	VL 907 (C)	0.0	5.1	7.1	14.2	14.2	6.6
16	HS 507 (C)	10.0	0.0	7.7	0.0	10.0	4.4
17	HPW 441	0.0	0.0	6.9	5.3	6.9	3.0
18	HPW 442	0.0	10.0	7.8	3.6	10.0	5.3
19	HS 562 (C)	15.4	0.0	3.8	0.0	15.4	4.8
20	VL 3017	0.0	0.0	0.0	3.2	3.2	0.8
20A	Infector	63.6	18.0	26.1	69.8	69.8	44.4
21	UP 3017	33.3	2.2	27.3	0.0	33.3	15.7
22	VL 3016	6.7	0.0	16.2	0.0	16.2	5.7
23	HS 662	11.1	0.0	4.0	0.0	11.1	3.8
24	HS 490 (C)	54.6	1.3	4.2	20.0	54.6	20.0
25	VL 892 (C)	0.0	0.0	3.7	0.0	3.7	0.9
26	HS 661	27.3	4.7	5.7	5.9	27.3	10.9
27	HS 660	7.1	0.0	0.0	0.0	7.1	1.8
28	VL 3018	0.0	0.0	0.0	0.0	0.0	0.0
29	HPW 459	26.7	3.4	22.2	0.0	26.7	13.1
II. NORTH WESTERN PLAIN ZONE							
30	UP 2981	66.7	0.0	29.6	0.0	66.7	24.1
31	DBW 221	100.0	31.7	0.0	56.7	100.0	47.1
32	DPW 621-50 (C)	10.0	0.0	0.0	3.0	10.0	3.3
33	DBW 222	0.0	5.0	21.4	0.0	21.4	6.6
34	BRW 3792	33.3	0.0	0.0	9.3	33.3	10.7
35	PBW 763	55.6	19.4	0.0	26.4	55.6	25.3
36	PBW 766	25.0	1.0	0.0	20.5	25.0	11.6
37	HD 3086 (C)	36.4	0.0	6.9	3.3	36.4	11.6
38	DBW 233	0.0	0.0	7.4	1.5	7.4	2.2
39	HD 3226	0.0	0.0	4.3	0.0	4.3	1.1
40	HD 2967 (C)	42.9	2.1	4.2	7.1	42.9	14.1
40A	Infector	87.5	25.9	13.8	75.4	87.5	50.6
41	PBW 801	40.0	0.0	2.9	0.0	40.0	10.7
42	DBW 88 (C)	25.0	3.5	0.0	0.0	25.0	7.1
43	PBW 800	50.0	0.0	0.0	7.7	50.0	14.4
44	WH 1105	0.0	0.0	31.6	0.0	31.6	7.9
45	PBW 771	62.5	18.6	0.0	12.7	62.5	23.5
46	WH 1124 (C)	27.3	0.0	0.0	3.3	27.3	7.6
47	DBW 90 (C)	16.7	0.0	0.0	0.0	16.7	4.2

S. No.	Entry	Flag smut incidence (%)					
		Ludhiana	Karnal	Hisar	Durgapura	HS	AV.
48	HD 3059 (C)	22.2	3.2	5.4	2.4	22.2	8.3
49	WH 1021 (C)	37.5	0.0	0.0	5.6	37.5	10.8
50	PBW 752*	62.5	0.0	3.8	0.0	62.5	16.6
51	DBW 173 (I) (C)	14.3	9.7	5.3	0.0	14.3	7.3
52	PBW 773	0.0	0.0	5.9	0.0	5.9	1.5
53	DBW 237	20.0	0.0	3.4	3.8	20.0	6.8
54	WH 1142 (C)	9.1	8.0	4.0	15.4	15.4	9.1
55	BRW 3806	0.0	0.0	0.0	52.7	52.7	13.2
56	WH 1080 (C)	20.0	0.0	0.0	0.0	20.0	5.0
57	HD 3237*	0.0	0.0	4.8	0.0	4.8	1.2
58	HI 1620*	16.7	0.0	8.8	0.0	16.7	6.4
59	PBW 644 (C)	71.4	4.7	4.3	2.2	71.4	20.7
60	HD 3043 (C)	9.1	0.0	4.0	2.2	9.1	3.8
60A	Infector	100.0	25.3	27.6	79.2	100.0	58.0
61	DBW 252	25.0	3.9	5.4	18.6	25.0	13.2
62	HI 1628	0.0	0.0	2.1	0.0	2.1	0.5
63	NIAW 3170	0.0	0.0	2.9	0.0	2.9	0.7
III. NORTH EASTERN PLAIN ZONE							
64	DBW 233	14.3	0.0	3.1	0.0	14.3	4.4
65	HD 3249	33.3	2.9	4.5	0.0	33.3	10.2
66	HD 3254	10.0	0.0	2.9	0.0	10.0	3.2
67	K 1006 (C)	0.0	3.3	3.3	0.0	3.3	1.7
68	HD 2733 (C)	20.0	3.1	3.1	16.4	20.0	10.7
69	DBW 221	58.3	1.8	3.8	9.4	58.3	18.3
70	K 1601	62.5	2.4	3.3	5.7	62.5	18.5
71	PBW 769	0.0	0.0	6.3	0.0	6.3	1.6
72	DBW 39 (C)	40.0	0.0	3.7	1.7	40.0	11.3
73	HD 2967 (C)	14.3	0.0	5.3	3.2	14.3	5.7
74	K 0307 (C)	9.1	0.0	4.0	0.0	9.1	3.3
75	DBW 187	7.1	0.0	5.9	20.0	20.0	8.3
76	DBW 223	30.0	6.1	6.3	8.1	30.0	12.6
77	PBW 762	37.5	0.0	2.9	8.6	37.5	12.3
78	WH 1218	0.0	5.9	3.0	5.4	5.9	3.6
79	HD 2888 (C)	72.7	0.0	4.8	0.0	72.7	19.4
80	HI 1612 (I) (C)	87.5	6.0	4.7	48.1	87.5	36.6
80A	Infector	80.0	27.3	29.2	58.4	80.0	48.7
81	WH 1235	0.0	0.0	3.4	0.0	3.4	0.9
82	BRW 3806	9.1	7.8	4.3	0.0	9.1	5.3
83	K 1317 (C)	0.0	0.0	4.2	0.0	4.2	1.0

S. No.	Entry	Flag smut incidence (%)					
		Ludhiana	Karnal	Hisar	Durgapura	HS	AV.
84	DBW 252	85.7	1.9	5.0	7.0	85.7	24.9
85	K 8027 (C)	50.0	1.0	4.0	7.0	50.0	15.5
86	HD 3171 (C)	21.4	2.4	2.9	0.0	21.4	6.7
87	HI 1628	0.0	0.0	4.0	0.0	4.0	1.0
IV. CENTRAL ZONE							
88	GW 1339 (d)	0.0	1.8	3.6	0.0	3.6	1.3
89	AKAW 4924	0.0	0.0	7.1	0.0	7.1	1.8
90	GW 322 (C)	30.8	2.8	14.3	3.7	30.8	12.9
91	HI 8713 (d) (C)	0.0	0.0	4.0	0.0	4.0	1.0
92	HI 8737 (d) (C)	0.0	0.0	5.5	0.0	5.5	1.4
93	HI 1544 (C)	81.8	12.3	6.3	85.7	85.7	46.5
94	GW 495	83.3	9.1	4.3	73.3	83.3	42.5
95	UAS 465 (d)	0.0	0.0	5.0	19.3	19.3	6.1
96	MPO 1343 (d)	0.0	0.0	4.2	0.0	4.2	1.0
97	DBW 110 (C)	0.0	5.3	2.7	0.0	5.3	2.0
98	DDW 47 (d)	0.0	0.0	3.1	0.0	3.1	0.8
99	MP 1331	14.3	4.5	3.7	0.0	14.3	5.6
100	MP 3288 (C)	10.0	2.9	4.3	8.3	10.0	6.4
100A	Infector	66.7	19.1	21.1	68.4	68.4	43.8
101	HI 8627 (d) (C)	0.0	0.0	3.8	0.0	3.8	1.0
102	UAS 466 (d)	0.0	2.0	5.4	0.0	5.4	1.9
103	NIAW 3170	0.0	0.0	3.7	2.0	3.7	1.4
V. PENINSULAR ZONE							
104	AKAW 4924	0.0	6.9	3.1	0.0	6.9	2.5
105	GW 491	0.0	0.0	6.6	0.0	6.6	1.7
106	GW 493	40.0	3.5	4.8	0.0	40.0	12.1
107	DBW 235	0.0	0.0	37.5	0.0	37.5	9.4
108	HI 1624	33.3	0.0	4.8	6.3	33.3	11.1
109	MACS 6222 (C)	27.3	4.4	0.0	0.0	27.3	7.9
110	DBW 168 (I) (C)	28.6	0.0	0.0	11.6	28.6	10.0
111	GW 495	50.0	12.4	17.4	11.3	50.0	22.8
112	MP 1338	0.0	0.0	2.2	0.0	2.2	0.6
113	MACS 3949 (d) (C)	0.0	8.1	3.1	0.0	8.1	2.8
114	HI 8800 (d)	0.0	0.0	8.3	0.0	8.3	2.1
115	MACS 6478 (C)	54.6	8.0	0.0	3.3	54.6	16.5
116	MACS 6709	8.3	0.0	0.0	8.9	8.9	4.3
117	HI 1625	70.0	4.8	0.0	0.0	70.0	18.7
118	UAS 428 (d) (C)	0.0	0.0	0.0	19.6	19.6	4.9
119	PBW 770	30.8	1.4	0.0	0.0	30.8	8.0

S. No.	Entry	Flag smut incidence (%)					
		Ludhiana	Karnal	Hisar	Durgapura	HS	AV.
120	GW 492	7.7	0.0	0.0	6.0	7.7	3.4
120A	Infector	54.6	26.9	27.3	56.9	56.9	41.4
121	GW 1346 (d)	0.0	0.0	6.7	0.0	6.7	1.7
122	HI 1605 (C)	0.0	0.0	5.6	0.0	5.6	1.4
123	AKDW 2997-16 (d) (C)	0.0	4.0	25.9	0.0	25.9	7.5
124	MPO 1336 (d)	0.0	0.0	2.9	0.0	2.9	0.7
125	UAS 446 (d) (c)	0.0	5.3	0.0	0.0	5.3	1.3
126	HI 8805 (d)	0.0	0.0	0.0	0.0	0.0	0.0
127	MACS 4058 (d)	0.0	0.0	0.0	0.0	0.0	0.0
128	MACS 6696	33.3	7.5	0.0	0.0	33.3	10.2
129	MACS 4059 (d)	0.0	0.0	0.0	0.0	0.0	0.0
130	NIAW 3170	0.0	0.0	0.0	0.0	0.0	0.0
131	DBW 93 (c)	44.4	9.2	15.0	2.7	44.4	17.8
132	MACS 6695	33.3	0.9	19.4	5.4	33.3	14.8
133	HI 8802 (d)	0.0	0.0	23.5	0.0	23.5	5.9
VI. SPECIAL TRIAL (Dicoccum)							
134	DDK 1029 (C)	0.0	0.0	25.0	0.0	25.0	6.3
135	MACS 6222 (Ae.) (C)	33.3	1.1	20.0	0.0	33.3	13.6
136	MACS 5051	0.0	0.0	7.1	0.0	7.1	1.8
137	HW 4101	0.0	0.0	5.5	0.0	5.5	1.4
138	DDK 1054	0.0	0.0	6.7	0.0	6.7	1.7
139	HW 1098 (C)	0.0	0.0	6.5	0.0	6.5	1.6
VII. SPECIAL TRIAL- Very Late Sown							
140	WR 544 (C)	37.5	0.0	5.5	0.0	37.5	10.8
140A	Infector	63.6	15.3	20.0	65.8	65.8	41.2
141	HD 3271	44.4	4.1	6.3	2.5	44.4	14.3
142	DBW 71 (C)	54.6	0.0	2.9	0.0	54.6	14.4
143	PBW 797	50.0	8.4	6.3	37.1	50.0	25.4
144	PBW 757	11.1	6.7	3.0	0.0	11.1	5.2
145	DBW 278	0.0	0.0	5.7	0.0	5.7	1.4
146	HI 1621	0.0	9.5	6.7	0.0	9.5	4.0
147	DBW 14 (C)	25.0	0.0	4.0	0.0	25.0	7.3
148	PBW 777	28.6	13.3	2.4	0.0	28.6	11.1
149	HD 3298	0.0	0.0	4.7	0.0	4.7	1.2

COOPERATORS

NAME	CENTRE
R.S. BENIWAL	HISAR

P.S. SHEKHAWAT AND NITIN CHAWLA	DURGAPURA
JASPAL KAUR, RITU BALA	LUDHIANA
SUDHEER KUMAR P.L. KASHYAP AND D.P. SINGH	KARNAL (COORDINATING UNIT)

7.3. FOOT ROT (*Sclerotium rolfsii*)

Test Locations: Dharwad and Indore

AVT entries along with checks were evaluated at Dharwad and Indore centers and data were not received from Indore center. AVTs (2017-2018) were evaluated against foot rot and entries wise reaction has been given in Tables 7.3. The entries showing upto 5 and 10.00 per cent incidence were categorized as highly resistant and resistant, respectively and are listed below:

AVTs Year 2017-18
Highly resistant (upto 5 % disease):
UP 3016, VL 1014, HPW 251 (C), HS 507 (C), UP 3017, HPW 459, UP 2981, DBW 221, PBW 766, HD 3043 (C), HD 3254, HD 2733 (C), DBW 252, K 8027 (C), AKAW 4924, GW 495 and MP 3288 (C)

Resistant (5-10 % disease):
HS 542 (C), HS 666, VL 829 (C), HPW 441, VL 892 (C), VL 3018, PBW 763, HD 3086 (C), HD 3226, DBW 90 (C), PBW 752*, DBW 252, HD 2888 (C), HI 1628, MPO 1343 (d), MP 1331, DBW 235, MACS 6478 (C), MACS 4058 (d), DBW 93 (c), MACS 6222 (Ae.) (C), MACS 5051, HW 4101 and HD 3271

Table 7.3. Performance of AVTs material against foot rot (% incidence) at Dharwad during 2017-2018

S. No.	Entry	Dharwad
I. NORTHERN HILL ZONE		
1	HS 542 (C)	6.7
2	HS 666	5.9
3	HS 665	15.4
4	VL 1015	27.8
5	HPW 450	12.5
6	HS 664	20.0
7	HPW 451	35.3
8	VL 1016	26.7
9	UP 3016	0.0
10	VL 1014	0.0
11	VL 829 (C)	5.6
12	HPW 251 (C)	0.0
13	HPW 349 (C)	11.8
14	HS 634	33.3
15	VL 907 (C)	22.2
16	HS 507 (C)	0.0
17	HPW 441	5.6
18	HPW 442	35.0
19	HS 562 (C)	10.5
20	VL 3017	27.8
20A	Infector	23.5
21	UP 3017	0.0
22	VL 3016	22.2
23	HS 662	27.8

S. No.	Entry	Dharwad
24	HS 490 (C)	22.2
25	VL 892 (C)	6.3
26	HS 661	10.5
27	HS 660	16.7
28	VL 3018	5.9
29	HPW 459	0.0
II. NORTH WESTERN PLAIN ZONE		
30	UP 2981	0.0
31	DBW 221	5.0
32	DPW 621-50 (C)	20.0
33	DBW 222	11.1
34	BRW 3792	16.7
35	PBW 763	5.6
36	PBW 766	5.0
37	HD 3086 (C)	10.0
38	DBW 233	11.1
39	HD 3226	5.3
40	HD 2967 (C)	20.0
40A	Infector	30.0
41	PBW 801	35.0
42	DBW 88 (C)	36.8
43	PBW 800	20.0
44	WH 1105	27.8
45	PBW 771	15.0
46	WH 1124 (C)	15.8
47	DBW 90 (C)	5.9
48	HD 3059 (C)	20.0
49	WH 1021 (C)	18.8
50	PBW 752*	5.3
51	DBW 173 (I) (C)	26.3
52	PBW 773	20.0
53	DBW 237	23.5
54	WH 1142 (C)	17.7
55	BRW 3806	17.7
56	WH 1080 (C)	26.3
57	HD 3237*	38.9
58	HI 1620*	17.7
59	PBW 644 (C)	33.3
60	HD 3043 (C)	0.0
60A	Infector	25.0
61	DBW 252	10.0
62	HI 1628	45.0
63	NIAW 3170	30.0
III. NORTH EASTERN PLAIN ZONE		
64	DBW 233	23.5
65	HD 3249	15.0
66	HD 3254	0.0
67	K 1006 (C)	11.1
68	HD 2733 (C)	0.0
69	DBW 221	11.1
70	K 1601	15.8
71	PBW 769	22.2

S. No.	Entry	Dharwad
72	DBW 39 (C)	11.1
73	HD 2967 (C)	26.3
74	K 0307 (C)	20.0
75	DBW 187	35.0
76	DBW 223	23.5
77	PBW 762	37.5
78	WH 1218	31.6
79	HD 2888 (C)	5.3
80	HI 1612 (I) (C)	31.6
80A	Infector	0.0
81	WH 1235	20.0
82	BRW 3806	29.4
83	K 1317 (C)	37.5
84	DBW 252	0.0
85	K 8027 (C)	0.0
86	HD 3171 (C)	15.0
87	HI 1628	5.9
IV. CENTRAL ZONE		
88	GW 1339 (d)	33.3
89	AKAW 4924	0.0
90	GW 322 (C)	22.2
91	HI 8713 (d) (C)	15.0
92	HI 8737 (d) (C)	20.0
93	HI 1544 (C)	22.2
94	GW 495	0.0
95	UAS 465 (d)	27.8
96	MPO 1343 (d)	10.0
97	DBW 110 (C)	33.3
98	DDW 47 (d)	33.3
99	MP 1331	6.3
100	MP 3288 (C)	0.0
100A	Infector	26.7
101	HI 8627 (d) (C)	17.7
102	UAS 466 (d)	15.0
103	NIAW 3170	11.8
V. PENINSULAR ZONE		
104	AKAW 4924	20.0
105	GW 491	45.0
106	GW 493	29.4
107	DBW 235	5.9
108	HI 1624	22.2
109	MACS 6222 (C)	10.5
110	DBW 168 (I) (C)	20.0
111	GW 495	47.4
112	MP 1338	27.8
113	MACS 3949 (d) (C)	26.3
114	HI 8800 (d)	28.6
115	MACS 6478 (C)	5.3
116	MACS 6709	21.1
117	HI 1625	29.4
118	UAS 428 (d) (C)	23.5
119	PBW 770	38.9
120	GW 492	35.0
120A	Infector	22.2

S. No.	Entry	Dharwad
121	GW 1346 (d)	35.7
122	HI 1605 (C)	45.0
123	AKDW 2997-16 (d) (C)	21.1
124	MPO 1336 (d)	11.8
125	UAS 446 (d) (c)	25.0
126	HI 8805 (d)	33.3
127	MACS 4058 (d)	6.3
128	MACS 6696	20.0
129	MACS 4059 (d)	26.3
130	NIAW 3170	21.1
131	DBW 93 (c)	5.6
132	MACS 6695	16.7
133	HI 8802 (d)	16.7
VI. SPECIAL TRIAL (Dicoccum)		
134	DDK 1029 (C)	25.0
135	MACS 6222 (Ae.) (C)	5.6
136	MACS 5051	7.1
137	HW 4101	6.7
138	DDK 1054	30.0
139	HW 1098 (C)	21.1
VII. SPECIAL TRIAL- Very Late Sown		
140	WR 544 (C)	11.1
140A	Infector	26.3
141	HD 3271	5.3
142	DBW 71 (C)	27.8
143	PBW 797	26.3
144	PBW 757	31.6
145	DBW 278	21.1
146	HI 1621	35.0
147	DBW 14 (C)	33.3
148	PBW 777	11.1
149	HD 3298	15.8

COOPERATOR

NAME	CENTER
P.V. PATIL	DHARWAD
SUDHEER KUMAR P.L. KASHYAP AND D.P. SINGH	KARNAL (COORDINATING UNIT)

7.4 HILL BUNT (*Tilletia foetida, T. caries*)

Test Locations: Almora, Bajoura and Malan

A total 29 AVT entries were evaluated at three locations and disease development was good at all centres. The data was taken by counting infected and healthy ear heads, for calculating per cent infected ear heads. There were differences in the disease incidence at three locations, hence the highest disease level as well as average was considered and has been given in Table 7.4.

AVTs 2017-18

Resistant (1-10 % disease):

VL 1014, VL 829 (C), VL 3017, UP 3017 and VL 3018

Table 7.3. Performance of AVT material against hill bunt (% incidence) under multilocational testing during 2017-2018

S. No.	Entry	Hill Bunt Incidence (%)				
		Malan	Bajaura	Almora	HS	Av.
I. NORTHERN HILL ZONE						
1	HS 542 (C)	45.9	12.9	18.2	45.9	25.7
2	HS 666	29.7	30.7	16.0	30.7	25.5
3	HS 665	16.9	31.4	9.0	31.4	19.1
4	VL 1015	34.1	17.3	12.0	34.1	21.1
5	HPW 450	14.3	15.3	3.1	15.3	10.9
6	HS 664	43.7	29.0	17.8	43.7	30.1
7	HPW 451	30.9	31.3	44.3	44.3	35.5
8	VL 1016	40.8	19.4	28.0	40.8	29.4
9	UP 3016	22.7	7.9	0.0	22.7	10.2
10	VL 1014	16.3	1.6	4.7	16.3	7.5
11	VL 829 (C)	15.2	1.6	3.1	15.2	6.6
12	HPW 251 (C)	15.2	9.1	8.9	15.2	11.1
13	HPW 349 (C)	48	24.3	16.9	48.0	29.7
14	HS 634	30.5	13.3	2.9	30.5	15.6
15	VL 907 (C)	27.8	3.6	8.8	27.8	13.4
16	HS 507 (C)	35.6	36.8	1.8	36.8	24.8
17	HPW 441	18.1	26.2	4.6	26.2	16.3
18	HPW 442	37.1	47.4	30.3	47.4	38.2
19	HS 562 (C)	42	21.4	29.1	42.0	30.8
20	VL 3017	15.3	3.0	8.0	15.3	8.8
21	UP 3017	9	0.0	15.0	15.0	8.0
22	VL 3016	16.1	23.7	2.6	23.7	14.1
23	HS 662	26.9	36.4	29.7	36.4	31.0
24	HS 490 (C)	22.1	0.0	9.6	22.1	10.6
25	VL 892 (C)	19.8	13.3	6.3	19.8	13.1
26	HS 661	24	33.3	2.6	33.3	20.0
27	HS 660	30.4	20.7	16.1	30.4	22.4
28	VL 3018	10.7	7.8	2.4	10.7	7.0
29	HPW 459	14.9	53.8	4.8	53.8	24.5

COOPERATORS

NAME	CENTRE
K. K. MISHRA	ALMORA
SACHIN	MALAN
RAKESH DEVLASH	BAJAURA
SUDHEER KUMAR, P.L. KASHYAP AND D.P. SINGH	KARNAL

PROGRAMME 8. 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 56th All India Wheat & Barley Workers' Meet held at BHU Varanasi in August, 2017. 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. 23 which was issued during the crop season. This was also put on ICAR-IIWBR website (www.iiwbr.org). All the issues of the Newsletter brought out during the crop season, are given as an annexure at the end of this report along with details of surveys conducted.

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. So far, the exotic diseases and pathotypes like Ug99 race of stem rust and wheat blast were not reported from any part of the country.

Strategy Planning Meetings

(i). Planning meeting on "Seed Treatment of Wheat" in the office of DG, Agriculture, Govt. of Haryana, Panchkula on 19 July 2017 under chairmanship of Hon. Shri . **Dusmanta Kumar Behera, Director, Agriculture, Govt. of Haryana, Krishi Bhavan, Sector 21, Panchkula on 19 July 2017:**The meeting was attended by senior addl. and deputy directors of Agriculture and MD of Haryana Beej Corporation as well as Dr. R.S. Beniwal of CCS HAU Hisar. The issue of seed treatment of wheat seed produced by public sector units in Haryana was discussed at length and supported fungicidal seed treatment keeping in view of presence of loose smut and flag smut in Haryana. It was agreed to treat the seed of wheat with recommended fungicides like tebuconazole 2DS, Carbendazim 50 WP and Carboxin 75 WP and tender the procurement of these using chemical name. It was suggested not mentioning seed treatment for Karnal bunt since it may not work until and unless seed crop is given foliar sprays of fungicides like propiconazole @0.1% at ear emergence stage.

(ii). Preparedness on occurrence of blast disease on wheat: Strategy planning meetings was also conducted on "Preparedness on occurrence of blast disease on wheat" on 07.9.2017 in Kolkata under Chairmanship of Additional Chief Secretary, Govt. of west Bengal. It was attended by Agriculture Commissioner and Joint Secretary (Crops) DAC & FW, ADG (PP&B), Director, IIWBR and other higher officials of Govt of West Bengal, ICAR officials and SAUs. It was decided to keep no wheat zone up to 5 km distance from Border of Bangladesh in Indian states, prevent entry of wheat seed and grains from Bangladesh, wheat holiday in Nadia and Murshidabad districts as well as planting of trap plot nurseries along Indo-Bangladesh borders.

(iii). 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 10 October 2017 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 1500 farmers attended the fair. The seed of rust resistant varieties like WB 02 and HD3086 was distributed. 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.

(iv). Management of yellow rust and Karnal bunt: Strategy planning meeting was conducted to "Evolving strategies for enhancing wheat production with special reference to management wheat rust and Karnal bunt disease"on 6.10.2017at IISR Lucknow, U. P. under the chairmanship of hon. Secretary (AC &FW). The overview was given by Director, IIWBR and states and SAUs of UP, Bihar, MP, Haryana, H.P and Punjab. The participants were informed about the yellow rust resistant varieties for different states and arranging corrections in the literature prepared by UP Plant Protection department. The meeting was also addressed by ACP, U. P., Secretary Agric. and Director, U. P. Govt. The Secretary AC & FW stressed the need of proper management of wheat diseases and lauded the efforts of IIWBR on evaluation and identification of wheat blast resistant wheat varieties. He stressed the need to increase3 the productivity in wheat in U.P. and in India so that excess grains may be exported. JS (Crops) of DAC & FW stressed the need to replace older and susceptible varieties of wheat with newly released varieties and exchange of information on diseases for their proper management at farmers' fields. Director, IIWBR Karnal offered help to all the wheat growing states and particularly to Haryana and U. P. in replacing old varieties of wheat and adoption of new technology in wheat production and protection.

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. 23 issues 1-5 in annexure.

Skill up gradation course entitled "Survey and surveillance, creation of epiphytotics and uniform recording of diseases in wheat and barley from 18 - 20 December 2017 at ICAR-IIWBR Karnal

In total there are 30 officers dealing with crop protection from centres of AICWBIP, IARI, New Delhi and Indore, SAUs, CIPMC (DPP&Q) Kolkata, NSC Hisar, State Agric Departments, U. P., KVK, Saharanpur, U. P and State Agric. department Haryana. We could not accommodate another 20 participants applied this time and may be trained later.

Training course on ""Disease surveillance and wheat seed production" will be conducted for state agriculture departments, SAUs and farmers on 9 January 2018 at

Bhola Paswan Shastri College of Agriculture (BAU), Purnea, Bihar: The state government officials of agriculture department and farmers were trained.

POST HARVEST SURVEYS
KARNAL BUNT (KB)

The post harvest grain analysis for presence of Karnal bunt in grains of farmers' fields collected from different regions was done by different cooperating centres of All India Coordinated Research Project on Wheat and Barley during April-June 2018. The Karnal bunt incidence was lower as compared to previous years during 2017-18 crop season. The report is given below:

KARNAL BUNT (KB)
A total of 8079 grain samples collected from various mandies in different zones, and were analyzed at cooperating centers (Table 8.1). Among different states samples taken from M.P., Gujarat, Maharashtra and Karnataka were found free from Karnal bunt infection. The overall infection was 21.8%. The samples from Haryana showed maximum infection (49.5%) followed by Rajasthan (49.0%) and Punjab (28.2%)

Table 8.1. Karnal bunt situation in the country during 2017-18 crop season

State	**Total samples**	**Infected samples**	**% infected samples**	**Range of infection**
Punjab	3380	671	28.2	0.1-0.9
Haryana	1867	923	49.5	0.05-2.0
Rajasthan	249	123	49.0	0.1-20.2
Uttarakhand	753	0	0	0
Jammu	383	31	8.09	0.1-2.0
H. P.	20	5	20.0	0 .04-0.12
U.P.	107	11	9.7	0.1-0.8
M.P.	234	0	0	0
Maharashtra	180	0	0	0
Gujarat	731	0	0	0
Karnataka	175	0	0	0
Total	**8079**	**1764**	**21.8**	0.1-20.2

Jammu
Out of 383 samples were collected from Jammu region, 31 (8.09%) samples were having Karnal bunt (KB) infection in the range of 0.01-8.98%). Samples from Jammu were having higher percentage of KB followed by Samba, Kathua and Udhampur whereas samples from Rajouri were free from KB.
(M.K. Pandey, Amrish Vaid, Deepak Kumar)

Table 8.2. Karnal bunt situation in Jammu during 2017-18 crop season

Districts	Total Samples	No. of infected samples	% infected samples	Number of samples showing different level of Karnal bunt incidence (%)		
				<0.0-0.25	0.26-1.00	1.01-2.00
Rajauri	16	0	0	0	0	0
Jammu	187	16	8.55	7	7	2
Samba	89	08	8.98	6	2	0
Kathua	71	06	8.45	6	0	0
Udhampur	20	01	5.00	0	1	0
Total	383	31	8.09	19	10	02

H. P.
Karnal Bunt was observed in samples of variety HD 2967, PBW621, DBW 621-50, HPW 236 and VL 829 (0 .04-0.12 %) in Dhaulakuan region.
(Akhilesh Singh)

Uttarakhand
In Uttarakhand 753 wheat samples were analyzed, these samples were collected from four districts of Uttarakhand namely, Udham Singh Nagar, Nainital, Dehradun and Haridwar. This year the samples collected from different areas were found to be free from Karnal bunt.
(J.Kumar, Deepshikha, K.Srivastava)

Table 8.3. Incidence of Karnal bunt in Uttarakhand during 2017-18 crop season

Districts	**Total samples**	**No. of infected samples**
1.U S Nagar		
a) Pantnagar	437	0
b) Kashipur	11	0
c) Bajpur	68	0
d) Khatima	103	0
2. Dehradun	16	0
3.Haridwar	38	0
4. Nainital(Kotabagh)	80	0
Total	**753**	0

Punjab
A total of 2380 samples were collected from 164 grain markets of Punjab state and 671 (28.19) samples showed Karnal bunt infection. Among different districts, samples from Pathankot showed highest incidence of KB (81.82%) followed by Amritsar and

Kapurthalla. The range of per cent KB infected samples was from 8.26 to 81.82%. The severity of KB was highest in the Amritsar district followed by Kapurthalla. The range of KB infection in other districts was 0.018 - 0.903% with average infection of 0.194%. (Jaspal Kaur, Ritu Bala)

Table 8.4. Karnal bunt situation in Punjab during 2017-18 crop season

District	Total Samples	Infected Samples	% infected samples	% KB infection
Amritsar	80	48	58.75	0.90
Barnala	71	10	14.08	0.05
Bathinda	91	16	17.58	0.10
Faridkot	109	9	8.26	0.02
Fatehgarh Sahib	109	9	8.26	0.02
Fazilka	91	9	9.89	0.04
Ferozepur	168	26	15.48	0.11
Gurdaspur	155	60	38.71	0.29
Hoshiarpur	173	69	39.88	0.21
Jallandhar	185	60	32.43	0.24
Kapurthala	128	61	47.66	0.38
Ludhiana	259	74	28.57	0.20
Mansa	42	6	14.29	0.04
Moga	110	22	20.00	0.07
Mohali	21	7	33.33	0.12
Muktsar	60	6	10.00	0.02
Nawanshar	75	8	10.67	0.04
Pathankot	33	27	81.82	0.08
Patiala	83	27	32.53	0.07
Ropar	78	15	19.23	0.11
Sangrur	135	52	38.52	0.22
Tarantarn	124	50	40.32	0.249
	2380	**671**	**28.19**	**0.19**

Haryana

A total of 1867 samples collected from both Southwest and Northeast Haryana and analysed for presence of KB and revealed that 49.5% samples were infected with KB and range of infection was 0.5-2.0%. The KB infection was higher in Southwest Haryana (60.3%) as compared to Northeast Haryana (38.6%) which seems to be a major shift in KB distribution. The highest KB infected samples were in districts Dadri and Mahendragarh (100%) followed by Bhiwani (97.3%), Hisar (93.4%), Rewari (83.9%) and Gurugram (80.0%). It may be due to use of sprinkler irrigation as well as little use of rice-wheat cropping system. The least KB infected samples were from districts, Fatehabad (2.5%) followed by Sirsa (6.1%), Jind (8.8%), Ambala (9.3%) and Rohtak (14.3%).

(R. S. Beniwal)

Table 8.5. Status of Karnal bunt in Haryana during 2017-18 crop season

Districts	Total samples	%Infected samples	Range of infection	Average infection
South West Districts				
Hisar	197	93.42	0.05-1.05	0.10
Rohtak	98	14.28	0.05-0.10	0.01
Bhiwani	74	97.29	0.05-1.05	0.17
Dadri	106	100.00	0.05-1.90	0.34
Mahendergarh	110	100.00	0.05-2.00	0.58
Rewari	62	83.87	0.05-0.45	0.10
Jhajjar	166	61.2	0.05-0.25	0.03
Gurugram	102	80.04	0.05-0.60	0.06
Nuh(Mewat)	116	76.72	0.05-0.15	0.027
Jind	114	8.77	0.05-0.20	0.008
Fatehabad	79	2.53	0.05-0.15	0.003
Sirsa	66	6.06	0.05-0.10	0.003
Mean (South west zone)	**1290**	**60.34**	**0.05-2.00**	**0.118**
North East zone				
Karnal	71	53.52	0.05-1.10	0.077
Ambala	43	9.30	0.05	0.005
Kurukshetra	128	23.43	0.05-0.45	0.027
Kaithal	32	25.00	0.05-0.10	0.017
Sonipat	42	35.28	0.05-0.10	0.019
Panipat	48	22.91	0.05-0.30	0.026
Palwal	88	64.77	0.05-0.30	0.054
Faridabad	68	58.82	0.05-0.15	0.044
Yamuna Nagar	57	54.38	0.05	0.050
Mean(North East Zone)	**577**	**38.60**	**0.05-0.45**	**0.035**
State Mean	**1867**	**49.47**	**0.05-2.00**	**0.076**

Rajasthan

A total of 249 samples collected from Alwar, Dausa and Jaipur were analysed for presence of KB and 122 samples (49%) were having KB in the range of 0.1-20.2%. A decreased trend in the KB incidence was witnessed during 2017-18 as compared to last crop season which may be due to no rains in the months of the February and March accompanied with high temperature at booting stage of crop.
(Pradeep S. Shekhawat)

U. P.

In district Faizabad, a total of 107 wheat grains were collected and examination of Karnal bunt. Karnal bunt was detected in varieties, PBW 154, PBW 502, PBW 343, LOK 1, SONALIKA, HD 2329, HD 2733, HD 2967, HP 1633, HP 1731 and HP 1741. Highest percent of KB was recorded in variety HD 2329(0.8%) where as SONALIKA has lowest percent (0.1%) infection.
(S. P. Singh)

Table 8.6. Karnal bunt situation in Rajasthan during 2017-18 crop season

Districts	Percent number of samples showing different levels of KB incidence					Total samples	Per cent infected samples	Incidence Range (%)
	0	0.1 - 1.0	1.1 - 5.0	5.1 - 10	>10			
Alwar								
Alwar	11	18	1	0	0	30	63.3	0.1 - 1.2
Bansur	5	20	7	0	0	32	84.4	0.1 - 3.9
Kherthal	14	10	4	1	0	29	51.7	0.1 - 7.0
Dausa								
Bandikui	6	9	1	0	0	16	62.5	0.1 - 4.6
Dausa	25	5	1	0	1	32	21.9	0.1 - **20.2**
Lalsot	19	13	0	0	0	32	40.6	0.1 - 0.8
Jaipur								
Bagru	22	5	0	0	0	27	18.5	0.1 - 0.3
Bassi	7	3	0	0	0	10	30.0	0.1 - 0.2
Chaksu	15	7	3	1	0	36	30.6	0.1 - 3.7
Kotputli	3	10	1	1	0	15	80.0	0.1 - 7.9
Total	**127**	**100**	**18**	**3**	**1**	**249**	**-**	**0.1 - 20.2**
%	**51.0**	**40.2**	**7.2**	**1.2**	**0.4**	**-**	**49.0**	**-**

M. P.

A total of 400wheat grain samples collected from different mandis of Indore and Dewas during April and May, 2018, were analyzed for Karnal bunt infection and none of the samples found infected with the disease. Likewise, a total of 234 wheat grain samples from 104 villages of 7 blocks across the two districts viz. Hoshangabad and Narsinghpur were collected and examined for KB. Like previous years, none of the grain samples collected so for had KB symptoms.
(T. L. Prakash, K. K. Mishra)

Table 8.7. Karnal bunt situation in M. P. during 2017-18 crop season

District	Blocks	No of villages	No of samples	KB incidence	Varieties
Hoshangabad	Hoshangabad Sheoni malva Keshala	38 23 15	 88 46 30	NIL NIL NIL	GW322,GW366, MP1203, HI 1544, Sriram302 and Lok 1
Narsinghpur	Kareli Chawarpatha Chichali saikheda	9 11 2 4	18 40 4 8	NIL NIL NIL NIL	GW322,GW366, MP 4010, MP1203, HI 1544, MP3288, MP 3336, Sriram302 and Lok 1
Total = 2	**7**	**104**	**234**	**NIL**	

Gujarat

Eleven 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 of 524 seed samples from marketing yards and 207 samples from farmers' fields were examined. The data indicated that like previous years, all the samples were free from Karnal bunt incidence.

(S. I. Patel)

Table 8.8. Karnal bunt situation in Gujarat during 2017-18 crop season

Market yard/Farmers' fields	Total samples examined	Black point infection			Karnal bunt incidence
		No.	Per cent	Range of infection	
[A] Market Yards :					
Mehsana	45	10	22.2	0.0 – 5.0	0.0
Visnagar	46	11	23.9	0.0 – 3.5	0.0
Kukarwada	38	9	23.7	0.0 – 3.7	0.0
Mansa	50	11	22.0	0.0 – 3.6	0.0
Dehgam	40	11	27.5	0.0 – 3.5	0.0
Talod	48	12	25.0	0.0 – 3.0	0.0
Idar	55	8	14.5	0.0 – 3.7	0.0
Vadali	40	8	20.0	0.0 – 3.4	0.0
Khedbrahma	42	9	21.4	0.0 – 3.8	0.0
Prantij	45	11	24.4	0.0 – 4.1	0.0
Vijapur	75	18	24.0	0.0 – 4.8	0.0
SUB TOTAL	**524**	**117**	**22.3**	**0.0 – 5.0**	**0.0**
Farmers' fields	207	39	18.8	0.0 – 5.2	0.0
TOTAL	**731**	**156**	**21.3**	**0.0 – 5.2**	**0.0**

Maharashtra

A total of 180 wheat grain samples were collected from Nandurbar, Akkalkuan, Kopargaon, Chalisgaon, Niphad, Shahada, Chandwad, Nashik and Dindori in the state and like previous years, no KB infection was found.

(B.C. Game, B.M. Ilhe, S.S. Dodake, C.B. Beldar)

Karnataka

A total of 175 wheat samples were collected from Badami, Bagalkot, Mudhol, Athani, Chikkodi, Gokak, Hubli, and Navalgund and analysed for the presence of KB. None of the sample showed KB infection and Karnataka state is free from KB over years.

It is concluded that KB incidence in Northwestern states is declining which may be due to rice wheat cropping system and lack of rains and fog at boot leaf stage. Unlike this in some drier districts of Haryana, KB incidence is on rise may be due to large scale adoption of sprinkler irrigation and little rice-wheat cropping system area. Like previous years, during 2017-18 crop season also the states like, M. P. and Gujarat (Central Zone) and Maharashtra and Karnataka (Peninsular zone) remained free from KB and may be used for KB free wheat production.

(P.V. Patil)

BLACK POINT (B.P.)

Gujarat

A total of 524 seed samples from marketing yards and 207 samples from farmers' fields were examined. The data indicated that per cent black point infection was ranged 14.5 (Idar) to 27.5 (Dehgam) in different marketing yards. The data further indicated that 39 samples (18.8 %) from farmers' field examined were found black point infected. In all, 21.3% samples showed black point infection in the range of 0.1 to 5.2%.

Karnataka

Over all the per cent black point infected was very low. The two samples showing more than 3% were the bread wheat (Sample no. 5 and 18) and were of UAS 304. The two pathogens were observed under microscope are *Bipolaris* and *Aiternaria.*

Table 8.9 Black point details 2017-18 (UAS Dharwad)

S. No.	Name of the farmer	Village	Taluka	District	Per cent BP
1	Shri. Prakash Dyamagouda	Kulali	Mudhol	Bagalkot	1.00
2	Shri. Dundappa Komar	Kulali	Mudhol	Bagalkot	0.66
3	Shri. Tammanna Muttur	Kulali	Mudhol	Bagalkot	2.00
4	Shri. Srikant mathapati	Shirol	Mudhol	Bagalkot	0.33
5	Shri. Iranna Patil	Shirol	Mudhol	Bagalkot	4.33
6	Shri. Shivanand Pareeth	Shirol	Mudhol	Bagalkot	1.33
7	Shri. Laxman Koti	Shirol	Mudhol	Bagalkot	0.66
8	Shri. Basavaraj Desai	Uttur	Mudhol	Bagalkot	0.33
9	Shri. Sikandar Garimani	Uttur	Mudhol	Bagalkot	2.33
10	Shri. Manjunath Badiger	Uttur	Mudhol	Bagalkot	0.66
11	Shri. Mahesh Desai	Kokatnur	Athani	Belgaum	0.33
12	Shri. Mahesh Gaygol	Manjari	Chikkodi	Belgaum	1.33
13	Shri. Santhosh Khoth	Manganur	Chikkodi	Belgaum	1.00
14	Shri. Vishwas Kulkarni	Manganur	Chikkodi	Belgaum	1.33
15	Shri. Maruti Magdum	Umarani	Chikkodi	Belgaum	0.66
16	Shri. Fhakrusab Lalsabnavar	Devagudihal	Hubli	Dharwad	1.33
17	Shri. Husensab Lalsabnavar	Devagudihal	Hubli	Dharwad	1.66
18	Shri. Muktumsab Lalsabnavar	Devagudihal	Hubli	Dharwad	3.00

Rajasthan

About 53 per cent samples were found infected with black point ranging incidence was 0.1-3.5 being maximum incidence was noted in a sample collected from Bagru mandi of district Jaipur. This year showed a sharp decrease in the BP incidence as compare to previous years due to no rains and hot climate in the months of the February and the March which was unfavourable to disease.

Table 8.10 Spectrum of Black Point of wheat in Rajasthan during 2017-18

S. No.	Location	Total samples	Number of BP infected samples	Per cent BP infected samples	BP incidence Range (%)
A	**District Alwar**				
1	Alwar	30	10	33.3	0.1-0.3
2	Bansur	32	24	75.0	0.1-1.1
3	Kherthal	29	11	45.8	0.2-0.7
B	**District Dausa**				
4	Bandikui	16	9	56.3	0.1-0.5
5	Dausa	32	8	25	0.2-1.5
6	Lalsot	32	22	68.8	0.1-2.3
C	**District Jaipur**				
7	Bagru	27	19	70.37	0.1-3.5
8	Bassi	10	3	30.0	0.1-0.3
9	Chaksu	36	19	52.8	0.1-2.2
10	Kotputli	15	6	40.0	0.1-0.4
Total		**249**	**131**	**-**	**-**
Per cent		**-**	**52.6**	**-**	**0.1-3.5**

Haryana
About 66.5% samples of wheat in Haryana were showing black point infection in the range of 0.05-1.15%.

Table 8. 11. Incidence of BP in Haryana during 2017-18

Black point infection 2017-18			
South West Districts	**% Infected samples**	**Range of infection**	**Average infection**
Hisar	97.36	0.05-0.30	0.110
Rohtak	17.34	0.05-0.10	0.008
Bhiwani	51.35	0.05-0.10	0.0148
Dadri	100	0.05-0.35	0.113
Mahendergarh	75	0.05-0.75	0.038
Rewari	59.67	0.05-0.20	0.045
Jhajjar	74.2	0.05-0.30	0.042
Gurugram	60.05	0.05-0.15	0.034
Nuh(Mewat)	84.48	0.05-0.55	0.089
Jind	-	-	-
Fatehabad	-	-	-
Sirsa	-	-	-
Mean (South west zone)	68.82	0.05-0.75	0.054

North East Districts			
Karnal	-		
Ambala	-		
Kurukshetra	--		
Kaithal	-		
Sonipat	45.02	0.05-0.10	0.025
Panipat	-		
Palwal	77.27	0.05-0.20	0.064
Faridabad	70.58	0.05-0.15	0.046
Yamuna Nagar	-		
Panchkula			
Mean (North East Zone)	64.29	0.05-0.75	0.054
State Mean	66.5	0.05-1.15	0.054

-not surveyed/analysed

U. P.

In district Faizabad, near by university campus 107 wheat grains were collected for examination for black point and grain discoloration diseases. Highest percentage of BP (0.4%) was observed in HD 2329 and it was lowest (0.2%) in PBW 154, LOK 1 and SONALIKA. Highest GD was recorded in PBW 154(2.2%) where as lowest was recorded in HD 2967, PBW 343 and LOK 1 (0.2%).

Table 8.11. Karnal bunt (KB), black point (BP) and grain discoloration (GD) infection in wheat grain samples from villages of district Faizabad-2017-2018

S. No.	Name of variety	No. of seeds Examines	No. of Seeds of K. B.	No. of Seeds of B.P.	No. of Seeds of discolouration	% of Range		
						K.B	B. P	G.D
1	PBW154	1000	00	00	04	00	00	0.0
2	PBW154	1000	00	00	10	00	00	1
3	PBW154	1000	00	02	10	00	0.2	1
4	PBW154	1000	00	00	12	00	00	1.2
5	PBW154	1000	00	02	10	00	0.2	1
6	PBW154	1000	00	02	02	00	0.2	0.2
7	PBW154	1000	02	00	22	0.2	00	2.2
8	PBW154	1000	00	00	00	00	00	00
9	PBW154	1000	00	00	00	00	00	00
10	PBW154	1000	00	02	06	00	0.2	0.4
11	PBW154	1000	00	02	06	00	0.2	0.6
12	PBW343	1000	00	00	00	00	00	00
13	PBW342	1000	00	00	02	00	00	0.2
14	PBW502	1000	02	00	10	0.2	00	1
15	PBW343	1000	00	00	06	00	00	0.6
16	PBW154	1000	00	00	00	00	00	00
17	PBW154	1000	00	00	00	00	00	00
18	PBW154	1000	02	00	10	0.2	00	1
19	PBW343	1000	02	00	08	0.2	00	0.8
20	PBW502	1000	00	00	06	00	00	0.6
21	LOK-1	1000	00	00	10	00	00	1

S. No.	Name of variety	No. of seeds Examines	No. of Seeds of K. B.	No. of Seeds of B.P.	No. of Seeds of discolouration	% of Range		
22	LOK-1	1000	00	02	02	00	0.2	0.2
23	LOK-1	1000	02	00	06	0.2	00	0.6
24	LOK-1	1000	00	00	00	00	00	00
25	SONALIKA	1000	01	02	08	0.1	0.2	0.8
26	SONALIKA	1000	00	00	04	00	00	0.4
27	UP-262	1000	00	00	00	00	00	00
28	UP-2338	1000	00	00	00	00	00	00
29	UP-2338	1000	00	00	00	00	00	00
30	UP-2338	1000	00	00	00	00	00	00
31	UP-2338	1000	00	00	00	00	00	00
32	RAJ-3765	1000	00	00	00	00	00	00
33	HUW-234	1000	00	00	00	00	00	00
34	HUW-234	1000	00	00	00	00	00	00
35	HD2329	1000	08	00	10	0.8	00	1
36	HD2329	1000	00	04	02	00	0.4	0.2
37	HD2967	1000	00	02	04	00	00	0.4
38	HD2329	1000	00	00	00	00	0.2	00
39	HD 2733	1000	00	00	06	00	00	0.6
40	HD 2967	1000	00	00	02	00	00	0.2
41	HD2967	1000	00	00	04	00	00	0.4
42	HD-2329	1000	00	02	00	00	0.2	00
43	HD-2967	1000	00	00	02	00	00	0.2
44	HD-2733	1000	02	00	08	0.2	00	0.8
45	HD-2733	1000	02	00	06	0.2	00	0.6
46	HD-2733	1000	00	00	10	00	00	1
47	HD-2329	1000	00	00	00	00	00	00
48	HD-2733	1000	00	00	04	00	00	0.4
49	HD-2967	1000	00	00	02	00	00	0.2
50	HP-1633	1000	06	00	06	0.6	00	0.6
51	HP-1633	1000	00	00	12	00	00	1.2
52	HP-1731	1000	00	00	06	00	00	0.6
53	HP-1744	1000	00	00	06	00	00	0.6
54	MDSN 20-17-18 53Entries	-	00	00	00	00	00	00

Punjab

Almost all the districts showed prevalence and incidence of black point and shriveled grains during the year 2017-18. During the current year there has been a decrease in BP severity over the last year. Similarly SG has also decreased as compared to 2016-17.

Table 8.12. Black point and Shriveled grains in the Punjab state during 2017-18

S. No.	Districts	Black point (BP)		Shriveled grains (SG)	
		% infected samples	% Average infection	% infected samples	% Average infection
1	Amritsar	66.25	0.19	66.25	0.24
2	Barnala	40.85	0.13	42.25	0.14
3	Bathinda	24.18	0.07	21.98	0.05
4	Faridkot	46.79	0.14	49.54	0.22
5	Fatehgarh Sahib	59.63	0.21	66.06	0.32
6	Fazilka	20.88	0.05	19.78	0.05
7	Ferozepur	55.36	0.19	51.79	0.32
8	Gurdaspur	39.35	0.11	40.00	0.12
9	Hoshiarpur	56.65	0.26	57.23	0.46
10	Jallandhar	30.27	0.11	28.65	0.10
11	Kapurthala	51.56	0.25	42.97	0.24
12	Ludhiana	45.17	0.15	45.95	0.18
13	Mansa	33.33	0.08	19.05	0.07
14	Moga	40.91	0.12	38.18	0.10
15	Mohali	42.86	0.12	47.62	0.12
16	Muktsar	33.33	0.08	31.67	0.08
17	Nawanshar	33.33	0.11	29.33	0.09
18	Pathankot	63.64	0.14	69.70	0.21
19	Patiala	66.27	0.26	72.29	0.39
20	Ropar	56.41	0.29	58.97	0.50
21	Sangrur	21.48	0.05	20.74	0.07
22	Tarantarn	66.67	0.26	63.49	0.23
State		**43.19**	**0.150**	**42.52**	**0.192**

Maharashtra

Table 8.13. Analysis of grain samples for black point in the jurisdiction during 2017-18 crop season (Niphad centre)

S. No.	Tahasil	Total samples	Infected	Per cent infected samples	Range of infection
1	Nandurbar	06	06	100	0.2-1.8
2	Akkalkuan	13	13	100	0.0-4.3
3	Kopargaon	23	18	78.3	0.0-5.9
4	Chalisgaon	32	26	81.2	0.0-2.6
5	Niphad	48	36	75.0	0.0-6.2
6	Shahada	11	11	100	0.2-3.8
7	Chandwad	12	10	83.3	0.0-2.5
8	Nashik	20	17	85.0	0.0-4.5
9	Dindori	23	16	69.6	0.0-4.5
	Total	**188**	**153**	**81.4**	**0.0-6.2**

Pathotype distribution of wheat and barley rust pathogens during 2017-18
IIWBR RS, Shimla

There was no major occurrence of wheat and barley rusts during 2017-18 in India. Incidence was far less than the earlier years and practically it was a rust free year. These diseases were kept under check with the help of cooperators, through exhaustive rust surveillance in different wheat growing areas of India and neighboring countries. Five hundred seventy one samples of wheat and barley rust, received from thirteen Indian states, Bhutan and Nepal were analyzed during the crop year. The detail of pathotypes analyzed during the crop season is given under.

i. Yellow rust of wheat and Barley (*Puccinia striiformis*)

During 2017-18, one hundred thirteen samples of yellow rust were analysed from seven Northern Indian states (Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Punjab, Haryana, Uttar Pradesh and Rajasthan), Bhutan and Nepal. Ten pathotypes were identified on the bases of Indian wheat stripe rust differentials. 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 (46.9%) followed by pt. 110S119 (31.9%). Barring 238S119, which was identified in 4% of the samples, remaining 7 pathotypes were observed in few samples only. It was also true for pt. 78S84 which was predominant up to 2010-11, was not observed in any of the yellow rust sample. *Puccinia striiformis* f. sp. *tritici* (Pst) population was found avirulent on *Yr5, Yr10, Yr15* and *YrSp*. From the analysis of barley yellow rust (*Puccinia striiformis* f. sp. *hordei*) samples, two pathotypes 0S0 (57) and 1S0 (M) were identified and found equally prevalent (Table 8.14) in India.

ii. Black rust of wheat (*Puccinia graminis* f. sp. *tritici*) (Pgt)

Seven pathotypes of black rust pathogen of wheat were identified from the analysis of 80 samples, received from five different Indian states and Nepal. Like previous years *Sr26, 27, 31, 32,35, 39, 40, 43, Tt3* and *Tmp* were resistant to the field population of black rust in India. Maximum black rust samples were received from Tamil Nadu and Karnataka. Pathotype 11 (79G31) with virulence to *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* and *SrMcN* was the most recurrent pathotype and observed in 60% of the samples analyzed from Gujarat, Karnataka, Maharashtra, and Madhya Pradesh. Pathotype 40A (62G29) was recorded in 24 samples received from Karnataka, Madhya Pradesh and Tamil Nadu. Other pathotypes such as 11A (203G15), 21 (9G5) 21-1(24G5), 117 (37G3), 117-6 (37G19) were observed in few samples only (Table 8.15).

iii. Brown rust of wheat (*P. triticina*)

During 2017-18, eighteen pathotypes of wheat brown rust were identified from the analysis of 353 samples, received from eleven different Indian states, Bhutan and Nepal. No virulence was detected for leaf rust resistance genes *Lr9*, *Lr19*, *Lr*24, *Lr*25, *Lr*29, *Lr*32, *Lr*39, *Lr*45 and *Lr*47. More than 100 samples were analysed from Karnataka (146) and Tamil Nadu (102). Pathotypes 77-9 and 77-5 were the most predominant and were identified in 64 and 24% of the samples, respectively. Similar trend was observed during previous year. Remaining 16 pathotypes were confined to 22% of the samples only. Pathotype 77-9 was the most widely distributed than any other pathotypes as it was detected from ten states and Nepal followed by pathotype 77-5, which was spotted in eight Indian states and Bhutan. The reduction in the frequency of pathotypes 104-2 and 104-3 continued this year too. Pathotypes 12-3, 12-9, 104A, 104-3, 106 and 162-4, each was identified only in one sample (Table 8.16).

50th wheat disease monitoring nursery (WDMN) 2017-18

Wheat disease monitoring nursery (earlier trap plot nursery/TPN) is an intelligent tool to monitor the occurrence and spreading pattern of wheat diseases especially rusts across different wheat growing zones of India. In addition, it helps to know the seasonal progress of the diseases in all the zones. Samples analyzed from WDMN give an overview of area wise natural distribution and load of different rust races. This nursery also helps in understanding the area wise progress of wheat diseases and the performance of different disease resistance genes/varieties. This is the golden jubilee year of WDMN/TPN as 50th wheat disease monitoring nursery was conducted at more than 40 locations, covering all the major wheat growing areas in the country, especially those situated near the bordering areas to the neighboring countries. The data have been received from 32 locations (Table 8.17) only.

Table 8.14. Pathotype distribution of ***Puccinia striiformis*** **in India during 2017-18**

S. No.	**State / Country**	**Number of isolates analyzed**	**Pat h o t y p e s**									
			P. striiformis* f. sp.*tritici								*P. striiformis* f. sp. *hordei*	
			46S119	110S119	238S119	110S84	46S103 (P)	47S103 (T)	6S0	7S0	OSO (57)	1SO (M)
1.	Jammu & Kashmir	05	01	04	-	-	-	-	-	-	-	-
2.	Himachal Pradesh	27	16	04	02	-	01	-	-	01	-	03
3.	Uttarakhand	25	08	09	02	-	-	-	01	04	01	-
4.	Punjab	23	11	09	01	01	01	-	-	-	-	-
5.	Haryana	16	12	03	-	-	-	-	01	-	-	-
6.	Uttar Pradesh	02	01	01	-	-	-	-	-	-	-	-
7.	Rajasthan	10	04	06	-	-	-	-	-	-	-	-
8.	Bhutan	01	-	-	-	-	-	01	-	-	-	-
9.	Nepal	04	-	-	-	-	-	-	01	-	03	-
Total		**113**	53	36	05	01	02	01	03	05	04	03

Table 8.15. Pathotype distribution of black rust (*Puccinia graminis tritici*) in India during 2017-18

S. No.	States	Samples Received	Samples Analyzed	Pathotypes identified*¥						
				11	11A	21	21-1	40A	117	117-6
1	Gujarat	14	11	08	02	-	-	-	01	-
2	Himachal Pradesh	03	00	-	-	-	-	-	-	-
3	Karnataka	34	30	26	-	-	-	03	-	01
4	Madhya Pradesh	09	09	07	-	-	-	02	-	-
5	Maharashtra	08	08	07	01	-	-		-	-
6	Tamil Nadu	34	19	-	-	-	-	19	-	-
7	Nepal	03	03	-	-	01	02		-	-
Total		**105**	**80**	48	03	01	02	24	01	01

11(79G31*; RRTSF¥), 11A (203G15; RHTSF), 21 (9G5; CHMSC) 21-1(24G5; CKMSC), 40A(62G29; PTHSC), 117 (37G3; KRCSC), 117-6 (37G19; KRHSC)

Table 8.16.Pathotype distribution of brown rust (*Puccinia triticina*) in India and neighboring countries during 2017-18.

S. No.	State/Country	Samples Received	Samples Analyzed	Pathotypes identified*																	
				12-1(5R37`)	12-3(49R37)	12-9 (93R37)	77-1 (109R63)	77-3 (125R55)	77-5 (121R63-1)	77-6 (121R55-1)	77-9 (121R60-1)	77-9+Raj1555	77-11(125R28)	77-11+ Raj1555	104A(21R31)	104-2 (21R55)	104-3 (21R63)	104-4-IWP94	106 (0R9)	162-4 (29r39)	162-5 (61R47)
1	Himachal Pradesh	10	9	-	-	-	-	-	3	-	5	-	-	-	-	-	-	-	-	-	1
2	Jammu & Kashmir	12	10	-	-	-	-	-	1	-	9	-	-	-	-	-	-	-	-	-	-
3	Punjab	23	22	-	-	1	-	-	-	-	21	-	-	-	-	-	-	-	-	-	-
4	Uttar Pradesh	04	4	-	-	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-	-
5	Assam	50	10	3	1	-	1	-	1	-	-	-	-	-	-	-	-	2	-	1	1
6	Madhya Pradesh	14	14	-	-	-	-	-	3	-	10	1	-	-	-	-	-	-	-	-	-

S. No.	State/Country	Samples Received	Samples Analyzed	Pathotypes identified*																	
				12-1(5R37`)	12-3(49R37)	12-9 (93R37)	77-1 (109R63)	77-3 (125R55)	77-5 (121R63-1)	77-6 (121R55-1)	77-9 (121R60-1)	77-9+Raj1555	77-11(125R28)	77-11+ Raj1555	104A(21R31)	104-2 (21R55)	104-3 (21R63)	104-4-IWP94	106 (0R9)	162-4 (29r39)	162-5 (61R47)
7	Rajsthan	03	2	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
8	Gujrat	06	6	-	-	-	-	-	-	-	5	1	-	-	-	-	-	-	-	-	-
9	Maharashtra	23	23	-	-	-	-	-	2	-	18	-	2	-	-	1	-	-	-	-	-
10	Karnataka	149	146	-	-	-	5	1	11	1	113	6	4	3	1	1	-	-	-	-	-
11	Tamil Nadu	107	102	1	-	-	1	1	56	1	41	-	-	-	-	-	1	-	-	-	-
Other Countries																					
1	Bhutan	01	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
2	Nepal	04	4	-	-	-	-	-	3	-	1	-	-	-	-	-	-	-	-	-	-
Total		**406**	**353**	**4**	**1**	**1**	**7**	**2**	**82**	**2**	**227**	**8**	**6**	**3**	**1**	**2**	**1**	**2**	**1**	**1**	**2**
12-1(FHPNM), 12-3(FGTTL), 77-1 (THTTB), 77-3 (THTTD), 77-5 (THTTM), 77-6 (THTTL), 77-9 (MHTKL),77-11(MGTTL), 104A(MGTDC), 104-2 (PHTTL), 104-3 (PHTTL), 106 (BBBBB)																					

Table 8.17. List of co-operators and locations where WDMN was planted during 2017-18

Northern Hills and High Altitude Zone		
Himachal Pradesh	R. Devlash Head, ICAR-IIWBR, RS, Shimla Sachin Upmanyu	Bajaura **Shimla** Malan (Kangra)
Jammu & Kashmir	M.K. Pandey AND Amrish Vaid M. K. Pandey and Dr. Deepak Kumar NA Bhat	Kathua Rajouri Khudwani
Uttarakhand	K.K. Mishra	Hawalbagh (Almora)
North Western Plains Zone		
Jammu & Kashmir	M.K. Pandey	Udhaywalla (Jammu)
Haryana	Rajender Singh Beniwal	Hisar
Himachal Pradesh	V.K. Rathee	Dhaulakuan
Rajasthan	P.S. Shekhawat and Nitin Chawla	**RARI, Durgapura, Jaipur**
Punjab	Jaspal Kaur	Abohar, Deenanagar, Gurdaspur, Langroya, Ludhiana,Ropar
Uttarakhand	Vishwanath, Deepshikha and Kanak Srivastava	Pantnagar
North Eastern Plains Zone		
Bihar	C. S. Azad	Sabour
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
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, B.M.Ilhe, C.B.Beldar N. R. Potdukhe	**A.R.S. Baner, (Pune)** **ARS, Niphad** **Akola**
Karnataka	P. V. Patil and Mr. S. V. Kulkarni	**Ugar Khurd (Dharwad)**
Tamil Nadu	S. Sivasamy	**Wellington**

There were 20 (21 for High Altitude Zone and North Hills Zone) entries in the nursery during 2017-18. 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 2017-18 crop season is 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

Seeds of all the entries along with the data booklets containing sowing plan, procedures and data sheets were sent to co-operators early in the season to ensure timely planting of the nursery. 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 for pathotype identification at ICAR-IIWBR, RS, Flowerdale, Shimla.

Disease incidence in WDMN

Information on wheat disease situation was receivedfrom 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 (Bihar), Ranchi (Jharkhand), Faizabad, Kanpur and Varanasi in Uttar Pradesh, Vijapur & Junagadh in Gujarat, Indore & Powarkheda in Madhya Pradesh, Jaipur (Rajasthan), Pune, Niphad & Akola in Maharashtra, Dharwad (Karnataka) and Wellington (Tamil Nadu)

Disease incidence in WDMN

The occurrence of wheat blast and *Sr31* virulences (Ug99 type of pathotypes) of black rust was not reported from any of the wheat growing zones of India. Yellow rust was noticed at all the locations of NHZ and NWPZ except Shimla, Abohar and Ropar. It was also observed at Kanpur in NEPZ. All the entries of WDMN at other locations of

NEPZ, CZ, PZ and SHZ were yellow rust free. Moderate yellow rust severity was observed at locations of NWPZ and NHZ. More than 60S severity of yellow rust was reported from eleven locations of NHZ and NWPZ. More than nine entries of WDMN had more than 40S severity at Almora, Bajaura and Jammu. Barley Local and Kharchia Mutant had 100S yellow rust severity at Bajaura.

Brown rust was reported from nine locations of NHZ and NWPZ *viz*. Kathua, Rajauri & Jammu in J. & K., Almora and Pantnagar in Uttarakhand, Langroya & Gurdaspur in Punjab, Durgapura (Rajasthan) and Hisar (Haryana). It was reported from all the locations of NEPZ except Ranchi. In central zone brown rust appeared at Vijapur, Indore and Powerkheda and in PZ and SHZ at Dharwad, Pune and Wellington. At Wellington (SHZ) brown rust appeared on all the entries of WDMN.

Of the 32 locations of WDMNs, black rust was observed only at Powerkheda in CZ, Dharwad in PZ and Wellington in SHZ. Other zones i.e. NHZ, NWPZ, and NEPZ were black rust free. Leaf blight was reported from WDMNs planted at Almora, Kathua, Rajouri, Jammu (Udhaywalla), Sabour, Ranchi, Faizabad, Kanpur, Varanasi, Pune, and Wellington. Almora, Kathua, Rajauri and Jammu 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 Jammu (22.01.18) followed by Kathua (27.01.18), Pantnagar (02.02.18), Rajouri (16.02.18), Hisar (26.02.18), Ludhiana (27.02.18) and Durgapura (28.02.18). Brown rust was first observed at Pune (02.02.18) followed by Dharwad 03.02.18), Powerkheda (10.02.18), Vijapur (17.02.17), Indore (19.02.18), Varanasi (22.02.18), Sabour (05.03.18), Faizabad (08.03.18) and Kanpur (10.03.18). Black rust was first observed at Powerkheda on 18.02.18.

Varietal Performance against wheat rusts

High Altitude and Northern Hills Zone

Maximum severity of yellow rust was observed at Almora, where ten entries of WDMN were showing more than 30S severity of yellow rust. However; C306, HPW349, and Barley local were yellow rust free at Almora. Shimla was the only center in NHZ where yellow rust was not observed on WDMN entries during offseason. WDMN entry HPW349 was yellow rust free at all the locations of NHZ, except at Kathua, where 10S severity of yellow rust was observed on it. HD2329 had more than 40S severity of yellow rust at all the locations of NHZ except at Malan and Shimla. Lal Bahadur was highly susceptible as it showed more than 40S severity of yellow rust at all the locations of NHZ where yellow rust appeared on WDMN. Brown rust appeared at Rajouri on Lal Bahadur (TMS) only, Kathua and Almora. At Kathua twelve entries showed brown rust infection between 5S to 40S. Nine entries *viz.* WL711, Agra local, Lal Bahadur, WL1562, HW2021, HW2008, C-306, VL 892 and HS507 had more than 20S brown rust infection at Kathua. Only six WDMN entries HD2204 (20S), WH147 (10S), Kharchia Mutant (TS), RNB1001 (5S), VL 892 (5S) and HS507 (5S) had brown rust infection at Almora. Black rust did not appear on WDMN entries in this zone.

North Western Plain Zone

Yellow rust severity was high at Dhaulakuan, Ludhiana, Jammu, Hisar, Langroya and Pantnagar in NWPZ. Ten entries of WDMN had more than 30S severity of yellow rust at Pantnagar. Similarly nine entries at Dhaulakuan and Jammu; and seven entries at Hisar and Langroya had more than 30S yellow rust severity. More than 40S severity of yellow rust appeared on WL711 at all the locations of NWPZ except Durgapura, Gurdaspur, Ropar and Abohar. HD2204 was yellow rust free at Durgapura, Jammu and Langroya. Nine entries (WL711, HD2329, Agra Local, HD2160, Lal Bahadur, WH147, HW2008, DL748-3, and HS420) of WDMN had yellow rust infection at all the locations of NWPZ where yellow rust appeared on WDMN entries. Brown rust appeared at all the locations of NWPZ except Dhaulakuan, Ludhiana, Ropar, Abohar and Deenanagar. Three entries viz. HP1633, DL784-3 and RNB1001 were free from brown rust infection at all the locations of NWPZ. At Pantnagar all the entries except HW2021, HP1633, DL784-3 and RNB1001 had brown rust infection. Brown rust appeared only on WDMN entries Agra Local, Lal Bahadur, and C306 at Durgapura, others were infection free**.** Black was not reported from this zone.

North Eastern Plain Zone

Yellow rust was observed only at Kanpur in NEPZ, where yellow rust was observed on WL1562 (40S), HW2008 (20S) and RNB1001. Brown rust appeared at all the locations of NEPZ except at Ranchi. At Varanasi it was reported only on entries WL711 (20S) and Kharchia Mutant (10S). Brown rust appeared on Agra local (40S), Lal Bahadur (10S) and K 8804 (10S) only at Kanpur. Eight WDMN entries (WL1562, HW2021, C306, HW2008, HP1633, HD2402, HP1102, HUW468) were BROWN rust free at all the locations of NEPZ. Black rust did not appear on any of the entries of WDMN in this zone.

Central Zone

Yellow rust did not appear in this zone. Brown rust was observed at all the locations of CZ except at Junagarh (Gujarat). At Indore and Vijapur, Lal Bahadur was the only entry showing brown rust infection of 5S and TR, respectively. At Powerkheda ten entries *viz.* WL711 (TR), HD2329 (5S), Agra Local (10S), HD2160 (TR), Lal Bahadur 10S, C306 (15S), WH147 (10S), DL 784-3 (TR), LOK-1 (10S), and GW 322 (5MS) were infected with brown rust. Black rust was observed only at Powerkheda in central zone, where 20S severity of black rust was observed on Lal Bahadur C 306, WH147, Agra Local and LOK-1. Nine entries (WL1562, HW2021, HD2204, HW2008, Kharchia Mutant, HP1633, HI 8663, HI1544, and GW366) 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, Pune and Wellington. At Dharwad, brown rust appeared on all the WDMN entries except HW2008, Kharchia Mutant, HP1633, DL784-3, RNB1001 and HW2022. More than 20MS severity of brown rust was reported from Dharwad on nine entries *viz.* WL711, HD2329, Agra Local, HD2160, Lal Bahadur, HD2204 WH147, MACS2496 and HW971. At Wellington twelve entries (WL711, Agra Local, Lal Bahadur, WL1562, HD2204, C306, WH147, MACS2496, Bijaga Yellow, HW971, HD2501 and HW2022) had more than 40S severity of brown rust. Black rust appeared on all the entries of WDMN except HW 971 and HW2021 in SHZ (Wellington). More than 20S severity of black rust appeared on WDMN entries WL711, HD2329, Agra Local, Lal Bahadur, WL1562, C306, WH147, Kharchia Mutant, HP1633 and Bijaga Yellow. In Peninsular Zone black rust appeared only on WH147 (5MS) at Dharwad. Other locations were black rust free in PZ.

Other diseases

Blights

Information on foliar blights was received from eleven locations. Earliest record of blight was from Ranchi (04.01.18) followed by Faizabad (31.01.18), Varanasi (08.02.18), Kathua (12.02.18), Sabour (16.02.18), Pune (20.02.18) and Jammu (24.02.18). Blight was reported from Almora, Kathua and Rajauri in Northern hills zone, where up to 36 severities 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 were free from wheat blight at other locations in NWPZ. All the entries of WDMNs in NEPZ except WL711, HD2160, Lal Bahadur, WL1562, HD2204, C306 and Kharchia Mutant at Kanpur, were infected with leaf blight disease. Maximum severity of leaf blight (Up to 78) was recorded at Faizabad. There was no leaf blight infection on any of the entries in central zone. In PZ and SHZ blight was reported from Pune and Wellington only. At Wellington all the WDMN entries had leaf blight infection, whereas, At Pune six entries (Lal Bahadur, WL1562, WH147, HP1633, DL784-3 and Bijaga Yellow) had blight infection.

Powdery mildew

Powdery mildew was reported from four locations *viz*. Almora, Kathua, Rajauri and Jammu. It was first seen at Kathua 12.02.18 on followed by Jammu on 24.02.18, Almora on 28.02.18 and at Rajauri (18.03.18). All the entries of WDMN were susceptible to powdery mildew at all these locations except DL784-3 at Rajouri. Maximum Powdery mildew severity was reported from Kathua, where 20 WDMN entries had powdery mildew score of 5 or more. Minimum severity of powdery mildew was observed at Almora where fifteen entries showed powdery mildew severity of 3 or less.

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SAARC Wheat Disease Monitoring Nursery (2017-18)

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 2017-18, SAARC wheat disease monitoring nursery was planted at 29 locations across the six SAARC countries (Table 8.18).

Table 8.18. Detail of SAARC-Wheat disease monitoring nursery locations during 2017-18.

S. No.	Country/ Locations	Contact person
1.	Nepal (3 sets)	CIMMYT, Delhi*
2.	Bangladesh (5 sets)	CIMMYT, Delhi
3.	Pakistan (2 sets)	CIMMYT, Delhi

4.	**Bhutan (1 set)**	CIMMYT, Delhi
5.	**Afghanistan (1 set)**	CIMMYT, Delhi
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 16 locations as detailed below.

Table 8.19. Locations of SAARC Wheat disease monitoring nursery in India during 2017-18

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
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 8.20. 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 and Wellington (Table 4). Yellow rust was observed at all the SAARC nursery locations in India except at Abohar, Deenanagar, Faizabad and Wellington. Yellow rust was first observed at Jammu (22.01.18), followed by Kathua (27.01.18), Pantnagar (02.02.18), Rajauri (16.02.18), Delhi (17.02.18) and Durgapura (01.03.18). All the entries of SAARC nursery were infected with yellow rust at Kathua, Jammu and Langroya. Eleven entries at Dhaulakuan & Ropar and ten entries at Langroya and Ludhiana had more than 40S yellow rust severity. At Almora all the entries except PBW660 and Chakwal86 and at Ludhiana all entries except HD2189 and PBW660 were observed to support high incidence of yellow rust. Maximum yellow rust severity (80S) was reported on PBW343 at Ropar, which had more than 20S severity at all the locations where yellow rust appeared except at Durgapura (10S) and Gurdaspur (5S). Yellow rust appeared only on PBW343 (20S), HD2687 (5S), Kohsar (5S) and Susceptible check (60S) at Delhi. Similarly at Durgapura yellow rust was observed on PBW343 (10S), Faisalabad85 (TMS), Inquilab91 (TMS), Rawal87 (TMS), Kohsar (TMR), Gourab (5S) and Check (20S) only. Entry PBW660 was resistance to yellow rust at all the locations except Kathua, Jammu and Langroya, where 5S severity was observed on it. More than 40S yellow rust severity was observed on entries PBW343, HD2687, HP1633, Raj3765, Faisalabad85, Inquilab91 and Gourab.

Brown rust was observed at all the SAARC nursery locations except at Dhaulakuan, Ludhiana, Ropar, Abohar and Deenanagar (Table 8.22). First report of brown rust was from Pantnagar on 19.02.18 followed by Faizabad (08.03.18), Durgapura (10.03.18), Jammu (13.03.18), Delhi (17.03.18) and Kathua (18.03.18). All the entries of SAARC-WDMN were brown rust free at Gurdaspur except HD2204. Similarly at Delhi brown rust appeared only on WL1562 and susceptible check whereas at Durgapura on PBW343 and susceptible check. Other entries were brown rust free at these locations. Brown rust appeared only on five entries (HD2204, Raj3765, Faisalabad85, Inquilab and susceptible check) at Rajouri. Maximum brown rust severity was reported from Wellington, where fifteen entries had more than 40S brown rust severity. HP1633 was brown rust free at all the locations except Faizabad and Wellington, where 5S and 20S severity of brown rust was reported on it, respectively. Similarly on PBW660 brown rust appeared only at Langroya (10S) and Wellington (5S).

Black rust was observed only at Wellington, in all the entries with severity ranged from 5S in Faisalabad83 to 80S on HP1633 (Table 8.21). The check entries, HP1633, Punjab85 and Chakwal86 had more than 40S black rust at Wellington.

Blights

All the entries at Almora, Kathua, Faizabad and Wellington were infected with leaf blight. Pak81 at Rajauri and PBW660, Chakwal86, Faisalabad85 and Kohsar at Jammu were leaf blight free. Highest severity of leaf blight was observed at Faizabad (35) followed by Wellington and Kathua. (Table 8.21).

Powdery mildew

Powdery mildew (Pm) has been reported from four SAARC-WDMN locations i.e. Almora, Jammu, Kathua and Rajauri. It was first reported at Kathua (12.02.18) and then at Jammu (24.02.18), Almora (28.02.18) and Rajouri (18.03.18). All the entries of the nursery were infected with Pm at all four locations except HD2189 at Rajouri and Annapurna at Jammu. Maximum Pm severity was observed at Kathua and Jammu as fourteen entries at Kathua and ten entries at Jammu had PM severity of more than 6. Minimum PM severity was seen at Almora, where sixteen entries had less than 5 score and twelve entries had less than 3 Pm score (Table 8.22).

Disease situation in other SAARC countries

Data from other SAARC countries i.e. Nepal, Bangladesh, Pakistan, Bhutan and Afghanistan are awaited.

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Flowerdale, Shimla-171 002

Table 8.21a. Incidence of rusts on SAARC Wheat Disease Monitoring Nursery in India during 2017-18

S. No.	Varieties	Yellow rust											
		ALM	DEL	DKN	DUR	GUR	JAM	KAT	LAN	LUD	PAN	RAJ	ROP
2	WL1562	60S	0	40S	0	5S	5S	20S	60S	10S	15S	10S	40S
3	HD2204	5S	0	40S	0	TS	20S	20S	10S	20S	5S	0	10S
4	PBW343	10S	0	40S	0	10S	60S	60S	10S	5S	5S	40S	5S
5	HD2687	40S	20S	40S	10S	5S	60S	60S	60S	40S	30S	20S	80S
6	HD2189	60S	5S	40S	0	5S	20S	20S	60S	40S	5S	20S	40S
7	HP1633	TS	0	0	0	0	10S	10S	5S	0	0	5S	0
8	RAJ3765	40S	0	40S	0	5S	40S	40S	20S	40S	40S	40S	40S
9	PBW660	40S	0	40S	0	5S	10S	10S	60S	60S	20S	5S	60S
10	PAK81	0	0	30S	0	0	5R	5R	5S	0	0	0	0
11	Punjab85	60S	0	40S	0	5S	20S	20S	60S	20S	10S	5S	20S
12	Chakwal86	20S	0	0	0	5S	10S	10S	60S	5S	0	TMS	5S
13	Faisalabad85	0	0	0	0	TS	10S	10S	10S	5S	10S	0	0
14	Inquilab91	60S	0	40S	TMS	5S	20S	20S	60S	40S	20S	5S	40S
15	Faisalabad83	10S	0	40S	TMS	5S	60S	60S	60S	40S	40S	40S	40S
16	Rawal87	20S	0	0	0	5S	40S	40S	20S	40S	15S	20S	5S
17	Kohsar	10S	0	0	TMS	tS	10S	10S	10S	20S	10S	0	10S
18	Bakhtawar94	20S	5S	30S	TMR	5S	20S	20S	20S	40S	10S	10S	40S
19	Gourab	5S	0	0	0	5S	5S	5S	10S	10S	5S	TMR	60S
20	Susceptible check	40S	0	40S	5S	5S	20S	20S	60S	60S	20S	5S	60S
Date of first Appearance		**28.03.18**	**17.02.18**	**22.02.18**	**01.02.18**	-	**22.01.18**	**27.01.18**	-	-	**02.02.18**	**16.02.18**	-

Table 8.21b. Incidence of rusts on SAARC Wheat Disease Monitoring Nursery in India during 2017-18

S. No.		Brown											Black
	Varieties	ALM	DEL	DUR	FAZ	GUR	JAM	KAT	LAN	PAN	RAJ	WEL	WEL
2	WL1562	0	0	0	10S	0	40S	40S	40S	0	0	80S	10S
3	HD2204	0	5S	0	5S	0	5S	5S	10S	10S	0	20S	10S
4	PBW343	5S	0	0	10S	5S	40S	60S	40S	10S	10S	60S	10S
5	HD2687	5S	0	5S	10S	0	20S	10S	5S	0	0	60S	10S
6	HD2189	0	0	0	0	0	10S	20S	40S	TS	0	60S	10S
7	HP1633	10S	0	0	5S	0	10S	20S	20S	0	0	40S	10S
8	RAJ3765	0	0	0	5S	0	0	0	0	0	0	20S	80S
9	PBW660	0	0	0	5S	0	10S	20S	10S	TS	TMS	40S	10S
10	PAK81	0	0	0	0	0	0	0	10S	0	0	5S	10S
11	Punjab85	0	0	0	0	0	10S	5S	20S	0	0	80S	10S
12	Chakwal86	0	0	0	0	0	20S	5S	20S	20S	0	20S	40S
13	Faisalabad85	0	0	0	0	0	0	0	20S	0	0	60S	40S
14	Inquilab91	5S	0	0	10S	0	40S	40S	5S	10S	10S	60S	20S
15	Faisalabad83	0	0	0	5S	0	20S	40S	60S	0	TMS	40S	20S
16	Rawal87	0	0	0	0	0	20S	20S	40S	5S	0	40S	10S
17	Kohsar	20S	0	0	0	0	40S	40S	40S	20S	0	80S	5S
18	Bakhtawar94	5S	0	0	0	0	5S	5S	20S	10S	0	80S	10S
19	Gourab	5S	0	0	0	0	40S	20S	10S	5S	0	60S	10S
20	Susceptible check	0	0	0	0	0	0	5S	0	30S	0	20S	10S
		16.04.18	17.03.18	10.03.18	08.03.18	-	13.03.18	18.03.18	-	19.02.18	30.03.18	-	-

***ALM= Almora, DEL=New Delhi, DKN=Dhaulakuan, DUR=Durgapura, GUR=Gurdaspur, JAM=Jammu, KAT=Kathua, LAN=Langroya, LUD=Ludhiana, PAN=Pantnagar, RAJ=Rajauri, ROP=Ropar, FAZ= Faizabad, WEL=Wellington**

Table 8.22. Incidence of leaf blight in SAARC Wheat Disease Monitoring Nursery during 2017-18 in India

S. No.	Varieties	Leaf blight severity					
		Almora	Faizabad	Kathua	Rajouri	Jammu	Wellington
1	Annapurna	11	35	27	12	26	34
2	WL1562	11	58	36	23	37	67
3	HD2204	01	68	36	12	46	67
4	PBW343	11	57	23	23	68	56
5	HD2687	02	46	23	23	13	45
6	HD2189	01	57	34	12	23	34
7	HP1633	02	46	36	36	66	34
8	RAJ3765	11	35	46	12	36	23
9	PBW660	01	36	23	24	12	45
10	PAK81	11	47	24	0	23	56
11	Punjab85	01	57	34	24	23	45
12	Chakwal86	01	46	21	12	16	56
13	Faisalabad85	01	46	12	12	13	23
14	Inquilab91	01	57	36	23	37	45
15	Faisalabad83	02	46	34	12	26	45
16	Rawal87	11	35	46	23	37	56
17	Kohsar	01	47	12	12	23	56
18	Bakhtawar94	01	46	12	12	23	34
19	Gourab	02	57	23	12	23	23
20	Susceptible check	12	78	26	23	46	45
Date of first appearance		**15.03.18**	**31.01.18**	**12.02.18**	**18.03.18**	**24.02.18**	**NA**

Table 8.23. Incidence of Powdery Mildew in SAARC Wheat Disease Monitoring Nursery during 2017-18 in India

S.No.	Varieties	Powdery Mildew severity			
		Almora	Jammu	Kathua	Rajauri
1	Annapurna	3	0	5	0
2	WL1562	3	5	7	5
3	HD2204	1	7	9	7
4	PBW343	5	5	6	5
5	HD2687	3	5	5	2
6	HD2189	1	3	4	0
7	HP1633	1	5	6	3
8	RAJ3765	5	7	9	5
9	PBW660	3	2	6	2
10	PAK81	3	7	5	5
11	Punjab85	7	6	7	5
12	Chakwal86	3	5	4	3
13	Faisalabad85	7	5	4	0
14	Inquilab91	3	7	9	4
15	Faisalabad83	5	5	6	3

16	Rawal87	3	9	9	5
17	Kohsar	3	9	8	7
18	Bakhtawar94	7	9	7	5
19	Gourab	5	9	9	7
20	Susceptible check	7	9	9	5
Date of first appearance		**28.02.2018**	**24.02.18**	**12.02.18**	**18.03.18**

PROGRAMME 9. INTEGRATED PEST MANGEMENT IN WHEAT

9.1 HOST RESISTANCE AGAINST DISEASES AND INSECT PESTS

I. Elite Plant Pathological Screening Nursery (EPPSN), 2017-18

Biotic stresses are the major production constraints in wheat. Growing of resistant cultivars has been the most effective and easy way to minimize losses due to biotic stresses in wheat in India. However, to develop resistant cultivars, breeders are in need of new sources of resistance to incorporate these in the future cultivars to tackle the threat of evolving new virulence of pathogens as well as new biotypes in insects. The present chapter deals with identification and utilization of multiple disease and insect pests resistant genotypes.

Total entries: 51; **Diseases:** Stripe, Leaf and Stem rusts
Centres:North: Karnal, Ludhiana, New Delhi, Pantnagar, Hisar, Durgapura, Almora, Jammu, Mallan (9); **South:** Wellington, Mahabaleshwar, Dharwad, Indore, Niphad (5)

The nursery was inoculated with most virulent and prevalent pathotypes of stripe, leaf and stem rusts as in case of PPSN. The record on rusts was taken at dough stage. The stripe or yellow rust records were taken from eight centres situated in the north and data from Mallan center was not considered. The stem rust data and leaf rust data of Mahabaleshwar, Niphad, Dharwad and Indore were taken for calculating ACI in South and data from Wellington is not considered. The highest score and ACI were calculated. Entries with ACI up to 10.0, were categorized as resistant (Table 9.1).

Resistant sources identified

Resistant to all the rusts:
DWR 251, HI 8791(d), HS 611, PBW 777, PBW 778, TL 3011(T), TL 3012(T), TL 3013(T), TL 3014(T), TL 3015(T), UAS 462(d), VL 3014, DBW 246, HS 645.

Resistant to stem and leaf rusts:
DDR 1052(dic.), DDR 1053(dic.), HS 644, HS 646, MACS 5047, MACS 6677

Resistant to leaf and strip rusts:
HD 3271, HI 1619, HPW 439, HS 648, KRL 370, PBW 780, WH 1316

Resistant to stem and stripe rusts:
UP 2993, VL 1011, VL 1012, HI 1620, IWP 5019, LINE 1172

Table 9.1. Entries tested in Elite Plant Pathological Screening Nursery, 2017-18

S.No.	Entry	Stem rust		Leaf rust				Stripe Rust	
		South		South		North		North	
Source: AVT IInd Year 2016-17		**HS**	**ACI**	**HS**	**ACI**	**HS**	**AV**	**HS**	**AV**
1	HI 1612	40S	22.5	10S	3.6	TS	0.2	10MS	3.3
Source: AVT Ist Year 2016-17									
2	DBW 251	20MS	3.5	20R	1.0	TS	0.2	10S	1.8
3	HI 8791 (d)	5MR	1.0	40R	4.1	5S	1.0	10MS	2.3
4	HS 611	5R	0.5	10MS	3.1	10S	2.2	5S	1.3
5	HS 630	5MR	1.3	20S	10.4	20S	6.0	20S	10.5
6	PBW 777	10MR	1.3	10R	0.5	0	0.0	0	0.0
7	PBW 778	10S	3.2	20S	6.0	20S	4.2	20S	8.7
8	TL 3011	TR	0.1	30R	1.6	0	0.0	5MR	0.5
9	TL 3012	TR	0.1	20R	1.1	10MS	1.6	5MR	1.5
10	TL 3013	5S	1.3	TMR	0.2	TS	0.2	10R	1.9
11	TL 3014	5S	1.3	20R	1.0	10MS	1.8	5MR	0.4
12	TL 3015	5S	1.3	15R	2.9	TS	0.2	5MR	3.8
13	UAS 462 (d)	10MS	4.1	30S	9.1	5S	1.4	20S	6.5
14	UP 2993	40MR	5.4	40S	11.5	0	0.0	TR	0.0
15	VL 1011	5S	3.3	10MS	2.8	40S	16.0	10S	2.0
16	VL 1012	40MR	6.3	30S	12.3	40S	10.0	TR	0.0
17	VL 3013	5R	0.4	20R	1.0	TS	0.2	40S	17.5
18	VL 3014	40MR	4.7	20R	1.3	5S	1.2	20MS	6.2
19	WH 1232	10MR	2.6	20MS	6.5	5S	1.2	40S	11.8
B. Resistant to Stem and Leaf rusts									
Source: AVT IInd Year 2015-16									
20	DBW 168	20MR	3.6	80S	21.1	40S	13.0	80S	51.7
20A	INFECTOR	100S	63.0	100S	80.0	80S	60.0	100S	86.7
21	UAS 375	20MS	4.8	40S	14.4	40S	14.2	80S	60.0
Source: AVT Ist Year 2016-17									
22	DDK 1052 (dic.)	10MR	1.3	40R	3.1	15S	5.4	60S	33.5
23	DDK 1053 (dic.)	TS	0.5	40R	2.1	20S	5.2	80S	42.7
24	HD 3219	20MS	6.2	10S	5.5	40S	13.0	80S	55.0
25	HPW 448	10MR	1.1	30S	10.4	40S	13.0	60S	32.3
26	HPW 449	5MS	1.6	40S	12.9	30MS	7.8	60S	31.2
27	HS 644	5R	0.4	5MS	1.2	5S	1.4	60S	27.3
28	HS 646	5MS	1.8	10MS	3.1	5S	1.0	70S	38.3
29	MACS 5047	10MR	1.3	30R	2.6	5S	1.6	80S	41.7
30	MACS 5049	5MR	0.8	30R	2.1	10S	3.2	80S	30.7
31	MACS 6677	30MR	5.3	20S	8.3	10MR	0.8	40S	18.5
32	MP 1318	20S	8.5	20S	6.3	40S	11.4	40S	16.7
C. Resistant to Leaf and Stripe rusts									
Source: AVT Ist Year 2016-17									

33	BRW 3773	60S	22.5	40S	11.0	40S	9.2	40MS	9.0
34	DBW 246	40MR	7.0	10MS	3.1	TR	0.0	TR	0.0
35	HI 1620	20MS	8.2	5MS	2.0	TS	0.2	40S	16.0
36	HD 3271	40S	17.9	20MS	5.6	10S	2.2	20S	8.5
37	HD 3272	40S	18.1	30S	13.1	40S	9.0	20S	10.7
38	HI 1619	60S	27.3	30R	2.1	TS	0.2	10S	3.1
39	HPW 439	60S	26.5	10MS	4.3	5S	1.2	10MS	1.7
40	HS 645	10S	3.8	20MS	5.1	TS	0.2	0	0.0
40A	INFECTOR	100S	67.0	100S	85.0	80S	64.0	100S	85.0
41	HS 648	40S	20.2	10MS	3.8	TS	0.2	5MS	1.1
42	KRL 370	40S	17.1	20R	1.1	5S	1.0	10S	6.5
43	PBW 750	40S	18.6	10MS	3.2	5S	1.2	40S	14.0
44	PBW 780	30S	12.1	20MS	5.0	TS	0.4	10MS	1.7
45	VL 1013	20S	10.0	20S	6.0	10S	3.0	5S	1.6
46	WH 1233	20S	9.2	30MS	8.8	TS	0.2	10S	3.5
47	WH 1316	40MS	14.4	20MS	8.3	TS	0.4	10S	5.0
Source: Dr. S.V. Sai Prasad, Indore									
48	B 662	10MR	1.1	10MS	5.8	5S	1.0	10S	2.5
49	HG 110	10MR	1.1	10MS	2.2	5S	1.0	5R	0.9
50	IWP 5019	20MS	7.3	10MR	1.7	20MS	5.4	60S	18.7
51	LINE 1172	20X	5.7	15R	2.8	20MS	4.2	40S	11.5

COOPERATORS:

NAME	CENTRE	RUSTS
Jaspal Kaur, Ritu Bala	Ludhiana	Stripe
R.S. Beniwal	Hisar	Leaf
Deepshikha, K.Srivastava	Pantnagar	Stripe And Leaf
P.S. Shekhawat	Durgapura	Stripe And Leaf
P.V. Patil	Dharwad	Stem And Leaf
T.L. Prakasha	Indore	Stem And Leaf
S.G. Sawashe	Mahabaleshwar	Stem And Leaf
V.K. Singh	New Delhi	Leaf
K K Mishra	Almora	Stripe
M.K. Pandey	Jammu	Stripe
B.C. Game, P.E. More	Niphad	Stem And Leaf
Sudheer Kumar And D P Singh	Karnal (Co-Ordinating Unit)	Stripe And Leaf

II. Multiple Disease Screening Nursery, 2017-18

Fifty three resistant sources identified in EPPSN against rusts are cross checked for resistance to other diseases at hot spot multi-locations under artificially created conditions to reconfirm their resistance. Data were considered for stem rust: Mahabaleshwar, Indore, Dharwar, Niphad and Wellington; for stripe rust: Ludhiana, Pantnagar, Mallan, and Karnal; for leaf rust (N): Delhi, Ludhiana and Karnal; for leaf rust (S): Mahabaleshwar, Indore, Dharwar, Niphad and Wellington; for Karnal bunt: Delhi, and Ludhiana; for leaf blight: Faizabad, Coachbehar, Kalyani; for Head scab: Delhi; for flag smut: Hisar, Ludhiana and Durgapura; for loose smut: Hisar, Ludhiana and Durgapura; for powdery mildew: Jammu, Pantnagar, and Mallan; and for cereal cyst nematode: Durgapura, hisar and Ludhiana. Based on the ACI up to 10.0, Karnal bunt up to 5.0%, Flag smut up to 5%, powdery mildew up to 3, head scab upto 2, and leaf blight up to Avg. score upto 35 and highest score upto 57 entries were categorized resistant (Table 9.2). Following entries were found to possess multiple disease resistance:

Resistant to all three rust +PM+FS+KB+FHB: PBW 725, TL 3006 (T), TL 3007 (T), VL 3012
Resistant to all three rust +FS+KB+FHB: PDW 344 (d), UAS 459 (d)
Resistant to all three rust +PM+FS+KB: HI 8774 (d), TL 3009 (T)
Resistant to all three rust +PM+FS+FHB: HPW 433
Resistant to all three rust +PM+FS: HS 628, HS 623, HS 622
Resistant to all three rust +FS+KB: RKD 283 (d)
Resistant to all three rust +PM+FS: TL 3008 (T)
Resistant to all three rust +FS+FHB: WH 1310
Resistant to all three rust +PM+FHB: DBW 220
Resistant to all three rust +FS: HPW 423, HI 8759 (d), HS 626
Resistant to all three rust +FHB: PBW 760, HS 627, PBW 757
Resistant to all three rust: PBW 756, WH 1216, WH 1184
Resistant to Stem and leaf rust +LB+PM+FS+KB: VL 3011
Resistant to Stem and leaf rust +PM+FS+KB+FHB: MACS 5044 (dic.)
Resistant to Stem and leaf rust +PM+FS+KB: DDK 1051 (dic.)
Resistant to Stem and leaf rust +FS+KB+FHB: MACS 5046 (dic.), VL 4001
Resistant to Stem and leaf rust +PM+FS: DBW 217
Resistant to Stem and leaf rust +FS+KB: RKD 292 (d)
Resistant to Stem and leaf rust +FS: AKAW 4842
Resistant to Stem and leaf rust+KB: WH 1215
Resistant to Stem and leaf rust: DBW 179, PBW 621
Resistant to leaf and yellow rust +PM+FS: HPW 424
Resistant to leaf and yellow rust +FS+KB+FHB: UP 2954
Resistant to LB+FS+FHB: WH 1184
Resistant to LB+KB: UP 2955

cooperators

Centers	Cooperators
LUDHIANA	JASPAL KAUR, RITU BALA
ALMORA	K. K. MISHRA
HISAR	R.S. BENIWAL
DHAULAKUAN	V. K. RATHEE
PANTNAGAR	J. KUMAR, DEEPSHIKHA, K. SRIVASTAVA
INDORE	T.L. PRAKASHA
MAHABALESHWAR	S.G. SAWASHE
COOCHBEHAR	S. HEMBRAM
WELLINGTON	P. NALLATHAMBI, C. UMA MAHESHWARI
FAIZABAD	S.P. SINGH
DURGAPURA	P.S. SHEKHAWAT
JAMMU	M. K. PANDEY
DHARWAD	P.V. PATIL
NEW DELHI	V.K. SINGH AND M.S. SAHARAN
VARANASI	S.S. VAISH
KARNAL	SUDHEER KUMAR, P.L. KASHYAP D. P. SINGH (COORDINATING UNIT)
FOR CCN	

DURGAPURA	S.P. BISHNOI
HISAR	PRIYANKA
LUDHIANA	RAMANNA KOULAGI

Table 9.2 Reactions of different entries of Multiple Diseases Screening Nursery, 2017-18 against diseases and CCN

S. No.	Entry	Stem rust		Leaf rust		Leaf rust		Stripe rust		LB (dd)		PM 0-9		FS%		KB%	FHB	CCN
		South		South		North		North										
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	HS	HS
Sources : EPPSN 2016-17 **A. Resistant to all three rusts**																		
Source: AVT II Year 2015-16																		
1	HI 8759 (d)	10MS	3.6	5MR	1.2	TS	0.3	10S	2.2	78	67	9	5	0	0	14.3	3	S
Source: AVT Ist Year 2015-16																		
2	HI 8774 (d)	10MR	2.4	20R	0.8	TMR	0.2	5S	1.0	68	67	4	2	3.6	1.2	4.0	3	S
3	HPPAU 05	10MS	2.8	20S	11.3	10S	3.3	5MS	2.0	78	67	5	3	25	11.2	7.2	5	S
4	HPW 423	20MS	6.2	20S	7.6	0	0.0	TR	0.1	56	46	7	4	16.7	5.6	8.6	4	HS
5	HPW 433	20MR	3.1	20MS	6.4	0	0.0	5MS	1.8	57	56	3	3	7.7	2.6	8.3	2	HS
6	HS 622	10MR	1.6	20S	7.2	0	0.0	0	0.0	78	57	3	2	20	9.4	5.2	4	HS
7	HS 623	30MR	4.1	5S	1.4	0	0.0	10MR	1.4	78	57	3	2	5	1.7	6.0	4	S
8	HS 626	20MR	3.4	20R	0.8	0	0.0	5MS	0.8	67	56	6	3	6.3	2.1	7.6	3	S
9	HS 628	10R	2.7	10R	0.6	0	0.0	5S	1.8	67	56	5	3	4.8	1.6	7.0	4	S
10	PBW 725	10MS	3.6	10MS	2.6	0	0.0	5S	1.0	56	45	5	3	4.9	1.6	4.5	2	HS
11	PBW 756	5MS	1.7	20MS	3.4	0	0.0	10S	5.0	57	45	7	4	80	31.5	8.6	3	HS
12	PBW 760	20MR	4.4	10MS	3.8	0	0.0	TR	0.0	67	46	9	5	50	22.9	7.5	2	HS
13	RKD 283 (d)	20MS	8.1	10MS	2.1	0	0.0	10S	3.8	78	68	7	4	0	0	5.0	4	HS
14	TL 3006 (T)	5R	1.4	5MR	2.6	5MR	0.9	10S	2.0	78	68	3	2	4.2	1.4	0.0	1	S
15	TL 3007 (T)	5R	1.6	5MR	1.2	5MS	2.0	10S	2.0	67	56	2	1	3.7	1.2	0.0	2	S
16	TL 3008 (T)	TR	0.1	5MR	2.6	5MR	0.7	10S	2.0	78	68	2	1	3.4	1.1	7.5	3	S
17	TL 3009 (T)	TR	0.1	15R	2.2	5MR	0.7	20S	4.0	78	68	3	2	2.8	0.9	0.0	3	S
18	VL 3002	20MS	6.4	30S	7.8	40S	13.7	20S	8.8	78	67	5	3	4.1	1.4	6.0	5	S

S. No.	Entry	Stem rust		Leaf rust		Leaf rust		Stripe rust		LB (dd)		PM 0-9		FS%		KB%	FHB	CCN
		South		South		North		North										
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	HS	HS
19	VL 3012	20MS	6.5	15R	2.4	0	0.0	10S	4.0	56	46	4	1	20	7.2	5.0	2	HS
20	WH 1181	20MS	6.2	20S	15.4	0	0.0	10S	5.0	67	46	4	2	0	0	2.0	4	HS
20A	INFECTOR	100S	57.5	100S	68.0	80S	60.0	100S	76.0	78	66	7	4	57.1	43.2	22.7	5	S
20B	RAJ 4015 for L.B.(C)	60S	21.5	80S	22.5	10S	9.0	20S	15.0	78	68	6	5	44.4	28.5	18.7	4	S
20C	UP 2338 for K.B.(C)	70S	28.8	80S	70.0	40S	30.0	60S	42.5	78	67	5	3	57.1	40.3	21.0	5	S
20D	PBW 343 for P.M.(C)	80S	29.4	80S	60.0	40S	30.0	80S	70.0	67	56	8	7	91.7	59.7	16.2	4	S
20E	Sonalika for L.S.(C)	80MS	46	90S	62.5	60S	40.0	90S	55.0	78	67	9	7	23.4	18.8	12.5	5	S
21	WH 1216	20MR	2.7	20MS	3.5	TR	0.1	20S	5.2	67	46	7	4	44.4	19	6.7	3	HS
22	WH 1310	10MR	3.7	TS	0.4	TR	0.1	10MR	1.0	78	56	9	4	0	0	16.7	2	HS
23	HS 627	10S	5.8	10S	3.0	0	0.0	10S	2.2	78	56	7	3	33.3	12	7.4	2	HS
24	WH 1184	10MS	2.1	80S	18.0	40S	16.7	10S	5.8	45	35	7	4	9.1	3	8.8	2	HS
B. Resistant to Stem and Leaf rusts																		
Source: AVT II Year 2015-16																		
25	HD 3171	20MS	8.6	40S	15.6	TR	0.1	40S	10.6	78	56	4	2	28.6	11.7	16.3	3	HS
26	WB 2	20MS	6.6	40S	12.8	5S	2.3	40S	17.6	67	56	3	2	6.3	2.1	7.0	3	S
Source: AVT Ist Year 2015-16																		
27	AKAW 4842	5MR	2.4	10MS	2.4	0	0.0	80S	56.0	78	46	7	5	4.8	3	20.0	3	HS
28	DBW 179	20MS	8.3	10S	3.4	TR	0.1	30S	13.2	56	46	5	4	41.7	16.6	19.4	3	HS
29	DBW 216	20MS	7.6	30S	9.4	20S	11.0	40S	19.0	78	57	3	3	6.8	2.3	13.5	4	HS
30	DBW 217	20MS	8.6	10S	4.4	5S	2.0	80S	36.0	67	56	7	5	33.3	17.1	8.9	4	HS
31	DBW 219	40MS	12.6	40S	8.4	5MR	0.9	50S	13.0	78	67	5	4	0	0	10.0	4	HS
32	DDK 1051 (dic.)	5R	1.6	30R	6.1	10S	4.7	40S	24.0	68	57	5	3	0	0	0.0	3	HS
33	MACS 5044 (dic.)	10MS	2.3	30R	6.3	10MS	4.0	40S	27.4	57	57	3	2	0	0	0.0	2	HS

S. No.	Entry	Stem rust		Leaf rust		Leaf rust		Stripe rust		LB (dd)		PM 0-9		FS%		KB%	FHB	CCN
		South		South		North		North										
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	HS	HS
34	MACS 5046 (dic.)	20MS	4.3	20R	0.8	10MS	3.0	80S	50.4	68	57	7	6	0	0	2.5	2	S
35	NW 6094	20MS	6.2	20S	12.0	5MR	0.7	20S	14.8	78	67	5	4	8.3	2.8	7.1	3	S
36	PBW 621	10S	3.7	20S	4.7	10S	3.3	80S	46.0	57	46	6	5	22.2	10.3	10.0	3	S
37	RKD 292 (d)	5MS	1.2	40R	8.9	10MR	1.4	80S	33.6	78	67	7	7	11.1	3.7	0.0	3	S
38	VL 4001	5MR	0.6	30S	6.4	0	0.0	60S	36.0	46	45	7	3	0	0	0.0	2	HS
39	WH 1215	20MS	8.6	40S	8.9	TR	0.1	20S	12.2	56	45	6	3	22.2	7.4	0.0	3	HS
40	UP 2955	10R	2.7	30S	10.8	10S	3.4	40S	24.2	46	36	7	4	90	34.1	0.0	5	S
40A	INFECTOR	100S	58.8	100S	80.0	80S	60.0	100S	74.0	78	67	7	5	40	28.5	28.1	5	S
40B	RAJ 4015 for L.B.(C)	80S	27.5	80S	22.0	40S	25.0	60S	31.3	78	67	7	5	70	43.8	17.3	3	S
40C	UP 2338 for K.B.(C)	70S	24.8	80S	65.0	60S	40.0	60S	47.5	78	57	5	4	25	21.4	23.0	5	S
40D	PBW 343 for P.M.(C)	80S	27.4	100S	67.5	40S	30.0	80S	65.0	57	46	7	6	59.7	46.4	18.9	3	S
40E	Sonalika for L.S.(C)	70S	28	100S	77.5	60S	35.0	80S	50.0	78	67	7	6	25	17	10.0	5	S
41	VL 3011	5R	1.5	20MS	5.5	5S	2.0	40S	15.4	45	35	5	3	2	0.7	0.0		S
C. Resistant to Leaf and Stripe rusts																		
Source: AVT Ist Year 2015-16																		
42	DBW 220	10MS	4.2	10R	0.5	TR	0.1	10S	2.2	68	57	4	2	16.7	6.3	12.5	2	S
43	PBW 757	10MS	2.2	10R	0.4	0	0.0	0	0.0	78	68	7	5	15.4	6.4	1.7	2	S
44	HPPAU 10	40MS	16.1	10R	0.5	5S	2.0	40S	12.4	78	67	4	3	2.3	0.8	13.2	3	S
45	HPW 424	40S	15.2	5MS	1.6	10S	4.7	20S	7.2	67	56	4	2	8.3	4.1	25.0	3	HS
46	NW 6046	40S	20.1	40S	12.0	10S	6.7	20S	6.8	68	57	9	5	7.1	2.4	16.7	5	S
47	PDW 344 (d)	10MS	4.4	5MS	1.6	10S	3.3	5S	1.2	67	56	7	6	2.2	0.7	0.0	2	S
48	UAS 459 (d)	10MS	2.3	10MS	4.2	TMR	0.2	10S	3.6	78	67	9	5	2	0.7	0.0	**2**	S

S. No.	Entry	Stem rust		Leaf rust		Leaf rust		Stripe rust		LB (dd)		PM 0-9		FS%		KB%	FHB	CCN
		South		South		North		North										
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	HS	HS
49	UP 2954	40S	13.8	5MS	1.6	5S	1.7	20S	8.2	56	46	9	5	5.9	2.7	0.0	2	S
D. Resistant to Stem and Leaf rusts& WB																		
50	DBW 88	20MS	6.2	10S	2.2	40S	18.3	60S	35.0	78	57	5	5	13.3	7.2	8.0	4	S
51	HD2967	40S	11.2	10S	3.0	5MS	2.7	80S	43.0	46	35	7	4	18.8	6.9	7.0	4	S
E. Resistant to Leaf rusts& WB																		
52	HD 3171	40MS	15.1	40S	13.0	0	0.0	60S	19.8	78	56	3	2	1.8	0.6	10.0	3	S
53	HD 3043	40MR	4.6	80S	17.7	60S	30.0	40S	25.3	67	46	3	2	1.5	0.5	2.9	4	S

III. Screening of MDSN 2016-17 entries against loose smut during 2017-18

Sixty nine entries of MDSN 2016-17were inoculated with loose smut during 2016-17 crop season and expression of loose smut was observed during 2017-18 season at Hisar, Durgapura and Ludhiana centres. The smutted and healthy tillers were counted and per cent infected tillers were calculated. The entries showing 0-5% infection were resistant to loose smut (Table 9.3).

Table 9.3. Performance of Multiple Disease Screening Nursery, 2016-17, against loose smut during 2017-18 crop season

S. No.	Entry	Loose smut infection (%)				
		Hisar	Durgapura	Ludhiana	HS	AV
A. Resistant to all three rusts						
Source: AVT II Year 2014-15						
1	PBW 723	10.0	17.5	10.7	17.5	12.7
Source: AVT Ist Year 2014-15						
2	HI 8765 (d)	5.0	0.0	0.0	5.0	1.7
3	HPBW 08	14.3	49.6	2.4	49.6	22.1
4	HPBW 09	31.6	8.3	23.8	31.6	21.2
5	HPW 422	21.3	3.8	0.0	21.3	8.4
6	HS 580	21.6	0.0	1.7	21.6	7.7
7	HS 596	31.8	24.0	8.8	31.8	21.5
8	HS 597	6.5	1.3	0.0	6.5	2.6
9	HS 599	3.3	15.0	3.5	15.0	7.3
10	K 1312	4.3	14.3	10.0	14.3	9.5
11	K 1314	5.0	0.0	0.0	5.0	1.7
12	MACS 4024	5.3	0.0	0.0	5.3	1.8
13	MACS 3970 (d)	4.3	3.2	0.0	4.3	2.5
14	MACS 3972 (d)	3.5	0.0	0.0	3.5	1.2
15	PBW 709	6.0	18.5	0.0	18.5	8.2
16	PBW 718	21.6	52.0	0.0	52.0	24.5
17	TL 3001 (T)	4.4	0.0	0.0	4.4	1.5
18	TL 3002 (T)	3.3	0.0	0.0	3.3	1.1
19	TL 3003 (T)	3.5	0.0	0.0	3.5	1.2
20	TL 3004 (T)	3.7	0.0	0.0	3.7	1.2
20A	Sonalika for L.S.(C)	81.1	66.7	45.3	81.1	64.4
21	TL 3005 (T)	6.3	0.0	0.0	6.3	2.1
22	UAS 453 (d)	4.5	0.0	4.8	4.8	3.1
23	UAS 455 (d)	3.3	43.9	4.2	43.9	17.1
24	VL 3007	16.6	8.6	14.9	16.6	13.4

S. No.	Entry	Loose smut infection (%)				
		Hisar	Durgapura	Ludhiana	HS	AV
25	VL 3008	42.6	6.5	21.6	42.6	23.6
26	WB5	31.1	34.2	8.6	34.2	24.6
B. Resistant to Stem and Leaf rusts						
Source: AVT Ist Year 2014-15						
27	DBW 147	32.5	26.4	12.9	32.5	23.9
28	DBW 150	62.5	25.2	14.3	62.5	34.0
29	DBW 181	11.7	36.8	26.3	36.8	24.9
30	DBW 182	26.6	16.8	0.0	26.6	14.5
31	DBW 183	15.0	14.4	0.0	15.0	9.8
32	DDK 1048 (dic.)	42.6	0.0	0.0	42.6	14.2
33	DDK 1049 (dic.)	33.3	0.0	0.0	33.3	11.1
34	DDW 31	4.6	1.3	1.1	4.6	2.3
35	GW 1315 (d)	10.0	9.5	Miss	10.0	9.8
36	GW 463	15.0	31.6	21.1	31.6	22.6
37	HD 3164	51.1	53.6	14.0	53.6	39.6
38	HPBW 01	62.5	36.1	10.2	62.5	36.3
39	HPBW 02	80.0	41.0	5.9	80.0	42.3
40	HPBW 05	81.6	43.8	0.0	81.6	41.8
40A	Sonalika for L.S.(C)	80.0	73.7	39.1	80.0	64.3
41	HUW 695	82.5	32.9	10.0	82.5	41.8
42	HUW 712	63.3	57.5	12.9	63.3	44.6
43	JWS 712	72.5	45.0	0.0	72.5	39.2
44	K 1313	81.1	16.9	13.6	81.1	37.2
45	K 1315	62.5	25.4	31.3	62.5	39.7
46	KRL 350	11.5	34.1	28.4	34.1	24.7
47	KRL 351	71.1	36.5	1.1	71.1	36.2
48	MACS 4020 (d)	2.5	0.0	0.0	2.5	0.8
49	MACS 5041	2.5	0.0	0.0	2.5	0.8
50	MACS 5043	11.1	0.0	0.0	11.1	3.7
51	PBW 716	12.5	23.0	4.0	23.0	13.2
52	PBW 719	16.6	12.7	9.0	16.6	12.8
53	UP 2883	41.1	21.4	0.0	41.1	20.8
54	VL 4001	62.5	28.6	7.3	62.5	32.8
55	WB1	43.3	25.9	7.2	43.3	25.5
56	WH 1309	71.1	58.8	1.0	71.1	43.6
C. Resistant to Leaf and Stripe rusts						

S. No.	Entry	Loose smut infection (%)				
		Hisar	Durgapura	Ludhiana	HS	AV
Source: AVT Ist Year 2014-15						
57	DDW 32	62.5	0.9	0.0	62.5	21.1
58	HD 3165	13.3	0.0	0.0	13.3	4.4
59	HS 600	12.5	28.3	0.0	28.3	13.6
60	PBW 721	31.3	36.9	10.0	36.9	26.1
60A	Sonalika for L.S.(C)	52.5	53.8	39.3	53.8	48.5
D. Resistant to Stem and Stripe rusts						
Source: AVT IInd Year 2014-15						
61	UAS 428 (d)	41.1	0.0	0.0	41.1	13.7
Source: AVT Ist Year 2014-15						
62	DBW 184	20.0	51.2	27.1	51.2	32.8
63	HD 3159	41.6	44.4	22.7	44.4	36.2
64	HI 1604	51.2	39.0	12.9	51.2	34.4
65	HPBW 07	42.5	35.2	20.8	42.5	32.8
66	HS 583	12.5	41.7	23.4	41.7	25.9
67	HS 601	43.3	26.8	23.1	43.3	31.1
68	PBW 707	31.3	34.5	6.2	34.5	24.0
69	VL 1006	32.5	45.6	17.0	45.6	31.7

COOPERATORS:

NAME	CENTRE
JASPAL KAUR, RITU BALA	LUDHIANA
R.S. BENIWAL	HISAR
P.S. SHEKHAWAT AND NITIN CHAWLA	DURGAPURA
SUDHEER KUMAR, P.L. KASHYAP AND D.P. SINGH	KARNAL (COORDINATING UNIT)

IV. Multiple pest screening nursery for 2017-18

Evaluation for insect resistance

(a) Shoot fly: Forty nine MPSN lines were screened against shoot fly at six locations *viz.* Dharwad, Durgapura, Ludhiana, Niphad, Kanpur and Kharibari. Out of tested entries, the average maximum score was observed in entry MACS 5044 (dic) and it was 28.35%. However, the minimum score of 6.30% was recorded for HI 8774 (d) (Table 9.4a).

(b) Brown wheat mite: Amongst tested entries, the highest population of 48.00 mites/ 10 cm^2 area was recorded for HPW 433 and lowest population of 4.00 mites/ 10 cm^2 was observed in entry VL 4001. Brown wheat mite population was highest (22.7 mites/ cm^2) on IWP 72(C) and lowest (10 mites/ 10 cm^2) on PBW 621 at Durgapura (Table 9.4a).

(c) Foliar aphid: Eighty seven MPSN lines were screened against foliar aphid at five locations *viz.*Niphad Ludhiana, Kharibari (W.B.), Karnal and Shillongani. The screened entries fall into either susceptible (grade 4) or highly susceptible (grade 5) categories. Based on average score of five locations, six entries *viz.*PBW 756, WH 1216, PBW 621, VL 4001, UP 2955, IWP 72 (C), VL 3011 scored 4.0 grade (Table 9.4b).
(d) 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, two entries viz. PBW 760, UP 2955 and UP 2954 was found to be moderately resistant (grade 3) to root aphid.Root aphid infestation was not observed on any genotype at Karnal (Table 9.4b).

Table 9.4a Screening of MPSN nursery against shoot fly and Brown Wheat mite 2017-18

S. No.	Entry	Shoot fly incidence (%)								Brown Wheat mite (No. of mites/10 cm² area)	
		Dharwad	Ludhiana	Durgapura	Niphad	Kharibari	Kanpur	AV.	HS	Ludhiana	Durgapura
A. Resistant to all three rusts											
Source:AVT II Year 2015-16											
1	HI 8759 (d)	14.40	18.00	10.66	5.00	1.00	21.42	11.75	21.42	23	10.7
Source:AVT Ist Year 2015-16											
2	HI 8774 (d)	3.16	9.89	10.33	3.33	2.00	9.09	6.30	10.33	45	10.3
3	HPPAU 05	17.14	10.00	12.33	5.00	1.00	14.28	9.96	17.14	23	12.3
4	HPW 423	10.71	5.20	10.33	3.33	2.00	24.00	9.26	24.00	15	10.3
5	HPW 433	13.79	12.50	16.00	5.00	2.00	21.42	11.79	21.42	48	16.0
6	HS 622	13.33	8.64	14.00	5.00	3.00	11.11	9.18	14.00	23	14.0
7	HS 623	10.97	11.02	11.00	6.66	2.00	13.66	9.22	13.66	20	11.0
8	HS 626	22.50	16.67	12.33	8.33	2.00	16.00	12.97	22.50	10	12.3
9	HS 628	11.21	26.21	13.00	5.00	2.00	22.72	13.36	26.21	25	13.0
10	PBW 725	10.00	14.52	12.66	6.66	3.00	9.52	9.39	14.52	20	12.7
11	PBW 756	13.57	20.83	11.66	5.00	2.00	17.82	11.81	20.83	23	11.7
12	PBW 760	11.22	9.33	11.00	6.66	2.00	18.18	9.73	18.18	15	11.0
13	RKD 283(d)	12.00	9.52	10.66	6.66	3.00	8.33	8.36	12.00	20	10.7
14	TL 3006 (T)	6.67	14.58	11.00	5.00	2.00	7.69	7.82	14.58	15	11.0
15	TL 3007 (T)	6.04	11.03	10.66	8.33	2.00	6.66	7.45	11.03	35	10.7
16	TL 3008 (T)	6.21	7.22	12.33	8.33	2.00	13.33	8.24	13.33	13	12.3
17	TL 3009 (T)	9.73	10.71	14.00	6.66	3.00	9.09	8.87	14.00	18	14.0
18	VL 3002	18.13	10.40	10.00	5.00	2.00	11.11	9.44	18.13	10	10.0
19	VL 3012	26.43	7.20	12.33	3.33	2.00	19.09	11.73	26.43	47	12.3
20	WH 1181	11.25	7.06	11.66	6.66	1.00	21.05	9.78	21.05	8	11.7
20A	SONALIKA (C)	7.14	29.73	-	15.00	2.00	14.28	13.63	29.73	-	-
20B	IWP 72 (C)	10.00	-	21.66	6.66	0.00	17.58	11.18	21.66	57	21.7
20C	A 9-30-1 (C	12.63	-	-	6.66	0.00	20.00	9.82	20.00	-	-
20D	GW 173 (C)	20.00	-	-	5.00	0.00	16.66	10.42	20.00	-	-
21	WH 1216	5.96	8.06	15.00	6.66	0.00	9.52	7.53	15.00	10	15.0
22	WH 1310	4.52	13.11	10.33	10.00	0.00	16.66	9.10	16.66	15	10.3
23	HS 627	3.45	10.16	12.33	6.66	2.00	7.14	6.96	12.33	10	12.3
24	WH 1184	6.00	11.32	11.66	8.33	3.00	21.87	10.36	21.87	20	11.7
B. Resistant to Stem and Leaf rusts											
Source:AVT II Year 2015-16											

S. No.	Entry	Shoot fly incidence (%)								Brown Wheat mite (No. of mites/10 cm² area)	
25	HD 3171	7.84	16.67	16.00	8.33	1.00	21.42	11.88	21.42	9	16.0
26	WB 2	20.74	9.80	11.33	8.33	0.00	16	11.03	20.74	15	11.3
Source:AVT Ist Year 2015-16											
27	AKAW 4842	12.22	14.38	12.33	5.00	2.00	17.85	10.63	17.85	10	12.3
28	DBW 179	3.10	12.40	13.66	8.33	2.00	16.66	9.36	16.66	9	13.7
29	DBW 216	3.46	11.01	11.66	5.00	2.00	16.66	8.30	16.66	6	11.7
30	DBW 217	13.78	16.09	10.66	6.66	2.00	11.11	10.73	16.09	8	10.7
31	DBW 219	3.40	15.50	11.33	8.33	3.00	10.00	8.65	15.50	13	11.3
32	DDK 1051 (dic.)	9.09	19.67	12.66	5.00	2.00	13.66	11.42	19.67	25	12.7
33	MACS 5044 (dic.)	29.17	24.31	15.66	6.66	2.00	16.66	17.56	29.17	20	15.7
34	MACS 5046 (dic.)	9.03	15.22	11.66	6.66	1.00	5.55	8.49	15.22	20	11.7
35	NW 6094	8.26	5.43	14.66	6.66	1.00	16.66	9.20	16.66	10	14.7
36	PBW 621	6.83	24.56	10.00	3.33	1.00	18.75	12.23	24.56	10	10.0
37	RKD 292 (d)	7.08	12.80	12.33	6.66	1.00	18.75	10.39	18.75	7.5	12.3
38	VL 4001	10.17	14.63	16.00	8.33	1.00	16.66	11.69	16.66	4	16.0
39	WH 1215	10.00	15.65	11.00	5.00	1.00	17.58	11.05	17.58	15	11.0
40	UP 2955	6.00	14.11	10.33	6.66	0.00	15.62	9.21	15.62	5	10.3
40A	SONALIKA (C)	5.00	29.63	-	13.33	1.00	16.00	12.91	29.63	-	-
40B	IWP 72 (C)	19.00	-	22.66	8.33	1.00	21.42	16.02	22.66	49	22.7
40C	A 9-30-1 (C	20.00	-	-	6.66	1.00	9.09	10.03	20.00	-	-
40D	GW 173 (C)	34.74	-	-	5.00	1.00	11.11	15.62	34.74	-	-
41	VL 3011	15.90	26.25	12.00	6.66	1.00	16.66	14.36	26.25	5	12.0
C. Resistant to Leaf and Stripe rusts											
Source: AVT Ist Year 2015-16											
42	DBW 220	8.39	26.55	13.33	5.00	1.00	18.75	13.60	26.55	5	13.3
43	PBW 757	15.38	15.70	12.33	8.33	1.00	22.22	13.33	22.22	6	12.3
44	HPPAU 10	16.76	13.22	10.33	6.66	2.00	21.42	12.75	21.42	5	10.3
45	HPW 424	19.64	17.24	11.33	10.00	1.00	13.33	12.51	19.64	8	11.3
46	NW 6046	10.48	13.64	13.66	10.00	1.00	16.62	11.08	16.62	8	13.7
47	PDW 344 (d)	3.67	12.05	15.33	8.33	1.00	16.66	9.74	16.66	18	15.3
48	UAS 459 (d)	10.00	14.01	10.33	10.00	2.00	20.00	11.27	20.00	20	10.3
49	UP 2954	14.71	9.80	12.66	8.33	1.00	15.55	10.74	15.55	11	12.7

Table 9.4b. Screening of MPSN nursery against foliar aphid and root aphid 2017-18

S. No.	Entry	Foliar aphids (1-5 scale)							Root aphid (1-5 scale)
		Ludhiana	Niphad	Kharibari	Karnal	Shillongani	AV.	HS	Ludhiana
A. Resistant to all three rusts									
Source:AVT II Year 2015-16									
1	HI 8759 (d)	5	4	4	5	4	4.50	5	4
Source:AVT Ist Year 2015-16									
2	HI 8774 (d)	5	4	4	5	2	4.50	5	5
3	HPPAU 05	5	5	5	5	2	5.00	5	5
4	HPW 423	5	5	5	5	3	5.00	5	4

S. No.	Entry	Foliar aphids (1-5 scale)							Root aphid (1-5 scale)
		Ludhiana	Niphad	Kharibari	Karnal	Shillongani	AV.	HS	Ludhiana
5	HPW 433	5	5	5	5	3	5.00	5	5
6	HS 622	5	5	5	5	3	5.00	5	4
7	HS 623	5	5	5	5	3	5.00	5	5
8	HS 626	4	5	5	4	4	4.50	5	4
9	HS 628	5	5	5	5	4	5.00	5	5
10	PBW 725	4	5	5	4	3	4.50	5	4
11	PBW 756	4	5	3	4	3	4.00	5	5
12	PBW 760	5	5	4	5	3	4.75	5	3
13	RKD 283 (d)	5	5	4	5	4	4.75	5	4
14	TL 3006 (T)	5	5	4	5	3	4.75	5	5
15	TL 3007 (T)	5	5	4	5	3	4.75	5	4
16	TL 3008 (T)	5	5	4	5	3	4.75	5	4
17	TL 3009 (T)	5	5	4	5	2	4.75	5	5
18	VL 3002	5	5	4	5	3	4.75	5	5
19	VL 3012	5	5	4	5	4	4.75	5	3
20	WH 1181	4	5	4	4	4	4.25	5	4
20A	SONALIKA (C) FOR SF	-	5	5	-	3	5.00	5	-
20B	IWP 72 (C) FOR BWM	-	5	4	-	3	4.50	5	-
20C	A 9-30-1 (C) FOR FA	5	5	5	5	2	5.00	5	-
20D	GW 173 (C) FOR RA	-	5	4	-	3	4.50	5	5
21	WH 1216	4	5	3	4	2	4.00	5	5
22	WH 1310	5	5	2	5	4	4.25	5	4
23	HS 627	5	5	3	5	3	4.50	5	5
24	WH 1184	5	5	4	5	4	4.75	5	4
B. Resistant to Stem and Leaf rusts									
Source:AVT II Year 2015-16									
25	HD 3171	5	5	4	5	4	4.75	5	4
26	WB 2	4	5	4	4	3	4.25	5	4
Source:AVT Ist Year 2015-16									
27	AKAW 4842	5	5	4	5	3	4.75	5	4
28	DBW 179	4	5	4	4	3	4.25	5	5
29	DBW 216	5	5	4	5	3	4.75	5	5
30	DBW 217	5	5	4	5	4	4.75	5	5
31	DBW 219	4	5	4	4	2	4.25	5	4
32	DDK 1051 (dic.)	5	5	4	5	2	4.75	5	4
33	MACS 5044 (dic.)	5	5	5	5	4	5.00	5	4
34	MACS 5046 (dic.)	4	5	4	4	3	4.25	5	5
35	NW 6094	4	5	5	4	4	4.50	5	4
36	PBW 621	4	5	3	4	4	4.00	5	5
37	RKD 292 (d)	4	5	5	4	4	4.50	5	4
38	VL 4001	4	5	3	4	3	4.00	5	4
39	WH 1215	4	5	5	4	4	4.50	5	5
40	UP 2955	4	5	3	4	3	4.00	5	3
40A	SONALIKA (C) FOR SF	-	5	5	-	3	5.00	5	-
40B	IWP 72 (C) FOR BWM	-	5	3	-	3	4.00	5	-
40C	A 9-30-1 (C) FOR FA	5	5	4	5	4	4.75	5	-
40D	GW 173 (C) FOR RA	-	5	5	-	3	5.00	5	5

S. No.	Entry	Foliar aphids (1-5 scale)							Root aphid (1-5 scale)
		Ludhiana	Niphad	Kharibari	Karnal	Shillongani	AV.	HS	Ludhiana
41	VL 3011	4	5	3	4	3	4.00	5	5
C. Resistant to Leaf and Stripe rusts									
Source: AVT Ist Year 2015-16									
42	DBW 220	5	5	4	5	4	4.75	5	5
43	PBW 757	4	5	5	4	4	4.50	5	5
44	HPPAU 10	5	5	3	5	4	4.50	5	5
45	HPW 424	5	5	3	5	3	4.50	5	5
46	NW 6046	5	5	4	5	4	4.75	5	4
47	PDW 344 (d)	4	5	4	4	3	4.25	5	4
48	UAS 459 (d)	5	5	4	5	3	4.75	5	4
49	UP 2954	5	5	4	5	3	4.75	5	3

COOPERATORS

NAME	CENTRE
POONAM JASROTIA AND D.P. SINGH	KARNAL (COORDINATING UNIT)
A.A. PATEL	VIJAPUR
BEANT SINGH	LUDHIANA
SANAY D. PATIL	NIPHAD
J.K. SINGH	KANPUR
A.S. BALODA	DURGAPURA
MD. WASIM REZA	KHARIBARI (W.B.)
K.K. SARMA	SHILLONGANI
P.V. PATIL	DHARWAD

V. National Genetic Stock Nursery (NGSN), 2017-18

The confirmed sources of multiple disease and insect pest resistance were contributed in the NGSN and were planted at 30 breeding centers across different agro climatic zones of country for their utilization in breeding for resistance to biotic stresses. All 23 entries were utilized in the range of 3.3 – 43.3% by the breeding centres (Fig. 9.1). The most utilized entries at many centres were HPW 695, K 1315, K 1314, and HS 597 (Table 9.5). The Pawarkheda centre, utilized maximum 18 entries in their breeding programme followed by Sagar and Udaipur (Fig. 9.2).

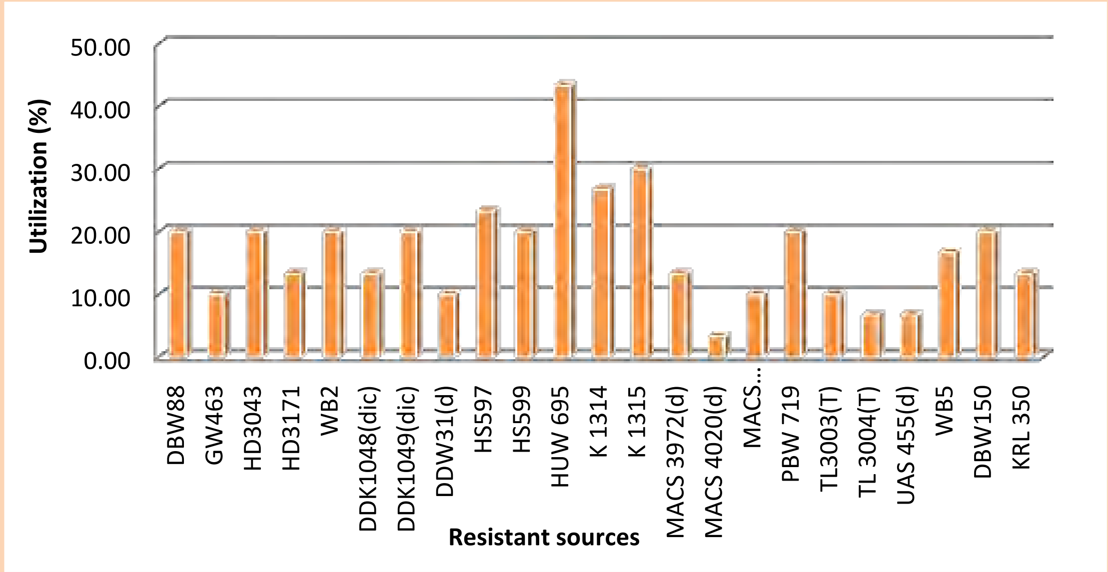

Fig. 9.1. Percent utilization of promising resistant genotypes at different breeding centres in NGSN, 2017-18

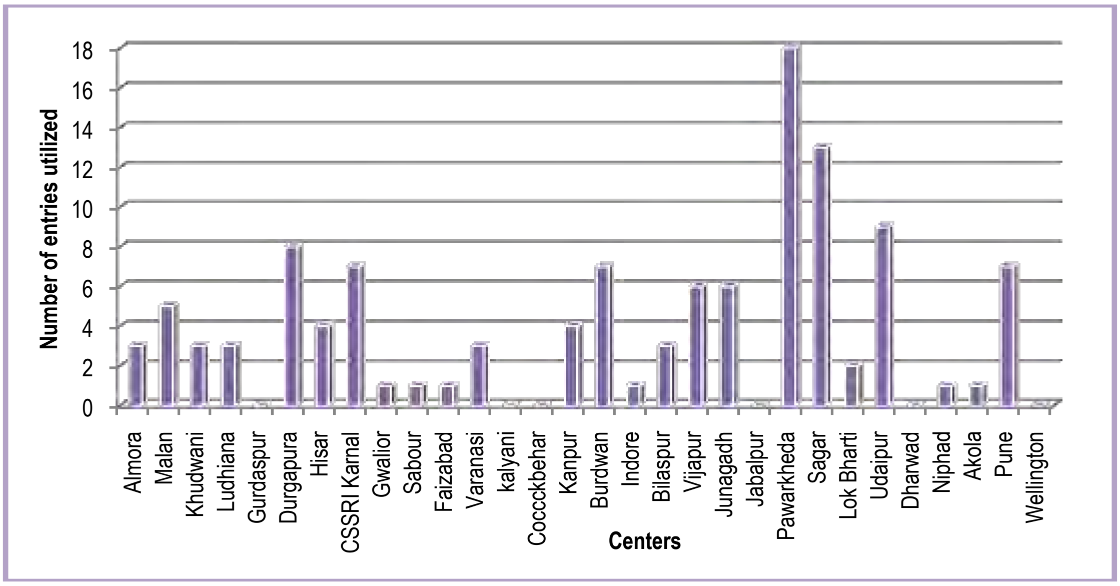

Fig. 9.2. Centre wise utilization of promising resistant genotypes from NGSN, 2017-18

Table 9.5. National genetic stock nursery (NGSN), 2017-18

S. No.	Entry	Almora	Malan	Khudwani	Ludhiana	Gurdaspur	Durgapura	Hisar	CSSRI Karnal	Gwalior	Sabour	Faizabad	Varanasi	kalyani	Coochbehar	Kanpur	Burdwan	Indore	Bilaspur	Vijapur	Junagarh	Jabalpur	Pawarkheda	Sagar	Lok Bharti	Udaipur	Dharwad	Niphad	Akola	Pune	Wellington	Total
1	DBW88								1		1	1					1									1				1		6
2	GW463						1										1						1									3
3	HD3043						1	1										1		2			1									6
4	HD3171		1				1									1							1									4
5	WB2			1				1	1								1			1	1											6
6	DDK1048(dic)							1																1		1				1		4
7	DDK1049(dic)			1									1											1		1			1	1		6
8	DDW31(d)																						1	1		1						3
9	HS597				1												1						1	3	1							7
10	HS599		1		1		1	1															1	1								6
11	HUW 695		1		1		1			1							1		1	2	1		1	1		1				1		13
12	K 1314	1	1				1		1							1			1				1	1								8
13	K 1315	1					1		1							1					1		1	2		1						9
14	MACS 3972(d)			1																			1			1				1		4
15	MACS 4020(d)																						1									1
16	MACS 5041(dic)												1										1							1		3
17	PBW 719								1								1				2		1					1				6
18	TL3003(T)																		1				1	1								3
19	TL 3004(T)																						1			1						2
20	UAS 455(d)		1																				1									2
21	WB5						1													1			1			1				1		5
22	DBW150	1							1				1								1		1	1								6
23	KRL 350								1							1	1								1							4
	Total	3	5	3	3	0	8	4	7	1	1	1	3	0	0	4	7	1	3	6	6	0	18	13	2	9	0	1	1	7	0	117

Cooperators: **D P SINGH, SUDHEER KUMAR, P.L. KASHYAP AND S. K. SINGH**

9.5. MANAGEMENT OF DISEASES: CHEMICAL CONTROL

Use of fungicides is required once a variety turns susceptible to new races of pathogens of rusts and other diseases. It is therefore important to test new molecules which may be used in emergency situation to manage epidemic of disease and minimizing lossess due to diseases.
Three such trials for the management of yellow rust, spike diseases and flag smut were conducted at different centres during 2017-18 crop season.

Yellow rust

Yellow rust (*Puccinia striiformis*) of wheat is an important disease in northern India and is favoured by cool weather. Its primary inoculum survives on the Himalyan hills during summer and is a source for infection in the foot hills and plains during crop season. Yellow rust survives well up to 23 ^{0}C and later during the month of March it turns to black coloured telial stage from yellow coloured uredial stage. The disease may infect the crop from air borne infection right from seedling till hard dough stage of crop. The pathogen mutates and creates new variability. As a result of it, the resistant cultivars turn susceptible after 4-5 years. The replacement of mega varieties like PBW 343 and HD 2967 which has become susceptible to yellow rust is not possible overnight and farmers continue to grow these due to their high yielding potential and preference of farmers. Keeping in view of it it is quite important to keep track of yellow rust on these varieties right from December till mid March in northwestern plains zone. The further spread of yellow rust is restricted by use of fungicides. Keeping in view of it, two readily available fungicides, Propiconazole and Trifloxystrobin+ Tebuconazole@ 0.6g/l, were applied on the wheat varieties PBW 343 and HD 2967. The first spray was applied at rust initiation and second and thirds at a gap of 15 days. The trial was conducted at Karnal, Jammu, Ludhiana, Hisar and Durgapura. Amongst different treatments (Figs. 9.3-9.4), the foliar sprays of propiconazole (0.1%) (3 sprays) were found best in PBW 343 whereas in HD 2967, three sprays of both propiconazole (0.1%) and Trifloxystrobin+ Tebuconazole@ 0.6g/l,were at par on an average of six locations. The yellow rust scores are given in Tables 9.6-9.10.

P.S. Shekhawat	**Durgapura**
Jaspal Kaur, Ritu bala	**Ludhiana**
R.S. Beniwal	**Hisar**
M.K. Pandey	**Jammu**
D.P. Singh, Sudheer Kumar, P.L. Kashyaop	**Karnal**

Table 9. 6. Effect of fungicidal sprays on yellow rust at Durgapra centre

CV. PBW 343			**Yellow rust severity**					
S. No.	**Treatments**	**No. of spray**	**BS-I (20-01-18)**	**AS-I (27-01-18)**	**BS-II (5-2-18)**	**AS- II (12-02-18)**	**BS-III (20-02-18)**	**AS- III (27-02-18)**
1	Trifloxystrobin+ Tebuconazole@ 0.6g/l,	1	5.7*	0.0	4.2	10.3	18.8	33.5
2	Trifloxystrobin+ Tebuconazole@ 0.6g/l,	2	5.5	0.0	3.5	0.0	0.0	0.0

3	Trifloxystrobin+ Tebuconazole@ 0.6g/l,	3	5.0	0.0	4.0	0.0	0.0	0.0
4	Propiconazole @ 1ml/l	1	5.1	0.0	5.5	15.0	27.7	45.0
5	Propiconazole @ 1ml/l	2	5.4	0.0	5.2	0.0	0.0	0.0
6	Propiconazole @ 1ml/l	3	5.0	0.0	5.0	0.0	0.0	0.0
7	Check		5.5	12.5	20.0	40.5	66.5	80.0
HD2967								
1	Trifloxystrobin+ Tebuconazole@ 0.6g/l,	1	4.5	0.0	5.0	8.7	15.5	25.7
2	Trifloxystrobin+ Tebuconazole@ 0.6g/l,	2	5.0	0.0	4.2	0.0	0.0	0.0
3	Trifloxystrobin+ Tebuconazole@ 0.6g/l,	3	5.7	0.0	3.2	0.0	0.0	0.0
4	Propiconazole @ 1ml/l	1	5.2	0.0	4.0	12.3	19.4	35.8
5	Propiconazole @ 1ml/l	2	5.0	0.0	4.2	0.0	0.0	0.0
6	Propiconazole @ 1ml/l	3	4.8	0.0	3.0	0.0	0.0	0.0
7	Check		5.7	10.2	18.3	32.4	45.9	70.5

Table 9.7 Effect of fungicidal sprays on yellow rust at Ludhiana centre

PBW343	**Nos. of sprays**	**Yellow rust score**					
Treatments		**DS(BI sp)**	**DS(A SP)**	**DS(BII sp)**	**DS(AII SP)**	**DS(BIII sp)**	**DS(AIII SP)**
		8.1.2018	**15.1.2018**	**23.1.2018**	**31.1.2018**	**14.2.2018**	**22.2.2018**
Trifloxystrobin+ Tebuconazole@ 0.6g/l,	One	10S	0	20S	20S	40S	60S
Trifloxystrobin+ Tebuconazole@ 0.6g/l,	Two	10S	0	5S	0	5MS	5S
Trifloxystrobin+ Tebuconazole@ 0.6g/l,	Three	5S	0	5MS	0	0	0
Propiconazole @ 1ml/l	One s	5S	0	5-10S	10-20S	20-40S	60S
Propiconazole @ 1ml/l	Two	10S	0	5MS	0	5MR	5S
Propiconazole @ 1ml/l	Three	5S	0	5S	0	5MS	0
Check		20S	40S	40S	60S	60-80S	80S
HD2967							
Trifloxystrobin+ Tebuconazole@ 0.6g/l,	One	5S	0	20S	20S	20-40S	40S
Trifloxystrobin+ Tebuconazole@ 0.6g/l,	Two	5S	0	5MS	0	10S	10-20S
Trifloxystrobin+ Tebuconazole@ 0.6g/l,	Three	5S	0	5S	0	5MS	0

Propiconazole @ 1ml/l	One s	5S	0	10S	20S	40S	40S
Propiconazole @ 1ml/l	Two	5S	0	5MS	0	5S	10S
Propiconazole @ 1ml/l	Three	10S	0	5MS	0	5MS	0
Check		10S	20S	40S	40S	60S	60S

Table 9.8. Effect of fungicidal sprays on yellow rust at Hisar centre

S.No.	Treatments	Disease severity before spray		
HD 2967		Ist spray 27.01.2018	IInd spray 13.02.2018	IIrd spray 28.02.2018
1	Unsprayed control	10S	40S	80S
2	Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- One spray at disease initiation	10S	0	20S
3	Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- Initial spray at disease initiation followed by second spray after 15 days	10S	0	0
4	Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- Initial spray at disease initiation followed by two sprays at 15 days interval	10S	0	0
5	Propiconazole(Tilt) @0.1% (20ml/20 lit water)-One spray at disease initiation	10S	0	20S
6	Trifloxystrobin+ Tebuconazole (NATIVO) @0.1% (20ml/20 lit water)- -Initial spray at disease initiation followed by second spray after 15 days	10S	0	0
7	Trifloxystrobin+ Tebuconazole(NATIVO) @ 0.1% (20ml/20 lit water)-Initial spray at disease initiation followed by two sprays at 15 days interval	10S	0	0
PBW 343				
1	Unsprayed control	10S	40S	80S
2	Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- One spray at disease initiation	10S	0	20S
3	Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- Initial spray at disease initiation followed by second spray after 15 days	10S	0	0
4	Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- Initial spray at disease initiation followed by two sprays at 15 days interval	10S	0	0
5	Propiconazole(Tilt) @0.1% (20ml/20 lit water)-One spray at disease initiation	10S	0	20S
6	Trifloxystrobin+ Tebuconazole (NATIVO) @0.1% (20ml/20 lit water)- -Initial spray at disease initiation followed by second spray after 15 days	10S	0	0
7	Trifloxystrobin+ Tebuconazole(NATIVO) @ 0.1% (20ml/20 lit water)-Initial spray at disease initiation followed by two sprays at 15 days interval	10S	0	0

Table 9.9. Effect of fungicidal sprays on yellow rust at Jammu centre

S.No.	Treatments	Yellow rust severity		
		Ist	IInd	IIIrd
HD-2967				
T1	Unsprayed control	15.00	45.00	75.00
T2	Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- One spray at disease initiation	2.50	17.50	55.00
T3	Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- Initial spray at disease initiation followed by second spray after 15 days	3.75	2.50	45.00
T4	Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- Initial spray at disease initiation followed by two sprays at 15 days interval	3.75	2.50	17.5
T5	Propiconazole(Tilt) @0.1% (20ml/20 lit water)-One spray at disease initiation	2.50	15.0	55.00
T6	Trifloxystrobin+ Tebuconazole (NATIVO) @0.1% (20ml/20 lit water)- -Initial spray at disease initiation followed by second spray after 15 days	2.50	8.75	11.25
T7	Trifloxystrobin+ Tebuconazole(NATIVO) @ 0.1% (20ml/20 lit water)-Initial spray at disease initiation followed by two sprays at 15 days interval	2.50	2.50	10
PBW-343				
T1	Unsprayed control	17.5	50.00	85.00
T2	Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- One spray at disease initiation	2.50	17.50	65.00
T3	Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- Initial spray at disease initiation followed by second spray after 15 days	3.75	20.00	45.00
T4	Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- Initial spray at disease initiation followed by two sprays at 15 days interval	3.75	8.75	17.5
T5	Propiconazole(Tilt) @0.1% (20ml/20 lit water)-One spray at disease initiation	2.50	20.00	55.00
T6	Trifloxystrobin+ Tebuconazole (NATIVO) @0.1% (20ml/20 lit water)- -Initial spray at disease initiation followed by second spray after 15 days	2.50	5.00	17.50
T7	Trifloxystrobin+ Tebuconazole(NATIVO) @ 0.1% (20ml/20 lit water)-Initial spray at disease initiation followed by two sprays at 15 days interval	3.75	5.00	10.00

Table 9.10. Effect of fungicidal sprays on yellow rust at Karnal centre

Treatments	Final yellow rust score			
HD 2967	R-I	R-II	R-III	R-Iv
Unsprayed control	30S	10S	20S	40MS
Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- One spray at disease initiation	20MS	10MS	20S	30MS
Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- Initial spray at disease initiation followed by second spray after 15 days	20MS	30S	10MS	40MS

Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- Initial spray at disease initiation followed by two sprays at 15 days interval	10MS	10S	20MS	10MS
Propiconazole(Tilt) @0.1% (20ml/20 lit water)-One spray at disease initiation	20MS	10MS	10S	20MS
Trifloxystrobin+ Tebuconazole (NATIVO) @0.1% (20ml/20 lit water)- -Initial spray at disease initiation followed by second spray after 15 days	20S	10S	20S	10MS
Trifloxystrobin+ Tebuconazole(NATIVO) @ 0.1% (20ml/20 lit water)-Initial spray at disease initiation followed by two sprays at 15 days interval	20MS	10MS	10S	20MS
PBW 343				
Unsprayed control	60S	40S	80S	40S
Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- One spray at disease initiation	40S	30S	40S	20S
Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- Initial spray at disease initiation followed by second spray after 15 days	20S	40S	40S	20MS
Trifloxystrobin+ Tebuconazole @ 0.06% (NATIVO) (12g/20 lit water)- Initial spray at disease initiation followed by two sprays at 15 days interval	20S	20S	30S	30MS
Propiconazole(Tilt) @0.1% (20ml/20 lit water)-One spray at disease initiation	40S	20S	40MS	40MS
Trifloxystrobin+ Tebuconazole (NATIVO) @0.1% (20ml/20 lit water)- -Initial spray at disease initiation followed by second spray after 15 days	40S	40S	20S	20S
Trifloxystrobin+ Tebuconazole(NATIVO) @ 0.1% (20ml/20 lit water)-Initial spray at disease initiation followed by two sprays at 15 days interval	20MS	40S	40S	30S

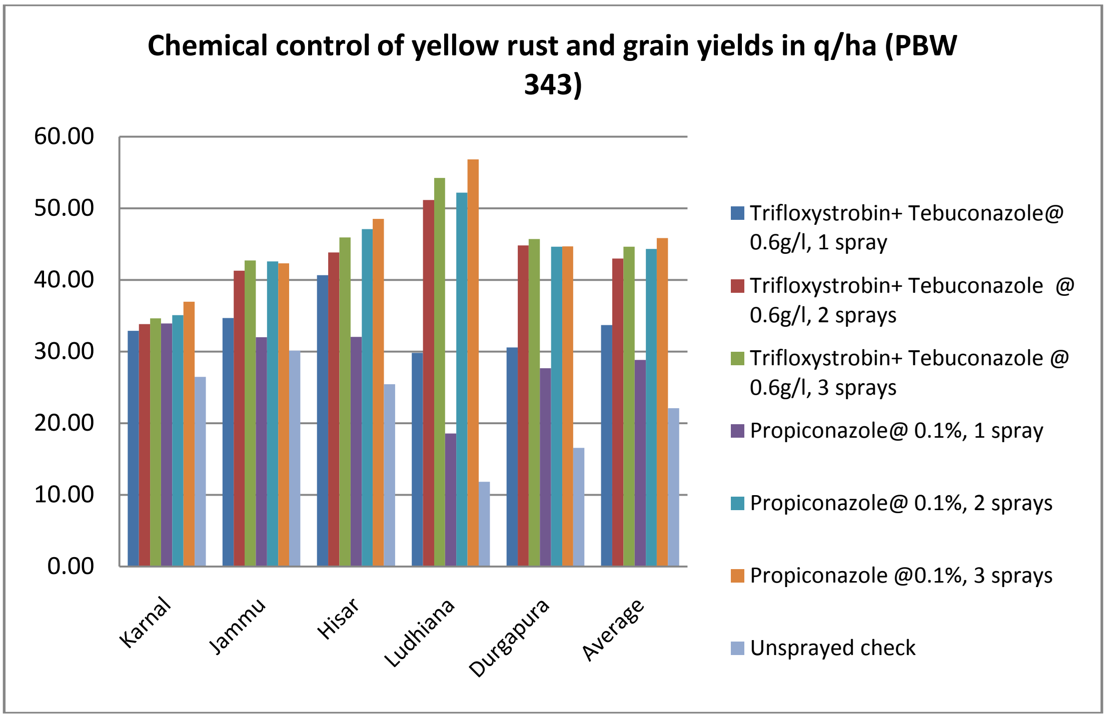

Fig. 9.3. Chemical control of yellow rust and effect on yield (PBW 343)

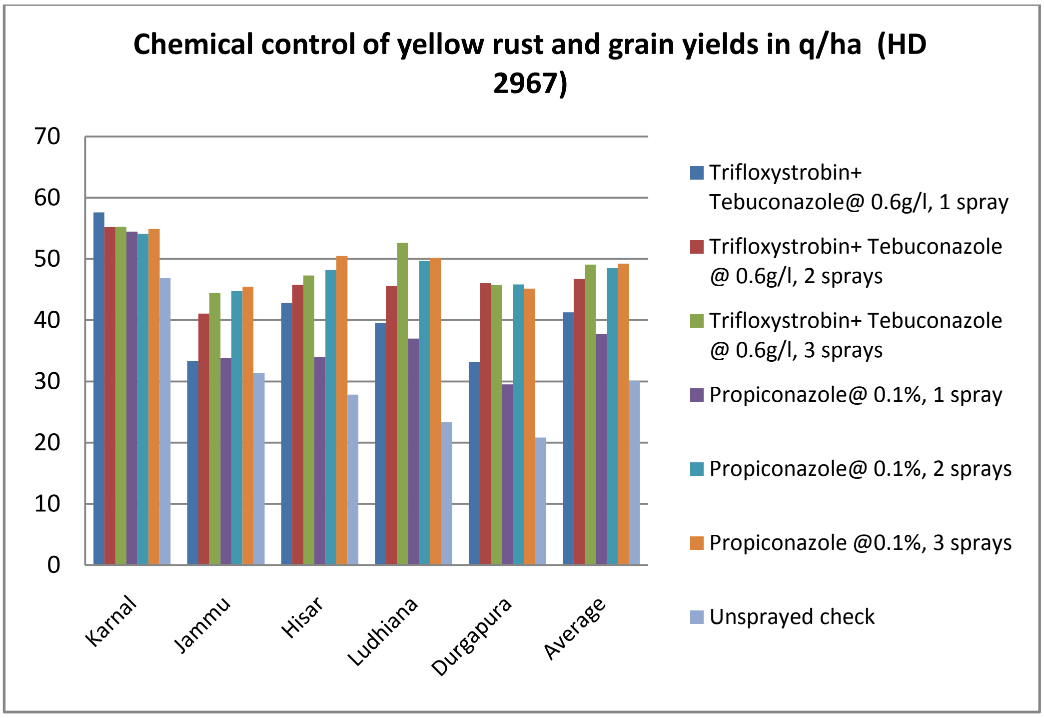

Fig. 9.4. Chemical control of yellow rust and effect on yield (HD 2967)

Flag smut

The flag smut was controlled fully by seed treatment of Tebuconazole 2% DS (@0.1%), Difenoconazole 3% (Dividend) @ 0.1%) and Carboxin 75% WP @ 0.25% at Durgapura. On an average, the incidence of flag smut was 1.2-2.2% in different treatments as compared to untreated control showing 28.0% infection (Tables 9.11-9.12, Fig. 9.5).

P.S. Shekhawat	**Durgapura**
Jaspal Kaur, Ritu bala	**Ludhiana**
R.S. Beniwal	**Hisar**
D.P. Singh, Sudheer Kumar, P.L. Kashyaop	**Karnal**

Table 9.11. Chemical control of flag smut

S.No.	Treatments	Doses (g or ml/ kg seed)	Percent Disease Incidence			Average
			R_1	R_2	R_3	
Durgapura						
1	Carboxin 17.5% + Thiram 17.5% (Vitavax ultra)	2.5 ml	2.2	2.7	3.8	2.9
2	Tebuconazole 5% (Raxil easy)	1.0 ml	1.5	0.0	1.0	0.83
3	Tebuconazole 2% DS	1.5 g	0.0	0.0	0.0	0.0
4	Difenoconazole 3% (Dividend)	1.0 g	0.0	0.8	1.0	0.6
5	Carbendazim 50%WP	2.5 g	1.0	0.5	0.0	0.5
6	Carboxin 75% WP	2.5 g	0.0	0.0	0.0	0.0
7	Untreated check	-	48.5	52.2	43.8	48.12
Hisar						
1	Carboxin 17.5% + Thiram 17.5% (Vitavax ultra)	2.5 ml	0	0	0	0.0
2	Tebuconazole 5% (Raxil easy)	1.0 ml	0	0	0	0.0
3	Tebuconazole 2% DS	1.5 g	0	0	0	0.0
4	Difenoconazole 3% (Dividend)	1.0 g	0	0	0	0.0
5	Carbendazim 50%WP	2.5 g	7.11	6.83	6.66	6.87
6	Carboxin 75% WP	2.5 g	0	0	0	0.0
7	Untreated check	-	12.66	13.33	12.50	12.83
Karnal						
1	Carboxin 17.5% + Thiram 17.5% (Vitavax ultra)	2.5 ml	-	-	-	-
2	Tebuconazole 5% (Raxil easy)	1.0 ml	6.2	5.3	4.6	5.4
3	Tebuconazole 2% DS	1.5 g	4.6	3.6	3.6	3.9
4	Difenoconazole 3% (Dividend)	1.0 g	5.6	3.8	3	4.1
5	Carbendazim 50%WP	2.5 g	1.9	1.9	2	1.9
6	Carboxin 75% WP	2.5 g	3.4	3.8	3.6	3.6
7	Untreated check	-	9.8	9.5	10.1	9.8
Ludhiana						
1	Carboxin 17.5% + Thiram 17.5% (Vitavax ultra)	4.16	4.16	2.66	4.44	3.8
2	Tebuconazole 5% (Raxil easy)	2.00	2	0	0	0.7
3	Tebuconazole 2% DS	2.10	2.1	0	0	0.7

4	Difenoconazole 3% (Dividend)	0.00	0	0	1.11	0.4
5	Carbendazim 50%WP	4.00	4	1.21	0.55	1.9
6	Carboxin 75% WP	1.21	1.21	0	0	0.4
7	Untreated check	37.00	37	41.5	45	41.2

Table 9. 12. Chemical control of flag smut (Summary Table)

S. No.		Durgapura	Hisar	Karnal	Ludhiana	Av.
1	Carboxin 17.5% + Thiram 17.5% (Vitavax ultra)	2.9	0	-	3.8	2.2
2	Tebuconazole 5% (Raxil easy)	0.83	0	5.4	0.7	1.7
3	Tebuconazole 2% DS	0	0	3.9	0.7	1.2
4	Difenoconazole 3% (Dividend)	0.6	0	4.1	0.4	1.3
5	Carbendazim 50%WP	0.5	6.87	1.9	1.9	2.8
6	Carboxin 75% WP	0	0	3.6	0.4	1.0
7	Untreated check	48.12	12.83	9.8	41.2	28.0

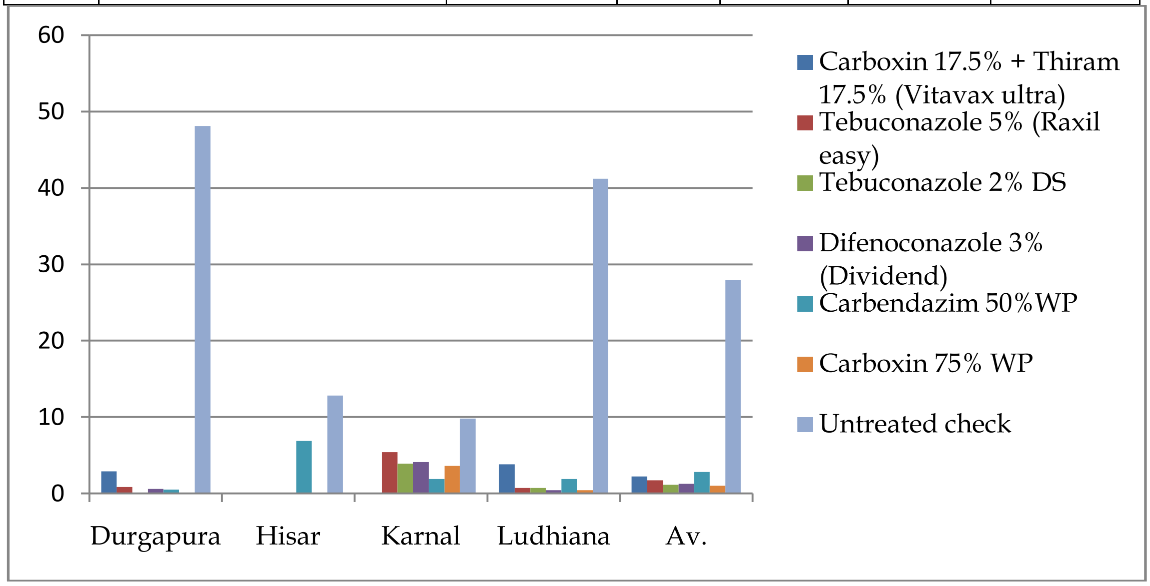

Fig. 9.5. Chemical control of flag smut

Spike diseases

The trial on chemical control was planted at four locations in West Bengal in Nadia and Murshidabad districts.The grain yield in case of Tebuconazole 50% + Trifloxystrobin 25% WG sprays @ 150+75 g a.i/ha, two sprays first at boot leaf and second 15 days thereafter, significantly increased (42.15 q/ha) as compared to unsprayed check (27.74 q/ha), on an average basis Table 9.13 & 9.14). The disease score was also reduced (Table 9.15).

Sunita Mahapatra, Dhiman Mukherjee **BCKV Kalyani**

D.P. Singh, Sudheer Kumar, P.L. Kashyaop **Karnal**

Table 9.13. Details of treatments applied for control of spike diseases.

T. No.	Treatment	Dosage / ha		No. of Applications	Time of Application
		a.i. (g)	Formulation (ml or g)		
1	Tebuconazole 50% + Trifloxystrobin 25% WG	200+100	400 g	Two	First spray at boot leaf (booting) stage. Second spray at 15 days after first spray.
2	Tebuconazole 50% + Trifloxystrobin 25% WG	200+100	400 g	One	At boot leaf (booting) stage
3	Tebuconazole 50% + Trifloxystrobin 25% WG	150+75	300 g	Two	First spray at boot leaf (booting) stage. Second spray at 15 days after first spray.
4	Tebuconazole 50% + Trifloxystrobin 25% WG	150+75	300 g	One	At boot leaf (booting) stage
5	Tebuconazole 250 EC (Tebuconazole 25.9% w/w EC)	200	800 ml	Two	First spray at boot leaf (booting) stage. Second spray at 15 days after first spray.
6	Trifloxystrobin 50% WG	100	200 g	Two	First spray at boot leaf (booting) stage. Second spray at 15 days after first spray.
7	Tricyclazole 75% WP	300	400 g	Two	First spray at boot leaf (booting) stage. Second spray at 15 days after first spray.
8	Propiconazole 25% EC	125	500 ml	Two	First spray at boot leaf (booting) stage. Second spray at 15 days after first spray.
9	Mancozeb 75% WP	1500	2000 g	Two	First spray at boot leaf (booting) stage. Second spray at 15 days after first spray.
10	Untreated Control	-	-	-	-

Table 9.14.Effect of fungicidal sprays on yield and 1000 grain wt.

T. No.	Treatment	Grain yield (q/ha)					1000 Grain wt (gm) (pooled value)
		Jalangi	Ranina gar II	Karim pur	Bhajanghat	Pooled value	
T_1	Tebuconazole 50% + Trifloxystrobin 25% WG	25.36	31.35	33.65	30.58	30.13	34.66

T_2	Tebuconazole 50% + Trifloxystrobin 25% WG	38.98	41.65	36.54	40.25	39.05	37.00
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	38.65	44.69	41.36	43.78	42.15	40.00
T_4	Tebuconazole 50% + Trifloxystrobin 25% WG	39.87	33.22	35.69	37.84	36.85	36.66
T_5	Tebuconazole 250 EC (Tebuconazole 25.9% w/w EC)	26.36	27.11	30.25	28.54	28.86	36.16
T_6	Trifloxystrobin 50% WG	31.65	34.36	31.25	28.97	31.15	37.83
T_7	Tricyclazole 75% WP	28.23	39.36	30.25	35.65	33.45	39.33
T_8	Propiconazole 25% EC	40.23	38.25	37.84	34.56	37.93	38.83
T_9	Mancozeb 75% WP	37.54	32.02	28.98	34.15	33.66	36.13
T_{10}	Untreated Control	28.98	30.65	28.47	23.69	27.74	36.16
SEm±		0.67	0.74	0.46	0.39	0.57	0.79
CD (P=0.05)		2.06	2.23	1.77	1.23	1.83	2.34

Table 9.15.Effect of fungicides on the disease incidence in west Bengal (av. Of 4 locations)

T. No.	**Treatment**	**Mean value spot blotch score**	**Average of Spike disease score**
		0-9 dd	**0-4 scale**
T_1	Tebuconazole 50% + Trifloxystrobin 25% WG	49.33	2
T_2	Tebuconazole 50% + Trifloxystrobin 25% WG	27.66	1
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	24.00	0
T_4	Tebuconazole 50% + Trifloxystrobin 25% WG	35.33	1
T_5	Tebuconazole 250 EC (Tebuconazole 25.9% w/w EC)	36.33	1
T_6	Trifloxystrobin 50% WG	25.00	0
T_7	Tricyclazole 75% WP	46.00	2
T_8	Propiconazole 25% EC	34.33	1
T_9	Mancozeb 75% WP	38.66	1
T_{10}	Untreated Control	57.66	2
	SEm±	**1.15**	
	CD (P=0.05)	**3.45**	

PROGRAMME 10: NEMATOLOGY

As per the activities earmarked for year 2017-18 in wheat nematology under AICRPW&B, the aspects like host resistance against CCN, ECN; survey and surveillance of CCN, ECN and other ectoparasitic nematodes; soil biological studies in wheat based different cropping systems besides integrated cereal cyst nematode management were covered. The highlights of the wheat nematology programme are given below:

10.1. Crop Health Survey
Durgapura centre
Cereal Cyst Nematode (CCN)
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.

Hisar
Crop health monitoring survey for nematodes was done in Hisar and Fatehabad, districts. Cereal cyst nematode was reported in 39.5 % (19/48) samples. Number of cysts ranged from 1-26 per 200 cc soil. Other plant parasitic nematodes present in 200 cc soil samples were *Pratylenchus* sp., *Hoplolaimus* sp., *Helicotylenchus* sp. and *Tylenchorhynchus* sp. Wheat seed gall nematode (*Anguina tritici*) was not recorded from the state. Crop health monitoring survey for nematodes was done in the village namely Balsamand, Agroha, Mangali, Ratia, Kohli, Kharakheri, Bhodia Khera, Dhingsara, Bathu, Shekhupura, Dadoli and Dharnia of Hisar and Fatehabad district. Community analysis of plant parasitic nematodes associated with wheat in Hisar and Fatehabad district.

Nematodespecies	Frequencyofoccurrence(%)
Heterodera avenae	39.5
*Pratylenchus*sp	35.4
Tylenchorhynchus sp.	43.7
Hoplolaimus sp.	29.2
Helicotylenchus sp.	14.6

Total number of samples collected = 48

Wellington centre

Observation revealed that none of the lines responded as the population of *Heterodera avenae* was not was found in this area. However the field population of other plant parasitic nematodes was as follows.

Nematodes/100cc soil	Kenthorai	ICAR-IARI (B2)	TNAU-Nanjanadu farm
Tylenchorhynchous sp.	33	-	-
Aphelenchus sp.	17	-	-
Aphelenchoides sp.	17	50	-
Helicotylenchus sp.	100	100	100
Pratylenchus sp.	117	-	50
Trichodorus sp.	100	100	-
Other PPN	17	83	83

In the farmers' field (Kenthorai village, Ooty), the bread wheat was grown in ~0.7 acre and out of ~0.5 acres were destroyed by grazing of Nilgiri Gaur (*Bos gaurus*) (Fig. 10.1). In TNAU-Nanjanadu farm the wheat crop was damaged by cutworms at vegetative stage. In ICAR-IARI, RS, Wellington, ~ 1 acre of wheat crop was damaged by Nilgiri Gaur (*Bos gaurus*) by grazing & trampling. Further Spotted muniah (*Lonchura punctulata*) and Rose finch (*Carpodacus erythrinus*) caused severe damage to bread wheat at the time of maturity.

Fig 10.1 Male (left) and Female (right) of Common Rose finches feeding on wheat grains

Ear Cockle Nematode, *Anguina tritici*

Ludhiana

A total of 2380 wheat grain samples were collected from 162 different grain markets of the Punjab State in the months of April, 2018 and were analyzed for ear cockle nematode. None of the samples showed incidence of ear cockle nematode.

Cereal Cyst Nematode and Other Soil Borne Nematodes

Ludhiana

One hundred and twelve soil and root samples were collected from twenty seven localities for the plant parasitic nematode infestation on wheat crop the state (Table 10.1). *Heterodera avenae* cyst, species of *Meloidogyne, Tylenchorhynchus, Hirschmanniella, Helicotylenchus* and *Hoploloaimus* were recorded. *H* cysts were recorded from Ballowal, Saroya (Nawanshahr District), Gurdaspur, Kharal (Gurdaspur District), Purika, Dasuya (Hoshiarpur District) and Kishangarh (Jalandhar District). The number of cysts recorded was 1-3 cysts/250 cc soil. Root knot nematode was also recorded up to 110 larvae/250cc soil and *Tylenchorhynchus* was recorded from all the collected with the highest of 460 larvae/250cc soil.

Table 10.1. Plant parasitic nematodes associated with wheat crop in Punjab (2017-2018)

Vllage/ Locality	No. of samples collected	Number of nematodes / 250 ml soil; Range (Frequency of occurrence %)					
		H. avenae (cysts)	*Meloidogyne* (Larvae)	*Tylenchorhynchus*	*Hirschmanniella*	*Helicotylenchus*	*Hoploloaimus*
Moron	4	0	30-50 (50.00)	120-320 (100.00)	80-120 (50.00)	30 (25.00)	30 (25.00)
Apra	4	0	40-60 (50.00)	80-230 (100.00)	40-110 (50.00)	20 (25.00)	-
Ballowal	4	2-3 (50.00)	30-50 (50.00)	110-360 (100.00)	30-130 (50.00)	20 (25.00)	-
Gurdaspur	6	1-2 (50.00)	60-110 (50.00)	190-460 (100.00)	50-120 (50.00)	40-80 (75.00)	-
Kolian	4	0	-	120-280 (100.00)	60-110 (50.00)	30-50 (50.00)	-
Kharal	4	1-2 (50.00)	-	180-320 (100.00)	40-80 (50.00)	-	40 (25.00)
Purika	4	1-2 (50.00)	40-80 (50.00)	130-340 (100.00)	70-130 (50.00)	-	
Araya Nagar	4	0	-	40-240 (100.00)	60-130 (50.00)	40 (25.00)	-
Bakhalaur	4	0	40-60 (50.00)	90-280 (100.00)	20-80 (50.00)	20-40 (50.00)	-
Langroya	4	0	30-50 (50.00)	110-260 (100.00)	-	20-40 (50.00)	-
Nasana Mai	4	0	50-90 (50.00)	120-310 (100.00)	50-110 (50.00)	30 (25.00)	-
Bhogpur	4	0	30-60 (50.00)	140-240 (100.00)	60-110 (50.00)	40-60 (50.00)	40 (25.00)
Saroya	4	2-3 (50.00)	40-70 (50.00)	180-320 (100.00)	80-140 (50.00)	-	20 (25.00)
Chakadana	6	0	20-60 (50.00)	110-240 (100.00)	-	-	
Mehandpur	4	0	40-80 (50.00)	90-260 (100.00)	30-80 (50.00)	-	-
Ladowal	4	0	40-60 (50.00)	120-360 (100.00)	60-120 (75.00)	30 (25.00)	20 (25.00)
Gathroan	4	0	50-80 (50.00)	210-410 100.00)	30-90 (50.00)	20-50 (50.00)	5-10 (50.00)
Begampura	4	0	60-110 (75.00)	110-240 (100.00)	50-160 100.00)	-	10 (25.00)
Kanapur	4	0	-	170-320 (100.00)	30-110 (50.00)	20-40 (50.00)	30-60 (50.00)
Dasuya	4	1-3 (50.00)	40-80 (50.00)	180-430 (100.00)	40-80 (50.00)	30 (25.00)	-
Purna Shallo	4	0	-	110-440 (100.00)	60-140 (75.00)	20-60 (50.00)	-

Jahangirpur	4	0	-	150-380 (100.00)	50-140 (100.00)	-	20-40 (50.00)
Kishangarh	4	1-3 (50.00)	30-70 (50.00)	130-320 (100.00)	40-120 (50.00)	-	30(25.00)
Dharo Chak	4	0	40-70 (50.00)	60-230 (100.00)	-	-	30-60 (50.00)
Mukerian	4	0	40-80 (50.00)	120-330 (100.00)	20-60 (50.00)	40 (25.00)	30 (25.00)
Abohar	4	0	20-50 (50.00)	90-260 (100.00)	30-70 (50.00)	20-50 (50.00)	-
Faridkot	4	0	40-70 (50.00)	100-280 (100.00)	20-40 (50.00)	20-40 (50.00)	40 (25.00)
Total	**112**	1-3	20-110	40-460	20-160	20-80	10-60

10.2. Studies of Pathotypes of *Heterodera avenae* at Durgapura

The pathotypes 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-estanzuellawhile rest showed susceptible reaction. Jaipur Population of CCN is Pathotype Ha 21. (Table 10.3).

10.3. Host resistance

Resistance against *Heterodera avenae*:

AVT entries

Durgapura centre

AVT were screened for resistance against *H. avenae*. One hundred forty nine wheat germplasms (AVT) were screened at Durgapura under naturally sick field against cereal cyst nematode, *H. avenae* (Pathotypes Ha 21) of RARI, Durgapura, Jaipur. The inoculums level was 7.9 L/gm of soil. Out of 148 germplasm, one has been found resistant (PZ-RI-304), whereas, eleven germplasm showed moderately resistant reaction viz. NHLSZ-1701, NHLSZ-1709, NHLSZ-1710, NWRI-307, NE-IR-107, NE-IR-112. NE-IR-306, CZ-TS-102, PZ-TS-101, PZ-TS-102 and PZ-TS-106 rest werefound susceptible (131) and highly susceptible (6) (Table 10.1).

Ludhiana

One hundred forty nine entries of AVT were screened for resistance against *H. avenae* (CCN) sick plot conditions. PBW 550 and HD 2967 were used as susceptible checks. Out of these none of the entry was found resistant. Only eight entries namely NWTS-102,NWTS-114,NWRI-303,NE-IR-103,NE-IR-108,CZ-TS-101,PZ-TS-101and DIC-101 have shown moderately resistant reaction. Rest of the entries were either susceptible or highly susceptible to CCN.

Hisar

Screening of wheat germplasm 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: Under AVT in total, 149 entries of wheat were screened against cereal cyst nematode under screen house conditions using nematode infested soil and no entry was found resistant.

New Delhi: None was found R or MR to CCN in AVT.

MDSN entries
Durgapura
Fifty three wheat germplasms (MDSN) were received from IIWBR, Karnal and nursery was planted in sick field condition against cereal cyst nematode, *Heterodera avenae* of RARI, Durgapura, Jaipur. The inoculums level was 8.2.0 L/gm of soil. Out of 53 germplasm, two was found resistant (WH 1181, HD 3043), whereas, five showed moderately resistant (Tolerant) reaction viz. PBW 756, TL 3006 (T), VL 3012, DBW 219, MACS 5046 (dic.), rest were found susceptible (45) and highly susceptible (1) (Table 10.2).
Ludhiana
Fifty three entries were evaluated for resistance to cereal cyst nematode, *H. avenae* and none were found resistant. Only eight entries namely HPPAU 05, WH 1216,WB 2,DBW 179,VL 4001,UP 2955, PDW 344 (d) and UP 2954 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.

Hisar
Under multiple diseases screening nursery trial, 53 entries were screened against *Heterodera avenae*, under screen house conditions. 51 entries gave susceptible or highly susceptible reaction and remaining two entries were found moderately resistant.

Root knot nematode, *Meloidogyne graminicola*
Ludhiana
AVT entries
One hundred forty nine entries under AVT were screened for resistance against root knot nematode, *Meloidogyne graminicola* in the nematode infested soil under pot culture conditions. PBW 621, PBW 550 and HD 2967 were used as susceptible checks. All the entries showed susceptible to highly susceptible reaction.

MULTIPLE DISEASE/ PEST SCREENING NURSERIS
Fifty three entries were evaluated for resistance to root knot nematode, *Meloidogyne graminicola* and none was found resistant. All the entries showed susceptible to highly susceptible reaction.

Table 10.2. Screening of wheat germplasm AVT against cereal cystnematode, *Heterodera avenae* (Jaipur Population) at Durgapura

Category	Cyst /Plant	AVT Entries
Resistant (1)	0-4	PZ-RI-304

Moderately Resistant (11)	5-9	NHLSZ-1701, NHLSZ-1709, NHLSZ-1710, NWRI-307, NE-IR-107, NE-IR-112. NE-IR-306, CZ-TS-102, PZ-TS-101, PZ-TS-102, PZ-TS-106

Table 10.3. Screening of MDSN entries against CCN (*Heterodera avenae*) (*Durgapura centre*)

Category	**Cyst /Plant**	Entries
Resistant (2)	0-4	WH 1181, HD 3043
Moderately Resistant (5)	5-9	PBW 756, TL 3006 (T), VL 3012, DBW 219, MACS 5046 (dic.)
Hisar centre		
Category	**Cyst /Plant**	Entries
Resistant	0-4	Nil
Moderately Resistant (2)	5-9	MACS 5046 (dic.) , HI 8759 (d)

10.4. Integrated CCN management

Durgapura

An experiment was conducted at Rajasthan Agricultural Research Institute, Durgapura, Jaipur in naturally infested soil. Inoculum level was 8.2 larvae/g soil of cereal cyst nematode. The experiment consisted of seven treatments *viz*Neem cake 10q/ha (soil application), Castor cake 10q/ha (soil application), Neem oil 10 ml/kg (seed treatment), Neem cake 5 q/ha + Neem oil, Castor cake 5 q/ha + Neem oil, 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 for count the 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 (35.70 q/ha) was recorded in Neem cake 5 q/ha +half dose of Neem oil with 7.22 cyst/ plant) with increase 92.97% in yield followed by Neem cake 10 q/ha (Grain yield – 32.0 q/ha; 9.22 cysts/plant). 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 (Table 10. 4).

Hisar centre

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 pots. Sowing of wheat var. HD-2967 was done on 24-11-2017 and two plants were maintained in each pot. There were seven treatments with three replications each

(Table 10.5). Castor cake and neem cake (10 g/kg soil) were mixed in soil 10 days before sowing. Neem oil @10 ml/kg seed was used as seed treatment. Observation on number of cysts was recorded, 110 days after sowing.

Among all these experiment, minimum number of cysts was observed in neem oil @10 ml/kg seed treatment followed by castor cake @ 10 g/pot, 10 days before sowing. While maximum number of cysts was recorded in control check treatment followed by Neem cake @ 10 g/pot 10 days before sowing treatment (Table 10.5).

Table 10.4 . Effect of various treatments on cereal cyst nematode at Durgapura

S.No.	**Treatments**	**Grain Yield of Wheat**		**Cysts/ Plant**
		Yield q/ha	**% Increase over control**	
1	Neem cake 10 q/ha	32.0	72.97	9.22
2	Castor cake 10 q/ha	27.0	45.94	13.54
3	Neem oil 10 ml /kg seed	25.6	38.37	15.00
4	Neem cake 5 q/ha + Neem oil 10 n /kg seed	35.7	92.97	7.22
5	Castor cake 5 q/ha + Neem oil 10 r /kg seed	30.8	67.56	11.25
6	Treated check (Carbofuran 1.5 kg ai/ha)	41.4	123.78	4.11
7	Untreated check (Raj-3765)	18.5	---	20.40
	CD5%	**1.32**		**0.34**

Table 10.5. Effect of various treatments on cereal cyst nematode at Hisar

Treatment	**No. of cysts/pot**
Control check	61
Neem oil @10 ml/kg seed treatment	40
Castor cake @ 5 g/pot combined with Neem oil @ 5 ml/kg seed treatment, 10 days before sowing	53.5
Castor cake @10 g/pot, 10 days before sowing	42
Neem cake @ 5 g/pot combined with Neem oil @ 5 ml/kg seed treatment, 10 days before sowing	56.5
Neem cake @ 10 g/pot, 10 days before sowing	58.5

Date of sowing: 24-11-2016

Cooperators

Priyanka	Hisar
S. P. Bisnoi	Durgapura
Pankaj	Delhi
Ramanna Koulagi	Ludhiana
J.Berliner	Wellington
D.P. Singh, Sudheer Kumar	Karnal (Coordinating unit)

PROGRAMME 11. ENTOMOLOGY

RESULTS OF COORDINATED ENTOMOLOGICAL EXPERIMENTS

Wheat entomology programme covers three aspects viz. host plant resistance, integrated pest management (IPM) and stored grain pest management. During 2017-18 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 integrated pest management aspect coveredsurvey and surveillance of insect-pests and their natural enemies, trapping efficiency of different type of insect-traps for monitoring insect-pests and effect of varied nitrogen fertilization on aphid and termite infestation in wheat. Besides, studies were also conducted on influence of sowing time on the incidence and population build-up of major insect pest of wheat and eco friendly management of foliar aphid and termites through bio-pestcides and chemical insecticides. The salient findlings of the experiments conducted during 2017-18 at various AICRP centres are given below.

11.1(A) HOST PLANT RESISTANCE

The host plant resistance is specific and its effects are cumulative; the longer the insect-resistant plant genes are employed, greater the benefits with decreasing amounts of wild germplasm available for using many plant species. There is clearly an urgent need to select genes conferring biotic stress resistance in acceptable agronomic backgrounds. 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.

A1: Entomological Screening Nurseries (ESN)

AVT-Entries

(a) Shoot fly

A total of 149 AVT wheat genotypes were screened against shoot fly, at six hotspot locations viz. Niphad, Ludhiana, Dharwad, Kanpur, Kharibari and Durgapura. The average infestation levels of AVT entries genotypes ranged from 4.59 % (GW 173 (C)) to 15.26 % (Sonalika) (Table A1-11.1a). Amongst 149 tested, entries, the lowest infestation of shootfly i.e 7.32% was recorded in entry PZ-RI-312, while highest infestation of 14.16% was recorded in entry VL 1016. At Niphad location, two entries viz. HS 665 & HPW 450 had lowest infestation of 1.66% whereas at Ludhiana, entry HS 490 (C) had lowest infestation of 6.06%. Two entries at Kanpur viz. DBW 278 & BRW

3806were recorded lowest infestation of 2.77% and at Dharwad entry, MPO 1336 (d) had lowest infestation of 1.50% (Table A1-11.1a).

(b) Brown wheat mite

A total of 149 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, the maximum mite population was observed in BRW 3806 (68/10 cm^2 area) while MACS 6709 (8/10 cm^2 area) recorded the minimum mite population (Table A1-11.1b).

(c) Foliar wheat aphid and root aphid

Foliar aphid: The foliar wheat aphid screenings nursery consisting of 149 AVT genotypes was screened at five locations *viz.*Niphad, Ludhiana, Karnal, Shillongani, 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.

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

On the basis of average grading of the foliar aphid infestation, all entries were categorized as resistant (grade 2), moderately resistant (grade 3), susceptible (grade 4) or highly susceptible (grade 5) to wheat foliar aphid (Table A1-11.1c)**.**

On the basis of average aphid score of five locations, entry DBW 222 scored lowest (3.25). At Shillongani centre, two entries were found to be resistant (grade 2). These were DBW 222 and WH 1142 (C). Five entries viz. HS 662, VL 3018, DBW 222 HD 2967 (C), and UAS 465 (d) at locations Ludhiana and Karnal showed moderately resistance response to foliar aphid.

However, at Kharibari, sixteen entries were found to be moderately resistant category and at location Niphad, all the entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category (Table A1-11.1c).

Root aphid: The screening nursery for root aphid was consisted of 149 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 149 entries, two entries *viz.*UP 3017and HD 3237 showed the moderately resistance reaction at Ludhiana and rest of them were either susceptible (grade 4) or highly susceptible (grade 5) to root aphid (Table A1-11.1c).

NIVT-Entries

(a) Foliar aphid:

On the basis of average aphid score of three locations, three entries, GW 509, RKD 331 and PDW 355 showed the moderately resistance reaction (3.67 average score) to foliar aphid. At Niphad location, all the entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category and none of the entry was found to be in grade 3 or 2 (Table A1-11.1d).

(A2) Multiple pest screening nurseries (MPSN)

(a)Shoot fly: Forty nine MPSN lines were screened against shoot fly at six locations *viz.* Dharwad, Durgapura, Ludhiana, Niphad, Kanpur and Kharibari. Out of tested entries, the average maximum score was observed in entry MACS 5044 (dic) and it was 28.35%. However, the minimum score of 6.30% was recorded for HI 8774 (d) (Table A2-11.1a).

(b)Brown wheat mite: Amongst tested entries, the highest population of 48.00 mites/ 10 cm^2 area was recorded for HPW 433 and lowest population of 4.00 mites/ 10 cm^2 was observed in entry VL 4001. Brown wheat mite population was highest (22.7 mites/ cm^2) on IWP 72(C) and lowest (10 mites/ 10 cm^2) on PBW 621 at Durgapura (Table A2-11.1a).

(c) Foliar aphid: Eighty seven MPSN lines were screened against foliar aphid at five locations *viz.*Niphad Ludhiana, Kharibari (W.B.), Karnal and Shillongani. The screened entries fall into either susceptible (grade 4) or highly susceptible (grade 5) categories. Based on average score of five locations, six entries *viz.*PBW 756, WH 1216, PBW 621, VL 4001, UP 2955, IWP 72 (C), VL 3011 scored 4.0 grade(Table A2-11.1b).
(d)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, two entries viz. PBW 760, UP 2955 and UP 2954 was found to be moderately resistant (grade 3) to root aphid.Root aphid infestation was not observed on any genotype at Karnal (**Table A2-11.1b**).

Table A1-11.1a: Screening of AVT lines against Shootfly (Year-2017-18)

Sr. No.	Entry	Shoot fly Incidence (%)						Av.
		Niphad	Ludhiana	Dharwad	Kanpur	Kharibari	Durgapura	
I. NORTHERN HILL ZONE								
1	HS 542 (C)	3.33	9.62	17.73	8.33	1.00	13.66	8.95
2	HS 666	3.33	12.90	12.68	17.5	1.00	16.00	10.57
3	HS 665	1.66	11.43	12.09	10.00	1.00	12.33	8.09
4	VL 1015	3.33	12.44	18.95	15.00	2.00	10.66	10.40

Sr. No.	Entry	Shoot fly Incidence (%)						Av.
		Niphad	Ludhiana	Dharwad	Kanpur	Kharibari	Durgapura	
5	HPW 450	1.66	12.59	16.55	13.88	1.00	14.00	9.95
6	HS 664	5.00	15.19	20.00	16.66	2.00	11.33	11.70
7	HPW 451	3.33	8.11	16.90	12.50	1.00	13.00	9.14
8	VL 1016	3.33	15.45	23.16	26.66	1.00	15.33	14.16
9	UP 3016	3.33	8.50	19.59	12.50	2.00	12.33	9.71
10	VL 1014	5.00	20.93	20.83	16.66	1.00	11.66	12.68
11	VL 829 (C)	6.66	14.29	8.57	20.83	2.00	13.00	10.89
12	HPW 251 (C)	3.33	12.57	22.14	16.06	2.00	17.66	12.29
13	HPW 349 (C)	6.66	12.50	13.85	22.81	2.00	15.00	12.14
14	HS 634	5.00	18.45	15.71	12.50	1.00	16.33	11.50
15	VL 907 (C)	6.66	18.86	16.67	8.33	1.00	12.66	10.70
16	HS 507 (C)	3.33	16.28	11.79	15.00	1.00	11.33	9.79
17	HPW 441	5.00	16.05	16.61	6.66	1.00	15.33	10.11
18	HPW 442	3.33	15.79	16.86	13.88	1.00	12.66	10.59
19	HS 562 (C)	6.66	19.00	14.89	10.00	2.00	14.33	11.15
20	VL 3017	5.00	10.91	20.00	14.00	2.00	10.66	10.43
20A	SONALIKA (C)	13.33	22.35	16.36	16.00	2.00	-	14.01
20B	IWP 72 (C)	6.66	-	12.73	12.50	2.00	21.33	11.04
20C	A 9-30-1 (C)	6.66	-	15.79	8.33	2.00	-	8.20
20D	GW 173 (C)	5.00	-	20.54	13.33	2.00	-	10.22
21	UP 3017	6.66	18.26	24.90	5.26	1.00	14.66	11.79
22	VL 3016	5.00	12.07	22.00	13.88	1.00	17.33	11.88
23	HS 662	3.33	10.39	18.72	7.50	1.00	11.33	8.71
24	HS 490 (C)	6.66	6.06	17.42	16.66	1.00	10.66	9.74
25	VL 892 (C)	8.33	15.45	20.00	10.86	1.00	13	11.44
26	HS 661	8.33	7.76	12.28	13.33	1.00	10.33	8.84
27	HS 660	10.00	7.69	18.52	14.70	2.00	12.00	10.82
28	VL 3018	6.66	17.65	14.72	16.66	1.00	11.00	11.28
29	HPW 459	8.33	14.73	18.52	11.76	2.00	13.33	11.45
II. NORTH WESTERN PLAIN ZONE								
30	UP 2981	5.00	18.18	18.33	17.50	1.00	13.66	12.28
31	DBW 221	6.66	24.87	6.74	25.00	2.00	11.66	12.82
32	DPW 621-50 (C)	8.33	26.44	14.00	6.77	1.00	10.33	11.15
33	DBW 222	5.00	13.89	17.83	5.55	2.00	12.66	9.49
34	BRW 3792	6.66	20.71	21.88	3.33	1.00	11.00	10.76
35	PBW 763	11.66	15.79	6.98	9.09	1.00	14.33	9.81
36	PBW 766	10.00	12.76	11.79	4.54	1.00	11.33	8.57
37	HD 3086 (C)	6.66	15.57	15.17	5.76	1.00	13.00	9.53
38	DBW 233	5.00	13.66	18.87	5.88	1.00	12.00	9.40
39	HD 3226	5.00	16.19	18.87	8.33	2.00	13.66	10.68
40	HD 2967 (C)	5.00	18.30	10.40	5.55	1.00	15.33	9.26
40A	SONALIKA (C)	15.00	36.46	8.10	13.33	2.00	-	14.98
40B	IWP 72 (C)	5.00	-	15.00	5.00	1.00	22.33	9.67
40C	A 9-30-1 (C)	6.66	-	14.19	12.50	2.00	-	8.84
40D	GW 173 (C)	5.00	-	16.98	14.23	1.00	-	9.30
41	PBW 801	3.33	18.98	27.83	6.66	2.00	15.00	12.30
42	DBW 88 (C)	6.66	17.33	17.60	9.99	1.00	13.66	11.04
43	PBW 800	5.00	14.20	12.16	8.82	2.00	10.66	8.81
44	WH 1105	6.66	12.43	16.30	4.52	1.00	11.33	8.71
45	PBW 771	8.33	13.27	31.76	9.06	2.00	10.00	12.40
46	WH 1124 (C)	6.66	14.55	12.80	8.33	1.00	14.66	9.67

Sr. No.	Entry	Shoot fly Incidence (%)						Av.
		Niphad	Ludhiana	Dharwad	Kanpur	Kharibari	Durgapura	
47	DBW 90 (C)	11.66	17.50	12.31	5.55	2.00	13.00	10.34
48	HD 3059 (C)	13.33	13.75	12.92	2.94	1.00	12.00	9.32
49	WH 1021 (C)	10.00	16.17	12.86	12.5	2.00	15.33	11.48
50	PBW 752*	11.66	18.25	15.56	5.88	1.00	11.00	10.56
51	DBW 173 (I) (C)	8.33	16.79	10.32	8.33	2.00	10.66	9.41
52	PBW 773	10.00	19.61	11.82	9.99	1.00	13.66	11.01
53	DBW 237	6.66	23.64	8.47	6.66	2.00	12.33	9.96
54	WH 1142 (C)	3.33	20.77	10.32	8.92	1.00	10.00	9.06
55	BRW 3806	5.00	20.25	15.56	4.16	2.00	15.33	10.38
56	WH 1080 (C)	5.00	8.20	12.31	11.11	1.00	10.66	8.05
57	HD 3237*	6.66	21.37	8.62	7.14	2.00	12.33	9.69
58	HI 1620*	5.00	19.44	12.22	5.55	1.00	14.66	9.65
59	PBW 644 (C)	6.66	17.04	7.74	6.66	2.00	10.33	8.41
60	HD 3043 (C)	5.00	16.47	9.66	2.77	1.00	14.00	8.15
60A	SONALIKA (C)	13.33	26.70	15.76	13.33	2.00	-	14.22
60B	IWP 72 (C)	5.00	-	14.12	12.49	1.00	20.66	10.65
60C	A 9-30-1 (C)	6.66	-	10.63	11.11	2.00	-	7.60
60D	GW 173 (C)	5.00	-	12.50	13.33	1.00	-	7.96
61	DBW 252	6.66	25.00	14.52	11.17	2.00	11.66	11.84
62	HI 1628	6.66	21.82	14.67	11.11	1.00	14.33	11.60
63	NIAW 3170	5.00	19.35	22.11	2.94	2.00	12.00	10.57
III. NORTH EASTERN PLAIN ZONE								
64	DBW 233	8.33	14.19	23.59	2.77	1.00	10.66	10.09
65	HD 3249	3.33	16.91	12.09	2.94	2.00	12.00	8.21
66	HD 3254	6.66	22.97	17.86	8.92	1.00	11.33	11.46
67	K 1006 (C)	13.33	14.67	11.23	4.54	2.00	12.66	9.74
68	HD 2733 (C)	3.33	16.96	8.75	8.92	1.00	13.66	8.77
69	DBW 221	3.33	14.12	12.31	8.33	2.00	10.66	8.46
70	K 1601	6.66	18.04	20.69	3.33	1.00	14.33	10.68
71	PBW 769	5.00	21.09	18.18	12.49	1.00	15.33	12.18
72	DBW 39 (C)	6.66	18.36	11.67	10.71	1.00	16.33	10.79
73	HD 2967 (C)	8.33	23.81	25.16	3.84	1.00	11.33	12.25
74	K 0307 (C)	3.33	25.44	11.92	6.25	1.00	13.33	10.21
75	DBW 187	3.33	16.33	19.09	6.66	1.00	11.66	9.68
76	DBW 223	3.33	19.86	18.60	13.33	1.00	12.00	11.35
77	PBW 762	6.66	15.46	10.18	3.33	1.00	10.00	7.77
78	WH 1218	5.00	18.87	14.22	6.66	2.00	15.00	10.29
79	HD 2888 (C)	6.66	26.32	16.88	14.7	1.00	10.33	12.65
80	HI 1612 (I) (C)	6.66	18.18	15.83	5.55	1.00	11.66	9.81
80A	SONALIKA (C)	15.00	29.57	18.57	11.66	1.00	-	15.16
80B	IWP 72 (C)	5.00	-	22.86	11.76	1.00	22.33	12.59
80C	A 9-30-1 (C)	6.66	-	24.55	13.88	1.00	-	11.52
80D	GW 173 (C)	5.00	-	17.69	11.11	1.00	-	8.70
81	WH 1235	6.66	18.13	14.29	5.55	2.00	12.66	9.88
82	BRW 3806	6.66	13.58	25.29	3.57	1.00	10.66	10.13
83	K 1317 (C)	6.66	21.76	11.25	2.77	2.00	12.00	9.41
84	DBW 252	3.33	11.25	11.89	6.66	1.00	12.33	7.74
85	K 8027 (C)	3.33	9.04	23.75	5.55	1.00	13.66	9.39
86	HD 3171 (C)	5.00	14.78	21.33	8.33	1.00	11.33	10.30
87	HI 1628	6.66	10.53	21.90	5.55	1.00	11.00	9.44
IV. CENTRAL ZONE								

Sr. No.	Entry	Shoot fly Incidence (%)						Av.
		Niph ad	Ludhiana	Dharwad	Kanpur	Kharibari	Durgapura	
88	GW 1339 (d)	5.00	15.79	20.00	5.5	1.00	15.33	9.46
89	AKAW 4924	6.66	17.96	12.86	8.33	1.00	11.33	9.36
90	GW 322 (C)	3.33	20.11	11.91	4.16	1.00	14.33	8.10
91	HI 8713 (d) (C)	3.33	12.63	8.57	22.22	1.00	10.66	9.55
92	HI 8737 (d) (C)	5.00	21.34	7.56	8.33	2.00	11.00	8.85
93	HI 1544 (C)	3.33	13.54	9.09	10.83	1.00	12.00	7.56
94	GW 495	6.66	10.71	12.61	8.33	2.00	10.00	8.06
95	UAS 465 (d)	6.66	23.08	9.47	9.99	1.00	13.66	10.04
96	MPO 1343 (d)	5.00	16.85	6.15	5.55	2.00	15.33	7.11
97	DBW 110 (C)	6.66	25.23	15.52	6.66	1.00	10.66	11.01
98	DDW 47 (d)	5.00	17.65	7.45	13.33	2.00	12.66	9.09
99	MP 1331	6.66	20.77	20.00	14.28	1.00	14.33	12.54
100	MP 3288 (C)	13.33	20.88	14.58	13.33	2.00	11.66	12.82
100A	SONALIKA (C)	16.66	31.93	7.23	14.28	1.00	-	14.22
100B	IWP 72 (C)	6.66	-	13.02	13.33	2.00	21.66	8.75
100C	A 9-30-1 (C)	6.66	-	14.55	15.28	1.00	-	9.37
100D	GW 173 (C)	5.00	-	13.33	5.00	2.00	-	6.33
101	HI 8627 (d) (C)	13.33	14.58	10.95	6.81	1.00	14.66	9.33
102	UAS 466 (d)	13.33	18.87	6.55	8.33	2.00	16.66	9.82
103	NIAW 3170	13.33	14.58	5.53	9.09	2.00	12.33	8.91
V. PENINSULAR ZONE								
104	AKAW 4924	11.66	7.32	11.33	13.33	1.00	11.33	9.33
105	GW 491	13.33	14.71	13.51	11.11	1.00	15.66	11.55
106	GW 493	10.00	21.43	7.91	6.66	1.00	14.66	10.28
107	DBW 235	11.66	8.44	9.09	11.11	1.00	11.33	8.77
108	HI 1624	13.33	11.54	12.78	15.00	1.00	10.66	10.72
109	MACS 6222 (C)	13.33	15.92	11.92	11.11	1.00	12.00	10.88
110	DBW 168 (I) (C)	11.66	17.54	11.82	11.11	1.00	14.00	11.19
111	GW 495	13.33	20.19	15.71	7.89	1.00	9.00	11.19
112	MP 1338	11.66	12.77	12.83	5.55	1.00	10.66	9.08
113	MACS 3949 (d)	10.00	18.11	7.80	13.33	1.00	12.33	10.43
114	HI 8800 (d)	8.33	15.85	5.41	13.33	1.00	9.00	8.82
115	MACS 6478 (C)	6.66	15.75	11.35	12.50	1.00	10.33	9.60
116	MACS 6709	6.66	20.00	11.64	12.50	1.00	16.00	11.30
117	HI 1625	6.66	18.40	7.00	8.33	1.00	12.33	8.95
118	UAS 428 (d) (C)	6.66	16.18	9.62	5.55	2.00	15.33	9.22
119	PBW 770	5.00	17.03	9.09	16.65	2.00	16.66	11.07
120	GW 492	6.66	10.37	8.20	10.00	2.00	12.33	8.26
120A	SONALIKA (C)	16.66	33.87	8.79	16.00	1.00	-	15.26
120B	IWP 72 (C)	6.66	-	4.38	16.66	2.00	22.33	10.41
120C	A 9-30-1 (C)	8.33	-	10.83	13.88	1.00	-	8.51
120D	GW 173 (C)	5.00	-	13.49	13.88	2.00	-	8.59
121	GW 1346 (d)	13.33	12.03	10.63	6.81	1.00	14.33	9.69
122	HI 1605 (C)	13.33	9.74	13.62	8.33	2.00	12.33	9.89
123	AKDW 2997-16 (d)	13.33	16.10	15.20	7.50	1.00	13.33	11.08
124	MPO 1336 (d)	10.00	14.17	1.50	8.33	2.00	10.33	7.72
125	UAS 446 (d) (c)	10.00	12.99	5.81	6.66	1.00	15.66	8.69
126	HI 8805 (d)	8.33	12.00	8.00	5.00	2.00	11.00	7.72
127	MACS 4058 (d)	8.33	11.63	8.40	8.33	1.00	13.00	8.45
128	MACS 6696	10.00	14.39	5.00	9.09	2.00	10.00	8.41

Sr. No.	Entry	Shoot fly Incidence (%)						Av.
		Niph ad	Ludhiana	Dharwad	Kanpur	Kharibari	Durgapura	
129	MACS 4059 (d)	10.00	11.90	5.60	13.33	1.00	16.33	9.69
130	NIAW 3170	8.33	7.41	10.77	10.00	0.00	13.66	8.36
131	DBW 93 (c)	10.00	20.93	7.14	13.33	0.00	11.66	10.51
132	MACS 6695	6.66	10.29	6.67	9.99	0.00	10.33	7.32
133	HI 8802 (d)	8.33	21.21	8.67	12.49	0.00	12.00	10.45
VI. SPECIAL TRIAL (Dicoceum)								
134	DDK 1029 (C)	13.33	10.81	29.47	10.00	0.00	11.00	12.44
135	MACS 6222 (Ae.) (C)	8.33	3.28	11.80	14.28	0.00	13.33	8.50
136	MACS 5051	8.33	12.07	22.50	10.00	0.00	15.66	11.43
137	HW 4101	10.00	9.76	11.85	10.00	0.00	10.33	8.66
138	DDK 1054	8.33	17.39	12.78	5.55	1.00	12.00	9.51
139	HW 1098 (C)	10.00	17.31	4.83	9.99	2.00	10.00	9.02
VII. SPECIAL TRIAL- Very Late Sown								
140	VLS-101	13.33	12.96	8.10	12.5	1.00	10.66	9.76
140A	SONALIKA (C)	15.00	30.95	2.86	9.99	1.00	-	11.96
140B	IWP 72 (C)	6.66	-	5.66	11.11	1.00	21.66	9.22
140C	A 9-30-1 (C)	6.66	-	5.60	8.33	1.00	-	5.40
140D	GW 173 (C)	5.00	-	4.85	7.50	1.00	-	4.59
141	HD 3271	8.33	13.07	4.71	8.33	1.00	14.00	8.24
142	DBW 71 (C)	6.66	23.26	5.37	8.30	1.00	12.33	9.49
143	PBW 797	16.67	26.67	6.34	6.25	1.00	11.33	11.38
144	PBW 757	13.33	22.73	2.86	4.16	1.00	10.33	9.07
145	DBW 278	10.00	27.27	2.07	2.77	1.00	15.66	9.80
146	HI 1621	10.00	26.19	10.30	4.16	2.00	14.00	11.11
147	DBW 14 (C)	11.66	23.68	7.89	8.33	1.00	13.00	10.93
148	PBW 777	16.67	28.57	9.06	3.33	2.00	10.66	11.72
149	HD 3298	11.66	22.73	13.04	22.20	1.00	11.33	13.66

Table A1-11.1b: Screening of AVT lines against brown wheat mite (Year-2017-18) (Centre:Ludhiana)

Sr. No.	Entry	No. of mites/10 cm² area	Sr. No	Entry	No. of mites/10 cm² area	Sr. No	Entry	No. of mites/10 cm² area
1	HS 542 (C)	18	51	DBW 173 (I)(C)	25	100A	IWP 72 (C)	50
2	HS 666	25	52	PBW 773	30	101	CZ-RI-305	30
3	HS 665	10	53	DBW 237	20	102	CZ-RI-306	18
4	VL 1015	25	54	WH 1142 (C)	60	103	CZ-RI-307	30
5	HPW 450	12	55	BRW 3806	68	104	PZ-TS-101	15
6	HS 664	12	56	WH 1080 (C)	40	105	PZ-TS-102	30
7	HPW 451	20	57	HD 3237*	10	106	PZ-TS-103	22
8	VL 1016	20	58	HI 1620*	35	107	PZ-TS-104	30
9	UP 3016	25	59	PBW 644 (C)	30	108	PZ-TS-105	17
10	VL 1014	17	60	HD 3043 (C)	40	109	PZ-TS-106	40
11	VL 829 (C)	35	60A	IWP 72 (C)	50	110	PZ-TS-107	15
12	HPW 251 (C)	30	61	DBW 252	35	111	PZ-TS-108	20
13	HPW 349 (C)	28	62	HI 1628	50	112	PZ-TS-109	15
14	HS 634	30	63	NIAW 3170	28	113	PZ-TS-110	15
15	VL 907 (C)	10	64	DBW 233	15	114	PZ-TS-111	10
16	HS 507 (C)	17	65	HD 3249	35	115	PZ-TS-112	17
17	HPW 441	24	66	HD 3254	55	116	PZ-TS-113	8
18	HPW 442	12	67	K 1006 (C)	50	117	PZ-TS-114	15
19	HS 562 (C)	25	68	HD 2733 (C)	45	118	PZ-TS-115	10

Sr. No.	Entry	No. of mites/10 cm² area	Sr. No	Entry	No. of mites/10 cm² area	Sr. No	Entry	No. of mites/10 cm² area
20	VL 3017	12	69	DBW 221	12	119	PZ-TS-116	15
20A	IWP 72 (C)	35	70	K 1601	35	120	PZ-TS-117	25
21	UP 3017	24	71	PBW 769	40	120A	IWP 72 (C)	35
22	VL 3016	15	72	DBW 39 (C)	40	121	PZ-RI-301	20
23	HS 662	30	73	HD 2967 (C)	25	122	PZ-RI-302	20
24	HS 490 (C)	35	74	K 0307 (C)	45	123	PZ-RI-303	35
25	VL 892 (C)	45	75	DBW 187	35	124	MPO 1336 (d)	28
26	HS 661	35	76	DBW 223	28	125	UAS 446 (d)	40
27	HS 660	17	77	PBW 762	54	126	HI 8805 (d)	30
28	VL 3018	50	78	WH 1218	30	127	MACS 4058	20
29	HPW 459	45	79	HD 2888 (C)	25	128	MACS 6696	35
30	UP 2981	60	80	HI 1612 (I) (C)	22	129	MACS 4059	20
31	DBW 221	60	80A	IWP 72 (C)	45	130	NIAW 3170	35
32	DPW 621-50 (C)	12	81	WH 1235	20	131	DBW 93 (c)	40
33	DBW 222	40	82	BRW 3806	15	132	MACS 6695	35
34	BRW 3792	67	83	K 1317 (C)	40	133	HI 8802 (d)	15
35	PBW 763	60	84	DBW 252	20	134	DDK 1029 (C)	50
36	PBW 766	40	85	K 8027 (C)	40	135	MACS 6222	32
37	HD 3086 (C)	22	86	HD 3171 (C)	60	136	MACS 5051	25
38	DBW 233	30	87	HI 1628	60	137	HW 4101	40
39	HD 3226	40	88	GW 1339 (d)	45	138	DDK 1054	20
40	HD 2967 (C)	35	89	AKAW 4924	35	139	HW 1098 (C)	15
40A	IWP 72 (C)	57	90	GW 322 (C)	40	140	VLS-101	10
41	PBW 801	55	91	HI 8713 (d)	40	140A	IWP 72 (C)	45
42	DBW 88 (C)	20	92	HI 8737 (d)	60	141	HD 3271	20
43	PBW 800	55	93	HI 1544 (C)	30	142	DBW 71 (C)	45
44	WH 1105	30	94	GW 495	35	143	PBW 797	28
45	PBW 771	30	95	UAS 465 (d)	15	144	PBW 757	35
46	WH 1124 (C)	30	96	MPO 1343	12	145	DBW 278	14
47	DBW 90 (C)	12	97	DBW 110	20	146	HI 1621	35
48	HD 3059 (C)	22	98	DDW 47 (d)	35	147	DBW 14 (C)	50
49	WH 1021 (C)	60	99	MP 1331	30	148	PBW 777	30
50	PBW 752*	25	100	MP 3288 (C)	30	149	HD 3298	25

Table A1-11.1c: Screening of AVT lines against foliar wheat aphids (Year-2017-18)

S.No.	Entry	Foliar aphid score (1-5 scale)					Average score	Maximum Score	Root aphid (No./plant) Ludhiana Centre only
		Ludhiana	Karnal	Kharibari	Shillongani	Niphad			
I. NORTHERN HILL ZONE									
1	HS 542 (C)	4	4	4	5	4	4.25	5	5
2	HS 666	4	4	5	5	4	4.50	5	4
3	HS 665	4	4	5	4	4	4.25	5	4
4	VL 1015	4	4	5	5	4	4.50	5	5
5	HPW 450	4	4	4	4	4	4.00	4	4
6	HS 664	4	4	5	4	4	4.25	5	5
7	HPW 451	4	4	3	5	4	4.00	5	4
8	VL 1016	4	4	5	4	4	4.25	5	5

9	UP 3016	4	4	4	5	4	4.25	5	4
10	VL 1014	4	4	3	5	5	4.00	5	5
11	VL 829 (C)	5	5	4	4	5	4.50	5	4
12	HPW 251 (C)	4	4	5	4	5	4.25	5	5
13	HPW 349 (C)	5	5	3	5	5	4.50	5	4
14	HS 634	4	4	4	4	5	4.00	4	5
15	VL 907 (C)	5	5	5	5	5	5.00	5	4
16	HS 507 (C)	5	5	3	5	4	4.50	5	4
17	HPW 441	4	4	4	4	5	4.00	4	4
18	HPW 442	4	4	3	5	5	4.00	5	5
19	HS 562 (C)	5	5	3	4	5	4.25	5	5
20	VL 3017	5	5	4	5	5	4.75	5	5
20A	SONALIKA (C) FOR SF	x	5	5	3	5	x	5	x
20B	IWP 72 (C) FOR BWM	5	4	3	3	5	3.75	5	x
20C	A 9-30-1 (C) FOR FA	x	5	4	3	5	x	5	x
20D	GW 173 (C) FOR RA	x	5	5	3	5	x	5	5
21	UP 3017	4	4	5	4	5	4.25	5	3
22	VL 3016	4	4	4	3	5	3.75	4	4
23	HS 662	3	3	4	4	4	3.50	4	4
24	HS 490 (C)	4	4	5	5	4	4.50	5	5
25	VL 892 (C)	4	4	4	4	5	4.00	4	5
26	HS 661	4	4	5	4	5	4.25	5	4
27	HS 660	4	4	4	4	5	4.00	4	5
28	VL 3018	3	3	5	4	5	3.75	5	4
29	HPW 459	4	4	5	4	5	4.25	5	4
II. NORTH WESTERN PLAIN ZONE									
30	UP 2981	4	4	5	4	5	4.25	5	5
31	DBW 221	5	5	5	5	5	5.00	5	5
32	DPW 621-50 (C)	4	4	5	4	5	4.25	5	5
33	DBW 222	3	3	5	2	5	3.25	5	5
34	BRW 3792	4	4	5	4	5	4.25	5	5
35	PBW 763	5	5	5	5	5	5.00	5	5
36	PBW 766	4	4	4	5	5	4.25	5	4
37	HD 3086 (C)	4	4	4	4	5	4.00	4	4
38	DBW 233	4	4	4	4	5	4.00	4	4
39	HD 3226	4	4	5	5	5	4.50	5	4
40	HD 2967 (C)	3	3	5	4	5	4.00	5	4
40A	SONALIKA (C) FOR SF	x	x	5	3	5	4.33	5	x
40B	IWP 72 (C) FOR BWM	5	5	5	3	5	4.60	5	x
40C	A 9-30-1 (C) FOR FA	x	x	5	3	5	x	5	x
40D	GW 173 (C) FOR RA	x	x	5	4	5	x	5	5
41	PBW 801	4	4	5	5	5	4.50	5	4
42	DBW 88 (C)	4	4	5	4	5	4.25	5	5
43	PBW 800	4	4	4	5	5	4.25	5	4
44	WH 1105	4	4	4	5	5	4.25	5	4
45	PBW 771	4	4	3	4	5	3.75	4	5
46	WH 1124 (C)	4	4	3	3	5	3.50	4	4
47	DBW 90 (C)	4	4	3	5	5	4.00	5	4
48	HD 3059 (C)	4	4	4	4	5	4.00	4	4

49	WH 1021 (C)	4	4	3	5	5	4.00	5	5
50	PBW 752*	4	4	4	4	5	4.00	4	4
51	DBW 173 (I) (C)	4	4	3	5	5	4.00	5	5
52	PBW 773	4	4	4	5	5	4.25	5	5
53	DBW 237	4	4	3	4	5	3.75	4	4
54	WH 1142 (C)	4	4	4	2	4	3.50	4	4
55	BRW 3806	4	4	3	4	5	3.75	4	4
56	WH 1080 (C)	4	4	4	4	5	4.00	4	5
57	HD 3237*	4	4	4	5	5	4.25	5	3
58	HI 1620*	4	4	4	4	5	4.00	4	4
59	PBW 644 (C)	4	4	4	5	5	4.25	5	5
60	HD 3043 (C)	4	4	4	4	5	4.00	4	5
60A	SONALIKA (C) FOR SF	x	x	4	3	5	3.50	4	x
60B	IWP 72 (C) FOR BWM	5	5	4	3	5	4.25	5	x
60C	A 9-30-1 (C) FOR FA	x	x	4	4	5	4.00	4	x
60D	GW 173 (C) FOR RA	x	x	3	3	5	3.00	3	5
61	DBW 252	4	4	4	4	5	4.00	4	4
62	HI 1628	5	5	5	5	5	5.00	5	4
63	NIAW 3170	5	5	5	5	5	5.00	5	5
III. NORTH EASTERN PLAIN ZONE									
64	DBW 233	4	4	5	4	5	4.25	5	4
65	HD 3249	4	4	5	5	5	4.50	5	4
66	HD 3254	4	4	5	4	5	4.25	5	4
67	K 1006 (C)	5	5	5	5	5	5.00	5	5
68	HD 2733 (C)	4	4	5	5	4	4.50	5	4
69	DBW 221	5	5	5	5	4	5.00	5	5
70	K 1601	5	5	5	5	5	5.00	5	4
71	PBW 769	5	5	5	5	5	5.00	5	4
72	DBW 39 (C)	4	4	5	5	5	4.50	5	5
73	HD 2967 (C)	5	5	5	5	5	5.00	5	4
74	K 0307 (C)	4	4	5	4	4	4.25	5	4
75	DBW 187	5	5	5	4	4	4.75	5	5
76	DBW 223	4	4	5	5	4	4.50	5	4
77	PBW 762	5	5	5	4	5	4.75	5	5
78	WH 1218	5	5	5	4	5	4.75	5	4
79	HD 2888 (C)	4	4	5	5	5	4.50	5	5
80	HI 1612 (I) (C)	4	4	5	5	5	4.50	5	4
80A	SONALIKA (C) FOR SF	x	x	5	3	5	4.00	5	x
80B	IWP 72 (C) FOR BWM	5	5	5	3	5	4.50	5	x
80C	A 9-30-1 (C) FOR FA	x	x	5	3	5	4.00	5	x
80D	GW 173 (C) FOR RA	x	x	5	3	5	4.00	5	5
81	WH 1235	4	4	5	5	5	4.50	5	5
82	BRW 3806	5	5	5	4	5	4.75	5	4
83	K 1317 (C)	5	5	5	5	5	5.00	5	4
84	DBW 252	4	4	5	4	4	4.25	5	5
85	K 8027 (C)	4	4	5	5	4	4.50	5	4
86	HD 3171 (C)	4	4	5		4	4.33	5	5
87	HI 1628	4	4	4	5	5	4.25	5	5
IV. CENTRAL ZONE									

88	GW 1339 (d)	5	5	3	4	5	4.25	5	5
89	AKAW 4924	4	4	4	5	5	4.25	5	4
90	GW 322 (C)	4	4	4	4	4	4.00	4	4
91	HI 8713 (d) (C)	4	4	4	4	4	4.00	4	4
92	HI 8737 (d) (C)	4	4	4	5	5	4.25	5	4
93	HI 1544 (C)	4	4	5	4	5	4.25	5	5
94	GW 495	4	4	5	4	5	4.25	5	5
95	UAS 465 (d)	3	3	5	4	5	3.75	5	5
96	MPO 1343 (d)	4	4	5	4	5	4.25	5	5
97	DBW 110 (C)	4	4	5	5	5	4.50	5	4
98	DDW 47 (d)	4	4	5	4	5	4.25	5	5
99	MP 1331	5	5	5	4	5	4.75	5	5
100	MP 3288 (C)	4	4	5	5	5	4.50	5	5
100A	SONALIKA (C) FOR SF	x	x	5	4	5	4.50	5	x
100B	IWP 72 (C) FOR BWM	5	5	5	3	5	4.50	5	x
100C	A 9-30-1 (C) FOR FA	x	x	5	4	5	4.50	5	x
100D	GW 173 (C) FOR RA	x	x	5	3	5	4.00	5	5
101	HI 8627 (d) (C)	5	5	5	5	5	5.00	5	4
102	UAS 466 (d)	4	4	5	5	5	4.50	5	4
103	NIAW 3170	5	5	5	5	5	5.00	5	5
V. PENINSULAR ZONE									
104	AKAW 4924	4	4	5	4	5	4.25	5	5
105	GW 491	4	4	5	5	5	4.50	5	5
106	GW 493	4	4	5	4	5	4.25	5	4
107	DBW 235	5	5	5	5	5	5.00	5	5
108	HI 1624	4	4	5	5	5	4.50	5	4
109	MACS 6222 (C)	4	4	5	4	5	4.25	5	4
110	DBW 168 (I) (C)	5	5	5	5	5	5.00	5	5
111	GW 495	5	5	5	4	5	4.75	5	4
112	MP 1338	5	5	5	4	5	4.75	5	4
113	MACS 3949 (d) (C)	5	5	5	5	5	5.00	5	5
114	HI 8800 (d)	4	4	5	4	5	4.25	5	4
115	MACS 6478 (C)	4	4	5	4	5	4.25	5	4
116	MACS 6709	4	4	5	5	5	4.50	5	4
117	HI 1625	5	5	5	5	5	5.00	5	4
118	UAS 428 (d) (C)	5	5	5	4	5	4.75	5	5
119	PBW 770	5	5	5		5	5.00	5	5
120	GW 492	4	4	5	5	5	4.50	5	5
120A	SONALIKA (C) FOR SF	x	x	5	3	5	x	5	x
120B	IWP 72 (C) FOR BWM	5	5	5	3	5	4.50	5	x
120C	A 9-30-1 (C) FOR FA	x	x	5	3	5	x	5	x
120D	GW 173 (C) FOR RA	x	x	5	3	5	x	5	5
121	GW 1346 (d)	5	5	5	5	5	5.00	5	4
122	HI 1605 (C)	4	4	5	4	5	4.25	5	4
123	AKDW 2997-16 (d) (C)	5	5	5	4	5	4.75	5	4
124	MPO 1336 (d)	4	4	5	3	5	4.00	5	4
125	UAS 446 (d) (c)	4	4	5	3	5	4.00	5	4
126	HI 8805 (d)	4	4	5	5	5	4.50	5	4
127	MACS 4058 (d)	5	5	5	4	5	4.75	5	4

128	MACS 6696	5	5	5	5	5	5.00	5	4
129	MACS 4059 (d)	4	4	5	3	5	4.00	5	5
130	NIAW 3170	4	4	5	4	5	4.25	5	4
131	DBW 93 (c)	5	5	5	4	5	4.75	5	4
132	MACS 6695	4	4	5	5	5	4.50	5	5
133	HI 8802 (d)	5	5	5	4	5	4.75	5	4
VI. SPECIAL TRIAL (Dicoceum)									
134	DDK 1029 (C)	5	5	5	5	5	5.00	5	5
135	MACS 6222 (Ae.) (C)	5	5	5	4	5	4.75	5	5
136	MACS 5051	4	4	5	4	5	4.25	5	4
137	HW 4101	5	5	5	5	5	5.00	5	5
138	DDK 1054	4	4	5	5	5	4.50	5	5
139	HW 1098 (C)	4	4	5	3	5	4.00	5	5
VII. SPECIAL TRIAL- Very Late Sown									
140	WR 544 (C)	4	4	5	5	5	4.50	5	4
140A	SONALIKA (C) FOR SF	x	x	5	3	5	x	5	x
140B	IWP 72 (C) FOR BWM	5	5	5	3	5	4.50	5	x
140C	A 9-30-1 (C) FOR FA	x	x	5	4	5	x	5	x
140D	GW 173 (C) FOR RA	x	x	5	3	5	x	5	5
141	HD 3271	5	5	5	5	5	5.00	5	4
142	DBW 71 (C)	4	4	5	4	5	4.25	5	4
143	PBW 797	5	5	5	3	5	4.50	5	4
144	PBW 757	5	5	5	5	5	5.00	5	5
145	DBW 278	4	4	5	4	5	4.25	5	5
146	HI 1621	4	4	5	4	5	4.25	5	5
147	DBW 14 (C)	5	5	5	4	5	4.75	5	4
148	PBW 777	5	5	5	4	5	4.75	5	4
149	HD 3298	4	4	5	5	5	4.50	5	4

Table A1-11.1d: Screening of NIVT lines against foliar wheat aphids (Year-2017-18)

S.No.	Entry	Foliar aphid score (1-5 scale)				
		Ludhiana	Karnal	Niphad	Av. score	Maximum Score
NIVT-1A						
1	WH 1240	5	5	5	5.00	5
2	PBW 782	4	4	5	4.33	5
3	RAJ 4528	5	5	5	5.00	5
4	PBW 783	4	4	5	4.33	5
5	UP 3002	5	5	5	5.00	5
6	HD 3279	5	5	5	5.00	5
7	UP 3003	5	5	5	5.00	5
8	K 1701	5	5	5	5.00	5
9	UP 3004	5	5	5	5.00	5
10	DBW 257	5	5	5	5.00	5
11	RAJ 4527	5	5	5	5.00	5
12	WH 1239	4	4	5	4.33	5
13	DBW 88 (C)	4	4	5	4.33	5
14	PBW 781	4	4	5	4.33	5

S.No.	Entry	Foliar aphid score (1-5 scale)				
		Ludhiana	Karnal	Niphad	Av. score	Maximum Score
15	HUW 826	4	4	5	4.33	5
16	DBW 253	4	4	5	4.33	5
17	RAJ 4529	4	4	5	4.33	5
18	PBW 784	4	4	5	4.33	5
19	HD 3280	4	4	5	4.33	5
20	HD 3086 (C)	4	4	5	4.33	5
20A	SONALIKA (C)	x	x	5	5.00	5
20B	IWP 72 (C)	x	x	5	5.00	5
20C	A 9-30-1 (C	5	5	5	5.00	5
20D	GW 173 (C)	x	x	5	5.00	5
21	HD 3281	4	4	5	4.33	5
22	K 1702	4	4	5	4.33	5
23	DBW 254	5	5	5	5.00	5
24	HD 3277	5	5	5	5.00	5
25	DBW 255	5	5	5	5.00	5
26	HD 3278	4	4	5	4.33	5
27	WH 1237	4	4	5	4.33	5
28	NW 7041	4	4	5	4.33	5
29	DBW 256	4	4	5	4.33	5
30	K 1006 (C)	4	4	5	4.33	5
31	WH 1238	4	4	5	4.33	5
32	UP 3001	4	4	5	4.33	5
33	NW 7037	4	4	5	4.33	5
34	PBW 785	4	4	5	4.33	5
35	HD 2967 (C)	4	4	5	4.33	5
36	HD 3276	4	4	5	4.33	5
NIVT-1B						
37	PBW 787	4	4	5	4.33	5
38	HD 3286	5	5	5	5.00	5
39	PBW 786	4	4	5	4.33	5
40	HD 3285	4	4	5	4.33	5
40A	SONALIKA (C)	x	x	5	5.00	5
40B	IWP 72 (C)	x	x	5	5.00	5
40C	A 9-30-1 (C	5	5	5	5.00	5
40D	GW 173 (C)	x	x	5	5.00	5
41	DBW 259	4	4	5	4.33	5
42	K 1703	4	4	5	4.33	5
43	PBW 788	4	4	5	4.33	5
44	K 1006 (C)	4	4	5	4.33	5
45	K 1704	4	4	5	4.33	5
46	UP 3005	5	5	5	5.00	5
47	HD 3282	4	4	5	4.33	5
48	WH 1243	4	4	5	4.33	5
49	NW 7028	4	4	5	4.33	5
50	HUW 828	4	4	5	4.33	5
51	HUW 827	4	4	5	4.33	5

S.No.	Entry	Foliar aphid score (1-5 scale)				
		Ludhiana	Karnal	Niphad	Av. score	Maximum Score
52	DBW 258	4	4	5	4.33	5
53	HD 2967 (C)	4	4	5	4.33	5
54	UP 3006	4	4	5	4.33	5
55	UP 3007	5	5	5	5.00	5
56	BRW 3814	4	4	5	4.33	5
57	DBW 260	4	4	5	4.33	5
58	WH 1242	4	4	5	4.33	5
59	K 1705	4	4	5	4.33	5
60	HUW 829	5	5	5	5.00	5
60A	SONALIKA (C)	x	x	5	5.00	5
60B	IWP 72 (C)	x	x	5	5.00	5
60C	A 9-30-1 (C	5	5	5	5.00	5
60D	GW 173 (C)	x	x	5	5.00	5
61	HD 3086 (C)	4	4	5	4.33	5
62	WH 1241	4	4	5	4.33	5
63	DBW 261	5	5	5	5.00	5
64	HD 3283	4	4	5	4.33	5
65	HD 3284	5	5	5	5.00	5
66	NW 7047	5	5	5	5.00	5
67	RAJ 4531	5	5	5	5.00	5
68	DBW 262	5	5	5	5.00	5
69	RAJ 4536	5	5	5	5.00	5
70	DBW 88 (C)	5	5	5	5.00	5
71	RAJ 4530	5	5	5	5.00	5
72	NW 7049	5	5	5	5.00	5
NIVT-2						
73	NIAW 3390	5	5	5	5.00	5
74	GW 322 (C)	5	5	5	5.00	5
75	GW 508	4	4	5	4.33	5
76	HP 1968	5	5	5	5.00	5
77	PBW 789	4	4	5	4.33	5
78	MACS 6727	4	4	5	4.33	5
79	GW 505	4	4	5	4.33	5
80	MACS 6222 (C)	5	5	5	5.00	5
80A	SONALIKA (C)	x	x	5	5.00	5
80B	IWP 72 (C)	x	x	5	5.00	5
80C	A 9-30-1 (C	5	5	5	5.00	5
80D	GW 173 (C)	x	x	5	5.00	5
81	MACS 6478 (C)	4	4	5	4.33	5
82	MACS 6729	4	4	5	4.33	5
83	WH 1244	4	4	5	4.33	5
84	HI 1544 (C)	5	5	5	5.00	5
85	CG 1028	4	4	5	4.33	5
86	MP 1350	4	4	4	4.00	4
87	GW 506	4	4	5	4.33	5
88	AKAW 5077	4	4	5	4.33	5

S.No.	Entry	Foliar aphid score (1-5 scale)				
		Ludhiana	Karnal	Niphad	Av. score	Maximum Score
89	DBW 263	4	4	5	4.33	5
90	RAJ 4532	4	4	5	4.33	5
91	HI 1632	5	5	5	5.00	5
92	UAS 398	5	5	5	5.00	5
93	MP 1348	5	5	5	5.00	5
94	MP 1349	4	4	5	4.33	5
95	AKAW 5078	4	4	5	4.33	5
96	MACS 6722	5	5	5	5.00	5
97	NIAW 3270	5	5	5	5.00	5
98	UP 3008	4	4	5	4.33	5
99	HI 1631	4	4	5	4.33	5
100	UAS 3001	4	4	5	4.33	5
100A	SONALIKA (C)	x	x	5	5.00	5
100B	IWP 72 (C)	x	x	5	5.00	5
100C	A 9-30-1 (C	5	5	5	5.00	5
100D	GW 173 (C)	x	x	5	5.00	5
101	DBW 264	5	5	4	4.67	5
102	MP 3493	4	4	5	4.33	5
103	GW 507	4	4	5	4.33	5
104	UAS 399	5	5	5	5.00	5
105	HI 1629	4	4	5	4.33	5
106	HI 1630	4	4	5	4.33	5
107	JW 5154	5	5	5	5.00	5
108	MP 3495	5	5	5	5.00	5
NIVT-3A						
109	RAJ 4535	4	4	5	4.33	5
110	WH 1247	5	5	5	5.00	5
111	HI 1563 (C)	4	4	5	4.33	5
112	DBW 90 (C)	4	4	5	4.33	5
113	WH 1248	4	4	5	4.33	5
114	HD 3290	4	4	5	4.33	5
115	NW 7033	5	5	5	5.00	5
116	PBW 793	4	4	5	4.33	5
117	HD 3291	4	4	5	4.33	5
118	PBW 792	5	5	5	5.00	5
119	K 1707	5	5	5	5.00	5
120	DBW 267	5	5	5	5.00	5
120A	SONALIKA (C)	x	x	5	5.00	5
120B	IWP 72 (C)	x	x	5	5.00	5
120C	A 9-30-1 (C	5	5	5	5.00	5
120D	GW 173 (C)	x	x	5	5.00	5
121	UP 3010	5	5	5	5.00	5
122	PBW 790	5	5	5	5.00	5
123	HP 1969	4	4	5	4.33	5
124	UP 3011	5	5	5	5.00	5
125	HUW 830	4	4	5	4.33	5

S.No.	Entry	Foliar aphid score (1-5 scale)				
		Ludhiana	Karnal	Niphad	Av. score	Maximum Score
126	PBW 791	5	5	5	5.00	5
127	DBW 107 (C)	4	4	5	4.33	5
128	HD 3288	4	4	5	4.33	5
129	DBW 269	4	4	5	4.33	5
130	K 1708	4	4	5	4.33	5
131	PBW 799	4	4	5	4.33	5
132	HD 3059 (C)	5	5	5	5.00	5
133	DBW 265	5	5	5	5.00	5
134	DBW 266	4	4	5	4.33	5
135	RAJ 4534	5	5	5	5.00	5
136	WH 1245	4	4	5	4.33	5
137	NW 7034	5	5	5	5.00	5
138	WH 1246	4	4	5	4.33	5
139	DBW 268	4	4	5	4.33	5
140	HD 3289	4	4	5	4.33	5
140A	SONALIKA (C)	x	x	5	5.00	5
140B	IWP 72 (C)	x	x	5	5.00	5
140C	A 9-30-1 (C	5	5	5	5.00	5
140D	GW 173 (C)	x	x	5	5.00	5
141	HD 3287	5	5	5	5.00	5
142	HUW 831	4	4	5	4.33	5
143	RAJ 4533	4	4	5	4.33	5
144	UP 3009	4	4	5	4.33	5
NIVT-3B						
145	GW 510	4	4	5	4.33	5
146	NIAW 3523	4	4	5	4.33	5
147	MP 3503	5	5	5	5.00	5
148	GW 511	4	4	5	4.33	5
149	MACS 6732	5	5	5	5.00	5
150	PBW 794	5	5	5	5.00	5
151	MP 1352	5	5	5	5.00	5
152	HI 1633	5	5	5	5.00	5
153	NIAW 3354	5	5	4	4.67	5
154	MP 3497	5	5	5	5.00	5
155	UAS 3002	5	5	5	5.00	5
156	MP 1351	5	5	5	5.00	5
157	GW 509	3	3	5	3.67	5
158	AKAW 5023	4	4	5	4.33	5
159	HD 2932 (C)	5	5	4	4.67	5
160	HI 1634	5	5	5	5.00	5
160A	SONALIKA (C)	x	x	5	5.00	5
160B	IWP 72 (C)	x	x	5	5.00	5
160C	A 9-30-1 (C	5	5	5	5.00	5
160D	GW 173 (C)	x	x	5	5.00	5
161	DBW 270	4	4	5	4.33	5
162	HD 2864 (C)	5	5	5	5.00	5

S.No.	Entry	Foliar aphid score (1-5 scale)				
		Ludhiana	Karnal	Niphad	Av. score	Maximum Score
163	HI 8807	4	4	5	4.33	5
164	MACS 6726	5	5	5	5.00	5
165	HI 8808	4	4	5	4.33	5
166	DBW 271	5	5	5	5.00	5
167	NIAW 3525	4	4	5	4.33	5
168	HD 3300	4	4	5	4.33	5
169	CG 1029	4	4	5	4.33	5
NIVT-4						
170	DDW 48	4	4	5	4.33	5
171	HI 8813	4	4	5	4.33	5
172	HI 8737 (C)	4	4	5	4.33	5
173	MACS 4085	5	5	5	5.00	5
174	MPO 1355	4	4	5	4.33	5
175	HI 8812	5	5	5	5.00	5
176	HI 8811	4	4	5	4.33	5
177	HI 8810	4	4	5	4.33	5
178	AKDW 5079	4	4	5	4.33	5
179	HI 8809	4	4	5	4.33	5
180	WHD 963	4	4	5	4.33	5
180A	SONALIKA (C)	x	x	5	5.00	5
180B	IWP 72 (C)	x	x	5	5.00	5
180C	A 9-30-1 (C	5	5	5	5.00	5
180D	GW 173 (C)	x	x	5	5.00	5
181	RKD 331	3	3	5	3.67	5
182	MACS 4083	5	5	5	5.00	5
183	GW 1348	5	5	5	5.00	5
184	NIDW 1171	5	5	5	5.00	5
185	UAS 468	5	5	5	5.00	5
186	MPO 1353	4	4	5	4.33	5
187	MPO 1354	4	4	5	4.33	5
188	UAS 469	4	4	5	4.33	5
189	PDW 355	3	3	5	3.67	5
190	HI 8713 (C)	4	4	5	4.33	5
191	DDW 49	4	4	5	4.33	5
192	NIDW 1158	4	4	5	4.33	5
193	MACS 3949 (C)	4	4	5	4.33	5
194	GW 1349	4	4	5	4.33	5
NIVT-5A						
195	UP 3012	4	4	5	4.33	5
196	PBW 644 (C)	4	4	5	4.33	5
197	WH 1250	4	4	5	4.33	5
198	K 1710	4	4	5	4.33	5
199	DBW 274	4	4	5	4.33	5
200	HD 3295	5	5	5	5.00	5
200A	SONALIKA (C)	x	x	5	5.00	5
200B	IWP 72 (C)	x	x	5	5.00	5
200C	A 9-30-1 (C	5	5	5	5.00	5

S.No.	Entry	Foliar aphid score (1-5 scale)				
		Ludhiana	Karnal	Niphad	Av. score	Maximum Score
200D	GW 173 (C)	x	x	5	5.00	5
201	HD 3294	4	4	5	4.33	5
202	HS 649	4	4	5	4.33	5
203	NW 7030	5	5	5	5.00	5
204	WH 1142 (C)	4	4	5	4.33	5
205	K 1317 (C)	5	5	5	5.00	5
206	UP 3013	4	4	5	4.33	5
207	DBW 275	5	5	5	5.00	5
208	BRW 3823	4	4	5	4.33	5
209	PBW 795	5	5	5	5.00	5
210	DBW 273	4	4	5	4.33	5
211	HD 3292	5	5	5	5.00	5
212	HD 2888 (C)	5	5	5	5.00	5
213	UP 3018	5	5	5	5.00	5
214	HUW 832	5	5	5	5.00	5
215	PBW 796	4	4	5	4.33	5
216	K 1711	4	4	5	4.33	5
217	WH 1251	4	4	5	4.33	5
218	DBW 272	4	4	5	4.33	5
219	HD 3293	4	4	5	4.33	5
NIVT-5B						
220	GW 1350 (d)	4	4	5	4.33	5
220A	SONALIKA (C)	x	x	5	5.00	5
220B	IWP 72 (C)	x	x	5	5.00	5
220C	A 9-30-1 (C	5	5	5	5.00	5
220D	GW 173 (C)	x	x	5	5.00	5
221	DBW 110 (C)	5	5	5	5.00	5
222	NIDW 1149 (d)	4	4	5	4.33	5
223	MP 3507	5	5	5	5.00	5
224	HI 8815 (d)	4	4	5	4.33	5
225	UAS 470 (d)	4	4	5	4.33	5
226	HI 8814 (d)	4	4	5	4.33	5
227	DBW 280	5	5	5	5.00	5
228	DBW 276	4	4	5	4.33	5
229	MP 1346	4	4	5	4.33	5
230	GW 512	5	5	5	5.00	5
231	HD 3297	4	4	5	4.33	5
232	MP 1345	4	4	5	4.33	5
233	HI 1605 (C)	5	5	5	5.00	5
234	MPO 1347 (d)	5	5	4	4.67	5
235	UAS 466 (d) (C)	4	4	5	4.33	5
236	MACS 4075 (d)	4	4	5	4.33	5
237	NIAW 3386	5	5	5	5.00	5
238	CG 1030	5	5	5	5.00	5
239	HD 3296	5	5	5	5.00	5
240	AKAW 5082	5	5	5	5.00	5

S.No.	Entry	Foliar aphid score (1-5 scale)				
		Ludhiana	Karnal	Niphad	Av. score	Maximum Score
240A	SONALIKA (C)	x	x	5	5.00	5
240B	IWP 72 (C)	x	x	5	5.00	5
240C	A 9-30-1 (C	5	5	5	5.00	5
240D	GW 173 (C)	x	x	5	5.00	5
241	MACS 6719	5	5	5	5.00	5
242	DBW 277	4	4	5	4.33	5
243	HI 8627 (d) (C)	4	4	5	4.33	5
244	HP 1970	4	4	4	4.00	4
IVT(NHZ)						
245	HPW 454	5	5	4	4.67	5
246	VL 2034	5	5	5	5.00	5
247	VL 2031	5	5	5	5.00	5
248	HS 650	5	5	5	5.00	5
249	VL 2033	4	4	5	4.33	5
250	HPW 455	5	5	5	5.00	5
251	HPW 453	4	4	5	4.33	5
252	UP 3014	5	5	5	5.00	5
253	HS 652	4	4	4	4.00	4
254	HS 507 (C)	5	5	4	4.67	5
255	HS 562 (C)	5	5	4	4.67	5
256	DBW 279	5	5	5	5.00	5
257	VL 2032	5	5	4	4.67	5
258	HS 651	5	5	4	4.67	5
259	HS 653	5	5	4	4.67	5
260	UP 3015	5	5	5	5.00	5
260A	SONALIKA (C)	x	x	5	5.00	5
260B	IWP 72 (C)	x	x	5	5.00	5
260C	A 9-30-1 (C	5	5	5	5.00	5
260D	GW 173 (C)	x	x	5	5.00	5

Table A2-10.1a: Screening of MPSN nursery against shoot fly and brown wheat mite2017-18

S. No.	Entry	Dharwad	Ludhiana	Durgapura	Niphad	Kharibari	Kanpur	Average incidence (%)	Highest incidence (%)	Brown Wheat mite (No. of mites/10 cm² area)	
										Ludhiana	Durgapura
A. Resistant to all three rusts											
Source:AVT II Year 2015-16											
1	HI 8759 (d)	14.40	18.00	10.66	5.00	1.00	21.42	11.75	21.42	23	10.7
Source:AVT Ist Year 2015-16											
2	HI 8774 (d)	3.16	9.89	10.33	3.33	2.00	9.09	6.30	10.33	45	10.3
3	HPPAU 05	17.14	10.00	12.33	5.00	1.00	14.28	9.96	17.14	23	12.3
4	HPW 423	10.71	5.20	10.33	3.33	2.00	24.00	9.26	24.00	15	10.3
5	HPW 433	13.79	12.50	16.00	5.00	2.00	21.42	11.79	21.42	48	16.0

6	HS 622	13.33	8.64	14.00	5.00	3.00	11.11	9.18	14.00	23	14.0
7	HS 623	10.97	11.02	11.00	6.66	2.00	13.66	9.22	13.66	20	11.0
8	HS 626	22.50	16.67	12.33	8.33	2.00	16.00	12.97	22.50	10	12.3
9	HS 628	11.21	26.21	13.00	5.00	2.00	22.72	13.36	26.21	25	13.0
10	PBW 725	10.00	14.52	12.66	6.66	3.00	9.52	9.39	14.52	20	12.7
11	PBW 756	13.57	20.83	11.66	5.00	2.00	17.82	11.81	20.83	23	11.7
12	PBW 760	11.22	9.33	11.00	6.66	2.00	18.18	9.73	18.18	15	11.0
13	RKD 283(d)	12.00	9.52	10.66	6.66	3.00	8.33	8.36	12.00	20	10.7
14	TL 3006 (T)	6.67	14.58	11.00	5.00	2.00	7.69	7.82	14.58	15	11.0
15	TL 3007 (T)	6.04	11.03	10.66	8.33	2.00	6.66	7.45	11.03	35	10.7
16	TL 3008 (T)	6.21	7.22	12.33	8.33	2.00	13.33	8.24	13.33	13	12.3
17	TL 3009 (T)	9.73	10.71	14.00	6.66	3.00	9.09	8.87	14.00	18	14.0
18	VL 3002	18.13	10.40	10.00	5.00	2.00	11.11	9.44	18.13	10	10.0
19	VL 3012	26.43	7.20	12.33	3.33	2.00	19.09	11.73	26.43	47	12.3
20	WH 1181	11.25	7.06	11.66	6.66	1.00	21.05	9.78	21.05	8	11.7
20A	SONALIKA (C)	7.14	29.73	-	15.00	2.00	14.28	13.63	29.73	-	-
20B	IWP 72 (C)	10.00	-	21.66	6.66	0.00	17.58	11.18	21.66	57	21.7
20C	A 9-30-1 (C	12.63	-	-	6.66	0.00	20.00	9.82	20.00	-	-
20D	GW 173 (C)	20.00	-	-	5.00	0.00	16.66	10.42	20.00	-	-
21	WH 1216	5.96	8.06	15.00	6.66	0.00	9.52	7.53	15.00	10	15.0
22	WH 1310	4.52	13.11	10.33	10.00	0.00	16.66	9.10	16.66	15	10.3
23	HS 627	3.45	10.16	12.33	6.66	2.00	7.14	6.96	12.33	10	12.3
24	WH 1184	6.00	11.32	11.66	8.33	3.00	21.87	10.36	21.87	20	11.7
B. Resistant to Stem and Leaf rusts											
Source:AVT II Year 2015-16											
25	HD 3171	7.84	16.67	16.00	8.33	1.00	21.42	11.88	21.42	9	16.0
26	WB 2	20.74	9.80	11.33	8.33	0.00	16	11.03	20.74	15	11.3
Source:AVT Ist Year 2015-16											
27	AKAW 4842	12.22	14.38	12.33	5.00	2.00	17.85	10.63	17.85	10	12.3
28	DBW 179	3.10	12.40	13.66	8.33	2.00	16.66	9.36	16.66	9	13.7
29	DBW 216	3.46	11.01	11.66	5.00	2.00	16.66	8.30	16.66	6	11.7
30	DBW 217	13.78	16.09	10.66	6.66	2.00	11.11	10.73	16.09	8	10.7
31	DBW 219	3.40	15.50	11.33	8.33	3.00	10.00	8.65	15.50	13	11.3
32	DDK 1051 (dic.)	9.09	19.67	12.66	5.00	2.00	13.66	11.42	19.67	25	12.7
33	MACS 5044 (dic.)	29.17	24.31	15.66	6.66	2.00	16.66	17.56	29.17	20	15.7
34	MACS 5046 (dic.)	9.03	15.22	11.66	6.66	1.00	5.55	8.49	15.22	20	11.7
35	NW 6094	8.26	5.43	14.66	6.66	1.00	16.66	9.20	16.66	10	14.7
36	PBW 621	6.83	24.56	10.00	3.33	1.00	18.75	12.23	24.56	10	10.0
37	RKD 292 (d)	7.08	12.80	12.33	6.66	1.00	18.75	10.39	18.75	7.5	12.3
38	VL 4001	10.17	14.63	16.00	8.33	1.00	16.66	11.69	16.66	4	16.0
39	WH 1215	10.00	15.65	11.00	5.00	1.00	17.58	11.05	17.58	15	11.0
40	UP 2955	6.00	14.11	10.33	6.66	0.00	15.62	9.21	15.62	5	10.3
40A	SONALIKA (C)	5.00	29.63	-	13.33	1.00	16.00	12.91	29.63	-	-
40B	IWP 72 (C)	19.00	-	22.66	8.33	1.00	21.42	16.02	22.66	49	22.7
40C	A 9-30-1 (C	20.00	-	-	6.66	1.00	9.09	10.03	20.00	-	-
40D	GW 173 (C)	34.74	-	-	5.00	1.00	11.11	15.62	34.74	-	-
41	VL 3011	15.90	26.25	12.00	6.66	1.00	16.66	14.36	26.25	5	12.0
C. Resistant to Leaf and Stripe rusts											
Source:AVT Ist Year 2015-16											
42	DBW 220	8.39	26.55	13.33	5.00	1.00	18.75	13.60	26.55	5	13.3
43	PBW 757	15.38	15.70	12.33	8.33	1.00	22.22	13.33	22.22	6	12.3
44	HPPAU 10	16.76	13.22	10.33	6.66	2.00	21.42	12.75	21.42	5	10.3
45	HPW 424	19.64	17.24	11.33	10.00	1.00	13.33	12.51	19.64	8	11.3
46	NW 6046	10.48	13.64	13.66	10.00	1.00	16.62	11.08	16.62	8	13.7
47	PDW 344 (d)	3.67	12.05	15.33	8.33	1.00	16.66	9.74	16.66	18	15.3

48	UAS 459 (d)	10.00	14.01	10.33	10.00	2.00	20.00	11.27	20.00	20	10.3
49	UP 2954	14.71	9.80	12.66	8.33	1.00	15.55	10.74	15.55	11	12.7

Table A2-10.1b: Screening of MPSN nursery against foliar aphid and root aphid during 2017-18

S.No.	Entry	Ludhiana	Niphad	Kharibari	Karnal	Shillongani	Average score	Highest score (%)	Root aphid (Ludhiana centre only)
A. Resistant to all three rusts									
Source:AVT II Year 2015-16									
1	HI 8759 (d)	5	4	4	5	4	4.50	5	4
Source:AVT Ist Year 2015-16									
2	HI 8774 (d)	5	4	4	5	2	4.50	5	5
3	HPPAU 05	5	5	5	5	2	5.00	5	5
4	HPW 423	5	5	5	5	3	5.00	5	4
5	HPW 433	5	5	5	5	3	5.00	5	5
6	HS 622	5	5	5	5	3	5.00	5	4
7	HS 623	5	5	5	5	3	5.00	5	5
8	HS 626	4	5	5	4	4	4.50	5	4
9	HS 628	5	5	5	5	4	5.00	5	5
10	PBW 725	4	5	5	4	3	4.50	5	4
11	PBW 756	4	5	3	4	3	4.00	5	5
12	PBW 760	5	5	4	5	3	4.75	5	3
13	RKD 283 (d)	5	5	4	5	4	4.75	5	4
14	TL 3006 (T)	5	5	4	5	3	4.75	5	5
15	TL 3007 (T)	5	5	4	5	3	4.75	5	4
16	TL 3008 (T)	5	5	4	5	3	4.75	5	4
17	TL 3009 (T)	5	5	4	5	2	4.75	5	5
18	VL 3002	5	5	4	5	3	4.75	5	5
19	VL 3012	5	5	4	5	4	4.75	5	3
20	WH 1181	4	5	4	4	4	4.25	5	4
20A	SONALIKA (C) FOR SF	-	5	5	-	3	5.00	5	-
20B	IWP 72 (C) FOR BWM	-	5	4	-	3	4.50	5	-
20C	A 9-30-1 (C) FOR FA	5	5	5	5	2	5.00	5	-
20D	GW 173 (C) FOR RA	-	5	4	-	3	4.50	5	5
21	WH 1216	4	5	3	4	2	4.00	5	5
22	WH 1310	5	5	2	5	4	4.25	5	4
23	HS 627	5	5	3	5	3	4.50	5	5
24	WH 1184	5	5	4	5	4	4.75	5	4
B. Resistant to Stem and Leaf rusts									
Source:AVT II Year 2015-16									
25	HD 3171	5	5	4	5	4	4.75	5	4
26	WB 2	4	5	4	4	3	4.25	5	4
Source:AVT Ist Year 2015-16									
27	AKAW 4842	5	5	4	5	3	4.75	5	4
28	DBW 179	4	5	4	4	3	4.25	5	5
29	DBW 216	5	5	4	5	3	4.75	5	5

30	DBW 217	5	5	4	5	4	4.75	5	5
31	DBW 219	4	5	4	4	2	4.25	5	4
32	DDK 1051 (dic.)	5	5	4	5	2	4.75	5	4
33	MACS 5044 (dic.)	5	5	5	5	4	5.00	5	4
34	MACS 5046 (dic.)	4	5	4	4	3	4.25	5	5
35	NW 6094	4	5	5	4	4	4.50	5	4
36	PBW 621	4	5	3	4	4	4.00	5	5
37	RKD 292 (d)	4	5	5	4	4	4.50	5	4
38	VL 4001	4	5	3	4	3	4.00	5	4
39	WH 1215	4	5	5	4	4	4.50	5	5
40	UP 2955	4	5	3	4	3	4.00	5	3
40A	SONALIKA (C) FOR SF	-	5	5	-	3	5.00	5	-
40B	IWP 72 (C) FOR BWM	-	5	3	-	3	4.00	5	-
40C	A 9-30-1 (C) FOR FA	5	5	4	5	4	4.75	5	-
40D	GW 173 (C) FOR RA	-	5	5	-	3	5.00	5	5
41	VL 3011	4	5	3	4	3	4.00	5	5
C. Resistant to Leaf and Stripe rusts									
Source:AVT Ist Year 2015-16									
42	DBW 220	5	5	4	5	4	4.75	5	5
43	PBW 757	4	5	5	4	4	4.50	5	5
44	HPPAU 10	5	5	3	5	4	4.50	5	5
45	HPW 424	5	5	3	5	3	4.50	5	5
46	NW 6046	5	5	4	5	4	4.75	5	4
47	PDW 344 (d)	4	5	4	4	3	4.25	5	4
48	UAS 459 (d)	5	5	4	5	3	4.75	5	4
49	UP 2954	5	5	4	5	3	4.75	5	3

11.2 (B). INTEGRATED PEST MANAGEMENT

B1: Survey and surveillance of insect-pests and their natural enemies in wheat and barley cropping systems *(All centres)*

Roving surveys wewre carried out at fortnightly intervals during the cropping season in wheat and barley crops for insect-pests and their natural enemies. Population and damage levels of different insect-pests will be recorded and indicated as grades or percent damage inflicted to crop. The peak period of pest activity and its severity of damage will also be recorded.

Centre: Ludhiana

In order to monitor the insect pest of wheat, survey of Punjab state were undertaken during 2017-18 crop season. The aphid incidence was above economic threshold level in some places viz. village Mullanpur & Jagraon (Ludhiana), Ajitwal & Dagru (Moga) and Salabatpura (Bhatinda) during the first week of March. 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. Minor incidence of termite (1-2 %) was also observed in villages Chonikmaan (Ludhiana), Mudaki and Bajakhana (Faridkot).

Some news appeared in different newspapers regarding the incidence of pink stem borer in different parts of Punjab during the month of December. Intensive surveys were carried out in the state of Punjab to monitor the pest prevalence. The incidence of pink stem borer (PSB) was observed in patches and within patches the PSB damage varied from 1-5 per cent. Following is the detail of PSB damage observed in some parts of Punjab(Table B1-11.2a):

Table B1-11.2a: Incidence of pink stem in Punjab

District	Village	Name of the Farmer	Pink stem borer incidence
Patiala	Kamalpur	S. Devinder Singh	4-5 % (2 acres)
	Chatehra	S. Balbir Singh and S. Jaswant Singh	2-3 patches of PSB infestation (4-5%)
Sangrur	Kheri	S. Sukhjinder Singh	3-4% (1 acre)
	Daula Singh wala	-	3-4 (1 acre) and poor germination due to deep sowing
Muktsar	Abul Khurana	S.Nachtar Singh Tikka	1-2%
Bhatinda	Tungwali	S. Jagjit Singh s/o Gurjant Singh	2-3%
	Nathana		1%

Centre: Niphad

The data regarding survey of the pest infesting wheat and their natural enemies was collected during 2017-18. 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 predator, grubs, beetles and Chrysoppa feeding on the aphid infested fields were also observed. The incidence of jassids was recorded in medium intensity (Table B1-11.2b).

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 low to moderate throughout the crop season. The population of *H. armigera*, pink stem borer and surface grasshopper were very low. The sporadic incidence of army worm was reported from some areas of Saurashtra region. While, the other pests like thrips, shoot fly, brown mite, jassids and cut worm were in occasional 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 Aakin (Araul) and Sarya dated 31.01.2018. The incidence of shootfly was observed 5-8 per cent for wheat varieties namely, DBW 39, DBW 107, HUW 234. The incidence of termite was observed in irrigated crop 10-15 per cent in same varieties of wheat. Barley infestion was observed 50-60 aphids/plant in variety K 551. The survey was done on dated 31.01.2018 and the termite infestation was observed 5% in wheat varieties namely, local, PBW 502 and Halna at both the villages Chandoli and Gyadinpurva. The termite infestation was observed 8% in wheat varieties namely, PBW 502 and HD 2967 at the villages Tirwa (Kannoj), Bhatipurva, Makarampurva, Bela and Bithuna surveyed on dated 31.01.2018. The survey was done on dated 06.02.2018 and the termite infestation was observed 10% in wheat varieties namely, K 0307, Halna and DBW 17 at the villages Karoundi (Lucknow) and Sindholi (Sitapur) and Patarakala. The shootfly infestation was observed 2% and termite infestation 6% in wheat varieties HD 2967 and RR 21 at the Medical Nagar village of Sitapur. The aphid infestation was observed 25-30 aphids/plant, while the shoot fly infestation was observed 2 per cent in wheat varieties HD 2967 and RR 21 at the district Lakhimpur Khiri (Table B1-11.2c).

Centre: Karnal

The survey of wheat in Punjab and Haryana state were undertaken during 2017-18 crop season. Moderate to severe incidence of wheat aphid and pink stemborer was observed in some village Kunjpura, Subhari, Racina and Hajwana etc of Karnal Incidence of foliar aphid, termites and pink stem borer was also recorded in Ladwa, Yamunanagar, Noorpur Bedi, Anandpur Saheb, Banur, Abhiyana Kalan Ropar and Bajrur, some places foliar aphid damage was recorded in some parts of Banur. The grubs and adults of coccinellid beetles were seen frequently in fields infested with aphids. The wheat varieties observed in this region were HD 2967 and H 3086.The incidence of foliar aphid was recored 5-25% while incidence was of pink stem stemborer was less than 5%.The termite damge was between 5-7% in the surveyed areas.

B2. Influence of sowing time on the incidence and population build-up of major insect pest of wheat (Centres: Ludhiana, Niphad, Karnal, Kharibari)

The effect of sowing time on the population build-up of major insect-pests of wheat was studied at four geographical locations to better understand the insect-pest behaviour under different climatic conditions.

Centre: Ludhiana

This experiment was conducted in the irrigated fields at Plant Breeding Research Farm, PAU Ludhiana. The wheat variety PBW 725 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 B2-11.2a).

1. **Termite damage**: The termite damage recorded at seedling stage in different dates of sowing indicated that early sown crop (1 Nov. 2017) 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 third week of December in early and timely sown crop while it appeared in last week of December and 4th 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 11th standard meteorological weeks of 2018 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.

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 B2-11.2b, that the aphid incidence was started from 33 days after sowing on crop sown at 1st Nov. (D1). The peak (62.86) number of aphids/shoot/plant was recorded in 2nd Meteorological week i.e. second week of January. The crop sown at 16th Nov., the incidence of aphid was started in 50th Meteorological week and it reached to peak in 2nd Meteorological week. In case of crop sown at 1st Dec. (D3) and 16th Dec. (D4), the aphid incidence was started in 1st and 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) and 16th Dec. (D4) were started in 47, 49, 1 and 4th MW, respectively.

The highest average yield of 43.05 q/ha was recorded in crop sown at 1st Dec. (D3) and it was lowest (30.55q/ha) in crop sown at 16th Dec. (D4).

Centre: Karnal

The experiment was conducted at Research farm of ICAR-IIWBR, Karnal under irrigated conditions.The wheat variety,HD 2967 was sown at four different dates of sowing at 15 days interval and no insecticide was applied for management of any insect-pest. 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, pink stem borer, termites etc. were recorded throughout crop growing season at peak period of their activity(Table B2-11.2c).

1.**Aphid incidence:**The data revealed indicated that the incidence of aphids were first started appearing on wheat crop sown on 1st Nov. (D1), and 16th Nov. (D2) with aphids per incidenece of .9 and 0.5 aphids/plant, respectively during 51st standard week. The population reached to its peak during 7th Standard week on D1 (16.7 aphids/plant) and during 8th standard week on D2 sown crop (21.9 aphids/plant) in the month of February. In case of D3 (1st Dec.) and D4 (31 Dec.) sown crops, the aphid appeared during 4th standard week with incidence of 04 and 0.6 aphids/plant, respectively. The aphid population reached peaked during10th standard week on D3 and D4 sown crops with aphid incidence as 18.4 and 18.7 aphids/plant, respectivey. The aphid population was highest on 5.2aphids/plant on early sown crop and lowest (3.9 aphids/plant) on late sown crop (D4)(Table B2-11.2c).

2.**Termite damage:** The termite damage was first recorded at seedling stage on D1 and D2 sown crops with infestation ranged from 2.8 to 4.1% damaged effective tillers / m row during 50th to 52nd standard weeks. At earhead stage, again termite damage was maximum (3.3% damaged effective tillers/ m row) in early sown crop D1. Termite infestation was highest on D1 (2.9 damaged effective tillers/ m row followed by D2 (2.4 damaged effective tillers/ m row), D3 (2.2 damaged effective tillers/ m row) and D4 (1.3 damaged effective tillers/ m row) sown crops (Table B2-11.2c).

Centre: Kharibari

An experiment was conducted at Regional Research sub-station (Terai Zone) UBKV, Kharibari, Darjeeling. The wheat variety HD2967 was sown on 1st December'2017, 15th December'2017 and 01st January'2018. 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 recorded 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 B2-11.2d).

Table B1-11.2b: Survey of wheat insect- pests and their natural enemies during 2017-18 (Centre:Niphad)

Locality and date of visit	Area surveyed (Rainfed/ Irrigated)	No. of samples observed	Variety and Stage of growth	Crop pest	Type of damage	Intensity	Natural enemy
Kasbe Sukene, Bhausaheb nagar, Pimpri, Dawachvadi and Deopur Tal. Niphad14.12.2017	Irrigated	35	HD 2189, Ajit 102, NIAW 34, Mohan wonder, LOK-1 Vegetative, Booting	Aphids Jassids	Major Minor	Heavy	*Coccinellids* Beetles
Nagde, Aadgaon, Nandesur, Nagarsul and Aandarsul Tal. Yeola 09.01.2018	Irrigated	30	LOK-1, Ajit 102, Ajit 72, Private companies Vegetative, Booting	Aphids Jassids	Major Minor	Medium	*Coccinellids* Beetles
Kotamgaon, Unkute, Deshmane, Kusmade & Jalgaon neur Tal. Yeola10.01.2018	Irrigated	40	LOK-1, Private companies, HD 2189, NIAW 34, Ajit 72, Nirmal Booting, Flowering, grain filling	Aphids	Major	Heavy	*Coccinellids* Beetles
Thangaon, Kanadi, Aadgaonrepa, Cusur & Naigavhan Tal. Yeola11.01.2018	Irrigated	50	Private companies, HD 2189, Mohan wonder, Ajit 72, Ankur, Nirmal,Booting, Flowering, grain filling	Aphids	Major	Heavy	*Coccinellids* Beetles
Kundewadi, Niphad, Naitala, Vinchur & Jalgaon Tal. Niphad 15.01.2018	Irrigated	45	LOK-1, HD 2189, Ajit 102, Mohan wonder, Private companies, Phule Samadhan Flowering, grain filling	Aphids Jassids	Major Major	Heavy Medium	*Coccinellids* Beetles, *Chrysopa*
Ozar, Konkangaon, Shirasgaon, Vadali Tal. Niphad 16.01.2018	Irrigated	40	LOK-1, HD 2189, Ajit 102, Mohan wonder, Private companies, Phule Samadhan, NIAW 1415, Flowering, grain filling	Aphids Jassids	Major Major	Heavy Medium	*Coccinellids* Beetles, *Chrysopa*

Table B1-11.2c: Survey of wheat and barley pests and their natural enemies during 2017-18 (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
30.01.2018 Aakin ,Saryia	Irrigated	10	DBW39, DBW107,HUW234, Barley local DBW39	Termite Aphid Shootfly	Major Major Minor	10-15 50-60Aphid/p 05-08%	x	x
30.01.2018 Chanduoli Gayadin purva Tirwa (Kannoj),Bhathai purva,Makarampurva,Bela,	Irrigated Irrigated	10	Local , PBW502 & Halna, BW502 & HD2967	Termite Termite	Major Major	5% 8%	x	x
06.02.2018,Karoundi (Lucknow), Sindholi (Sitapur), PataraKala	Irrigated	10	K307, Halna, & DBW17	Shootfly Termite	Minor Major	5% 10%	x	x
06.02.2018, Tedwa, Chelola (Sitapur),Medical Nagar,(Sitipur),Lakhimpur	Irrigated Irrigated Irrigated	10	PBW343, K0307 and Halna,HD2967,RR-21 HD2967	Shootfly Termite Termite Aphid Shootfly	Minor Major Nil Major Minor	2% 6% - 25-30Aphids/p 2%	x	x

Table B1-11.2d: Survey of wheat insect- pests and their natural enemies during 2017-18 (Centre: Shillongani)

Locality & date		Area surveyed (Rainfed/Irrigated)	No. of samples observed	Variety & Stage of Growth	Crop Pest Name, Intensity of damage, Status of attack	Natural enemy
2 FN, Dec.23 (2017)	Korchung, Nagaon	Irrigated	3	Vegetative	Sporadic infestation of Cutworm, Field Cricke tand Flea Beetle	
	Bhakatgaon, Nagaon	- do-	3	HD 2967	- do -	
	Naramari, Nagaon	- do-	2	- do -	- do -	
2 FN, Jan.,18 (2018)	Korchung, Nagaon	Irrigated	3	do -		
	Bhakatgaon, Nagaon	- do-	3	- do -	-	
	Naramari, Nagaon	- do-	2	- do -	-	
2 FN, Feb., 19 (2018)	Korchung, Nagaon	Irrigated	3	Reproductive	White ear head (WEH), 6% Aphid infestation 11%.Sporadic infestation of Heliothis armigera larvae, Nezara viridula and painted bug	*Micraspis discolor*, *Coccinella repanda*, *Cccinella septempunctata* are the predators recorded in the wheat fields in the reproductive stage of the crop. *M. discolor* and *C. repanda* are the common predators of aphid. Syrphid larvae are also recorded. Moreover, various types of spiders are also observed.
	Bhakatgaon, Nagaon	- do-	3	do -	White ear head (WEH), 8% Aphid infestation 16%Sporadic infestation of Heliothis armigera larvae, Nezara viridula and painted bug	
	Naramari, Nagaon	- do-	2	- do -	Aphid (*Sitobion miscanthi*) infestation 11 %, WEH 4%.Sporadic infestation of Heliothis armigera larvae, Nezara viridula and painted bug	
1 FN, Mar., 10 (2018)	Korchung, Nagaon	Irrigated	3	- do -	Aphid infestation 7 %, WEH 9% Sporadic population of Painted bug & Nezara viridula	
	Bhakatgaon, Nagaon	- do-	3	- do -	Aphid infestation14 %, WEH 7 % Sporadic population of Painted bug & Nezara viridula	
	Naramari, Nagaon	- do-	2	- do -	Aphid infestation11 %, WEH 9 %. Sporadic population of Painted bug & Nezara viridula	

Table B2-11.2a: Effect of sowing dates on population build of major insect-pests in wheat during 2017-18 (Centre-Ludhiana)

Standard Weeks	Rainfall (mm)	Temperature (^{0}C)		Relative humidity (%)		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	17.1	9.3	90	70	-	-	-	-	2.31/2.95	1.76/2.80	-	-
51(17Dec-23Dec)	0	21.9	7.4	91	47	0.4	0.2	0	0	2.66/3.80	2.29/3.09	0.92/2.08	-
52(24Dec-31Dec)	0	20.7	6.3	96	49	0	0.2	0	0	1.58/3.13	1.21/2.83	1.12/2.79	1.09/2.08
1(1Jan-7Jan)	0	15.9	5.4	96	66	0	0	0	0	-	-	0.97/2.52	1.10/1.82
2(8Jan-14Jan)	0	20.8	5.3	94	43	0.2	0	0	0	-	-	-	-
3(15Jan-21Jan)	0	22.0	6.1	92	40	0.6	0.2	0	0	-	-	-	-
4(22Jan-29Jan)	18.4	15.5	7.6	93	76	1.8	0.8	0.4	0.6	-	-	-	-
5(29 Jan-4Feb)	0	21.2	7.6	91	46	4.2	2.8	1.8	0.2	-	-	-	-
6(5Feb-11Feb)	2.4	21.1	5.6	89	38	8.2	4.6	2	2.4	-	-	-	-
7(12Feb-18Feb)	21.4	21.1	9.3	89	53	14.6	6.8	5.4	2	-	-	-	-
8(19Feb-25Feb)	3.2	25.5	11.7	88	48	21.4	10.6	7.8	10.4	-/3.25	-/2.84	-/2.68	0.96/1.85
9(26 Feb-4Mar)	0	25.8	13.1	89	51	10.8	22.8	13.4	12.8	-	-	-	-
10(5Mar-11Mar)	0	27.2	12.2	88	42	9	15.4	20.2	18.4	-	-	-	-
11(12Mar-18Mar)	0	29.9	14.1	85	30	2.2	6.8	14.8	19.2	-	-	-	-
12(19Mar-25Mar)	0	29.2	14.2	86	44	0.2	2	6.2	8.2	-	-	-	-
13(26 Mar-1Apr)	0	33.1	16.5	74	29	0	0	0	3.8	-	-	-	-
14(2Apr-8Apr)	0	34.8	20.3	69	33	0	0	0	0	-	-	-	-

Table B2-11.2b: Effect of sowing dates on population build of major insect-pests in wheat during2017-18 (Centre-Niphad)

Standard Weeks	Rain fall (mm)	Temperature (^{0}C)		Relative Humidity (%)		Mean aphid incidence (Aphids/plant/tiller)				Mean jassid incidence (Jassid/plant)			
		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.)
47(19-25 Nov)	0.0	30.3	14.1	84	41	-	-	-	-	0.86	-	-	-
48(26Nov-2Dec)	0.0	29.3	10.7	81	37	-	-	-	-	3.33	-	-	-
49 (3 to 9 Dec)	0.0	26.5	15.8	84	59	3.33	-	-	-	11.40	0.66	-	-
50 (10-16 Dec)	0.0	28.6	12.5	81	50	11.80	0.93	-	-	15.93	1.73	-	-
51 (17-23 Dec)	0.0	28.1	10.9	82	49	21.73	2.40	-	-	21.06	2.26	-	-
52 (24-31 Dec)	0.0	28.4	8.0	80	35	41.46	12.00	-	-	29.73	6.66	-	-
1 (1-7 Jan)	0.0	27.5	8.1	81	44	60.53	19.20	2.13	-	37.46	13.93	2.53	-
2 (8-14 Jan)	0.0	28.0	10.8	80	40	62.86	25.86	5.26	-	19.60	15.46	5.33	-
3 (15-21 Jan)	0.0	30.3	11.2	78	32	27.46	15.53	8.00	-	5.60	8.73	7.06	-
4 (22-28 Jan	0.0	28.9	7.5	79	35	0.60	7.26	13.60	1.26	-	5.20	8.60	1.13
5 (29 Jan-4Feb)	0.0	30.5	8.6	78	33	-	3.33	4.66	5.33	-	2.86	5.60	4.66
6 (5-11 Feb)	0.0	31.2	11.0	76	35	-	0.80	1.13	2.73	-	2.20	4.20	5.86
7 (12-18 Feb)	0.0	32.0	10.8	78	32	-	-	-	-	-	1.66	1.60	3.53
8 (19-25 Feb)	0.0	32.7	11.2	70	30	-	-	-	-	-	-	-	-
9 (26Feb-4 Mar)	7.4	33.5	10.9	69	34	-	-	-	-	-	-	-	-
10 (5-11 Mar)	0.0	34.0	13.9	72	29	-	-	-	-	-	-	-	-
11 (12-18 Mar)	0.0	33.8	16.0	74	32	-	-	-	-	-	-	-	-
Yield q/ha						**32.87**	**38.88**	**43.05**	**30.55**	**-**	**-**	**-**	**-**

Table B2-11.2c: Effect of sowing dates on population build of major insect-pests in wheat 2017-18 (Centre-Karnal)

Standard Weeks	Rain fall (mm)	Temperature (^{0}C)		Relative Humidity (%)		Mean aphid incidence (Aphids/plant/tiller)				Termites (% affected tillers/meter row)			
		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.)
50(10Dec-16Dec)	5.2	19.3	09.1	98.6	66.1	-	-	-	-	3.3	3.8	-	-
51(17Dec-23Dec)	0.0	20.9	07.9	92.3	57.0	0.9	0.5	0	0	4.1	3.1	2.1	-
52(24Dec-31Dec)	0.0	21.5	05.7	98.7	55.9	0.8	0.5	0	0	3.1	2.8	2.8	2.1
1(1Jan-7Jan)	0.0	12.9	06.2	100.0	79.6	0	0	0	0	-	-	2.5	1.8
2(8Jan-14Jan)	0.0	20.4	03.9	94.7	46.3	1.2	0	0	0	-	-	-	0.5
3(15Jan-21Jan)	0.0	21.5	05.1	100.0	48.9	1.5	0.8	0	0.5	-	-	-	-
4(22Jan-29Jan)	34.2	17.7	06.7	96.3	75.9	1.8	1.0	0.2	0.7	-	-	-	-
5(29 Jan-4Feb)	0.0	21.9	07.8	92.7	51.3	5.4	2.5	1.5	0.3	-	-	-	-
6(5Feb-11Feb)	0.0	21.0	05.3	92.6	41.4	9.5	4.8	2.6	2.5	-	-	-	-
7(12Feb-18Feb)	29.0	21.4	08.6	94.1	57.7	16.7	7.9	7.5	2.7	-	-	-	-
8(19Feb-25Feb)	0.0	24.7	10.4	95.0	55.9	22.5	11.7	7.9	11.5	3.3	2.8	2.7	1.8
9(26 Feb-4Mar)	0.0	26.8	13.0	93.1	51.6	11.9	21.9	12.5	12.6	1.2	1.0	0.9	0.5
10(5Mar-11Mar)	0.0	27.5	11.0	89.7	44.1	8.3	16.5	18.4	11.2	-	-	-	-
11(12Mar-18Mar)	0.0	29.6	12.7	86.6	38.3	3.4	7.7	12.8	9.2	-	-	-	-
12(19Mar-25Mar)	7.4	29.5	13.7	86.3	39.6	0.5	1.9	5.6	7.3	-	-	-	-
13(26 Mar-1Apr)	0.0	32.4	15.2	71.7	36.1	0	0	0	4.5	-	-	-	-
14(2Apr-8Apr)	0.0	34.3	17.5	68.4	40.4	0	0	0	0	-	-	-	-
Average		24.0	9.4	90.7	51.2	5.2	4.8	4.3	3.9	2.9	2.4	2.2	1.3
Yield q/ha						41.45	43.87	40.05	35.80	-	-	-	-

Table B2-11.2d: Effect of sowing dates on population build of major insect pests in wheat 2017-18 (Centre-Kharibari)

Standard Weeks	Rainfall (mm)	Relative humidity		Temperature ^{0}C		Aphid incidence (Aphids/tiller)		
		Max RH	Min RH	Max Temp	Min Temp	Date of sowing 01.12.17	Date of sowing 16.12.17	Date of sowing 01.01.18
48	0.00	88.67	46.00	27.97	12.17	0	0	0
49	0.00	88.14	48.43	28.23	11.94	0	0	0
50	0.00	90.71	55.86	27.33	13.36	12	0	0
51	0.00	89.86	52.29	26.11	12.06	15.56	0	0
52	0.00	89.00	45.57	26.57	10.57	35.64	18.56	0
53	0.00	91.14	52.86	24.33	9.10	75.55	38.72	0
1	0.00	93.00	58.71	21.51	7.00	105.35	62.35	0
2	0.00	91.14	55.43	22.41	8.41	125.97	75.45	5.75
3	0.00	89.71	50.71	24.17	10.23	175.15	145.78	45.96
4	0.00	89.14	53.29	23.16	10.59	295.35	245.8	101.85
5	0.00	89.71	62.86	22.53	11.64	305.86	254.56	156.76
6	0.00	89.00	46.86	26.07	11.83	182.4	212.69	167.9
7	0.00	89.57	49.43	27.04	13.10	101.8	175.64	140.75
8	0.46	89.29	51.71	28.17	14.69	71.85	135.25	120.75
9	0.83	87.86	48.29	29.54	15.11	40.37	85.3	95.65
10	1.16	87.57	46.86	30.47	15.39	15.1	45.15	47.89
11	0.00	87.71	39.71	31.89	15.83	10.25	20.2	28.68
12	0.00	87.71	39.71	31.89	15.83	7.95	12.56	19.1
13	0.91	88.29	46.71	32.00	16.69	5.15	5.95	8
14	0.69	90.29	46.00	31.66	17.49	1.15	1.75	2
Yield qt/ha						18.35	19.65	18.56

B3. Evaluation of trapping efficiency of different type of insect-traps for aphids (**Centres:** Ludhiana, Niphad, Karnal)

Different types of traps viz., tray-traps, sticky-traps and pheromone lures and their placement in the crop will be tested to determine the efficiency of traps to capture aphids in the field. The criterion of trap colour, material and cost of trap will be considered for selection of traps for the experiment. The population of alate (winged) and wingless forms of aphids captured in traps will be recorded during the season.

Treatment Details:

Treatment no.	**Treatment details**
T1	Yellow sticky trap X 60 cm height
T2	Yellow sticky trap X 120 cm height
T3	Blue sticky trap X 60 cm height
T4	Blue sticky trap X 120 cm height
T5	Yellow tray trap X 10 cm height
T6	Yellow tray trap X 20 cm height
T7	Blue tray trap X 10 cm height
T8	Blue tray trap X 20 cm height

Observations:

1. The population of alate (winged) and wingless forms of aphids captured in traps were recorded at weekly interval during the season.

Centre: Ludhiana

Different types of traps viz., sticky-traps and tray-traps and their placement in the crop was tested to determine the efficiency of traps to capture aphids in the field. The population of alate (winged) and apterous forms of aphids captured in traps were recorded at weekly interval during the season.

The observation recorded clearly revealed that the number of aphids trapped more in yellow coloured traps were relatively higher than blue colour traps on all dates of observations. The efficiency of sticky traps was relatively better than water traps. The 100 cm higher traps matched with the canopy of crop and recorded more aphids as compared with 150 cm high traps(Table B3-11.2a).

Centre: Niphad

The data revealed significant differences among various treatments regarding captured number of aphids and jassids. Yellow sticky trap installed at 60 cm height recorded maximum (218.00, 388.67, 417.00, 439.33, 484.33, 572.67, 595.67 and 515.67) number of captured aphids at 19, 26, 33, 40, 47, 54, 61 and 68 days after sowing as against the minimum number of captured aphids were recorded in blue tray trap installed at 20 cm height (9.00, 10.33, 12.00, 20.00, 21.67, 20.00, 26.33 and 16.67). At 75, 82, 89 and 96 days after sowing the yellow sticky traps installed at 120 cm height recorded highest of 222.67, 172.33, 84.33 and 55.67 number of captured aphids. It is indicated from the results that the yellow sticky traps installed at 60 cm height was found to be effective for aphids capturing in early growing stage of the crop i.e. upto 68 days after sowing and same coloured trap was found effective after 68 days of the crop when installed at 120 cm height. Both yellow and blue colored tray trap installed at 10 and 20 cm height were found in effective for capturing the population of aphids(Table B3-11.2b).

Data revealed that the highest (3933.33) seasonal total number of captured aphids were recorded in yellow sticky trap installed at 60 cm height while lowest of 140.67 were recorded in blue tray traps installed at 20 cm height (Table B3-11.2b).

It revealed that the highest (2181.67) seasonal total captured jassids were recorded in yellow sticky trap installed at 60 cm height. The population of the jassids were not observed in blue colored sticky as well as tray trap during growing season of the crop. Yellow tray trap installed at 10 and 20cm height recorded very less (14.58 and 7.36) number of captured jassids. It indicated that the tray trap of both blue and yellow coloured installed at 10 and 20 cm height and also blue sticky trap installed at 60 and 120 cm height were found ineffective for attraction of jassids(Table B3-11.2c).

Data regarding natural enemies are presented in (Table B3-11.2d)revealed that the maximum (125.33) season's total captured natural enemies were recorded on yellow sticky trap installed at 60 cm height. It showed that the yellow colored traps were also preferred by natural enemies.

Data regarding grain yield revealed that the various traps showed the significant differences for yield. The yellow sticky traps installed at 60 cm height recorded highest (38.65) grain yield. It was at par with the treatment of yellow sticky traps installed at 120cm height. The tray trap of blue colored installed at 10cm height recorded minimum yield of 32.87 q/ha.

Centre: Karnal

The data revealed significant differences among various treatments regarding captured number of aphids. Yellow sticky trap installed at 60 cm height recorded maximum average number of aphids i.e 33.7.8 as against the minimum average number of captured aphids i.e 16.1 aphids recorded in blue tray trap installed at 20 cm height. The highest (4053.3 aphids) seasonal total captured aphids were recorded in yellow sticky trap installed at 60 cm height while minimum (193.3 aphids) were recorded in blue tray trap installed at 20 cm height(Table B3-11.2e).The maximum season's total number of natural enemies (143.4) was captured on yellow sticky trap installed at 60 cm height. It indicated that the yellow colored traps were also preferred by natural enemies (Table B3-11.2f).

The observation recorded clearly revealed that the number of aphids trapped more in yellow coloured traps were relatively higher than blue colour traps on all dates of observations. The efficiency of sticky traps was relatively better than tray traps.

Table B3-11.2a: Relative abundance of aphids captured in different types of trap during 2017-18 (Centre: Ludhiana)

Treatment	Number of aphids captured per trap at different dates of observation										Season total	Av. Mean
	15-1-18	22-1-18	29-1-18	5-2-18	19-2-18	26-2-18	5-3-18	12-3-18	19-3-18	27-3-18		
Yellow sticky trap X 100 cm height	48	69	106	34	122	270	250	240	130	90	1359	135.9
Yellow sticky trap X 150 cm height	31	35	42	16	60	170	180	110	90	31	765	76.5
Blue sticky trap X 100 cm height	34	43	136	38	105	225	230	225	135	60	1231	123.1
Blue sticky trap X 150 cm height	19	35	51	18	65	120	100	90	50	26	574	57.4
Yellow tray trap X 100 cm height	8	50	62	10	70	105	210	200	70	40	825	82.5
Yellow tray trap X 150 cm height	4	22	20	3	50	30	40	60	45	23	297	29.7
Blue tray trap X 100 cm height	6	30	34	8	55	90	190	190	63	33	699	69.9
Blue tray trap X 150 cm height	0	12	10	8	43	22	35	70	33	18	251	25.1

Table B3-11.2b: Relative abundance of aphids captured in different types of trap during 2017-18 (Centre: Niphad)

TN	Treatment Details	Number of aphids captured per trap at												Season total	Av. Mean
		19 DAS	26 DAS	33 DAS	40 DAS	47 DAS	54 DAS	61 DAS	68 DAS	75 DAS	82 DAS	89 DAS	96 DAS		
T1	Yellow sticky trap X 60 cm height	218.00 (14.79)	388.67 (19.74)	417.00 (20.44)	439.33 (20.98)	484.33 (22.03)	572.67 (23.95)	595.67 (24.43)	515.67 (22.73)	126.33 (11.27)	98.33 (9.95)	46.33 (6.88)	31.00 (5.65)	3933.33	327.78
T2	Yellow sticky trap X 120 cm height	106.67 (10.37)	291.67 (17.09)	301.33 (17.39)	341.00 (18.49)	376.00 (19.42)	401.33 (20.06)	410.67 (20.29)	331.33 (18.23)	222.67 (14.96)	172.33 (13.16)	84.33 (9.23)	55.67 (7.52)	3095.00	257.92
T3	Blue sticky trap X 60 cm height	133.00 (11.57)	292.00 (17.07)	316.00 (17.80)	355.00 (18.87)	363.33 (19.08)	385.67 (19.66)	391.00 (19.80)	313.67 (17.74)	24.00 (4.99)	14.67 (3.95)	10.00 (3.28)	3.00 (1.90)	2601.33	216.78
T4	Blue sticky trap X 120 cm height	72.67 (8.57)	193.33 (13.93)	213.00 (14.62)	226.33 (15.07)	255.67 (16.02)	297.33 (17.27)	312.33 (17.70)	276.00 (16.64)	48.67 (7.04)	32.00 (5.74)	21.67 (4.76)	11.00 (3.46)	1960.00	163.33
T5	Yellow tray trap X 10 cm height	37.00 (6.14)	53.33 (7.36)	63.00 (7.99)	71.33 (8.50)	77.00 (8.83)	81.33 (9.07)	88.67 (9.47)	72.33 (8.55)	15.00 (3.99)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	559.00	46.58
T6	Yellow tray trap X 20 cm height	16.00 (4.11)	38.67 (6.28)	48.33 (7.02)	55.33 (7.50)	58.33 (7.70)	58.67 (7.72)	62.33 (7.96)	43.67 (6.68)	10.33 (3.33)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	391.67	32.64
T7	Blue tray trap X 10 cm height	15.00 (3.99)	16.67 (4.20)	23.33 (4.92)	32.33 (5.76)	38.33 (6.26)	36.67 (6.12)	40.33 (6.43)	23.00 (4.89)	5.33 (2.52)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	231.00	19.25
T8	Blue tray trap X 20 cm height	9.00 (3.15)	10.33 (3.29)	12.00 (3.59)	20.00 (4.57)	21.67 (4.76)	20.00 (4.58)	26.33 (5.21)	16.67 (4.18)	4.67 (2.38)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	140.67	11.72
	SE +	0.33	0.46	0.24	0.23	0.23	0.17	0.14	0.19	0.20	0.17	0.18	0.18	--	--
	CD at 5%	1.01	1.42	0.72	0.71	0.71	0.53	0.42	0.57	0.62	0.51	0.54	0.55	--	--

DAS=Days after sowing Figures in parentheses indicate arc sin values

Table B3-11.2c: Relative abundance of jassids captured in different types of trap during 2017-18 (Centre: Niphad)

TN	Treatment Details	Number of jassids captured per trap at												Season total	Av. Mean
		19 DAS	26 DAS	33 DAS	40 DAS	47 DAS	54 DAS	61 DAS	68 DAS	75 DAS	82 DAS	89 DAS	96 DAS		
T1	Yellow sticky trap X 60 cm height	115.33 (10.77)	255.33 (16.01)	270.33 (16.45)	282.33 (16.83)	292.00 (17.11)	315.33 (17.78)	320.33 (17.93)	286.67 (16.96)	17.67 (4.31)	12.00 (3.60)	8.33 (3.02)	6.00 (2.63)	2181.67	181.81
T2	Yellow sticky trap X 120 cm height	85.33 (9.29)	146.67 (12.14)	150.67 (12.32)	202.00 (4.24)	213.33 (14.64)	234.67 (15.35)	242.00 (15.59)	224.33 (15.01)	10.00 (3.30)	3.67 (2.14)	5.67 (2.56)	4.67 (2.36)	1523.00	126.92
T3	Blue sticky trap X 60 cm height	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00	0.00
T4	Blue sticky trap X 120 cm height	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00	0.00
T5	Yellow tray trap X 10 cm height	0.00 (1.00)	10.00 (3.31)	19.33 (4.47)	29.67 (5.51)	32.33 (5.76)	35.33 (6.02)	27.67 (5.35)	17.00 (4.24)	3.67 (2.16)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	175.00	14.58
T6	Yellow tray trap X 20 cm height	0.00 (1.00)	0.00 (1.00)	5.00 (2.39)	9.67 (3.25)	14.67 (3.95)	19.67 (4.54)	22.67 (4.86)	13.33 (3.76)	3.33 (2.06)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	88.33	7.36
T7	Blue tray trap X 10 cm height	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00	0.00
T8	Blue tray trap X 20 cm height	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00	0.00
	SE +	0.16	0.14	0.24	0.22	0.18	0.13	0.11	0.14	0.14	0.10	0.13	0.13	--	--
	CD at 5%	0.50	0.42	0.74	0.67	0.54	0.39	0.34	0.43	0.43	0.30	0.41	0.38	--	--

DAS=Days after sowing Figures in parentheses indicate arc sin values

Table B3-11.2d: Relative abundance of natural enemies captured in different types of traps during 2017-18 (Centre: Niphad)

TN	Treatment Details	Number of natural enemies captured per trap at												Season total	Av. Mean
		19 DAS	26 DAS	33 DAS	40 DAS	47 DAS	54 DAS	61 DAS	68 DAS	75 DAS	82 DAS	89 DAS	96 DAS		
T1	Yellow sticky trap X 60 cm height	2.67 (1.91)	8.33 (3.05)	9.67 (3.25)	13.33 (3.77)	15.00 (4.00)	21.67 (4.76)	22.67 (4.86)	24.00 (5.00)	5.00 (2.43)	1.67 (1.63)	0.00 (1.00)	1.33 (1.52)	125.33	10.44
T2	Yellow sticky trap X 120 cm height	0.67 (1.24)	2.00 (1.73)	2.67 (1.91)	5.00 (2.43)	8.67 (3.10)	15.00 (4.00)	18.67 (4.43)	21.00 (4.69)	5.67 (2.58)	2.33 (1.82)	2.00 (1.73)	1.33 (1.52)	85.00	7.08
T3	Blue sticky trap X 60 cm height	0.00 (1.00)	0.00 (1.00)	0.67 (1.24)	1.67 (1.58)	1.67 (1.58)	3.33 (2.08)	3.67 (2.16)	4.67 (2.38)	2.33 (1.82)	1.33 (1.52)	0.00 (1.00)	0.00 (1.00)	19.33	1.61
T4	Blue sticky trap X 120 cm height	1.00 (1.38)	0.67 (1.28)	1.00 (1.38)	0.67 (1.28)	1.33 (1.52)	2.67 (1.91)	3.33 (2.08)	4.00 (2.23)	3.67 (2.14)	1.67 (1.63)	0.00 (1.00)	0.00 (1.00)	20.00	1.67
T5	Yellow tray trap X 10 cm height	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.67 (1.24)	2.00 (1.72)	1.33 (1.52)	2.00 (1.73)	1.00 (1.38)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	7.00	0.58
T6	Yellow tray trap X 20 cm height	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	1.00 (1.38)	0.67 (1.24)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	1.67	0.14
T7	Blue tray trap X 10 cm height	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.67 (1.24)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.67	0.06
T8	Blue tray trap X 20 cm height	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00	0.00
	SE +	0.11	0.13	0.13	0.18	0.16	0.10	0.08	0.15	0.15	0.08	--	0.06	--	--
	CD at 5%	0.33	0.38	0.41	0.55	0.49	0.31	0.23	0.44	0.47	0.24	--	0.17	--	--

DAS=Days after sowing   Figures in parentheses indicate arc sin values

Table B3-11.2e: Relative abundance of jassids captured in different types of trap during 2017-18 (Centre: Karnal)

TN	Treatment Details	Number of aphids captured per trap at												Season total	Av. Mean
		19 DAS	26 DAS	33 DAS	40 DAS	47 DAS	54 DAS	61 DAS	68 DAS	75 DAS	82 DAS	89 DAS	96 DAS		
T1	Yellow sticky trap X	228.0	398.7	427.0	449.3	494.3	582.7	605.7	525.7	136.3	108.3	56.3	41.0	4053.3	337.8
	60 cm height	(15.1)	(20.0)	(20.7)	(21.2)	(22.3)	(24.2)	(24.6)	(22.9)	(11.7	(10.5)	(7.6)	6.5)		(17.3)
T2	Yellow sticky trap X	111.7	296.7	306.3	346.0	381.0	406.3	415.7	336.3	227.7	177.3	89.3	60.7	3155.0	262.9
	120 cm height	(10.6)	(17.3)	(17.5)	(18.6)	(19.5)	(20.2)	(20.4)	(18.4)	(15.1)	(13.4)	(9.5)	(7.9)		(15.7)
T3	Blue sticky trap X	138.0	297.0	321.0	360.0	368.3	390.7	396.0	318.7	29.0	19.7	15.0	8.0	2661.3	221.8
	60 cm height	(11.8)	(17.3)	(17.9)	19.0)	(19.2)	(19.8	19.9)	(17.9)	(5.5)	(4.5)	(4.0)	(3.0)		(13.3)
T4	Blue sticky trap X	77.7	198.3	218.0	231.3	260.7	302.3	317.3	281.0	53.7	37.0	26.7	16.0	2020.0	168.3
	120 cm height	(8.9)	(14.1)	(14.8)	15.2)	(16.2)	(17.40	(17.8)	(16.8)	(7.4)	(6.2)	(5.3)	(4.1)		(12.0)
T5	Yellow tray trap X	42.0	58.3	68.0	76.3	82.0	86.3	93.7	77.3	20.0	5.0	3.4	5.0	617.4	51.4
	10 cm height	(6.6)	(7.7)	(8.3)	(8.8)	(9.1)	(9.3)	(9.7)	(8.9)	(4.6)	(2.4)	(2.1)	(2.4)		(6.7)
T6	Yellow tray trap X	21.0	43.7	53.3	60.3	63.3	63.7	67.3	48.7	15.3	5.0	3.2	2.0	446.9	37.2
	20 cm height	(4.7)	(6.7)	7.4)	7.8)	(8.0)	(8.0)	(8.3)	7.0	(4.0)	(2.4)	(2.0)	(1.7)		(5.7)
T7	Blue tray trap X	20.0	21.7	28.3	37.3	43.3	41.7	45.3	28.0	10.3	5.5	2.3	0.0	283.8	23.6
	10 cm height	(4.6)	(4.8)	(5.4)	6.2)	(6.7)	(6.5)	(6.8)	(5.4)	(3.4)	(2.5)	(1.8)	(1.0)		(4.6)
T8	Blue tray trap X	14.0	15.3	17.0	25.0	26.7	25.0	31.3	21.7	9.7	4.5	3.1	0.0	193.3	16.1
	20 cm height	(3.9)	(4.0)	(4.2)	(5.1)	(5.3)	(5.1)	(5.7)	(4.8)	(3.3)	(2.3)	(2.0)	(1.0)		(3.9)
	SE +	0.5	0.7	0.4	0.5	0.3	0.2	0.2	0.3	0.4	0.1	0.4	0.3	--	2.1
	CD at 5%	2.4	2.0	1.6	1.5	1.4	1.2	1.0	0.7	0.5	0.6	0.7	0.4	--	3.5

DAS=Days after sowing Figures in parentheses indicate arc sin values

Table B3-11.2f: Relative abundance of natural enemies captured in different types of traps during 2017-18 (Centre: Karnal)

TN	Treatment Details	Number of natural enemies captured per trap at												Season total	Av. Mean
		19 DAS	26 DAS	33 DAS	40 DAS	47 DAS	54 DAS	61 DAS	68 DAS	75 DAS	82 DAS	89 DAS	96 DAS		
T1	Yellow sticky trap X	5.7	9.8	10.5	15.2	17.2	23.1	24.2	26.0	7.0	3.7	1.0	0.0	143.4	11.9
	60 cm height	(2.6)	(3.3)	(3.4)	(4.0)	(4.3)	(4.9)	(5.0)	(5.2)	(2.8)	(2.2)	(1.4)	(1.0)		(3.6)
T2	Yellow sticky trap X	1.2	3.5	3.5	6.5	10.0	17.0	20.2	23.1	5.7	2.5	2.2	1.0	96.4	8.0
	120 cm height	(1.5)	(2.1)	(2.1)	(2.7)	(3.3)	(4.2)	(4.6)	(4.9)	(2.6)	(1.9)	(1.8)	1.4)		(3.0)
T3	Blue sticky trap X	0.0	0.0	0.7	1.7	1.7	3.3	3.7	4.7	2.3	1.3	0.0	0.0	19.3	1.6
	60 cm height	(1.0)	(1.0)	(1.3)	(1.6)	(1.6)	(2.1)	(2.2)	(2.4)	(1.8)	(1.5)	(1.0)	1.0)		(1.6)
T4	Blue sticky trap X	1.0	0.7	1.0	0.7	1.3	2.7	3.3	4.0	3.7	1.7	0.0	0.0	20.0	1.7
	120 cm height	(1.4)	(1.3)	(1.4)	(1.3)	(1.5)	(1.9)	(2.1)	(2.2)	(2.2)	(1.6)	(1.0)	1.0)		(1.6)
T5	Yellow tray trap X	0.0	0.0	0.0	0.0	1.0	0.0	0.3	1.6	0.0	0.0	0.0	0.0	2.9	0.2
	10 cm height	(1.0)	(1.0)	(1.0)	(1.0)	(1.4)	(1.0)	(1.1)	(1.6)	(1.0)	(1.0)	(1.0)	1.0)		(1.1)
T6	Yellow tray trap X	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.7	0.0	0.0	0.0	2.3	0.2
	20 cm height	(1.3)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.4)	(1.3)	(1.0)	(1.0)	1.0)		(1.1)
T7	Blue tray trap X	0.0	1.0	0.0	0.0	0.5	0.0	0.0	0.8	0.0	0.0	0.0	0.0	2.3	0.2
	10 cm height	(1.0)	(1.4)	(1.0)	(1.0)	(1.2)	(1.0)	(1.0)	(1.3)	(1.0)	(1.0)	(1.0)	1.0)		(1.1)
T8	Blue tray trap X	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.1
	20 cm height	(1.0)	(1.0)	(1.4)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	1.0)		(1.0)
	SE +	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.2	0.2	0.1	--	0.1	--	0.2
	CD at 5%	0.2	0.4	0.5	0.6	0.4	0.3	0.2	0.5	0.5	0.3	--	0.3	--	0.4

DAS=Days after sowing Figures in parentheses indicate arc sin values

B4. Effect of varied nitrogen fertilization on aphid and termite infestation in wheat
(**Centres:** Ludhiana, Niphad, Karnal)

Impact of three different doses (low, medium & high) of nitrogen application on population abundance of foliar aphid and termites was investigated in wheat. The nitrogen doses for NWPZ locations will be 0, 75,150 and 225 kg/ha while for PZ location, it will be 0, 60,120 and 180 kg/ha.

Observations:

1. Aphid: Population of aphids per plant, natural enemies (adult and grubs) per plot
2. Termite: Plant population per meter row length, per cent damaged shoots and effective tillers in each treatment
3. Yield q/ha
4. Nitrogen status of plants at flag leaf stage and at the time of harvest

Treatment details

Ludhiana centre	
Main plot (Nitrogen rate kg/ha)	**Sub plot (Varieties)**
N0 -- (Control/without nitrogen)	V1—HD 2967,
N75 --(50% less than recommended dose)	V2—PBW 660
N150 -- (Recommended dose)	
N225 -- (50% more than recommended dose)	
Niphad centre	
Main plot (Nitrogen rate kg/ha)	**Sub plot (Varieties)**
N0 -- (Control/without nitrogen)	V1-- NIAW 1994,
N60 --(50% less than recommended dose)	V2-- MACS 6222
N120 -- (Recommended dose)	V3--A-9-30-1
N180 -- (50% more than recommended dose)	
Karnal centre	
Main plot (Nitrogen rate kg/ha)	**Sub plot (Varieties)**
N0 -- (Control/without nitrogen)	V1—HD 2967,
N75 --(50% less than recommended dose)	V2—HD 3036
N150 -- (Recommended dose)	V3--A-9-30-1
N225 -- (50% more than recommended dose)	

Centre: Ludhiana

Impact of three different doses (low, medium & high) of nitrogen application on population abundance of foliar aphid was investigated in wheat. The nitrogen doses were 0, 75,150 and 225 kg/ha. Populations of aphids per plant, natural enemies (adult and grubs) per square meter were recorded at fortnightly intervals. The population of aphid and their natural enemies was very low for statistically analysis on most of the date of observations, however clear differences were observed at peak period of their activity (Table B4-11.2a). The yield per treatment was recorded to determine the individual effect of each dose of nitrogen application on aphid abundance.

The incidence of aphids and their natural enemies increased significantly with the increase in dosages of nitrogen level. Yields levels were also higher at higher nitrogen levels.

Centre: Niphad

Aphids:

Nitrogen fertilization: Data indicated that the wheat plants differed significantly in their degree of infestation with aphids according to dose of nitrogen fertilization. The maximum (19.32) number of aphids/shoot/plant were recorded in treatment with Nitrogen 180 kg/ha i.e. 50% more than recommended dose as against the minimum (9.71) number of aphids/shoot/plant were recorded in treatment with Nitrogen 0 kg/ha i.e. without nitrogen. The increase in population of aphids was observed as the dose of nitrogen increased. It indicated that the aphid attraction/preference was more towards the higher dose of nitrogen fertilization. This high level of nitrogen results in greenish crop but also attract the more number of aphids. The present study depicted low aphid population at zero nitrogen fertilization to the crop while more application nitrogen fertilization over recommended dose increases the aphid population (Table B4-11.2b).

Varieties: Data revealed significant differences among each other. The variety NIAW 1994 showed significantly less (10.75) number of aphids/shoot/plant whereas the maximum (20.62) were recorded in variety A-9-30-1(Table B4-11.2b).

Nitrogen fertilization x varietal interaction: Among interaction of nitrogen fertilization and variety, the minimum (7.13) number of aphids/shoot/plant were recorded in variety NIAW 1994 with Nitrogen 0 kg/ha i.e. without nitrogen fertilization. The highest (26.99) number of aphids/shoot/plant were recorded in variety A-9-30-1 with Nitrogen 180 kg/ha i.e. 50% more than recommended dose (Table B4-11.2b).

Jassids:

Nitrogen fertilization: The maximum (14.16) number of jassids/plant were recorded in treatment with Nitrogen 180 kg/ha i.e. 50% more than recommended dose as against minimum (5.89) number of jassids/plant were recorded in Nitrogen 0 kg/ha i.e. without nitrogen fertilization (Table B4-11.2c).

Varieties: Data revealed significant differences among each other. The variety NIAW 1994 showed significantly minimum (9.44) number of jassids/plant whereas the maximum (11.04) were recorded in variety A-9-30-1 (Table B4-11.2c).

Nitrogen fertilization x varietal interaction: Among interaction of nitrogen fertilization and variety, the minimum (5.42) number of jassids/plant were recorded in variety NIAW 1994 with Nitrogen 0 kg/ha i.e. without nitrogen fertilization. The highest (14.72) number of jassids/plant were recorded in variety A-9-30-1 with Nitrogen 180 kg/ha i.e. 50% more than recommended dose (Table B4-11.2c).

Yield:

Nitrogen fertilization: Data regarding yield revealed that the treatment with Nitrogen 120 kg/ha i.e. recommended dose recorded highest of 33.18 q/ha grain yield whereas Nitrogen 0 kg/ha i.e. without nitrogen fertilization recorded minimum of 23.14 q/ha. It indicated that the grain yield was affected by both of nitrogen fertilization and population of aphids, hence the treatment with Nitrogen 180 kg/ha i.e. 50% more than recommended dose recorded less grain yield than Nitrogen 120 kg/ha i.e. recommended dose of nitrogen because of maximum population of aphids appeared on it and again control without nitrogen recorded less grain yield than Nitrogen 120 kg/ha i.e. recommended dose of nitrogen even though recorded minimum number of aphids than Nitrogen 120 kg/ha i.e. recommended dose but aphid affected in it due to less supply of nitrogen to the crop(Table B4-11.2d).

Varieties: In case of varieties the highest grain yield of 32.98 q/ha was recorded in variety NIAW 1994 followed by MACS 6222 (31.83 q/ha). The minimum yield of 18.51 q/ha was recorded in variety A-9-30-1(Table B4-11.2d).

Nitrogen fertilization x varietal interaction: Among nitrogen fertilization and varieties the highest (38.42 q/ha) grain yield was recorded in variety NIAW 1994 fertilized with Nitrogen 120 kg/ha i.e. recommended dose. The lowest (16.20 q/ha) grain yield was recorded the variety A-9-30-1 with Nitrogen 0 kg/ha i.e. without nitrogen fertilization (Table B4-11.2d).

Centre: Karnal

Impact of three different doses (low, medium & high) of nitrogen application on population abundance of foliar aphid was investigated in wheat. The nitrogen doses were 0, 75,150 and 225 kg/ha. Populations of aphids per plant, natural enemies (adult and grubs) per square meter were recorded at fortnightly intervals. The highest number of aphids were recorded in treatment of 225 kg/ha nitrogen application. The population was 28.20, 26.53 and 31.25 aphids/plant in variety HD 2967, HD 3086 and A-9-30-1, respectively.Similarly, the natural enemy population was also higher in treatment which received 225 kg/ ha nitrogen. The population of coccinellids was recored to be 10.51, 11.23 and 9.36 beetles per square meter, resptively. Among nitrogen fertilization and varieties the highest (58.00 q/ha) grain yield was recorded in variety HD 2967 fertilized with Nitrogen 225 kg/ha i.e. recommended dose. The lowest (32.56 q/ha) grain yield was recorded the variety A-9-30-1 with Nitrogen 0 kg/ha i.e. without nitrogen fertilization (Table B4-11.2e).

The incidence of aphids and their natural enemies increased significantly with the increase in dosages of nitrogen level. Yields levels were also higher at higher nitrogen levels (Table B4-11.2e).

Table B4-11.2a: Effect of nitrogen fertilization on aphid abundance in various wheat varieties (Centre: Ludhiana)

S. No.	Nitrogen dosages	Variety	Aphid population per earhead		Coccinellids population per square meter		Grain Yield (q/ha)
			8-3-2018	**15-3-2018**	**15-3-2018**	**28-3-2018**	
1	0 (Control/without nitrogen)	HD2967	8.90 (3.14)	9.36 (3.21)	2.83 (1.94)	5.13 (2.47)	41.42
2	0 (Control/without nitrogen)	PBW 660	8.86 (3.12)	9.03 (3.16)	1.76 (1.66)	5.86 (2.61)	39.06
3	75(50% less than recommended dose)	HD2967	14.23 (3.89)	16.56 (4.18)	3.93 (2.21)	7.30 (2.87)	52.48
4	75(50% less than recommended dose)	PBW 660	11.73 (3.56)	16.66 (4.20)	3.56 (2.13)	7.19 (2.86)	49.95
5	150(Recommended dose)	HD2967	20.30 (4.61)	26.26 (5.21)	4.76 (2.40)	7.43 (2.90)	59.37
6	150(Recommended dose)	PBW 660	18.63 (4.42)	22.63 (4.85)	4.63 (2.37)	7.63 (2.93)	59.77
7	225(50% more than recommended dose)	HD2967	27.63 (5.34)	31.20 (5.67)	6.16 (2.67)	9.06 (3.12)	63.24
8	225(50% more than recommended dose)	PBW 660	26.66 (5.25)	28.06 (5.39)	6.83 (2.79)	9.53 (3.24)	62.77
CD (p=0.05)			(0.43)	(0.28)	(0.25)	(0.20)	3.59

* Figures within parentheses are transformed means

Date of sowing : 08.11.2017 Plot size : 7.5 m^2

Date of harvest : 20.04.2018 Replications : Three

Table B4-11.2b: Effect of nitrogen fertilization on aphid abundance in various wheat varieties (Centre: Niphad)

SN	Treatments	NIAW 1994	MACS 6222	A-9-30-1	Mean
1	0 (Control/without nitrogen)	7.13 (2.85)	8.52 (3.09)	13.48 (3.81)	**9.71 (3.25)**
2	60 (50% less than recomm. dose)	7.63 (2.94)	10.47 (3.39)	16.48 (4.18)	**11.53 (3.50)**
3	120 (Recomm. dose)	13.74 (3.84)	15.77 (4.10)	25.55 (5.15)	**18.35 (4.36)**
4	180 (50% more than recomm. dose)	14.50 (3.94)	16.47 (4.18)	26.99 (5.29)	**19.32 (4.47)**
	Mean	**10.75 (3.39)**	**12.81 (3.69)**	**20.62 (4.61)**	

Figures in parentheses indicate V_{n+1} transformed value

Factors	SE ±	CD at 5%
Nitrogen fertilization (N)	**0.01**	**0.04**
Varieties (V)	**0.01**	**0.03**
Interaction (NxV)	**0.02**	**0.06**

Table B4-11.2c: Effect of nitrogen fertilization on jassid abundance in various wheat varieties (Centre: Niphad)

SN	Treatments	NIAW 1994	MACS 6222	A-9-30-1	Mean
1	0 (Control/without nitrogen)	5.42 (2.53)	5.68 (2.59)	6.58 (2.75)	5.89 (2.62)
2	60 (50% less than recomm. dose)	6.63 (2.76)	7.31 (2.88)	8.21 (3.04)	7.38 (2.89)
3	120 (Recomm. dose)	12.13 (3.62)	13.14 (3.76)	14.63 (3.95)	13.30 (3.78)
4	180 (50% more than recomm. dose)	13.59 (3.82)	14.16 (3.89)	14.72 (3.97)	14.16 (3.89)
	Mean	9.44 (3.19)	10.08 (3.28)	11.04 (3.43)	

Figures in parentheses indicate V_{n+1} transformed value

Factors	SE ±	CD at 5%
Nitrogen fertilization (N)	**0.01**	**0.04**
Varieties (V)	**0.01**	**0.03**
Interaction (NxV)	**0.02**	**0.05**

Table B4-11.2d: Effect of nitrogen fertilization on yield in various wheat varieties (Centre: Niphad)

SN	Treatments	NIAW 1994	MACS 6222	A-9-30-1	Mean
1	0 (Control/without nitrogen)	26.85	26.38	16.20	23.14
2	60 (50% less than recomm. dose)	28.70	27.77	16.20	24.22
3	120 (Recomm. dose)	38.42	37.50	23.61	33.18
4	180 (50% more than recomm. dose)	37.96	35.65	18.05	30.55
	Mean	32.98	31.83	18.51	

Figures in parentheses indicate V_{n+1} transformed value

Factors	SE ±	CD at 5%
Nitrogen fertilization (N)	**0.32**	**0.97**
Varieties (V)	**0.41**	**1.21**
Interaction (NxV)	**0.96**	**2.88**

Table B4-11.2e: Effect of nitrogen fertilization on aphid abundance in various wheat varieties (Centre:Karnal)

S. No.	Nitrogen dosages	Variety	Aphid population per earhead		Coccinellids population per square meter		Grain Yield (q/ha)
			8-3-2018	15-3-2018	15-3-2018	28-3-2018	
1	0 (Control/without nitrogen)	HD2967	11.65 (3.56)	12.10 (3.62)	2.93 (1.98)	6.00 (2.65)	37.00
2	0 (Control/without nitrogen)	HD3086	10.88 (3.45)	10.23 (3.35)	2.86 (1.96)	6.96 (2.82)	36.06
3	0 (Control/without nitrogen)	A-9-30-1	19.23 (4.50)	15.36 (4.04)	2.52 (1.88)	5.23 (2.50)	32.56
4	75(50% less than recommended)	HD2967	19.23 (4.50)	20.52 (4.64)	4.53 (2.35)	8.30 (3.05)	46.68
5	75(50% less than recommended)	HD3086	17.73 (4.33)	18.60 (4.43)	3.60 (2.14)	8.19 (3.03)	45.86
6	75(50% less than recommended)	A-9-30-1	25.36 (5.13)	22.53 (4.85)	3.22 (2.05)	7.69 (2.95)	36.62
7	150(Recommended dose)	HD2967	22.35 (4.83)	25.42 (5.14)	5.92 (2.63)	8.43 (3.07)	51.40
8	150(Recommended dose)	HD3086	20.36 (4.62)	23.45 (4.94)	5.23 (2.50)	8.63 (3.10)	50.23
9	150(Recommended dose)	A-9-30-1	28.03 (5.39)	29.36 (5.51)	5.00 (2.45)	7.54 (2.92)	37.53
10	225(50% more than recommended)	HD2967	25.63 (5.16)	28.20 (5.40)	7.00 (2.83)	10.51 (3.39)	58.00
11	225(50% more than recommended)	HD3086	23.56 (4.96)	26.53 (5.25)	7.23 (2.87)	11.23 (3.50)	57.32
12	225(50% more than recommended)	A-9-30-1	29.37 (5.51)	31.25 (5.68)	6.25 (2.69)	9.36 (3.22)	39.23
CD (p=0.05)			(0.59)	(0.32)	(0.29)	(0.24)	3.59

* Figures within parentheses are transformed means

Date of sowing	:	22.11.2017	Plot size	:	7.5 m^2
Date of harvest	:	20.04.2018	Replications	:	Three

B5. Basic studies for development of IPM strategies (Centres: Vijapur, Ludhiana, Niphad, Karnal,Kharibari)

The study was conducted to generate region-wise data on population dynamics of major insect-pests of wheat and barley for developing pest-forcasting models. Weather parameters of a location will be correlated with insect population to determine the effect of climatic variations on the pest population dynamics under changing climate scenario.

Centre: Vijapur

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 revealed that the first appearance of the pests was noticed in the second week of February which continued till the first week of March.

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 indicated that 10.71 per cent parasitism by *Campolatis chlorideae* on *H. armigera* larvae (Table B5-11.2a).

Table B5-11.2a: Seasonal activity of *H .armigera* and its natural parasitism (Location: Vijapur)

Sr. No.	Date of observation	No. of larvae/ 50 plant	No. of larvae observed	No. of larvae parasitized	Percent parasitism	Name of parasite
1.	29/01/18	0	0	0	10.71	*Campoletis chlorideae*
2.	05/02/18	0	0	0		
3.	12/02/18	1	5	0		
4.	19/02/18	1	9	1		
5.	26/02/18	1	8	1		
6.	04/03/18	1	6	1		
7.	011/03/18	0	0	0		
8.	18/03/18	0	0	0		

Centre: Ludhiana

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 1 m² 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 26.01.2018 on wheat crop and it started rising and reached its peak on 02.03.2018 (Table B5-11.2b). Thereafter population of wheat aphid started declining and it drastically decreased after 30.03.2018. The population of Coccinellid beetle remained low up to 02.03.2018 and thereafter it started rising and reach its peak on 16.03.2018 (two weeks after the peak period of activity of wheat aphid).

Population dynamics of barley aphid: The aphid population first appeared on 26.01.2018 on barley crop and it started rising and reached its peak on 02.03.2018 (Table B5-11.2c). Thereafter aphid population started declining and became very low after 30.03.2018. The population of coccinellid beetles remained low up to 09.03.2018 (one week after the peak period of activity of barley aphid) and thereafter it stated rising and reached its peak on 23.03.2018 (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.

Centre: Niphad

The weekly observations on wheat aphids were recorded along with different weather parameters. Data presented in Table B5-11.2d-f. revealed that the maximum (59.70) number of aphids/shoot/plant were observed in 2nd Meteorological week when the maximum and minimum temperatures were 28.0 and 10.8 °C respectively and average relative humidity was 60.0 per cent. The incidence of jassids on wheat was also recorded. The maximum (33.90) population of the jassids/plant were recorded in 1st Meteorological week when the maximum and minimum temperatures were 27.5 and 8.1 °C, respectively. The maximum (8.50) natural enemies/m^2 was recorded in 2nd MW when maximum and minimum temperature were 28.0 and 10.8°C, respectively and average humidity was 60 per cent.

Centre: Karnal

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 1m^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 25.1.2018 on wheat crop and it started rising and reached its peak (63.5 aphids/plant) on 23.02.2018 (Table B5-11.2g.). Thereafter population of wheat aphid started declining. The population of Coccinellid beetle started from 09-02-2018 and reaches its peak (8.7 beetles/m^2) on 06.03.2018.

Population dynamics of barley aphid:

The aphid population was high as compared to wheat during the whole crop season (Table B5-10.2h.). It first appeared on 25.01.2018 on barley crop and it started rising and reached its first peak (117.0 aphids/plant) on 23.02.2018. The population of coccinellid beetles remained low up to 25.02.2018 (the peak period of activity of barley aphid) and thereafter it stated rising and reached its peak (9.6 beetles/m^2) on 06.03.2018. 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 B5-11.2b: Pest modeling for foliage aphids and their natural enemies (Centre: Ludhiana)

Date	Plant No.(No. of aphids/tiller)											Collateral host (Barley)			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Avg.	P1	P2	P3	Avg.
12.01.2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19.01.2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26.01.2018	1	0	0	0	0	0	0	1	0	0	0.2	0	1	0	0.33
02.02.2018	4	2	1	3	1	2	1	0	0	1	1.5	0	2	4	2.00
09.02.2018	4	1	1	0	0	3	4	5	2	3	2.3	0	7	6	4.33
16.02.2018	4	0	8	9	5	0	0	8	7	4	4.5	14	12	8	11.33
23.02.2018	11	10	20	10	14	0	14	22	12	10	12.3	18	24	15	19.00
02.03.2018	10	14	10	14	19	10	20	21	28	19	16.5	22	29	24	25.00
09.03.2018	10	11	15	15	15	24	14	10	18	15	14.7	16	14	22	17.33
16.03.2018	8	2	2	4	4	3	11	8	5	8	5.5	10	10	11	10.33
23.03.2018	0	0	0	1	1	3	4	0	4	0	1.3	7	4	14	8.33
30.03.2018	0	0	0	0	0	0	0	1	0	0	0.1	2	5	9	5.33
Date	Plant No.(Coccinellid beetle/sq m area)											Collateral host (Barley)			
12.01.2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19.01.2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26.01.2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
02.02.2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
09.02.2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
16.02.2018	1	0	0	0	0	1	0	0	0	1	0.3	0	0	0	0.00
23.02.2018	4	4	0	5	6	0	0	1	0	1	2.1	0	0	0	0.00
02.03.2018	4	7	4	0	0	4	0	3	2	0	2.4	1	0	0	0.00
09.03.2018	11	8	10	8	9	4	0	4	8	15	7.7	0	0	0	0.33
16.03.2018	8	14	18	4	2	10	9	10	0	14	8.9	1	2	4	0.00
23.03.2018	0	2	1	0	4	1	1	2	0	1	1.2	8	4	10	2.33
30.03.2018	0	0	0	0	1	0	0	0	0	1	0.2	4	5	7	7.33

Table B5-11.2b: Pest modeling for foliage aphids and their natural enemies (Centre: Ludhiana)

Date	Plant No.(No. of aphids/tiller)											Collateral host (wheat)			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Avg.	P1	P2	P3	Avg.
12.01.2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19.01.2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26.01.2018	0	1	0	0	0	0	0	1	2	0	0.4	1	0	0	0.33
02.02.2018	0	2	4	0	4	4	0	0	4	1	1.9	4	2	1	2.33
09.02.2018	0	7	6	4	1	5	5	0	6	1	3.5	4	1	1	2.00
16.02.2018	14	12	8	8	20	11	10	11	8	9	11.1	4	0	8	4.00
23.02.2018	18	24	15	29	18	21	30	24	28	22	22.9	11	10	20	13.67
02.03.2018	22	29	24	28	34	29	31	19	17	45	27.8	10	14	10	11.33
09.03.2018	16	14	22	19	17	40	30	22	18	20	21.8	10	11	15	12.00
16.03.2018	10	10	11	71	0	18	10	22	8	8	16.8	8	2	2	4.00
23.03.2018	7	4	14	10	0	0	10	15	7	9	7.6	0	0	0	0.00
30.03.2018	2	5	9	5	8	7	6	0	1	1	4.4	0	0	0	0.00
12.01.2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Date	Plant No.(Coccinellid beetle/sq m area)											Collateral host (wheat)			
12.01.2018	0	0	0	0	0	0	0	0	0	0	0.00	0	0	0	0.00
19.01.2018	0	0	0	0	0	0	0	0	0	0	0.00	0	0	0	0.00
26.01.2018	0	0	0	0	0	0	0	0	0	0	0.00	0	0	0	0.00
02.02.2018	0	0	0	0	0	0	0	0	0	0	0.00	0	0	0	0.00
09.02.2018	0	0	0	0	0	0	0	1	0	0	0.10	0	0	0	0.00
16.02.2018	0	0	0	1	0	0	0	0	0	0	0.10	1	0	0	0.33
23.02.2018	0	0	0	0	1	0	0	0	2	2	0.50	4	4	0	2.67
02.03.2018	1	0	0	5	0	2	5	0	0	0	1.30	4	7	4	5.00
09.03.2018	0	0	0	1	0	1	0	0	4	8	1.40	11	8	10	9.67
16.03.2018	1	2	4	8	4	0	8	2	4	8	4.10	8	14	18	13.33
23.03.2018	8	4	10	8	0	12	14	9	11	22	9.80	0	2	1	1.00
30.03.2018	4	5	7	4	0	0	4	5	3	6	3.80	0	0	0	0.00
12.01.2018	0	0	0	0	0	0	0	0	0	0	0.00	0	0	0	0.00

Table B5-11.2c: Population dynamics of wheat aphid during 2017-18 (Centre: Niphad)

Date of observation	MW	Plant No. (No. of aphids/tiller)											Collateral host (barley)				Rain fall (mm)	Temperature (⁰C)		Humidity (%)	
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Avg.	P1	P2	P3	Avg.		Max	Min	Morn	Even
Nov. 5-11	**45**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	29.2	12.3	80	34
12-18	**46**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	30.0	11.6	78	32
19-25	**47**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	30.3	14.1	84	41
26-2	**48**	0	0	1	0	0	2	1	1	2	0	**0.60**	0	0	0	**0**	0.0	29.3	10.7	81	37
Dec. 3-9	**49**	5	12	11	10	11	8	5	3	4	5	**7.40**	4	5	3	**4.00**	4.8	26.5	15.8	84	59
10-16	**50**	15	13	14	12	17	11	10	12	11	14	**12.90**	8	7	6	**7.00**	0.0	28.6	12.5	81	50
17-23	**51**	25	27	23	27	29	28	30	27	25	21	**25.20**	18	15	16	**16.33**	0.0	28.1	10.9	82	49
24-31	**52**	45	45	47	43	49	44	41	46	45	43	**44.80**	35	42	42	**39.67**	0.0	28.4	8.0	80	35
Jan. 1-7	**01**	55	59	64	57	65	68	55	49	57	50	**57.90**	40	59	60	**53.00**	0.0	27.5	8.1	81	44
8-14	**02**	54	62	55	59	61	67	53	57	69	60	**59.70**	40	52	54	**58.67**	0.0	28.0	10.8	80	40
15-21	**03**	27	25	23	30	27	22	24	28	25	29	**26.00**	20	23	10	**17.67**	0.0	30.3	11.2	78	32
22-28	**04**	5	0	0	3	0	2	0	0	3	3	**1.60**	0	0	0	**0.0**	0.0	28.9	7.5	79	35
29-4	**05**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	30.5	8.6	78	33
Feb. 5-11	**06**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	31.2	11.0	76	35
12-18	**07**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	32.0	10.8	78	32
19-25	**08**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	32.7	11.2	70	30
26-4	**09**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	33.5	10.9	69	34
Mar. 5-11	**10**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	34.0	13.9	72	29
12-18	**11**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	33.8	16.0	74	32

Table B5-11.2e: Population dynamics of jassids during 2017-18 (Centre: Niphad)

Date of observation	MW	Plant No. (No. of jassids/tiller)											Collateral host (Wheat)				RF(mm)	Temperature (⁰C)		Humidity (%)	
		P1	P2	P3	Max	Min	Max	Min	P8	P9	P10	Avg.	P1	P2	P3	Avg.		Max	Min	Morn	Even
Nov. 5-11	**45**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	29.2	12.3	80	34
12-18	**46**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	30.0	11.6	78	32
19-25	**47**	2	2	4	2	4	2	3	2	2	3	**2.60**	0	0	0	**0.0**	0.0	30.3	14.1	84	41
26-2	**48**	9	8	4	13	7	15	14	2	5	17	**9.40**	0	0	0	**0.0**	0.0	29.3	10.7	81	37
Dec. 3-9	**49**	12	15	11	18	9	10	27	15	8	7	**13.20**	0	0	0	**0.0**	4.8	26.5	15.8	84	59
10-16	**50**	19	13	27	28	17	14	17	21	24	15	**19.50**	0	0	0	**0.0**	0.0	28.6	12.5	81	50
17-23	**51**	25	21	18	24	22	25	27	21	24	23	**23.00**	0	0	0	**0.0**	0.0	28.1	10.9	82	49

24-31	**52**	30	35	31	27	38	35	27	36	35	34	**32.80**	0	0	0	**0.0**	0.0	28.4	8.0	80	35
Jan. 1-7	**01**	33	39	37	38	35	34	39	27	25	32	**33.90**	0	0	0	**0.0**	0.0	27.5	8.1	81	44
8-14	**02**	25	20	21	18	17	25	21	29	22	20	**21.80**	0	0	0	**0.0**	0.0	28.0	10.8	80	40
15-21	**03**	10	5	7	7	0	0	3	3	4	7	**4.60**	0	0	0	**0.0**	0.0	30.3	11.2	78	32
22-28	**04**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	28.9	7.5	79	35
29-4	**05**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	30.5	8.6	78	33
Feb. 5-11	**06**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	31.2	11.0	76	35
12-18	**07**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	32.0	10.8	78	32
19-25	**08**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	32.7	11.2	70	30
26-4	**09**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	33.5	10.9	69	34
Mar. 5-11	**10**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	34.0	13.9	72	29
12-18	**11**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	33.8	16.0	74	32

Table B5-11.2f: Population dynamics of *coccinellid* beetle during 2017-18 (Centre: Niphad)

Date of observation	MW	Plant No. (No. of beetle/sq m area)											Collateral host				Rain fall (mm)	Temperature (^{0}C)		Humidity (%)	
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Avg.	P1	P2	P3	Avg.		Max	Min	Morn	Even
Dec. 3-9	**49**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	4.8	26.5	15.8	84	59
10-16	**50**	2	1	1	2	1	1	1	2	2	2	**1.50**	1	0	2	**1.00**	0.0	28.6	12.5	81	50
17-23	**51**	3	2	4	2	2	2	4	0	0	3	**2.20**	1	1	2	**1.33**	0.0	28.1	10.9	82	49
24-31	**52**	4	5	4	2	4	3	2	1	4	2	**3.10**	2	1	2	**1.67**	0.0	28.4	8.0	80	35
Jan. 1-7	**01**	5	3	3	4	5	5	4	5	3	5	**4.20**	2	1	2	**1.67**	0.0	27.5	8.1	81	44
8-14	**02**	7	9	9	10	7	8	8	11	9	7	**8.50**	2	2	2	**2.00**	0.0	28.0	10.8	80	40
15-21	**03**	5	7	6	6	7	5	4	5	5	3	**5.30**	1	2	3	**2.00**	0.0	30.3	11.2	78	32
22-28	**04**	2	2	1	2	1	1	0	0	0	2	**1.10**	0	2	0	**0.67**	0.0	28.9	7.5	79	35
29-4	**05**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	30.5	8.6	78	33
Feb. 5-11	**06**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	31.2	11.0	76	35
12-18	**07**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	32.0	10.8	78	32
19-25	**08**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	32.7	11.2	70	30
26-4	**09**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	33.5	10.9	69	34
Mar. 5-11	**10**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	34.0	13.9	72	29
12-18	**11**	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**	0.0	33.8	16.0	74	32

Table B5-11.2g: Population dynamics of wheat aphid and Coccinellid beetle during 2017-18 (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.
25.01.2018	5	2	2	9	7	4	7	5	6	8	5.5	13	24	18	18.3
01.02.208	12	25	20	12	11	17	15	3	9	14	13.8	28	43	28	33.0
09.02.2018	54	35	55	26	36	23	28	42	43	34	37.6	34	34	42	36.7
15.02.2018	62	42	37	43	54	49	52	48	34	67	48.8	57	76	44	59.0
23.02.2018	84	50	67	38	47	62	44	76	87	80	63.5	87	66	114	89.0
01.03.2018	74	32	71	67	76	58	64	56	48	64	61.0	84	47	43	58.0
06.03.2018	24	38	22	26	26	37	44	27	24	27	29.5	48	34	44	42.0
13.03.2018	32	20	16	23	17	25	34	38	13	11	22.9	34	18	37	29.7
22.03.2018	10	9	7	15	16	10	14	15	18	23	13.7	11	26	11	16.0
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.
25.01.2018	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0.0
01.02.208	0	0	2	2	0	3	0	0	0	0	0.7	0	2	3	1.7
09.02.2018	2	0	3	4	0	2	2	3	2	1	1.9	2	3	1	2.0
15.02.2018	5	2	1	2	2	4	5	8	2	2	3.3	4	4	2	3.3
23.02.2018	7	5	4	3	5	8	6	1	3	2	4.4	3	3	5	3.7
01.03.2018	22	1	14	4	2	3	7	2	2	6	6.3	5	5	10	6.7
06.03.2018	15	8	15	12	6	15	3	5	6	2	8.7	8	7	11	8.7
13.03.2018	12	5	13	6	2	5	12	13	11	4	8.3	12	13	8	11.0
22.03.2018	4	8	6	8	2	3	10	7	5	1	5.4	5	7	10	7.3

Table B5-11.2h: Population dynamics of barley aphid& Coccinellid beetle during 2017-18 (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.
25.01.2018	12	7	9	7	22	17	27	22	12	12	14.7	10	8	8	8.7
01.02.208	37	32	47	57	32	62	46	37	32	42	42.4	17	27	32	25.3
09.02.2018	57	67	97	37	77	82	47	72	62	97	69.5	37	52	47	45.3
15.02.2018	77	107	92	112	102	77	122	47	62	79	87.7	47	77	67	63.7
23.02.2018	12	142	107	142	162	177	112	77	167	72	117.0	77	82	112	90.3
01.03.2018	57	72	92	47	42	77	97	42	102	57	68.5	42	57	37	45.3
06.03.2018	27	17	77	47	77	35	27	47	17	32	40.3	24	22	42	29.3
13.03.2018	13	22	42	12	32	12	27	32	22	37	25.1	27	12	17	18.7
22.03.2018	10	8	22	7	11	9	17	27	12	22	14.5	10	12	13	11.7
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.
25.01.2018	3	0	0	3	0	3	0	3	0	3	1.5	0	0	0	0.0
01.02.208	3	4	3	0	3	2	2	7	4	0	2.8	3	3	3	3.0
09.02.2018	3	11	4	3	0	4	3	7	3	0	3.8	5	3	4	4.0
15.02.2018	4	4	12	3	5	7	3	12	0	4	5.4	9	3	4	5.3
23.02.2018	11	6	9	3	4	3	11	4	4	7	6.2	4	11	3	6.0
01.03.2018	7	11	4	13	10	5	12	4	13	9	8.8	6	7	9	7.3
06.03.2018	15	3	12	4	10	5	8	16	13	10	9.6	8	9	6	7.7
13.03.2018	14	16	4	15	3	12	4	5	13	7	9.3	7	8	10	8.3
22.03.2018	12	15	4	11	3	12	4	5	8	7	8.1	6	0	8	4.7

B6. Zone specific IPM modules (Centres: Karnal, Ludhiana, Niphad, Kanpur)
The integrated pest modules consisting of effective cultural, physical, biological and chemical components of integrated pest management were formulated and tested against major pests of wheat viz., foliar aphids, shootfly and termites.

Centre: Ludhiana

The comparison of the results of IPM module with farmer's practices revealed a difference in aphid incidence, termite and pink stem borer (PSB) damage. The termite damage ranged from 2.48-2.94 per cent in farmer's practices while it was 0.20-0.68 per cent in IPM field (Table B6-11.2a). Similarly there were 0.96-2.62 per cent PSB damaged plants in farmer's practice while it was 0.44-0.96 in IPM field. The aphid incidence remained below economic threshold level of 5 aphids per earhead in IPM field while it ranged from 13.93 to 16.46 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. Relatively higher incidence of brown wheat mite was also recorded in farmer's practice as compared to IPM plots.

Centre: Niphad

The data revealed that the IPM module recorded least (11.10 and 5.60) number of aphids/shoot/plant at 60 and 75 days after sowing whereas it was 42.50 and 57.60 in farmer practices treated plot. The population of aphid in IPM module plot was not observed upto 60 days after sowing. The minimum (0.00, 3.80 and 2.30) number of jassids/plant were recorded in IPM module at 45, 60 and 75 days after sowing as against farmers practice plot it was 19.30, 32.00 and 20.00. Population of natural enemies were recorded in plot of farmer practices since 45 days after sowing to till 90 days after sowing. Incidence of termite and stem borer was not recorded in IPM treated as well as farmer practices plot. The highest grain yield of 59.72 q/ha was recorded in IPM treated plot and lowest (40.27 q/ha) in farmers practice plot(Table B6-11.2b).

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 enemies was little higher than IPM treatment. The highest population of aphids was recored after 50 days i.e 152.0 aphids/shoot in IPM treatment as compared to 75.0 aphids/shoot in FP treatment. The highest grain yield of 51.49 q/ha was recorded in IPM treated plot and lowest (45.53 q/ha) in farmers practice plot(Table B6-11.2c).

Centre: Kharibari

The data indicated that the population of insect-pests in IPM module treatment was higher than Farmer's practice treatment (Table B6-11.2d).

Table B6-11.2a: Effect of treatments of IPM modules on pests of wheat (Centre: Ludhiana)

Sr.. No.	Days after sowing	Treatments	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
		t value	-	-	-	-	-	-
2.	30	IPM	0	0	0.2 (1.54)*	-	-	0..44 (3.15)*
		FP	0	0	2.48 (8.98)*	-	-	0.96 (5.11)*
		t value	-	-		-	-	
3.	45	IPM	0	0	0.68 (4.28)*	-	-	0.80 (5.08)*
		FP	0	0	2.94 (9.84)*	-	-	2.62 (8.90)*
		t value	-	-		-	-	
4.	60	IPM	0	0	0	-	-	0
		FP	0	0	0	-	-	0
		t value	-	-		-	-	
5.	75	IPM	0-1	0	0	-	-	0
		FP	0-1	0	0	-	-	0
		t value						
6.	90	IPM	2.46 (1.76)**	0	0	-	-	0
		FP	13.93(3.83)**	0	0	-	-	0
		t value	(0.51)	-	-	-	-	
7.	At earhead stage	IPM	2.60 (1.81)**	6.80 (2.75)**	0	-	5.00 (2.38)**	0
		FP	16.46 (4.06)**	1.26 (1.44)**	0	-	31.53 (5.65)**	0
		t value	(0.63)	(0.33)	-	-	(0.36)	-
8.	Yield (qt/ha)	IPM	58.4 q/ha					
		FP	52.8 q/ha					

IPM = Integrated Pest Management;FP = Farmers Practice* Figures in parentheses are arcsine transformed means

Table B6-11.2b: Effect of treatments of IPM modules on pests of wheat (Centre: Niphad)

SN	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
1.	Pre count	IPM	0.0	0.0	0.0	0.0	0.0	0.0
		FP	0.0	0.0	0.0	0.0	0.0	0.0
2.	30	IPM	0.0	0.0	0.0	0.0	0.0	0.0
		FP	9.60	10.30	0.0	0.0	0.0	0.0
3.	45	IPM	0.0	0.0	0.0	0.0	0.0	0.0
		FP	15.50	19.30	0.0	1.30	0.0	0.0
4.	60	IPM	11.10	3.80	0.0	0.0	0.0	0.0
		FP	42.50	32.20	0.0	2.70	0.0	0.0
5.	75	IPM	5.60	2.30	0.0	0.0	0.0	0.0
		FP	57.60	20.00	0.0	8.40	0.0	0.0
6.	90	IPM	0.0	0.0	0.0	0.0	0.0	0.0
		FP	3.30	1.60	0.0	1.00	0.0	0.0
7.	At maturity	IPM	0.0	0.0	0.0	0.0	0.0	0.0
		FP	0.0	0.0	0.0	0.0	0.0	0.0
8.	Yield q/ha	IPM	**59.72**					
		FP	**40.27**					

IPM= Integrated Pest Management FP= Farmers practice (Non IPM)

Table B6-11.2c: Effect of treatments of IPM modules on pests of wheat (Location: Karnal)

SN	Days	Treatments	No. of aphids/ shoot/ plant	No. of jassids /plant	No. of Brown wheat mite 10 cm^2 /leaves	No. of natural enemies/ m^2	Termite damage %	Stem borer % infested tillers	Yield q/ha
1.	30	IPM	13.00	0.00	0.00	0.00	3.66	0.00	IPM 51.49
		FP	20.00	0.00	0.00	0.00	3.20	0.00	
2.	40	IPM	69.00	0.00	0.00	1.62	2.33	0.00	
		FP	124.00	0.00	0.00	2.20	4.23	0.00	
3.	50	IPM	75.00	0.00	0.00	2.45	1.45	0.00	
		FP	152.00	0.00	0.00	6.17	5.89	0.00	
4.	60	IPM	65.00	0.00	0.00	4.40	0.00	3.45	FP (Non IPM) 45.53
		FP	82.70	0.00	0.00	11.69	0.00	5.03	
5.	70	IPM	40.50	0.00	0.00	14.52	0.00	2.73	
		FP	49.00	0.00	0.00	15.10	0.00	5.63	
6.	80	IPM	10.20	0.00	0.00	09.40	0.00	2.20	
		FP	12.40	0.00	0.00	10.30	0.00	2.27	

IPM= Integrated Pest Management FP= Farmers practice (Non IPM)

Table B6-11.2d: Effect of IPM modules on incidence and infestation of major insect-pests of wheat 2017-18 (Centre-Kharibari)

S.No	Time of observation	Treatments	Mean no. of aphids/ shoot	Mean no. of lady bird beetle/shoot	% termite infestation	Mean no. of Jassids/ shoot	Mean no. of mites/10 cm2 leaf area	% pink stem borer infestation
1	Pre-count	IPM	55.76	3	x	x	x	12
		FP	58.9	3	x	x	x	10
		t value	x	x	x	x	x	X
2	30	IPM	45..55	2	x	x	x	3
		FP	25.56	2	x	x	x	2
		t value	x	x	x	x	x	X
3	45	IPM	35.89	2	x	x	x	2
		FP	18.75	0	x	x	x	1
		t value	x	x	x	x	x	x
4	60	IPM	21.7	2	x	x	x	0
		FP	8.92	1	x	x	x	0
		t value	x	x	x	x	x	x
5	75	IPM	14.95	3	x	x	x	0
		FP	2.95	0	x	x	x	0
		t value	x	x	x	x	x	x
6	90	IPM	8.45	3	x	x	x	1
		FP	1.05	1	x	x	x	3
		t value	x	x	x	x	x	x
7	At maturity	IPM	1.25	5	x	x	x	0
		FP	0.55	2	x	x	x	0
		t value	x	x	x	x	x	x
8	Yield (qt/ha)	IPM	15.75	x	x	x	x	22.38
		FP	18.12	x	x	x	x	20.15
		t value	x	x	x	x	x	

B7. Eco friendly management of foliar aphid (Centres: Karnal, Ludhiana, Niphad, Kharibari and Pantnagar)

New bio-pesticides and new chemicals at lower doses were evaluated against foliar aphids in wheat. Insect population counts before and after the treatments were recorded along with yield in each treatment.

Treatment details:

SN	Treatments	Dose (ml or g/ha
1.	Imidacloprid 17.8 SL	100 ml
2.	Quinalphos 25 EC	400 ml
3.	Acetamiprid 20SP	100 g
4.	*Azadirachtin* 1500 ppm	3 ml/l
6.	*Beauveria bassiana* (2x10^8 cfu)	5 g/l
7.	*Metarhizium anisopliae* (2x10^8 cfu)	3 g/l
8.	Untreated check	-

Observations:

Spray of insecticides was initiated just after the average infestation of10 aphids/shoot was observed and repeated at an interval of 15 days. Five shoot from each treatment were selected and tagged randomly for recording observations. Observations were recorded on the basis of average population of survival aphids. Pre count was taken 24 hours before spray and post count was taken on 1, 2, 7 and 15 days after spray. The average population of aphid survived per shoot was worked out and subjected to the statistical analysis.

Centre: Ludhiana

This trial was conducted under irrigated conditions at Plant Breeding Research Farm, PAU, Ludhiana. The wheat variety PBW 725 was sown on 8th Nov.2017 in the plots of 6 rows of 6 m length in a replicated trial. Seven treatments were made when the aphid population reached at 4-5 aphids/earhead. There were total of eight 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 (Table B7-11.2a).

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. When observed one day after spray, acetamiprid recorded minimum (1.38 aphids/earhead) and was at par with all other insecticidal treatments except untreated check (22.04 aphids/earhead) and *Beauveria bassiana and Metarhizium anisopliae*. Similar trends were observed two days after treatment. Seven and fifteen days after spray, coragen was the best treatment, however these was at par with all other insecticidal treatment and better than untreated check.

Maximum Grain yield (q/ha) was recorded in plots treated with acetamiprid (60.93) treated plots. However, all the insecticidal treatments recorded higher than grain yield than untreated check (50.45) (Table B7-11.2a).

Centre: Niphad

Data recorded on average population of survived foliage feeding aphids is presented in (Table B7-11.2b). It is revealed that all the treatments were found effective against aphids as they showed significantly lower aphid's population than untreated control. At 1 day after spray, the plots treated with acetamiprid 20 SP @ 100g/ha registered significantly minimum (0.70) number of aphids/shoot/plant as compared to rest of the treatments and it was at par with quinalphos 25 EC @ 400 ml/ha (0.73) and imidacloprid 17.8 SL @ 100 ml/ha (0.90). At 2 and 7 days after spray the treatment with imidacloprid 17.8 SL @ 100 ml/ha, acetamiprid 20 SP @ 100g/ha and quinalphos 25 EC @ 400 ml/ha recorded cent per cent control of aphids. Among various biopesticides the treatment with *Metarhizium anisopliae* (2x10^8 cfu) @ 3g/l water recorded minimum of 15.17 number of aphids/shoot/plant at 2 days after spray. It was followed by Azadirachtin 1500 ppm @ 3ml/l (17.13), *Lecannicillium lecanni* (2x10^8 cfu) @ 3g/l (17.43) and *Beauveria bassiana* (2x10^8 cfu) @ 5g/l (17.70) at 2 days after spray. At 7 days after *Beauveria bassiana* (2x10^8 cfu) @ 5g/l recorded minimum of 8.10 number of aphid/shoot/plant and it was at par with *Lecannicillium lecanni* (2x10^8 cfu) @ 3g/l (8.20), Azadirachtin 1500 ppm @ 3ml/l (8.60) and *Metarhizium anisopliae* (2x10^8 cfu) @ 3g/l (8.73). At 15 days after spray very less increase in aphid population in various insecticidal and biopesticidal treated plots were observed as compare to untreated control. The highest (40.60, 57.93, 63.43, 69.57 and 77.57) number of aphids/shoot/plant were recorded at 1, 2, 7 and 15 days after spray, respectively in untreated control plot.

In case of natural enemies, the maximum (1.18/m^2) number of natural enemies was recorded in untreated control. The minimum (0.05) number of natural enemies per square meter was recorded in quinalphos 25 EC @ 400 ml/ha.

Maximum yield of 63.88 q/ha was obtained in plot treated with imidacloprid 17.8 SL @ 100 ml/ha which was at par with acetamiprid 20 SP @ 100g/ha (62.96 q/ha) and quinalphos 25 EC @ 400 ml/ha (62.11) as against lowest in control plot (34.26 q/ha). Among various biopesticides *Beauveria bassiana* (2x108 cfu) @ 5g/l recorded highest yield of 56.01 q/ha and it was at par with *Lecannicillium lecanni* (2x10^8 cfu) @ 3g/l (55.01) and Azadirachtin 1500 ppm @ 3ml/l (52.77).

Centre: Karnal

Aphid population did not differ significantly among all treatments one day before spray. When observed one day after spray, acetamiprid recorded minimum (1.70 aphids/earhead) and was at par with all other insecticidal treatments except untreated check (59.66 aphids/earhead) and bio-pestcides treatments. Similar trends were observed two days,seven and fifteen days after spray, , acetamiprid was the best treatment, however these was at par with all other insecticidal treatments and better than untreated check.The performance of *Azadirahctin* 1500 ppm, *Beauveria bassiana and Metarhizium anisopliae* was comparatively lower than chemical insecticides.Out of these three, *Azadirahctin* 1500 ppm was better than *Azadirahctin* 1500 ppm.

Maximum Grain yield (q/ha) was recorded in plots treated with acetamiprid (57.05) treated plots. However, all the insecticidal treatments recorded higher than grain yield than untreated check (35.24) (Table B7-11.2c).

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), Flubendamide (Fame 480 SC), Pride (Acetamiprid 20SP), Chlorantranilipride 18.5 SC(Coragen), *Azadirahctin* 1500 ppm, *Verticillium lecanni* (2 x 10^8c.f.u), *Beaveria bassiana* (2 x 10^8c.f.u), *Metarhizium anisopliae,* Rogar (Dimethoate 30 EC).The wheat variety HD

2697 was sown on 11th December'2017 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 B7-11.2d). The reduction in the wheat aphid population build up of *Rhopalosiphum maidis* due to application of Confidor (Imidacloprid 17.8 SL), Flubendamide (Fame 480 SC), Pride (Acetamiprid 20SP), Chlorantranilipride 18.5 SC(Coragen) was found to be 97.02 to 100% , respectively, over untreated control. The other bio-pesticides *Azadirahctin* 1500 ppm, *Verticillium lecanni* (2 x 10^8c.f.u), *Beaveria bassiana* (2 x 10^8c.f.u), *Metarhizium anisopliae* was found to be at 72.99% to 94.46% respectively, over untreated control and farmers check Rogar (Dimethoate 30 EC) was found 99.63% to 100.00% respectively, over untreated control.

Grain yield (q/ha) obtained was maximum from Clothianidin 50 WDG (31.56) treated plots followed by flubendamide (23.21), Confidor (Imidacloprid 17.8 SL) (22.52), Chlorantranilipride 18.5 SC(Coragen) (21.99) and Pride (Acetamiprid 20SP) (24.55) *Azadirahctin* 1500 ppm (22.84), *Verticillium lecanni* (2 x 10^8c.f.u) (19.26), *Beaveria bassiana* (2 x 10^8c.f.u) (22.45), *Metarhizium anisopliae*(18.69) and Rogar (Dimethoate 30 EC) (23.52) treated plots. However, all the insecticidal treatments recorded higher than grain yield than untreated check (15.75)(Table B7-11.2d).

Table B7-11.2a: Efficacy of various insecticides and biopesticides against foliar aphid during 2017-18 Centre: 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	22.20	1.67 (1.63)	1.32 (1.52)	1.04 (1.42)	0.78 (1.33)	59.55
2	Fame (Flubendamide 480 SC)	250 ml	20	22.23	1.74 (1.65)	1.23 (1.49)	1.15 (1.46)	0.83 (1.35)	60.00
3	Pride (Acetamiprid 20SP)	100 gm	20	21.46	1.38 (1.54)	1.08 (1.44)	1.03 (1.42)	0.76 (1.32)	60.93
4	Coragen (Chlorantranilipride 18.5 SC)	100 ml	20	21.13	1.67 (1.63)	1.13 (1.45)	0.92 (1.38)	0.65 (1.28)	58.53
5	Azadirachtin 10000 ppm	3.0 (ml/l)	-	21.10	7.94 (2.98)	7.50 (2.91)	5.70 (2.58)	5.03 (2.45)	53.15
6	*Beauveria bassiana* (2 x 108c.f.u)	5 g/l	-	21.26	11.73 (3.52)	12.08 (3.61)	8.20 (3.03)	6.12 (2.66)	51.11
7	*Metarhizium anisopliae*	3 g/l	-	20.93	11.43 (3.52)	12.13 (3.62)	6.75 (2.78)	6.80 (2.79)	51.06
8	Control	-	-	21.43	22.04 (4.79)	21.82 (4.77)	17.80 (4.33)	15.46 (4.05)	50.45
CD (p=0.05)				NS	(0.19)	(0.21)	(0.17)	(0.17)	4.36

* Figures within parentheses are transformed means

Date of sowing	:	08.11.2017	Plot size	:	7.5 m^2
Date of insecticidal application	:	05.03.2018	Variety	:	PBW 725
Date of harvest	:	20. 04.2018	Replications	:	Three

Table B7-11.2b: Efficacy of various insecticides and biopesticides against foliar aphid during 2017-18 (Centre: Niphad)

S.No.	Treatments	Dose (ml or g/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	100 ml	40.93 (6.47)	0.90 (1.38)	0.00 (1.00)	0.00 (1.00)	9.97 (3.31)	63.88	0.12 (1.05)
2	Quinalphos 25%EC	400ml	41.33 (6.51)	0.73 (1.31)	0.00 (1.00)	0.00 (1.00)	10.40 (3.38)	61.11	0.05 (1.02)
3	Acetamiprid 20SP	100 g	42.13 (6.57)	0.70 (1.30)	0.00 (1.00)	0.00 (1.00)	10.80 (3.44)	62.96	0.07 (1.03)
4	*Azadirachtin* 1500 ppm	3 ml/l	41.33 (6.51)	23.10 (4.91)	11.43 (3.52)	8.60 (3.10)	25.13 (5.11)	52.77	0.23 (1.11)
5	*Lecanicillium lecanni* ($2x10^8$ c.f.u.)	3 g/l	40.73 (6.46)	34.47 (5.96)	17.43 (4.29)	8.20 (3.03)	16.73 (4.21)	55.55	0.21 (1.10)
6	*Beauveria bassiana* ($2x10^8$ c.f.u.)	5 g/l	40.80 (6.46)	35.30 (6.03)	17.70 (4.32)	8.10 (3.01)	16.93 (4.24)	56.01	0.21 (1.10)
7	*Metarhizium anisopliae*	3 g/l	41.40 (6.51)	35.20 (6.02)	15.17 (4.02)	8.73 (3.12)	16.57 (4.19)	55.09	0.16 (1.08)
8	Untreated check	-	40.60 (6.45)	57.93 (7.68)	63.43 (8.03)	69.57 (8.40)	77.57 (8.86)	34.26	1.18 (1.48)
	SE ±		**0.05**	**0.04**	**0.06**	**0.04**	**0.07**	**0.05**	**1.92**
	CD at 5%		**NS**	**NS**	**0.17**	**0.12**	**0.21**	**0.16**	**5.82**

*DAS- Days after spray, figures in parentheses indicate V_{n+1} transformed value,
Date(s) of Insecticides/biopesticides application: i) 22/12/2017 ii) 06/1/2018

Table B7-11.2c: Efficacy of various insecticides and biopesticides against foliar aphid during 2017-18 (Centre: Karnal)

SN	Treatments	Dose (ml or g/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	100 ml	36.33 (6.11)	2.45 (1.86)	1.65 (1.63)	1.11 (1.45)	1.90 (1.70)	53.33	0.10 (1.05)
2	Quinalphos 25%EC	400ml	40.00 (6.40)	2.73 (1.93)	2.01 (1.73)	1.89 (1.70)	1.90 (1.70)	56.12	0.07 (1.02)
3	Acetamiprid 20SP	100 g	41.10 (6.49)	1.70 (1.64)	1.58 (1.61)	1.08 (1.44)	1.02 (1.42)	57.05	0.09 (1.03)
4	*Azadirachtin* 1500 ppm	3 ml/l	42.30 (6.58)	25.22 (5.12)	19.89 (4.57)	10.33 (3.37)	8.10 (3.02)	52.43	0.28 (1.11)
5	*Lecanicillium lecanni* ($2x10^8$ c.f.u.)	3 g/l	42.40 (6.59)	36.40 (6.12)	18.43 (4.41)	10.24 (3.35)	9.73 (3.20)	54.23	0.23 (1.10)
6	*Beauveria bassiana* ($2x10^8$ c.f.u.)	5 g/l	41.33 (6.51)	37.40 (6.20)	16.45 (4.18)	10.32 (3.36)	9.90 (3.30)	52.12	0.24 (1.10)
7	*Metarhizium anisopliae*	3 g/l	42.44 (6.59)	38.24 (6.26)	14.25 (3.91)	11.76 (3.57)	10.78 (3.43)	51.07	0.18 (1.08)
8	Untreated check	-	42.66 (6.61)	59.66 (7.79)	65.66 (8.16)	63.33 (8.02)	45.50 (6.82)	35.24	1.25 (1.48)
	SE ±		**0.04**	**0.06**	**0.07**	**0.06**	**0.06**	**0.04**	**0.03**
	CD at 5%		**NS**	**0.17**	**0.13**	**0.15**	**0.22**	**0.17**	**0.04**

*DAS- Days after spray, figures in parentheses indicate $\sqrt{n+1}$ transformed value,
Date(s) of Insecticides/biopesticides application: i) 22/12/2017 ii) 06/1/2018

Table B7-11.2d: Efficacy of various insecticides and biopesticides against foliar aphid during 2017-18 (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 (q/ha)	% increase in yield over control (q/ha)
			I st Spray				Av. Aphid population/ shoot after spray	% reduction over control	Before spray Population	II nd Spray				Av. Aphid population/ shoot after spray	% reduction over control		
			1 DAT	2 DAT	7 DAT	15 DAT				1 DAT	2 DAT	7 DAT	15 DAT*				
Confidor (Imidacloprid 17.8 SL)	20	82.46 (9.11)	72.35 (8.54)	35.12 (5.97)	0.20 (0.84)	0.35 (0.92)	27.01	99.63	25.15 (5.06)	10.20 (3.27)	3.10 (1.90)	0.00 (0.71)	0.25 (0.87)	3.39	99.1	22.52	42.98
Fame (Flubendamide 480 SC)	20	87.96 (9.41)	52.16 (7.26)	20.10 (4.54)	1.95 (1.57)	0.10 (0.77)	18.58	99.90	30.20 (5.54)	15.20 (3.96)	6.20 (2.59)	0.00 (0.71)	0.00 (0.71)	5.35	100.0	23.21	47.37
Pride (Acetamiprid 20SP)	20	92.93 (9.67)	69.25 (8.35)	30.10 (5.53)	18.10 (4.31)	1.02 (1.23)	29.62	99.03	28.10 (5.35)	19.10 (4.43)	7.20 (2.77)	4.35 (2.20)	0.60 (1.05)	7.81	98.1	24.55	55.87
Coragen (Chlorantraniliprid e 18.5 SC)	20	87.93 (9.40)	48.20 (6.98)	18.10 (4.31)	2.93 (1.85)	2.12 (1.62)	17.84	97.88	22.20 (4.76)	16.35 (4.10)	4.60 (2.26)	3.20 (1.92)	0.75 (1.12)	6.23	97.0	21.99	39.62
Azadirachtin 1500 ppm	3.0	82.32 (9.10)	62.15 (7.92)	37.19 (6.14)	18.10 (4.31)	22.25 (4.77)	34.92	76.20	45.20 (6.76)	30.25 (5.55)	18.20 (4.32)	6.20 (2.59)	3.00 (1.87)	14.41	94.1	22.84	76.76
Verticillium lecanni (2 x 108c.f.u)	3	75.15 (8.70)	55.20 (7.46)	45.10 (6.75)	30.20 (5.54)	20.10 (4.54)	37.65	76.44	62.20 (7.92)	45.30 (6.77)	30.10 (5.53)	20.20 (4.55)	3.90 (2.10)	24.88	94.4	19.26	79.43
Beauveria bassiana (2 x 108c.f.u)	5	77.18 (8.81)	52.10 (7.25)	38.10 (6.21)	20.20 (4.55)	10.40 (3.30)	30.20	88.13	54.40 (7.41)	40.29 (6.39)	32.10 (5.71)	23.25 (4.87)	8.90 (3.07)	26.14	85.5	22.45	80.63
Metarhizium anisopliae	3	82.16 (9.09)	63.20 (7.98)	48.10 (6.97)	39.20 (6.30)	25.20 (5.07)	43.93	72.99	65.18 (8.10)	55.10 (7.46)	42.30 (6.54)	31.25 (5.63)	18.10 (4.31)	36.69	75.4	18.69	18.67
Rogor (Dimethoate 30 EC)	300	82.46 (9.11)	42.10 (6.53)	20.90 (4.63)	9.20 (3.11)	0.35 (0.92)	18.14	99.63	25.10 (5.06)	12.20 (3.56)	6.10 (2.57)	0.00 (0.71)	0.00 (0.71)	4.58	100.0	23.52	49.33
Untreated check	-	89.92 (9.51)	92.10 (9.62)	94.65 (9.75)	98.20 (9.93)	102.10 (10.13)			115.15 (10.75)	120.20 (10.99)	122.35 (11.08)	124.90 (11.20)	130.35 (11.44)			15.75	
SEm±		2.61	2.11	1.83	1.17	0.94			1.72	1.58	0.98	0.85	0.88				
CD at 5%		7.73	6.22	5.42	3.47	2.78			5.09	4.66	2.89	2.52	2.60				

B8. Eco friendly management of termites (Centres: Durgapura, Kanpur, Ludhiana and Vijapur)
Few selected new chemicals along with botanicals as seed treatment were tested against termites. The observations on plant population per meter row length, per cent damaged shoots and effective tillers were taken at different stages of crop.

B8a. Management of termites through seed treatment

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 8th Nov 2017. 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 B8a-11.2a 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 treatments recorded significantly lower per cent damaged effective tillers/ m row than the untreated check. However, the termite damage was significantly more in *Beauveria bassiana* and *Metarhizium anisopliae* as compared to all other pesticide treatments.

At ear head stage, the per cent damaged effective tillers per meter row (in marked spots) were minimum in the plot treated with clothianidin @ 1.5 gm/kg of seed (1. 61) and it was on par with all the other treatments except untreated check and two other biocontrol treatments. The numbers of damaged effective tillers/ha were lowest in plots treated with thiamethoxam 70 WS @ 1.0 ml/kg of seed (10333). All these insecticide treated plots recorded significantly lower number of damaged tillers/ha as compare to untreated check.

There were significant differences in the treatment for grain yield (g/m row). The grain yield (q/ha) obtained was maximum in plot treated with fipronil and it was at par with all insecticidal seed treatments. The data revealed that all the treatments has significantly higher yield than the untreated check (43.15).

Centre: Vijapur

An experiment on ecofriendly management of termite through seed treatment was carried out at Wheat Research Station, Vijapur under irrigated conditions and the results are summarized in Table B8a-11.2b. 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. The result of percent damaged effective tillers/m row found non-significant among the treatments however, the maximum and minimum per cent damaged effective tillers/meter row was observed in untreated check and in the treatment of fipronil 5 SC @ 0.3 g a.i./kg seed respectively. The result of number of damaged effective tillers/ha revealed that significantly the lowest damage were recorded in treatment of fipronil 5 SC @ 0.3 g a.i./kg seed followed by acephate 50% + imidacloprid 1.8% (Lancer Gold) @ 2 g a.i./kg seed as compared to untreated check. There was also significantly low termite damage recorded in bio-pesticide as compared to untreated check. The grain yield in g/m row revealed non-significant difference among the treatments. The maximum grain yield (g/m row) was recorded in the plot treated with fipronil 5 SC @ 0.3 g a.i./kg seed as compared to untreated check. The data on grain yield computed on the basis of q/ha from different treatments showed non-significant differences among all the treatments although the maximum grain yield was obtained from fipronil 5 SC @ 0.3 g a.i./kg seed treated plot followed by treatment of acephate 50% + imadacloprid 1.8% (Lancer Gold) @ 2 g a.i./kg seed.

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 B8a-11.2c. The plant population / m row that was counted after 3 weeks of sowing revealed non-significant difference among the treatments.The data further revealed that termite damage was observed during 3rd,4th and 5th week after sowing in all the treatments but more in *Metarhizium anisopliae* (2.8%) and in untreated was 9%. Percent damaged effective tiller / m row was maximum in untreated check (19.30%), whereas it was minimum in the treatment of Imidacloprid 600 FS (0.44%), at par with Lancer gold (0.63%), Fipronil 5 SC (0.65%) and Lacenta 40% was 0.74% respectively. On the basis of number of damaged effective tiller / ha, the highest damage was recorded in untreated check (41853), significantly lowest damage was noticed in Imidacloprid 600 FS (3509).The maximum grain yield (gm / m / row) was recorded in the plot treated with Imidacloprid 600 FS (42.03) as compared to untreated check (21.84). The grain yield data computed on the basis of q / ha from different treatments indicated that maximum yield was observed in Imidacloprid 600 FS (44.26 q / ha) was at par with Lancer Gold (42.87 q / ha) and lowest yield was observed in untreated check (22.81 q / ha).

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 (B8a-11.2d). 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. 3.05 per cent. The incidence of termite after 4 weeks of sowing ranged from 0.45 to 0.73 per cent, while in untreated plot it was 3.41 per cent. The incidence of termite after 5 weeks of sowing range from 1.61 to 1.79 per cent, while in untreated plot it was 3.61 per cent, significantly less damaged shoot were recorded in treated plot with fipronil 40% + imidacloprid 40 WG and fipronil 5SC, which was at par clothianidin 50 WDG 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 were at par clothianidin 50 WDG and imadacloprid 600FS (48%). Maximum damage of effective tiller per meter row was recorded in the treated plots with fipronil 40 % + imidacloprid 40 WG and Fipronil 5 SC which was at par clothionidin 50 WDG and imidacloprid 600 FS (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 3163.33 to 3716.66 while it was 17583.33 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 clothianidin 50 WDG 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 clothianidin 50 WDG and imidacloprid 600 FS (48%).

The result concluded that insecticide fipornil 40% + imidacloprid 40WG @ 3.0gm and fipronil 5SC @ 10ml were superior to clothianidin 50 WDG @ 1.5 gm, imidacloprid 600 FS (48%).

Experiment B8b: Management of termites through broadcast application in standing 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 8th Nov, 2017 in the replicated trial in 40 sq. m. plots. There were seven treatments including 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 B8b-11.2a) 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 fipronil 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 also lowest (11500) in fipronil 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 (50.15 q/ha) in fipronil treated plot. However, all treatments recorded significantly higher grain yield than untreated check.

Table B8a-11.2a: Eco-friendly management of termitethrough seed treatment (Centre: 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 (q/ha)
				3 weeks	4 weeks	5 weeks			
1	Thiamethoxam 25WG	3.2 gm	47.06	1.17 (7.42)	1.38 (7.88)	1.53 (8.17)	1.85 (8.78)	11083 (105.27)	47.78
2	Thiamethoxam 70WS	1.0 ml	45.90	1.18 (7.45)	1.31 (7.73)	1.18 (7.44)	1.82 (8.75)	10333 (101.60)	48.20
3	Fipronil 5 SC	6.0 ml	45.70	0.93 (6.85)	1.29 (7.69)	1.34 (7.79)	1.87 (8.85)	12083 (109.79)	49.78
4	Imidacloprid 600FS	2 ml	47.30	0.89 (6.77)	1.24 (7.56)	1.41 (7.94)	1.76 (8.63)	11583 (107.57)	49.33
5	Clothianidin 50 WDG	1.5 gm	46.76	0.90 (6.79)	1.15 (7.38)	1.44 (8.00)	1.61 (8.35)	12666 (112.39)	49.41
6	*Beauveria bassiana*	5 gm/kg seed	47.73	2.03 (9.15)	1.78 (8.68)	1.70 (8.53)	3.10 (10.93)	158333 (125.72)	45.64
7	*Metarhizium anisopliae*	3 gm/kg seed	46.06	1.87 (8.85)	1.84 (8.79)	1.60 (8.32)	3.25 (11.16)	15666 (125.09)	45.65
8	Untreated check	-	46.43	3.00 (10.78)	2.96 (10.71)	3.38 (11.36)	4.60 (13.04)	21500 (146.59)	43.15
CD (p=0.05)			NS	(0.76)	(0.60)	(0.75)	(0.78)	(8.52)	2.23

* Figures in parentheses are transformed means

Date of sowing	:	8-11-2017	Plot size	:	40 m²
Date of insecticidal application	:	7-11-2017	Variety	:	PBW 660
Date of harvest	:	20-4-2018	Replications	:	Three

Table B8a-11.2b: Eco-friendly management of termitethrough seed treatment during 2017-18 (Location: Vijapur)

S. 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 q/ha
					3rd	4th	5th			
1.	Thiamethoxam 25 WG	0.8	62	90.33	0.00* (0.00)	0.00* (0.00)	0.00* (0.00)	2.36* (0.17)	1186**bc (3484)	14.62
2.	Acephate 50% + Imidacloprid 1.8% (Lancer Gold)	2.0	55	87.00	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	1.28 (0.15)	988ab (2369)	16.33
3.	Fipronil 5 SC	0.3	56	90.00	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	718a (1115)	16.47
4.	Imidacloprid 600 FS *	2.4	59	86.67	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	1.15 (0.12)	1302bc (4181)	14.42
5.	Clothianidin 50 WDG	0.75	57	89.33	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	1.49 (0.20)	1371c (4599)	12.05
6.	Fipronil+Imidacloprid 40 % WG (Lacenta)	1.2	56	85.00	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	1.19 (0.13)	1147bc (3205)	15.76
7.	*Beauveria bassiana* (g/kg seed)	5	58	88.67	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	1.63 (0.24)	1392c (5017)	11.80
8.	*Metarhizium anisopliae* (g/kg seed)	3	61	87.33	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	1.62 (0.24)	1349b (4320)	14.07
9.	Untreated Check	-	59	87.33	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	3.52 (0.38)	1885d (8361)	11.45
	S.Em.±		3.0	3.70	-	-	-	0.69	126	1.35
	C.D. at 5%		NS	NS	-	-	-	NS	377	NS
	C.V.%		-	-	-	-	-	-	-	16.53

* Figures followed within same column are Arcsin percentage transformation ** Figures followed within same column are square root transformation
Figures given in parenthesis are actual mean value Figures followed with same letter(s) are not differed statistically
Date of seed treatment : 24/11/2017 Date of sowing : 25/11/2017 Plot size : Gross : 14.0m x 2.76 m (Spacing:23 cm row to row)
Date of Plant population count : 16 /12/2017 Date of harvesting : 24/03/2018 Net: 13.0m x 1.84m Variety: GW 496 Condition : Irrigated
Design : R.B.D Replications: Three Spacing : 23 cm between row No. of rows / plot: 12

Table B8a-11.2c: Eco-friendly management of termitethrough seed treatment during 2017-18 (Centre: Durgapura)

Treatments	Dose gm/ml/ kg seed	Plant population/m row	Percent damaged shoot/m row	Per cent damaged effective tillers/m row at ear head stage	No. of damaged effective tillers/ ha	Grain yield	
						g/m row	q/ha
Fipronil 40%+ Imidacloprid 40% (Lacenta)	3	42.66	0.56 (4.26)*	0.74 (4.91)	6064.66	39.94	41.31
Fipronil 5SC	10	40.00	0.55 (4.24)	0.66 (4.67)	5971.66	40.62	41.68
Imidacloprid 600 FS	4	44.33	0.22 (2.68)	0.44 (3.75)	3509.00	42.03	44.26
Clothianidin 50 WDG	1.5	41.66	0.86 (5.31)	1.15 (6.150)	9925.33	38.89	40.28
Acephate 50% + Imidacloprid 1.8% (Lancer Gold)	4	42.00	0.52 (4.15)	0.63 (4.54)	5868.33	41.01	42.87
Thiomethoxam 25 WG	3.2	41.33	0.98 (5.68)	2.59 (9.19)	10861.33	37.49	38.76
Metarhizium anisopliae	3	41.00	2.8 (4.22)	7.32 (15.64)	25649.70	33.46	29.84
Beauveria bassiana	5	41.66	2.5 (9.62)	6.02 (14.17)	22568.30	33.93	30.98
Untreated check	-	40.33	9.0 (17.46)	19.30 (26.04)	41853	21.84	22.81
SEm	-	0.481	0.39	0.53	91.19	0.86	0.59
CD @ 5%	-	N/A	1.18	1.60	275.75	2.41	1.80
CV	-	2.005	9.80	9.28	1.07	3.78	2.78

*Figures in parentheses are angular transformed value

Table B8a-11.2d: Eco-friendly management of termitethrough seed treatment during 2017-18 (Centre: 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	30.70	0	0.64 (4.59)	1.75 (7.49)	1.63 (7.27)	3616.66 (60.13)	45.83	18.71
2.	Acephate 50% + Imidacloprid 1.8 %	4.0g	30.83	0	0.69 (4.76)	1.76 (7.49)	1.73 (7.49)	3716.66 (60.96)	44.48	18.22
3.	Fipronil 5 SC (regent)	10.0ml	33.83	0	0.51 (4.09)	1.62 (7.27)	1.50 (7.04)	3200.00 (56.56)	47.83	20.38
4.	Imidacloprid 600 FS (48%)	4.0ml	32.4	0	0.58 (4.37)	1.75 (7.49)	1.56 (7.04)	3566.66 (59.72)	46.26	19.17
5.	Clothianidin 50 WDG	1.5g	31.6	0	0.57 (4.33)	1.66 (7.27)	1.51 (7.04)	3383.33 (58.16)	47.30	20.06
6.	Fipronil 40% + Imidacloprid 40 WG	3.0g	35.4	0	0.45 (3.85)	1.61 (7.27)	1.46 (6.80)	3163.33 (56.24)	47.96	20.46
7.	Chlorantaniliprid 18.5SC	3.0g	31.23	0	0.73 (4.90)	1.79 (7.49)	1.78 (7.49)	3758.33 (61.30)	44.10	18.25
8.	Control	-	33.9	3.05	3.41 (10.63)	3.61 (10.49)	3.84 (11.24)	17583.33 (132.60)	32.66	15.33
	SEm±		NS	-	0.11	0.52	0.06	1.44	0.38	0.24
	CD at 5%		NS	-	0.37	1.79	0.20	3.84	1.30	0.82

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

Date of sowing : 26.11.2017
Date of insecticidal application : 25.11.2017
Date of plant population counts : 26.12.2017
Date of harvest : 24.04.2018
Plot size Gross : 4 x 5m = 20 Sqm.
Design : R.B.D. (3 reps.)
Variety : K8027 (Unirrigated)
No. of rows/plot :23

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 9 treatments which were broadcasted after 3 weeks of germination and were compared with untreated check. 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 at broadcasting stage was non-significant in all the treatments including untreated check.The data further revealed that termite damage was observed 5th week after sowing in all the treatments but more in *Metarhizium anisopliae*(11.13%) and in untreated was 15%.However, at ear head stage all the insecticides recorded significantly lower percent of damaged effective tiller / m row but lowest (4.39%)was observed in Imidacloprid 17.8 SL than untreated check (20.27%). The number of damaged effective tillers/ha was alsorecorded lowest (6194.67) in Imidacloprid 17.8 SLbroadcast 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 (36.06) in Imidacloprid 17.8 SL and lowest in untreated check (19.83). The grain yield (q / ha) was recorded highest in Imidacloprid 17.8 SL (39.20) was at par with Lacenta 40% (37.81) and lowest in untreated check (19.60) (Table B8b-11.2c).

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 sown on 26.11.2017 and each was replicated thrice (Table B8b-11.2d) - 2). The initial plant population counts indicated had no significant difference among all the treatments. The incidence of termite after three weeks of sowing no significant difference all the treatments range from 2.72 to 3.05 per cent. However, the incidence of termite after four weeks of sowing ranges 0.50 to 0.81 while in untreated plot 3.28 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 fipronil 5 SC@ 2.5l/ha, which did not differ significantly acephate 50% + imidacloprid 1.8% @ 350gm/ha, thiamethoxam 35 FS @ 250ml/ha, imidacloprid 17.8% @ 400ml/ha and clorentranilprid 18.5% @ 200ml/ha. All the insecticidal treatment showed superiority over untreated check in minimizing the per cent damage effective tillers. The number of effective tillers/ha in different treatments ranged from 2333.33 to 5316.66 while it was 14240.00 in untreated plots. 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 fipronil 5SC@ 2.5 l/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, fipronil 5SC @ 2.5l/ha, acephate 50% + imidacloprid 1.8% @ 350gm/ha, thiamethoxan 35 FS @ 250ml/ha, imidacloprid 17.8% @ 400ml/ha and chlorentranilprid 18.5% SC 200ml/ha treated plots.

Table B8b-11.2a: Management of termites through broadcast application in standing crop during 2017-18(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 (q/ha)
				3 weeks	4 weeks	5 weeks			
1	Imidacloprid 17.8 SL	400ml	47.03	2.53 (10.01)	0.81 (6.58)	1.05 (7.12)	1.93 (8.95)	11666 (108.01)	49.39
2	Thiamethoxam 25WG	300gm	48.16	2.51 (9.98)	0.88 (6.74)	1.01 (7.05)	1.78 (8.66)	11166 (105.67)	48.96
3	Fipronil 5 SC	2.5 l	48.20	2.47 (9.92)	0.81 (6.56)	1.10 (7.26)	1.77 (8.65)	11500 (107.17)	50.15
4	Imidacloprid 600FS	300 gm	46.56	2.84 (10.52)	0.83 (6.62)	0.98 (6.99)	1.78 (8.67)	11666 (106.03)	49.24
5	Clothianidin 50 WDG	200 gm	47.06	2.75 (10.37)	0.91 (6.82)	1.07 (7.18)	1.84 (8.79)	13916 (117.94)	49.66
6	*Beauveria bassiana*	5 kg	47.13	2.57 (10.08)	1.74 (8.59)	1.85 (8.81)	2.51 (10.00)	13416 (115.82)	49.95
7	*Metarhizium anisopliae*	3 kg	46.03	2.78 (10.43)	1.90 (8.90)	1.75 (8.62)	2.51 (10.00)	13416 (115.82)	47.15
8	Untreated check	-	48.20	2.72 (10.33)	3.85 (11.75)	3.46 (11.47)	3.51 (11.55)	19833 (140.81)	43.75
CD (p=0.05)		-	NS	NS	(0.68)	(0.81)	(0.87)	(5.47)	1.42

* Figures in parentheses are transformed means

Date of sowing	:	08-11-2017	Plot size	:	40 m^2
Date of insecticidal application	:	05-12-2017	Variety	:	PBW 660
Date of harvest	:	20-04-2018	Replications	:	Three

Table B8b-11.2b:Management of termites through broadcast application in standing crop during 2017-18 (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 q/ha
			3rd	4th	5th			
1.	Imidacloprid 17.8 SL	80	0.00* (0.00)	0.00* (0.00)	0.00* (0.00)	0.00*a (0.00)	1339**abc (4320)	18.70
2.	Acephate 50% + Imidacloprid 1.8% (Lancer Gold)	175	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00a (0.00)	1279abc (4599)	18.26
3.	Fipronil 5 SC	80	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00a (0.00)	1038ab (2369)	20.54
4.	Thiamethoxam 30FS	75	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00a (0.00)	1442abc (5435)	18.03
5.	Imidacloprid 600 FS	144	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00a (0.00)	1171ab (3066)	19.05
6.	Clothianidin 50 WDG	100	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00a (0.00)	1378abc (4320)	18.41
7.	Fipronil+Imidacloprid 40 % WG (Lacenta)	400	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00a (0.00)	917a (2090)	21.53
8.	*Beauveria bassiana* (g/ha)	500	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	5.33c (0.96)	1793c (7525)	15.65
9.	*Metarhizium anisopliae*(g/ha)	300	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	3.59b (0.41)	1630bc (6689)	16.25
10.	Untreated Check	-	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	8.17d (2.13)	2600d (16026)	14.86
	S.Em ±		-	-	-	0.57	208	1.36
	C.D. at 5%		-	-	-	1.70	619	NS
	C.V.%		-	-	-	-	-	13.02

* Figures followed within same column are Arcsin percentage transformation ** Figures followed within same column are square root transformation Date of sowing: 25/11/2017 ; Date of insecticide application: 13/12/2017; Date of harvesting: 24/03/2018; Design: R.B D; Replications: Three; Spacing: 23 cm between row; No. of rows / plot: 12; Plot size: Gross: 14.0m x 2.76m; Net: 13.0m x 1.84m; Variety: GW 496; Condition : Irrigated

Table B8b-11.2c: Management of termites through broadcast application in standing crop during 2017-18 (Location: Durgapura)

S. No.	Treatments	Dose ml/gm/lit./ha	Plant population/ m row	Per cent damaged shoot/m row	Percent damaged effective tillers/m row at ear head stage	No. of damaged effective tillers/ ha	Grain yield q/ha
1.	Imidacloprid 17.8 SL	400	41.667	3.34 (10.52)*	4.39 (12.07)	6194.67	39.20
2.	Fipronil 5SC	1600	41.333	4.81 (12.62)	5.87 (14.01)	9795.00	37.30
3.	Acephate 50% + Imidacloprid 1.8% (Lancer Gold)	350	41.667	5.08 (13.02)	7.99 (16.40)	10180.00	36.06
4.	Imidacloprid 600 FS	300	42.000	5.06 (12.99)	7.68 (16.07)	10042.73	36.33
5.	Clothianidin 50 WDG	200	41.667	5.44 (14.47)	8.56 (16.99)	11646.70	34.45
6.	Fipronil 40%+ Imidacloprid 40% (Lacenta)	1000	41.333	4.53 (12.27)	5.83 (13.96)	9666.67	37.81
7.	Thaimethoxam 35FS	250	40.333	5.48 (13.52)	10.36 (18.75)	22000.00	31.77
8.	*Metarhizium anisopliae*	3	41.667	11.13 (19.65)	16.56 (24.00)	29958.00	28.15
9.	*Beauveria bassiana*	5	40.667	10.56 (18.95)	15.00 (22.77)	28433.30	29.05
10.	Untreated check	-	40.667	15.00 (23.06)	20.27 (48.14)	43255.00	19.60
	SEm	**-**	**1.32**	**0.38**	**0.38**	**225.34**	**0.57**
	CD@ 5%	**-**	**N/A**	**1.14**	**1.15**	**674.72**	**1.72**
	CV	**-**	**5.187**	**4.42**	**3.63**	**2.15**	**3.02**

*Figures in parentheses are angular transformed value

Table B8b-11.2d:Management of termites through broadcast application in standing crop during 2017-18(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 q/ha
				3 weeks	4 weeks	5 weeks			
1.	Thiamethoxam 25 WG	300g	37.60	2.96	0.56 (4.29)	1.22 (6.29)	1.27 (6.29)	3000.00 (54.77)	43.17
2.	Imidacloprid 17.8 %	400g	35.47	2.81	0.74 (4.93)	1.77 (7.49)	1.65 (7.27)	5233.33 (72.34)	41.33
3.	Acephate 50% + Imidacloprid 1.8 %	350g	34.37	2.88	0.67 (4.69)	1.43 (6.80)	1.46 (6.80)	4700.00 (68.55)	42.58
4.	Fipronil 5 SC (regent)	2.5lit.	35.67	3.03	0.65 (4.62)	1.41 (6.80)	1.40 (6.80)	4166.66 (64.54)	42.79
5.	Thiamethoxam 35F.S.	250ml	34.83	2.77	0.70 (4.80)	1.57 (7.04)	1.51 (7.04)	4816.66 (69.40)	42.00
6.	Imidacloprid 600 FS (48%)	300ml	34.78	2.85	0.72 (4.87)	1.68 (7.27)	1.61 (7.27)	4983.33 (70.59)	41.66
7.	Clothianidin 50 WDG	200g	33.78	3.05	0.62 (4.52)	1.35 (6.55)	1.36 (6.55)	3750.00 (61.23)	43.00
8.	Fipronil 40% + Imidacloprid 40 WG	1000g	34.34	2.72	0.50 (4.05)	1.18 (6.02)	1.21 (6.29)	2333.33 (48.30)	43.50
9.	Chlorantaniliprid (Coragen) 18.5 SC	200ml	34.60	3.01	0.81 (5.16)	1.80 (7.71)	1.68 (7.27)	5316.66 (72.91)	41.16
10.	Control	-	33.36	2.84	3.28 (10.31)	3.26 (10.31)	2.91 (9.81)	14240.00 (119.33)	35.16
	SEm±	**-**	**NS**	**NS**	**0.10**	**0.24**	**0.28**	**1.53**	**0.31**
	CD at 5%	**-**	**-**	**-**	**0.32**	**0.73**	**0.85**	**4.69**	**1.03**

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

Date of sowing : 26.11.2017
Date of insecticidal application : 26.12.2017
Date of plant population counts : 25.12.2017
Date of harvest : 28.04.2018

Plot size Gross : 4 x 5m = 20 Sqm.
Design : R.B.D (3 reps.)
Variety : K0402(Irrigated)
No. of rows/plot : 23

11.3 STORED GRAIN PEST MANAGEMENT

11.3 (i). Studies on the insecticidal treatments on seed viability during storage under ambient condition against store grain pests, *Trogoderma granarium or Rhizopertha dominica* (Centres: Karnal and Niphad)

Plants having toxicity effects on insects will be tested as seed protectant to wheat seed/grains against major stored grain insect pests; *Sitophilus oryzae* or *Rhizopertha dominica*

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	--

Observations:

1. One kg of clean and pest free seed of wheat was taken for each treatment with three replications in cloth bags.
2. Five pair of adults of *Sitophilus oryzae* inoculated in each treatment.
3. The 1st census count initiated 45 days after inoculation of insects and continued at 75, 105, 135, 165 and 195 days. At each census the dead insects should be removed.
4. Percent reduction in the insect population
5. Weight of seed grains was taken at the end of each census and the data analyzed statistically.

Centre:Niphad

The data pertaining to effect of various plant materials as seed protectant to wheat seed against grain weevil (*Sitophilus oryzae* L.) in wheat seed is depicted in Table C-11.3a & b. The data indicated significant differences among the treatments.

Population of grain weevil:

The data indicated that the seed treatment with *Vekhand* powder and its combinations with Neem leaves, Jungli Imli and Gulwel powder proved to be significantly effective in controlling the population of grain weevil (*Sitophilus oryzae* L.) as compared to rest of the treatments. The seed treatment with *Vekhand* powder @ 10 g/kg of seed recorded significantly lowest (5.67, 7.33, 0.00, 0.00, 0.00 and 0.00) number of survival grain weevil at 45, 75, 105, 135, 165 and 195 days after inoculation, respectively over untreated control i.e 118.67, 174.33, 985.67, 1226.33, 1316.00 and 1334.33. Survival population of grain weevil were not recorded in treatments *Vekhand* powder @ 10 g/kg seed, *Vekhand* powder + Neem leaves, *Vekhand* powder + Jungli Imli and *Vekhand* powder + Gulwel powder @ 5+5 g/kg of seed at 135, 165 and 195 days after inoculation. This treatment was statistically at par with the treatments of *Vekhand* powder + Neem leaves, *Vekhand* powder + Jungli Imli and *Vekhand* powder + Gulwel powder @ 5+5 g/kg of seed(Table C-11.3 a).

Percent reduction of grain weevil over untreated control:

The treatment with *Vekhand* powder @ 10 g / kg seed recorded highest (95.26, 95.31, 100.00, 100.00, 100.00 and 100.00) per cent reduction of grain weevil at 45, 75, 105, 135, 165 and 195 days after inoculation, respectively as against the zero per cent reduction in untreated control, it was at par with *Vekhand* powder + Neem leaves, *Vekhand* powder + Jungli Imli and *Vekhand* powder + Gulwel powder @ 5+5 g/kg of seed at 45, 75, 105, 135, 165 and 195 days after inoculation(Table C-11.3 a).

Weight of grains:

The treatment with *Vekhand* powder @ 10 g / kg seed recorded significantly highest (993.33, 986.67, 982.33, 981.33, 980.00 and 946.00 g) grain weight over all the treatments including untreated control. It is at par with *Vekhand* powder + Neem leaves, *Vekhand* powder + Jungli Imli and *Vekhand* powder + Gulwel powder @ 5+5 g/kg of seed at 45, 75, 105, 135, 165 and 195 days after inoculation. The untreated control recorded minimum (916.67, 786.00, 707.33, 644.67, 611.33 and 593.33 g) weight of grains at 45, 75, 105, 135, 165 and 195 days after inoculation. It indicated that the loss in weight of grain was increasing as the days after inoculation increased. Also it indicated that the seed treatment alone of *Vekhand* powder and combination of *Vekhand* powder plus other plant products were found to be effective for the control of grain weevil (Table C-11.3 b).

Germination and seedling vigour index:

Germination test of the different treatments were taken at 195 days after storage of seed. Data revealed that the maximum germination percentage of 93.33% was found in seed treatment with *Vekhand* powder @ 10 g / kg seed as against lowest in untreated control (31.33%). Seedling vigour index was maximum of 1905.60 in seed treatment with *Vekhand* powder @ 10 g / kg seed as against lowest in untreated control (313.36)(Table C-11.3 b).

Centre: Karnal

The seed treatment with *Vekhand* powder @ 10 g/kg of seed recorded significantly lowest (7.2, 8.3, 2.0, 1.0,2.0 and 1.5) number of survival grain weevil at 45, 75, 105, 135, 165 and 195 days after inoculation, respectively over untreated control i.e 120.2, 175.3, 987.7, 1227.3, 1318.0 and 1335.8. The treatment with *Vekhand* powder + Neem leaves, @ 5+5 g/kg of seed recorded significantly highest (96.6, 94.8, 98.0, 97.0, 98.5 and 100.0 at 45, 75, 105, 135, 165 and 195 days after inoculation, respectively) per cent reduction of grain weevil over all the treatments including untreated control(2.0, 1.5, 2.0, 2.0, 1.5 and 1.0%).(Table C-11.3 c).

The treatment with *Vekhand* powder + Neem leaves, @ 5+5 g/kg of seed recorded significantly highest (998.78,996.00,991.78,989.76,986.67 at 45, 75, 105, 135, 165 and 195 days after inoculation, respectively) grain weight over all the treatments including untreated control. The recorded average grain weight was highest (990.72) in*Vekhand* powder + Neem leaves, @ 5+5 g/kg of seed. It is at par with *Vekhand* powder@ 10 g / kg seed,*Vekhand* powder + Jungli Imli and *Vekhand* powder + Gulwel powder @ 5+5 g/kg of seed. The maximum germination percentage of 95.41% was found in seed treatment with *Vekhand* powder @ 10 g / kg seed as against lowest in untreated control (33.41%). Seedling vigour index was maximum of 1907.68 in seed treatment with *Vekhand* powder @ 10 g / kg seed as against lowest in untreated control (315.44)

The data indicated that the seed treatment with *Vekhand* powder and its combinations with Neem leaves, Jungli Imli and Gulwel powder proved to be significantly effective in controlling the population of grain weevil (*Sitophilus oryzae* L.) as compared to rest of the treatments (Table C-11.3 c &d).

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Table C-11.3a: Effect of plant products as seed protectant on survival population of grain weevil and per cent reduction of grain weevil (Centre: Niphad)

TN	Treatments Details	Dose(g/kg seed)	No. of live grain weevil at						% Reduction of grain weevil over untreated control					
			45 DAI	75 DAI	105 DAI	135 DAI	165 DAI	195 DAI	45 DAI	75 DAI	105 DAI	135 DAI	165 DAI	195 DAI
T1	Neem leaves powder (*Azadirachta indica*)	10	97.00 *(9.89)	167.33 (12.97)	596.33 (24.39)	866.67 (29.45)	932.67 (30.55)	1069.33 (32.69)	18.16 **(24.93)	6.67 (8.85)	39.68 (39.02)	29.28 (32.70)	28.86 (32.36)	19.65 (25.63)
T2	Vekhand powder (*Acorus calamus*)	10	5.67 (2.57)	7.33 (2.88)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	95.26 (77.44)	95.31 (77.67)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
T3	Jangli imli powder (*Phyllanthus niruri*)	10	82.33 (9.09)	105.00 (10.28)	296.67 (17.25)	696.33 (26.41)	761.33 (27.60)	932.67 (30.54)	30.44 (32.96)	35.49 (35.67)	69.67 (56.58)	43.11 (41.02)	42.05 (40.40)	33.44 (35.23)
T4	Giloe (*Tinospora cordifolia*)/Gulvel powder	10	96.67 (9.88)	162.00 (12.76)	475.67 (21.83)	911.00 (30.19)	965.67 (31.09)	1007.67 (31.76)	18.46 (25.19)	13.88 (17.82)	51.35 (45.76)	25.47 (30.26)	26.55 (30.98)	24.42 (29.59)
T5	Vekhand powder + Neem leaves	5+5	6.33 (2.69)	10.33 (3.36)	2.33 (1.75)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	94.62 (76.70)	93.29 (75.28)	99.75 (87.64)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
T6	Jangli imli + Neem leaves	5+5	90.33 (9.55)	176.67 (13.32)	358.00 (18.92)	446.67 (21.13)	599.33 (24.45)	739.67 (27.20)	23.51 (28.53)	9.65 (14.07)	63.72 (52.95)	63.38 (52.78)	54.53 (47.60)	44.42 (41.77)
T7	Giloe + Neem leaves	5+5	90.33 (9.56)	135.33 (11.56)	559.33 (23.65)	600.67 (24.47)	769.67 (27.75)	844.33 (29.06)	23.70 (29.03)	20.02 (24.50)	42.47 (40.58)	51.14 (45.64)	41.51 (40.09)	36.76 (37.30)
T8	Vekhand powder + Jangli imli	5+5	6.67 (2.77)	7.67 (2.94)	5.00 (2.28)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	94.37 (76.25)	95.29 (77.52)	99.49 (86.62)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
T9	Vekhand powder + Giloe	5+5	9.33 (3.20)	10.00 (3.31)	3.00 (1.72)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	92.08 (73.72)	93.71 (75.66)	99.72 (88.25)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
T10	Jangli imli + Giloe	5+5	80.00 (8.99)	142.33 (11.91)	374.67 (19.36)	757.00 (27.52)	898.00 (29.98)	969.67 (31.15)	32.71 (34.83)	30.87 (32.83)	61.42 (51.65)	38.30 (38.22)	31.66 (34.21)	27.29 (31.45)
T11	Untreated control	--	118.67 (10.94)	174.33 (13.11)	985.67 (31.38)	1226.33 (35.03)	1316.00 (36.28)	1334.33 (36.54)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	SE ±		**0.27**	**0.59**	**0.66**	**0.54**	**0.48**	**0.48**	**2.70**	**5.47**	**1.74**	**1.21**	**1.21**	**1.83**
	CD at (5%)		**0.80**	**1.76**	**1.96**	**0.77**	**1.44**	**1.42**	**8.03**	**16.28**	**5.18**	**3.61**	**3.59**	**5.42**

*Figures in parentheses indicate V_{n+1} transformed value

** Figures in parentheses indicate arc sin value

Table C-11.3b: Effect of plant products as seed protectant on grain weight, germination and seedling vigour (Centre: Niphad)

TN	Treatments Details	Dose(g/kg seed)	Weight of grains at						% Germination at 195 DAI	Seedling vigour index
			45 DAI	75 DAI	105 DAI	135 DAI	165 DAI	195 DAI		
T1	Neem leaves powder (*Azadirachta indica)*	10	933.33	888.33	791.33	740.00	723.00	701.67	58.33 (49.79)	963.55
T2	Vekhand powder (*Acorus calamus*)	10	993.33	986.67	982.33	981.33	980.00	946.00	93.33 (75.00)	1905.60
T3	Jangli imli powder (*Phyllanthus niruri*)	10	933.33	912.33	836.67	814.67	785.00	766.00	52.33 (46.32)	615.86
T4	Giloe (*Tinospora cordifolia*) / Gulvel powder	10	936.67	897.00	795.00	787.33	751.33	728.00	57.00 (49.02)	682.20
T5	Vekhand powder + Neem leaves	5+5	996.67	994.00	990.67	988.67	984.67	979.33	91.66 (73.15)	1687.46
T6	Jangli imli + Neem leaves	5+5	940.00	895.33	807.67	777.67	721.67	701.33	56.00 (48.45)	749.53
T7	Giloe + Neem leaves	5+5	943.33	892.67	810.00	774.00	720.33	693.33	55.67 (48.27)	719.60
T8	Vekhand powder + Jangli imli	5+5	996.67	991.33	988.00	982.67	980.00	978.33	91.00 (73.15)	1710.43
T9	Vekhand powder + Giloe	5+5	993.33	986.00	984.00	982.67	980.00	976.67	92.67 (74.32)	1657.36
T10	Jangli imli + Giloe	5+5	936.67	904.00	819.67	777.33	733.00	700.33	55.33 (48.04)	647.03
T11	Untreated control	--	916.67	786.00	707.33	644.67	611.33	593.33	31.33 (33.40)	313.36
	SE ±			**3.17**	**3.33**	**3.51**	**5.16**	**11.54**	**2.93**	**30.61**
	CD at (5%)		5+5	**9.33**	**9.80**	**10.31**	**15.17**	**33.93**	**8.61**	**90.04**

Table C-11.3c: Effect of plant products as seed protectant on survival population of grain weevil and per cent reduction of grain weevil (Centre: Karnal)

TN	Treatments Details	Dose(g/ kg seed)	No. of live grain weevil at						% Reduction of grain weevil over untreated control					
			45 DAI	75 DAI	105 DAI	135 DAI	165 DAI	195 DAI	45 DAI	75 DAI	105 DAI	135 DAI	165 DAI	195 DAI
T1	Neem leaves powder (*Azadirachta indica)*	10	98.5 (10.0)	168.3 (13.0)	598.3 (24.5)	867.7 (29.5)	934.7 (30.6)	1070.8 (32.7)	20.2 (26.7)	8.2 (16.6)	41.7 (40.2)	31.3 (34.0)	30.4 (33.4)	20.7 (27.0)
T2	Vekhand powder (*Acorus calamus*)	10	7.2 (2.9)	8.3 (3.1)	2.0 (1.7)	1.0 (1.4)	2.0 (1.7)	1.5 (1.6)	97.3 (80.5)	96.8 (79.7)	96.7 (79.5)	95.1 (77.2)	96.6 (79.3)	99.0 (84.2)
T3	Jangli imli powder (*Phyllanthus niruri*)	10	83.8 (9.2)	106.0 (10.3)	298.7 (17.3)	697.3 (26.4)	763.3 (27.6)	934.2 (30.6)	32.4 (34.7)	37.0 (37.5)	71.7 (57.8)	45.1 (42.2)	43.6 (41.3)	34.4 (35.9)
T4	Giloe (*Tinospora cordifolia*)/Gulvel powder	10	98.2 (10.0)	(163.0 (12.8)	477.7 (21.9)	912.0 (30.2)	967.7 (31.1)	1009.2 (31.8)	20.5 (26.9)	15.4 (23.1)	53.4 (46.9)	27.5 (31.6)	28.1 (32.0)	25.4 (30.3)
T5	Vekhand powder + Neem leaves	5+5	7.8 (3.0)	11.3 (3.5)	4.3 (2.3)	1.0 (1.4)	2.0 (1.7)	1.5 (1.6)	96.6 (79.4)	94.8 (76.8)	98.0 (81.9)	97.0 (80.0)	98.5 (83.0)	100.0 (90.0)
T6	Jangli imli + Neem leaves	5+5	91.8 (9.6)	177.7 (13.4)	360.0 (19.0)	447.7 (21.2)	601.3 (24.5)	741.2 (27.2)	25.5 (30.3)	11.2 (19.5)	65.7 (54.2)	65.4 (54.0)	56.0 (48.5)	45.4 (42.4)
T7	Giloe + Neem leaves	5+5	91.8 (9.6)	136.3 (11.7)	561.3 (23.7)	601.7 (24.5)	771.7 (27.8)	845.8 (29.1)	25.7 (30.5)	21.5 (27.6)	44.5 (41.8)	53.1 (46.8)	43.0 (41.0)	37.8 (37.9)
T8	Vekhand powder + Jangli imli	5+5	8.2 (3.0)	8.7 (3.1)	7.0 (2.8)	1.0 (1.4)	2.0 (1.7)	1.5 (1.6)	96.4 (79.0)	94.8 (76.9)	99.8 (87.3)	98.6 (83.1)	99.2 (84.7)	97.6 (81.0)
T9	Vekhand powder + Giloe	5+5	10.8 (3.4)	11.0 (3.5)	5.0 (2.4)	1.0 (1.4)	2.0 (1.7)	1.5 (1.6)	94.1 (75.9)	95.2 (77.4)	97.7 81.2)	98.7 (83.3)	95.0 (77.0)	97.6 (81.1)
T10	Jangli imli + Giloe	5+5	81.5 (9.1)	143.3 (12.0)	376.7 (19.4)	758.0 (27.5)	900.0 (30.0)	971.2 (31.2)	34.7 (36.1)	32.4 (34.7)	63.4 (52.8)	40.3 (39.4)	33.2 (35.2)	28.3 (32.1)
T11	Untreated control	--	120.2 (11.0)	175.3 (13.3)	987.7 (31.4)	1227.3 (35.0)	1318.0 (36.3)	1335.8 (36.6)	2.0 (8.1)	1.5 (7.0)	2.0 (8.1)	2.0 (8.1)	1.5 (7.0)	1.0 (5.7)
	SE $\pm$		**0.29**	**0.56**	**0.69**	**0.53**	**0.51**	**0.50**	**2.77**	**5.49**	**1.78**	**1.29**	**1.30**	**1.87**
	CD at (5%)		**0.82**	**1.180**	**1.94**	**0.79**	**1.42**	**1.45**	**8.43**	**16.22**	**5.19**	**3.67**	**3.99**	**5.56**

*Figures in parentheses indicate V_{n+1} transformed value ** Figures in parentheses indicate arc sin value

Table C-11.3d: Effect of plant products as seed protectant on grain weight, germination and seedling vigour (Centre: Karnal)

TN	Treatments Details	Dose (g/kg seed)	Weight of grains at							% Germination at 195 DAI	Seedling vigour index
			45 DAI	75 DAI	105 DAI	135 DAI	165 DAI	195 DAI	Average		
T1	Neem leaves powder (*Azadirachta indica*)	10	935.44	890.33	792.44	741.09	725.00	703.67	798.00	60.41(51.0)	965.63
T2	Vekhand powder (*Acorus calamus*)	10	995.44	988.67	983.44	982.42	982.00	948.00	980.00	95.41(77.6)	1907.68
T3	Jangli imli powder (*Phyllanthus niruri*)	10	935.44	914.33	837.78	815.76	787.00	768.00	843.05	54.41(47.5)	617.94
T4	Giloe (*Tinospora cordifolia*) / Gulvel powder	10	938.78	899.00	796.11	788.42	753.33	730.00	817.61	59.08(50.2)	684.28
T5	Vekhand powder + Neem leaves	5+5	998.78	996.00	991.78	989.76	986.67	981.33	990.72	93.74(75.5)	1689.54
T6	Jangli imli + Neem leaves	5+5	942.11	897.33	808.78	778.76	723.67	703.33	809.00	58.08(49.6)	751.61
T7	Giloe + Neem leaves	5+5	945.44	894.67	811.11	775.09	722.33	695.33	807.33	57.75(49.5)	721.68
T8	Vekhand powder + Jangli imli	5+5	998.78	993.33	989.11	983.76	982.00	980.33	987.89	93.08(74.7)	1712.51
T9	Vekhand powder + Giloe	5+5	995.44	988.00	985.11	983.76	982.00	978.67	985.50	94.75(76.8)	1659.44
T10	Jangli imli + Giloe	5+5	938.78	906.00	820.78	778.42	735.00	702.33	813.55	57.41(49.8)	649.11
T11	Untreated control	--	918.78	788.00	708.44	645.76	613.33	595.33	711.61	33.41(35.3)	315.44
	SE ±		**4.34**	**3.64**	**4.65**	**4.45**	**6.54**	**12.54**	**5.32**	**3.95**	**30.65**
	CD at (5%)		**13.60**	**10.23**	**7.56**	**13.00**	**14.23**	**32.34**	**16.56**	**9.63**	**92.04**

ANNEXURES

ANNEXURE 1.1. Seedling Resistance Test of AVT against pathotypes of black rust (*Puccinia graminis tritici*) at Shimla during 2017-18

S. No.	Variety/ Line	PATHOTYPES																										Postulated genes
		11	11A	14	15-1	21	21-1	21A-2	24A	34-1	40	40A	40-1	40-2	40-3	42B	117A	117A-1	117-1	117-2	117-3	117-4	117-5	117-6	122	184	295	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	17	18	19	20	21	22	23	24	25	26	27	
I. NORTHERN HILL ZONE																												
1	HS 542 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
2	HS 666	R	R	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	-
3	HS 665	S	R	R	R	R	R	R	R	R	R	R	MS	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	*Sr11+*
4	VL 1015	R	R	R	MR	R	R	R	R	R	R	R	MS	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	*Sr7b+*
5	HPW 450	R	S	R	R	R	R	R	R	R	R	R	MR	S	MS	R	R	R	R	R	R	R	R	R	R	R	R	*Sr28+5+*
6	HS 664	MS	R	R	R	R	R	R	R	R	R	R	MS	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	*Sr28+5+11+*
7	HPW 451	R	R	R	R	R	R	R	R	R	R	MS	S	S	MR	R	R	R	R	R	R	R	R	R	R	R	R	*Sr8a+5+*
8	VL 1016	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
9	UP 3016	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
10	VL 1014	MR	R	R	R	R	R	R	R	R	R	R	S	MS	MR	R	R	R	R	R	R	R	R	R	R	R	S	*Sr9b+11+*
11	VL 829 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+2+*
12	HPW 251 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
13	HPW 349 (C)	R	R	R	R	R	MS	R	R	R	R	R	R	S	MR	R	R	R	R	R	R	R	R	MR	R	R	R	*Sr7b+*
14	HS 634	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
15	VL 907 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
16	HS 507 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
17	HPW 441	S	S	R	MS	R	R	R	MR	R	R	R	S	S	MS	R	S	R	R	R	R	R	R	R	S	R	MR	-
18	HPW 442	MS	R	R	R	R	R	R	MR	R	R	R	R	R	S	MR	MS	MR	MS	R	MS	R	R	MR	S	R	MS	*Sr11+*
19	HS 562 (C)	R	R	R	S	R	R	R	R	R	R	R	S	S	MR	R	R	R	R	R	R	R	R	R	S	R	MR	*Sr8a+9b+*
20	VL 3017	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-
21	UP 3017	S	R	R	R	R	R	R	MR	R	R	R	MS	R	MR	MS	R	MS	MR	R	MR	R	R	MS	S	MS	MS	*Sr11+*
22	VL 3016	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr28+5+*
23	HS 662	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
24	HS 490 (C)	MS	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr28+9b+*
25	VL 892 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2+*
26	HS 661	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2*+R
27	HS 660	MR	MR	R	MR	R	R	R	MR	R	R	R	MS	S	MS	R	MR	MR	MR	MS	MS	MR	MS	R	MR	R	S	*Sr7b+*
28	VL 3018	R	R	R	S	R	S	R	R	R	R	R	S	S	MR	R	R	R	R	R	R	R	R	MR	R	R	R	*Sr7b+*
29	HPW 459	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
II. NORTH WESTERN PLAIN ZONE																												
30	UP 2981	R	R	R	R	R	S	S	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	*Sr28+7b+*
31	DBW 221	MR	S	MR	S	S	MS	S	MR	R	MS	R	MR	S	R	S	MR	MS	MS	MR	MS	S	S	S	S	S	S	*Sr7b+*
32	DPW 621-50 (C)	MR	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2+*
33	DBW 222	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
34	BRW 3792	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr8a+5+*
35	PBW 763	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2*+R

36	PBW 766	R	MS	R	R	R	R	R	R	R	R	R	S	R	R	S	R	R	R	R	R	R	R	R	R	R	R	-
37	HD 3086 (C)	S	S	R	S	R	R	R	MS	R	R	R	S	S	R	MR	R	R	R	R	R	R	R	R	S	R	S	*Sr7b+2+*
38	DBW 233	R	S	R	S	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr28+8a+5+2+*
39	HD 3226	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R
40	HD 2967 (C)	R	R	R	S	R	R	R	R	R	R	R	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Sr8a+11+2+*
41	PBW 801	MS	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr11+*
42	DBW 88 (C)	S	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr11+2+*
43	PBW 800	R	R	R	MS	R	R	R	R	R	R	R	MR	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	-
44	WH 1105	R	R	R	R	R	R	R	R	R	R	R	S	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	*Sr11+2+*
45	PBW 771	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
46	WH 1124 (C)	MS	S	R	S	R	R	R	R	R	R	R	S	S	R	R	R	R	R	R	R	R	R	R	S	R	S	*Sr7b+2+*
47	DBW 90 (C)	S	S	R	S	R	R	R	R	R	R	R	S	S	S	R	R	R	R	R	R	R	R	R	S	R	MS	*Sr13+2+*
48	HD 3059 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	MR	R	R	*Sr11+2+*
49	WH 1021 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
50	PBW 752*	S	R	R	R	R	R	R	R	R	R	R	MS	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	*Sr13+11+*
51	DBW 173 (I) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+2+*
52	PBW 773	R	R	R	MR	R	MS	R	R	R	R	R	S	S	MS	R	R	R	R	R	R	R	R	R	R	R	R	-
53	DBW 237	MR	R	R	R	R	R	R	R	R	R	R	S	R	R	MR	R	R	R	R	R	R	R	MR	R	R	R	*Sr2+*
54	WH 1142 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
55	BRW 3806	MR	MS	R	MR	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr28+*
56	WH 1080 (C)	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr9e+2+*
57	HD 3237*	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
58	HI 1620*	MR	R	R	R	R	R	R	R	R	R	R	MS	R	MR	MR	R	R	R	R	R	R	R	R	R	R	R	*Sr11+7b+*
59	PBW 644 (C)	MR	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	MR	MR	R	R	*Sr11+2+*
60	HD 3043 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
61	DBW 252	R	R	R	R	R	R	R	R	R	R	R	S	R	S	R	R	R	R	R	R	R	R	R	R	R	R	*Sr8a+5+11+2+*
62	HI 1628	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
63	NIAW 3170	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2+*
III. NORTH EASTERN PLAIN ZONE																												
64	DBW 233	R	R	R	S	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	*Sr28+8a+5+*
65	HD 3249	R	R	R	R	R	R	R	R	R	R	R	MR	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2+*
66	HD 3254	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
67	K 1006 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	MS	R	*Sr8a+9b+11+*
68	HD 2733 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
69	DBW 221	S	S	R	S	R	S	S	MS	R	S	S	R	S	S	S	R	S	MR	R	MR	MS	S	MR	S	MS	S	*Sr7b+*
70	K 1601	R	R	R	MS	R	R	R	R	R	R	R	MR	R	R	MR	MR	R	R	R	MR	MR	R	MS	R	R	S	*Sr7b+*
71	PBW 769	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
72	DBW 39 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
73	HD 2967 (C)	R	R	R	MS	R	R	R	R	R	R	R	S	MR	S	R	R	R	R	R	R	R	R	R	R	R	R	*Sr8a+11+2+*
74	K 0307 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	MR	R	*Sr2+*
75	DBW 187	S	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr5+11+*
76	DBW 223	R	R	R	S	R	R	R	R	R	R	R	MR	R	R	R	R	R	MR	MR	R	R	R	MS	R	R	R	*Sr9e+7b+*
77	PBW 762	R	R	R	S	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	MR	R	*Sr30+*
78	WH 1218	S	R	R	R	R	R	R	R	R	R	R	MR	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	*Sr30+5+*
79	HD 2888 (C)	R	R	R	R	R	R	R	R	S	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+2+*
80	HI 1612 (I) (C)	MS	S	R	S	R	R	S	R	R	S	R	MS	S	MR	MR	R	MR	R	MR	R	R	R	MR	R	R	R	*Sr7b+2+*
81	WH 1235	S	S	R	MR	R	R	R	R	R	R	R	MR	R	S	R	MR	R	MR	MR	R	R	R	R	R	R	MR	*Sr28+*
82	BRW 3806	S	R	R	MR	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr28+*

83	K 1317 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
84	DBW 252	MR	R	R	R	R	R	R	R	R	R	R	MS	R	S	R	R	R	R	R	R	R	R	R	R	R	R	*Sr8a+5+11+*
85	K 8027 (C)	S	R	R	R	R	MR	MS	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr11+2+*
86	HD 3171 (C)	S	R	R	R	R	R	R	R	R	R	R	MS	R	R	MS	R	R	MR	R	R	R	R	R	R	R	R	*Sr11+7b+2+*
87	HI 1628	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2*+R
IV. CENTRAL ZONE																												
88	GW 1339 (d)	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	S	S	MR	R	R	R	S	S	R	MS	MS	*Sr13+11+*
89	AKAW 4924	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	*Sr2*+R
90	GW 322 (C)	MS	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	MR	R	MR	R	MR	R	MR	R	MR	*Sr11+2+*
91	HI 8713 (d) (C)	R	R	R	MR	R	R	R	MS	R	R	MS	R	R	R	R	MS	R	S	MR	MR	MS	MR	S	R	S	R	*Sr9e+2+*
92	HI 8737 (d) (C)	R	R	R	MR	R	R	R	S	R	R	R	R	R	MR	MR	S	MR	MR	R	R	MR	R	MR	MS	MS	S	*Sr9e+2+*
93	HI 1544 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	*Sr24+2+*R
94	GW 495	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
95	UAS 465 (d)	R	R	R	MR	R	R	R	MS	R	R	S	R	R	R	R	S	MS	S	MS	MS	MS	MS	S	R	MS	R	*Sr11+7b+*
96	MPO 1343 (d)	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	MS	R	S	MS	S	R	MR	MS	S	R	MS	S	-
97	DBW 110 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
98	DDW 47 (d)	R	R	R	MS	R	R	R	MR	R	R	R	R	R	R	R	S	MS	MR	R	MR	MS	MS	S	R	R	R	*Sr11+7b+*
99	MP 1331	S	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	MR	R	R	R	R	R	R	R	R	*Sr8a+5+*
100	MP 3288 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24*+R
101	HI 8627 (d) (C)	R	R	R	R	R	R	R	MR	R	R	R	R	S	R	R	MR	MR	MS	R	R	MR	R	MR	R	MS	R	*Sr9e+2+*
102	UAS 466 (d)	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	MS	MR	S	R	R	MR	R	MS	R	MS	R	*Sr11+*
103	NIAW 3170	R	R	R	MS	R	R	R	R	R	R	MR	R	R	MR	R	R	R	MR	R	R	R	R	R	R	R	R	-
V. PENINSULAR ZONE																												
104	AKAW 4924	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
105	GW 491	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2*+R
106	GW 493	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
107	DBW 235	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-
108	HI 1624	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
109	MACS 6222 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
110	DBW 168 (I) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
111	GW 495	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
112	MP 1338	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R
113	MACS 3949 (d) (C)	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	S	MR	R	R	MS	S	MR	MS	R	S	R	*Sr7b+2+*
114	HI 8800 (d)	R	R	R	R	R	R	R	S	R	MR	R	R	R	R	R	R	S	R	S	R	R	MS	S	R	R	R	*Sr11+*
115	MACS 6478 (C)	S	R	R	R	R	R	R	R	R	R	R	MR	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	*Sr28+*
116	MACS 6709	S	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	*Sr28+*
117	HI 1625	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
118	UAS 428 (d) (C)	R	R	R	R	R	R	R	MR	R	R	R	MR	R	R	R	S	MR	MR	MS	MR	MS	R	MS	R	S	R	*Sr7b+*
119	PBW 770	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
120	GW 492	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2*+R
121	GW 1346 (d)	MR	R	R	R	R	R	R	MS	R	R	R	R	R	R	S	R	MR	MR	MS	R	R	R	MR	R	MS	MR	*Sr11+7b+*
122	HI 1605 (C)	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr5+11+*
123	AKDW 2997-16 (d) (C)	MS	S	R	R	S	S	MS	MS	R	MS	MR	MS	S	S	MS	S	MS	S	MR	S	S	S	S	S	S	S	*Sr7b+2+*
124	MPO 1336 (d)	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	MR	MR	S	S	S	S	S	S	R	MS	R	*Sr11+*
125	UAS 446 (d) (c)	R	R	R	R	R	R	R	MR	R	MR	R	R	R	R	R	S	R	S	MR	MS	S	MS	MS	R	R	R	*Sr11+2+*
126	HI 8805 (d)	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	MR	MR	MS	R	MR	MR	R	R	R	*Sr13+11+*
127	MACS 4058 (d)	R	R	MR	R	R	R	R	MS	R	R	R	R	R	MR	R	MS	S	MR	MR	MR	S	MR	MS	S	MS	S	*Sr13+*
128	MACS 6696	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	-

129	MACS 4059 (d)	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	MR	MS	MS	MS	MS	R	MS	MS	S	MR	R	S	*Sr11+*
130	NIAW 3170	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-
131	DBW 93 (c)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
132	MACS 6695	R	R	R	R	R	R	R	R	R	R	R	S	R	MS	R	R	R	R	R	R	R	R	R	R	MR	R	*Sr9b+11+7b+*
133	HI 8802 (d)	R	R	R	R	R	R	R	S	R	R	R	MR	R	S	R	MS	MR	MR	R	MR	MR	MR	MS	R	R	R	*Sr13+*
VI. SPECIAL TRIAL (Dicoccum)																												
134	DDK 1029 (C)	R	R	R	R	R	R	R	S	R	R	R	R	R	R	S	MR	R	MR	MR	R	MR	R	S	R	R	MR	*Sr11+2+*
135	MACS 6222 (Ae.) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
136	MACS 5051	MR	R	R	R	R	R	R	MS	R	R	R	R	R	S	S	MS	MS	MR	MS	R	R	R	MS	MS	S	S	*Sr11+*
137	HW 4101	MR	R	R	R	R	R	R	S	R	R	R	R	R	S	S	MR	MS	MR	MS	MS	R	R	MR	R	R	S	*Sr13+11+7b+*
138	DDK 1054	S	R	R	R	R	R	R	S	R	R	R	R	R	R	S	S	MS	MR	MR	MR	R	R	MR	R	R	MS	*Sr11+7b+*
139	HW 1098 (C)	R	R	R	R	MR	R	R	S	R	R	R	R	R	R	S	R	R	MR	MR	MR	R	MR	MS	R	MR	MS	*Sr11+2+*
VII. SPECIAL TRIAL- Very Late Sown																												
140	WR 544 (C)	R	R	R	R	R	R	R	R	R	R	R	S	R	S	R	R	R	R	R	R	R	R	R	MR	R	MR	*Sr28+8a+2+*
141	HD 3271	MS	S	R	MR	R	MR	R	R	R	R	R	MS	S	MS	S	R	R	R	MR	MR	MR	R	R	S	MR	MS	*Sr2+*
142	DBW 71 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+*
143	PBW 797	S	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	MS	R	R	R	R	R	MS	R	R	*Sr11+7b+2+*
144	PBW 757	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
145	DBW 278	S	R	R	R	R	R	R	R	R	R	R	S	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	*Sr11+2+*
146	HI 1621	MR	R	R	S	R	R	R	R	R	R	R	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Sr28+*
147	DBW 14 (C)	MR	R	R	R	R	R	R	R	R	R	R	MS	R	S	R	R	R	R	R	R	R	R	R	R	R	R	*Sr28+11+2+*
148	PBW 777	R	R	R	R	R	R	R	R	R	R	R	MS	R	S	R	R	R	R	R	R	R	R	R	R	R	R	-
149	HD 3298	R	R	R	R	R	R	R	R	R	R	R	S	R	S	R	R	R	R	R	R	R	R	R	R	R	MR	*Sr30+*

ANNEXURE 1.2. Seedling Resistance Test of AVT against pathotypes of brown rust (*Puccinia triticina*) at Shimla during 2017-18

S. No.	Variety/line	PATHOTYPES																							postulation Gene
		11	**12-2**	**12-5**	**12-7**	**12-8**	**16-1**	**77**	**77-1**	**77-2**	**77-5**	**77-6**	**77-7**	**77-8**	**77-9**	**77A-1**	**77-10**	**104-2**	**104-3**	**104B**	**106**	**108-1**	**162-1**	**162A**	**162-3**	
		3	4	5	6	2	7	8	9	10	11	1	12	13	14	15	16	17	18	19	20	22	23	24	25	
I. NORTHERN HILL ZONE																										
1	HS 542 (C)	R	R	R	S	R	R	S	R	S	S	S	S	R	S	S	S	R	R	R	R	R	R	R	R	*Lr*13+10+
2	HS 666	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
3	HS 665	R	R	R	R	R	R	R	NG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
4	VL 1015	R	S	R	S	R	R	R	R	S	S	S	S	R	S	NG	S	S	S	S	R	R	R	R	R	*Lr*23+10+
5	HPW 450	R	S	MS	S	R	R	S	MX	S	S	S	M	R	S	M	S	S	S	R	R	R	MS	R	R	*Lr*13+
6	HS 664	R	MS	S	S	R	R	S	R	S	S	S	S	S	S	S	S	S	S	MR	R	R	S	R	R	*Lr*13+
7	HPW 451	R	R	R	S	R	R	R	R	S	S	S	S	R	S	R	S	S	S	R	R	R	S	S	S	*Lr*13+10+
8	VL 1016	R	S	R	S	R	R	R	R	S	S	S	S	R	S	NG	S	S	S	R	R	NG	NG	R	R	*Lr*23+10+
9	UP 3016	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*26+9+
10	VL 1014	R	R	R	R	R	R	R	NG	MS	R	S	S	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*23+1+
11	VL 829 (C)	R	R	R	R	R	R	R	R	R	S	R	S	R	MS	R	R	S	MX	R	NG	R	MR	R	R	*Lr*26+34+
12	HPW 251 (C)	R	R	R	R	R	R	R	R	R	S	S	S	R	S	R	MR	MS	R	R	R	R	R	R	R	*Lr*26+23+

13	HPW 349 (C)	R	S	S	R	R	R	S	R	S	S	S	S	R	S	R	S	S	MS	R	R	R	MR	R	R	*Lr*13+10+
14	HS 634	R	S	M	R	R	R	S	M	S	S	S	S	R	S	S	S	S	S	R	R	R	R	R	MS	*Lr*13+
15	VL 907 (C)	R	R	R	R	R	R	R	R	R	R	S	S	R	S	R	R	R	R	R	R	R	R	R	R	*Lr*26+1+
16	HS 507 (C)	R	R	R	R	R	R	R	R	R	MS	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*26+1+
17	HPW 441	R	S	R	S	R	R	R	R	S	R	S	S	R	S	R	S	S	S	R	R	R	R	R	R	*Lr*23+10+
18	HPW 442	R	S	R	R	R	R	S	M	S	S	S	S	R	S	NG	S	MX	S	R	R	R	R	R	R	*Lr*23+
19	HS 562 (C)	R	MX	R	S	R	R	R	R	S	MX	MX	S	R	MX	R	S	MX	S	R	R	R	R	R	R	*Lr*23+
20	VL 3017	R	MS	R	R	R	R	S	S	S	S	S	S	R	S	S	S	R	R	R	R	R	R	R	R	*Lr*13+
21	UP 3017	R	MS	S	S	S	R	S	S	S	S	S	S	R	S	R	S	S	S	S	R	NG	S	R	S	-
22	VL 3016	R	S	R	R	R	R	MS	R	R	R	S	S	R	S	R	S	S	R	R	R	R	R	R	R	*Lr*23+
23	HS 662	R	R	R	R	R	R	R	R	R	S	S	MS	R	R	R	R	R	M	R	R	R	R	R	R	*Lr*26+23+1+
24	HS 490 (C)	R	R	R	R	R	R	M	R	S	S	S	S	R	S	R	S	S	S	R	R	R	R	R	R	*Lr*23+
25	VL 892 (C)	R	R	R	R	R	R	R	R	S	S	S	S	R	S	R	S	S	S	R	R	R	R	R	R	*Lr*13+10+
26	HS 661	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
27	HS 660	R	S	R	R	R	R	S	R	S	S	S	S	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*23+
28	VL 3018	R	R	R	R	R	R	MR	NG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
29	HPW 459	R	R	R	R	R	R	R	R	M	S	S	S	NG	MX	R	R	R	R	R	R	R	R	R	R	*Lr*26+23+1+
II. NORTH WESTERN PLAIN ZONE																										
30	UP 2981	R	R	R	R	R	R	R	R	R	S	S	S	R	R	R	R	R	R	R	R	NG	R	R	R	*Lr*23+1+
31	DBW 221	R	S	S	S	R	R	S	R	S	S	S	S	R	S	MS	S	S	S	MS	R	R	R	R	R	*Lr*13+
32	DPW 621-50 (C)	R	R	R	S	R	R	R	S	S	S	S	S	R	S	R	S	R	S	R	R	R	S	R	R	*Lr*13+10+
33	DBW 222	R	R	R	R	R	R	R	R	R	R	R	S	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*26+23+10+
34	BRW 3792	R	R	R	R	R	R	R	R	S	R	S	R	R	S	R	R	R	R	R	NG	R	R	R	R	*Lr*23+
35	PBW 763	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
36	PBW 766	R	R	R	R	R	R	R	R	S	MS	S	S	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*13+10+
37	HD 3086 (C)	R	MR	R	S	R	R	R	S	S	S	S	S	R	S	R	S	S	S	R	R	R	R	R	R	*Lr*13+10+3+
38	DBW 233	R	R	R	R	R	R	R	R	R	S	S	R	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*13+10+
39	HD 3226	R	MR	R	S	R	R	R	R	S	S	S	S	R	S	R	S	S	S	S	R	R	S	MS	R	*Lr*23+10+
40	HD 2967 (C)	R	R	R	R	R	R	R	R	R	S	S	S	R	S	R	S	R	R	R	R	R	MS	R	R	*Lr*23+
41	PBW 801	R	R	R	R	R	R	R	S	S	S	S	S	MS	S	R	S	R	R	R	R	R	MS	R	R	*Lr*10+
42	DBW 88 (C)	R	R	R	R	R	R	R	M	R	S	S	S	R	S	R	S	R	R	R	R	R	MS	R	R	*Lr*13+10+
43	PBW 800	R	R	R	R	R	R	R	R	R	M	S	S	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*13+
44	WH 1105	R	R	R	R	R	R	MS	MS	R	S	S	R	S	S	S	S	R	R	R	R	R	R	R	R	*Lr*13+
45	PBW 771	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*26+R
46	WH 1124 (C)	R	R	R	S	R	R	R	S	S	S	S	S	R	S	R	S	S	S	R	R	NG	MS	MS	R	*Lr*13+10+
47	DBW 90 (C)	R	R	R	S	R	R	R	S	S	S	S	S	R	S	R	S	S	S	R	R	R	MR	MS	R	*Lr*13+10+
48	HD 3059 (C)	R	R	R	R	R	R	R	R	MS	S	S	S	S	S	R	S	R	R	R	R	R	R	R	R	*Lr*13+
49	WH 1021 (C)	R	NG	R	R	R	R	R	MS	R	S	S	S	R	M	R	R	R	R	R	R	R	R	R	R	*Lr*26+1+
50	PBW 752*	R	R	R	R	R	R	R	R	S	S	S	S	S	S	R	S	R	R	R	R	R	R	R	R	*Lr*13+10+
51	DBW 173 (I) (C)	R	R	R	R	R	R	R	R	R	S	S	S	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*26+10+3+
52	PBW 773	R	R	R	R	R	R	MS	R	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*13+
53	DBW 237	R	R	R	R	R	R	R	R	R	S	S	R	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*13+10+
54	WH 1142 (C)	R	R	R	S	R	R	R	R	R	S	S	S	R	R	R	R	S	S	R	NG	R	R	R	R	*Lr*26+23+
55	BRW 3806	R	NG	R	R	R	R	S	S	S	S	S	S	S	S	S	S	R	R	R	R	R	R	R	R	*Lr*13+1+
56	WH 1080 (C)	R	MS	S	R	R	R	S	NG	S	S	S	S	R	R	R	S	R	MS	R	R	S	R	R	R	*Lr*13+
57	HD 3237*	R	MS	MX	S	R	R	S	S	S	S	S	S	R	S	S	S	S	S	S	R	R	R	R	R	*Lr*13+3+
58	HI 1620*	R	R	R	R	R	R	R	R	R	S	S	R	R	MS	R	S	R	R	R	R	R	R	R	R	*Lr*13+10+3+
59	PBW 644 (C)	R	R	R	R	R	R	MR	MX	S	S	S	S	R	S	S	S	S	S	R	R	R	R	R	R	*Lr*13+1+

60	HD 3043 (C)	R	R	R	R	R	R	R	S	R	S	S	S	R	S	R	S	S	S	R	R	R	R	R	R	*Lr*26+1+*
61	DBW 252	R	R	R	R	R	R	R	S	R	S	S	S	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*13+10+
62	HI 1628	R	R	R	R	R	R	S	S	S	S	S	S	MS	S	S	S	R	MS	R	R	R	R	R	R	*Lr*13+
63	NIAW 3170	R	R	R	R	R	NG	R	M+	S	S	S	S	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*13+10+
III. NORTH EASTERN PLAIN ZONE																										
64	DBW 233	R	R	R	R	R	R	R	R	R	MS	S	R	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*13+10+
65	HD 3249	R	R	R	R	R	R	R	R	MS	MS	S	R	R	S	R	S	R	R	R	R	R	S	R	R	*Lr*13+10+
66	HD 3254	R	R	R	R	R	R	R	R	R	R	S	R	R	S	R	R	R	R	R	R	R	R	R	R	*Lr*26+23+
67	K 1006 (C)	R	R	R	R	R	R	S	R	MS	S	S	S	R	S	R	S	S	S	R	R	R	R	R	R	*Lr*13+1+
68	HD 2733 (C)	R	R	S	MS	MX	R	R	R	R	S	S	S	R	S	R	S	S	S	R	R	R	S	R	R	*Lr*26+34+
69	DBW 221	R	R	S	MS	R	R	S	S	S	S	S	S	MX	S	S	S	S	S	S	R	R	R	R	R	*Lr*13+
70	K 1601	R	R	S	MS	R	R	S	MX	S	S	S	S	NG	S	S	S	S	S	S	R	R	R	R	R	*Lr*13+
71	PBW 769	R	R	R	R	R	R	S	S	S	S	S	S	R	S	S	S	S	S	MX	R	R	S	R	S	*Lr*13+
72	DBW 39 (C)	R	R	R	R	R	R	MR	R	S	S	S	S	R	S	S	R	S	S	R	R	R	R	R	R	*Lr*26+23+10+
73	HD 2967 (C)	R	R	R	R	R	R	R	R	R	S	S	R	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*23+
74	K 0307 (C)	R	R	R	R	R	R	S	R	MS	S	S	MS	R	S	MS	S	S	S	R	R	R	R	R	R	*Lr*23+1+
75	DBW 187	R	R	R	R	R	R	R	R	S	S	S	R	R	MS	R	MS	R	R	R	R	R	R	R	R	*Lr*23+10+*
76	DBW 223	R	MS	MS	S	S	R	R	R	S	S	S	S	R	S	R	S	S	S	S	R	S	R	R	R	*Lr*23+
77	PBW 762	R	R	S	R	R	R	R	R	R	MS	S	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*23+10+2a+
78	WH 1218	R	R	S	R	R	R	R	R	S	MX	R	S	R	R	R	R	S	R	R	R	S	R	R	R	*Lr23+2a*+
79	HD 2888 (C)	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*24+
80	HI 1612 (I) (C)	R	S	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	S	S	S	R	R	R	R	R	*Lr*23+
81	WH 1235	R	R	R	R	R	R	R	NG	S	S	S	MS	R	S	R	S	R	S	R	R	R	R	R	R	*Lr*23+
82	BRW 3806	R	R	R	R	R	R	S	S	S	S	S	S	R	S	S	S	R	S	R	R	R	R	R	R	*Lr*13+1+
83	K 1317 (C)	R	R	R	R	R	R	S	S	S	S	S	S	R	S	S	S	S	S	R	R	R	R	R	R	-
84	DBW 252	R	R	R	R	R	R	R	M	S	S	S	R	R	S	R	S	R	MS	R	R	R	R	R	R	*Lr*13+10+
85	K 8027 (C)	R	S	R	R	R	R	R	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*13+
86	HD 3171 (C)	R	R	R	S	R	R	R	R	S	S	S	S	R	S	NG	S	S	S	R	R	R	MX	R	R	*Lr*23+13+10+
87	HI 1628	R	R	R	R	R	R	MS	MS	S	S	S	S	S	S	S	S	R	S	R	R	R	MS	R	R	*Lr*13+10+
IV. CENTRAL ZONE																										
88	GW 1339 (d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
89	AKAW 4924	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
90	GW 322 (C)	R	R	R	R	R	R	S	R	S	S	S	S	R	S	MS	S	R	R	R	R	R	R	R	R	*Lr*13+1+
91	HI 8713 (d) (C)	S	S	S	MS	S	S	R	R	S	MS	R	R	R	R	R	R	S	S	S	S	R	S	R	R	*Lr*13+
92	HI 8737 (d) (C)	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	S	S	S	R	NG	R	R	R	-
93	HI 1544 (C)	R	R	R	R	NG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*24+R
94	GW 495	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
95	UAS 465 (d)	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	*Lr*23+13+
96	MPO 1343 (d)	MX	R	S	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	NG	R	*Lr*23+
97	DBW 110 (C)	R	MR	R	R	R	R	S	M	S	S	S	S	R	S	S	S	R	S	R	R	R	R	R	R	*Lr*13+
98	DDW 47 (d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
99	MP 1331	R	R	R	R	R	R	R	R	R	S	S	S	R	S	R	S	S	S	R	R	R	R	R	S	-
100	MP 3288 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	*Lr*24+R
101	HI 8627 (d) (C)	MS	MS	S	S	S	S	R	R	R	R	R	R	R	R	R	R	S	S	MS	S	R	S	R	S	*Lr*13+
102	UAS 466 (d)	S	S	S	S	S	S	R	R	R	R	MS	R	R	MS	R	R	S	S	S	S	R	MS	R	R	*Lr*13+
103	NIAW 3170	R	R	R	R	R	R	R	M	S	S	S	S	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*13+10+
V. PENINSULAR ZONE																										
104	AKAW 4924	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

105	GW 491	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
106	GW 493	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
107	DBW 235	R	R	R	R	R	R	MS	R	S	R	S	R	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*13+10+1+
108	HI 1624	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*26+R
109	MACS 6222 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
110	DBW 168 (I) (C)	R	R	R	R	R	R	R	S	R	S	S	MS	R	MS	R	R	R	S	R	R	R	MS	R	R	*Lr*26+
111	GW 495	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
112	MP 1338	R	MS	R	R	R	NG	R	M	S	S	S	S	R	S	R	S	S	S	R	R	R	R	R	R	*Lr*23+
113	MACS 3949 (d) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
114	HI 8800 (d)	R	R	S	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-
115	MACS 6478 (C)	R	R	R	R	R	R	R	R	S	S	S	S	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*23+1+
116	MACS 6709	R	R	R	R	R	R	R	R	S	S	S	S	S	R	S	S	R	R	R	R	R	R	R	R	*Lr*13+10+
117	HI 1625	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
118	UAS 428 (d) (C)	MX	R	S	R	R	MX	R	R	R	MS	S	S	R	S	R	S	S	R	S	R	R	MR	R	R	-
119	PBW 770	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*26+
120	GW 492	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
121	GW 1346 (d)	S	MS	R	R	R	S	R	R	S	R	S	R	R	R	R	R	S	S	R	S	R	R	R	R	*Lr*13+10+
122	HI 1605 (C)	R	R	S	R	S	R	R	R	R	R	S	S	R	S	R	S	S	S	R	R	R	R	S	R	*Lr*13+
123	AKDW 2997-16 (d) (C)	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	-
124	MPO 1336 (d)	R	R	MS	R	R	R	R	R	R	MS	R	R	R	R	R	R	S	MS	R	R	NG	R	R	R	*Lr*23+13+
125	UAS 446 (d) (c)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
126	HI 8805 (d)	R	MX	S	S	R	MS	R	R	R	MS	R	R	R	MR	R	R	S	S	R	R	R	R	R	R	*Lr*13+
127	MACS 4058 (d)	R	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	S	S	R	R	R	R	R	R	*Lr*23+
128	MACS 6696	R	S	S	S	S	R	S	S	S	S	S	S	R	S	S	S	S	S	S	R	MS	MS	S	S	*Lr*13+
129	MACS 4059 (d)	S	MS	S	S	S	S	R	MS	R	S	S	S	S	S	S	S	S	S	S	S	R	S	MS	S	*Lr*13+
130	NIAW 3170	R	R	R	R	R	R	R	R	S	S	S	S	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*13+10+
131	DBW 93 (c)	R	R	R	R	R	R	R	R	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*26+23+
132	MACS 6695	R	MS	S	S	S	R	S	S	S	S	S	S	R	S	S	S	S	S	S	R	MS	R	R	S	-
133	HI 8802 (d)	R	R	MS	R	R	S	R	R	R	R	R	R	R	R	R	R	S	MS	R	R	R	R	R	R	*Lr*23+
VI. SPECIAL TRIAL (Dicoccum)																										
134	DDK 1029 (C)	R	MR	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	S	R	R	R	R	*Lr*13+
135	MACS 6222 (Ae.) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R*
136	MACS 5051	R	R	R	R	R	S	R	R	R	MS	R	R	R	R	R	MS	R	R	R	S	R	R	R	R	*Lr*18+
137	HW 4101	R	R	R	R	R	S	R	R	S	R	R	R	R	R	R	R	MS	MS	R	S	R	R	R	R	*Lr*18+
138	DDK 1054	R	R	R	R	R	S	MR	R	R	R	R	R	R	R	R	MX	S	MS	R	S	R	R	R	R	*Lr*18+
139	HW 1098 (C)	S	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	S	R	R	S	R	R	R	R	*Lr*18+
VII. SPECIAL TRIAL- Very Late Sown																										
140	WR 544 (C)	R	R	R	R	R	R	S	R	S	S	S	S	R	S	R	S	R	R	R	R	R	R	R	R	*Lr*13+1+
141	HD 3271	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	*Lr*13+10+
142	DBW 71 (C)	R	R	S	S	S	R	R	S	R	S	S	S	R	MS	R	R	S	S	R	R	R	MS	R	S	*Lr*26+
143	PBW 797	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
144	PBW 757	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*26+R*
145	DBW 278	R	R	R	R	R	R	R	R	M	S	S	S	S	S	S	S	R	R	R	R	R	R	R	R	*Lr*1+
146	HI 1621	R	S	R	R	R	R	S	S	S	S	S	S	S	S	S	S	MS	S	MR	R	R	R	R	R	*Lr*13+
147	DBW 14 (C)	R	MS	R	S	R	R	R	R	R	S	MS	S	R	S	R	S	S	S	R	R	R	R	MS	R	*Lr*23+
148	PBW 777	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R*
149	HD 3298	R	S	S	S	R	R	R	R	MX	R	R	R	R	R	R	MX	S	S	MR	R	R	MS	R	R	*Lr*23+2a

ANNEXURE 1.3. Seedling Resistance Test of AVT against pathotypes of yellow rust (*Puccinia striiformis tritici*) at Shimla during 2017-18

S. No.	Variety/line	PATHOTYPE																		
		46S19	110S119	78S84	110S84	238S119	110S247	T	P	111S68	79S68	79S4	7S0	K	6S0	20A	L	N	38A	Postulated genes
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
I. NORTHERN HILL ZONE																				
1	HS 542 (C)	R	S	R	R	S	MX	R	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
2	HS 666	S	S	S	S	S	R	S	S	S	S	R	S	S	MS	R	R	R	S	-
3	HS 665	S	S	R	S	S	S	MS	R	R	R	R	R	MS	R	R	R	R	R	*Yr2+*
4	VL 1015	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
5	HPW 450	S	S	S	R	S	S	MS	S	MS	S	R	R	MS	R	R	R	R	R	*Yr2+*
6	HS 664	R	R	R	R	R	R	S	R	R	R	R	R	S	R	R	R	R	R	*Yr2+*
7	HPW 451	R	S	R	R	S	R	S	R	S	R	R	R	R	R	R	R	R	R	*Yr2+*
8	VL 1016	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
9	UP 3016	R	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
10	VL 1014	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	-
11	VL 829 (C)	R	MS	S	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+18+*
12	HPW 251 (C)	MS	S	MS	MS	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
13	HPW 349 (C)	S	S	R	R	S	S	S	S	R	R	R	R	S	R	R	R	R	R	*Yr2+*
14	HS 634	S	S	S	S	S	S	S	S	S	MS	R	R	R	R	R	R	R	R	*Yr2+*
15	VL 907 (C)	R	S	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+18+*
16	HS 507 (C)	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
17	HPW 441	MX	S	R	MS	S	S	S	S	MS	R	R	S	S	MS	R	R	R	S	-
18	HPW 442	S	S	R	S	S	S	S	S	R	R	R	R	S	R	R	R	R	R	*Yr2+*
19	HS 562 (C)	S	S	R	R	S	S	S	S	R	R	R	R	R	R	R	R	R	R	*YrA+*
20	VL 3017	S	S	R	R	S	S	S	S	R	R	R	R	MS	R	R	R	R	R	*YrA+*
21	UP 3017	R	S	R	R	S	MS	R	R	R	R	R	R	R	R	R	R	R	R	*YrA+*
22	VL 3016	S	S	MS	R	S	S	S	S	S	MS	R	R	R	R	R	R	R	R	*Yr2+*
23	HS 662	S	S	R	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
24	HS 490 (C)	R	S	R	R	S	S	R	R	R	R	R	R	MR	R	R	R	R	R	*YrA+*
25	VL 892 (C)	R	S	R	R	S	MS	R	R	R	R	R	R	S	R	R	R	R	R	*YrA+*
26	HS 661	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
27	HS 660	S	S	S	S	S	S	S	S	S	R	R	R	S	R	R	R	R	R	-
28	VL 3018	S	S	S	R	S	S	S	S	MS	MS	R	R	S	R	R	R	R	R	*Yr2+*
29	HPW 459	R	S	S	R	MS	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
II. NORTH WESTERN PLAIN ZONE																				
30	UP 2981	S	S	S	R	S	S	S	S	MS	R	R	R	S	R	R	R	R	R	*Yr2+*
31	DBW 221	S	S	MS	R	S	S	S	S	S	R	S	R	S	R	R	R	R	R	-

32	DPW 621-50 (C)	R	S	R	MS	S	S	R	R	MS	R	R	R	MR	R	R	R	R	R	-
33	DBW 222	R	S	R	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
34	BRW 3792	R	S	R	R	S	MS	R	MX	R	R	R	R	MS	R	R	R	R	R	*YrA+*
35	PBW 763	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
36	PBW 766	MS	S	R	R	S	S	S	MS	R	R	R	R	MS	R	R	R	R	R	*YrA+*
37	HD 3086 (C)	S	S	R	R	MS	S	S	S	R	R	R	R	S	R	R	R	R	R	*Yr2+*
38	DBW 233	R	S	R	MS	S	S	S	S	S	S	R	R	S	R	R	R	R	R	*Yr2+*
39	HD 3226	MS	S	R	MS	S	S	MS	S	R	R	R	R	MS	R	R	R	R	R	*Yr2+*
40	HD 2967 (C)	S	S	R	R	S	S	S	S	R	R	R	R	S	R	R	R	R	R	*Yr2+*
41	PBW 801	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
42	DBW 88 (C)	R	S	R	MS	S	S	R	R	R	R	R	R	MR	R	R	R	R	R	*YrA+*
43	PBW 800	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
44	WH 1105	R	S	R	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
45	PBW 771	R	R	MR	R	MS	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
46	WH 1124 (C)	R	S	R	R	S	S	S	S	R	R	R	R	S	R	R	R	R	R	*Yr2+*
47	DBW 90 (C)	S	S	R	MS	S	S	S	S	R	R	R	R	S	R	R	R	R	R	*Yr2+*
48	HD 3059 (C)	R	S	R	R	S	S	R	R	MR	R	R	R	R	R	R	R	R	R	*Yr2+*
49	WH 1021 (C)	R	S	R	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
50	PBW 752*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
51	DBW 173 (I) (C)	R	S	R	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+A+*
52	PBW 773	S	S	R	R	S	S	S	S	MS	R	MS	R	S	R	R	R	MS	R	-
53	DBW 237	MS	S	R	R	S	S	S	S	R	R	R	R	S	R	R	MS	R	R	*Yr2+*
54	WH 1142 (C)	R	S	R	MS	S	S	R	S	R	R	R	R	R	R	R	R	R	R	*Yr9+*
55	BRW 3806	MS	S	R	R	S	S	R	S	R	R	R	R	MS	R	R	R	R	R	*YrA+*
56	WH 1080 (C)	S	S	MX	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr2+*
57	HD 3237*	MS	S	MS	R	S	S	S	S	R	R	R	R	S	R	R	MS	R	R	*Yr2+*
58	HI 1620*	MS	S	MS	R	S	S	S	MS	R	R	R	R	S	R	R	R	R	R	*YrA+*
59	PBW 644 (C)	R	S	R	R	S	S	R	R	MS	R	MS	R	R	R	MS	R	S	MR	*Yr2+*
60	HD 3043 (C)	R	MS	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+A+
61	DBW 252	R	S	R	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*YrA+*
62	HI 1628	S	S	MS	MS	S	S	S	S	MS	R	R	R	S	R	R	R	R	R	*Yr2+*
63	NIAW 3170	S	S	S	S	S	S	S	S	S	S	S	MS	S	MS	MX	R	S	MS	-
III. NORTH EASTERN PLAIN ZONE																				
64	DBW 233	R	S	R	R	S	S	S	S	MS	R	S	R	S	MS	R	R	R	R	*Yr2+*
65	HD 3249	MS	S	MS	R	S	S	S	S	R	R	R	R	S	R	R	R	R	R	*Yr2+*
66	HD 3254	R	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
67	K 1006 (C)	S	S	S	S	S	S	S	S	S	S	S	MS	S	R	MS	R	S	S	*Yr2+*
68	HD 2733 (C)	S	S	S	R	S	S	R	MS	R	R	R	R	R	R	R	R	R	R	*Yr9+18+*
69	DBW 221	S	S	MS	R	S	S	S	S	MS	R	R	R	S	R	S	R	R	R	*Yr2+*
70	K 1601	S	S	MS	R	S	S	S	S	MS	R	R	MS	S	MR	R	R	R	R	-
71	PBW 769	S	MS	S	R	S	MS	S	MS	MS	R	R	MS	S	R	R	R	R	MR	-
72	DBW 39 (C)	S	S	S	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*

73	HD 2967 (C)	S	S	R	R	S	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr2+*
74	K 0307 (C)	S	S	S	S	S	S	S	S	S	MS	R	R	R	S	R	R	R	R	*Yr2+*
75	DBW 187	S	S	R	R	S	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr2+*
76	DBW 223	S	S	R	MS	S	S	S	S	R	R	R	R	MS	R	R	R	R	R	*Yr2+*
77	PBW 762	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
78	WH 1218	S	S	S	MS	S	S	S	S	R	R	R	R	MS	R	R	R	R	R	*Yr2+*
79	HD 2888 (C)	S	S	R	R	R	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr2+*
80	HI 1612 (I) (C)	S	S	MS	MS	S	S	MS	S	R	R	R	R	R	R	R	MS	R	R	*Yr2+*
81	WH 1235	S	S	R	MS	S	MS	R	S	R	R	R	R	MS	R	R	S	R	R	*Yr2+*
82	BRW 3806	S	S	R	R	S	S	MS	MS	R	R	R	R	R	R	R	R	R	R	*YrA+*
83	K 1317 (C)	R	MS	R	R	S	S	MS	MS	R	R	R	R	MS	R	R	R	R	R	**YrA+*
84	DBW 252	R	S	R	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	-
85	K 8027 (C)	MS	S	R	R	S	S	MS	MS	R	R	S	R	MS	R	R	MS	R	R	*Yr2+*
86	HD 3171 (C)	R	R	MS	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
87	HI 1628	S	S	R	R	S	S	S	S	MS	R	R	R	S	R	R	R	R	R	*Yr2+*
IV. CENTRAL ZONE																				
88	GW 1339 (d)	S	R	S	S	S	S	R	S	MS	R	S	MS	S	MS	S	R	S	MS	-
89	AKAW 4924	S	S	S	MS	S	S	S	S	S	R	R	S	S	R	R	S	R	R	-
90	GW 322 (C)	S	S	S	MS	S	S	S	S	MS	R	R	R	S	R	R	R	R	R	*Yr2+*
91	HI 8713 (d) (C)	S	S	S	R	S	S	S	R	R	R	R	S	S	R	R	R	R	R	-
92	HI 8737 (d) (C)	MS	S	S	MS	MS	S	MS	S	R	R	R	MS	S	R	R	R	R	MS	*Yr2+*
93	HI 1544 (C)	MS	S	MS	MS	S	S	MS	MR	S	S	S	MS	MS	R	S	R	R	MS	*Yr2+*
94	GW 495	R	S	MS	MS	S	MS	MS	R	S	MS	S	MR	R	MS	MS	MS	R	R	-
95	UAS 465 (d)	R	R	MS	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	-
96	MPO 1343 (d)	S	S	S	MS	R	S	S	MS	S	S	S	S	S	S	NG	R	R	MS	-
97	DBW 110 (C)	S	S	S	R	S	S	S	S	MS	R	R	R	S	R	R	R	R	R	*Yr2+*
98	DDW 47 (d)	R	MS	S	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
99	MP 1331	MS	S	MR	R	S	S	S	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
100	MP 3288 (C)	R	S	MS	R	S	S	S	S	MS	R	R	R	MS	R	R	S	R	R	*Yr2+*
101	HI 8627 (d) (C)	R	S	S	MS	S	S	R	R	R	R	R	S	R	R	R	R	R	R	-
102	UAS 466 (d)	R	S	R	R	S	S	MS	MS	S	R	R	S	MS	R	R	MS	R	R	-
103	NIAW 3170	S	S	S	MS	S	S	S	S	S	MS	R	MS	S	MS	MR	MS	R	MS	-
V. PENINSULAR ZONE																				
104	AKAW 4924	S	S	S	S	S	S	S	S	S	R	MS	MS	S	MS	MS	R	MS	R	-
105	GW 491	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	-
106	GW 493	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	-
107	DBW 235	R	S	R	S	S	S	S	MS	MS	R	R	R	R	R	MS	R	R	R	*Yr2+*
108	HI 1624	R	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
109	MACS 6222 (C)	S	S	R	S	S	S	MS	R	R	R	R	MS	R	R	R	R	R	R	-
110	DBW 168 (I) (C)	MS	S	MS	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
111	GW 495	MS	S	R	MS	S	S	MS	MR	MS	S	S	MS	S	MS	R	R	MR	R	-
112	MP 1338	MS	S	R	R	S	S	MS	MS	S	R	MR	R	R	R	R	R	R	R	*Yr2+*

113	MACS 3949 (d) (C)	S	MS	R	R	MS	R	S	MS	R	R	R	S	R	MS	R	R	R	R	*Yr2+*
114	HI 8800 (d)	R	S	R	R	S	S	S	R	R	R	R	MS	R	R	R	R	R	R	-
115	MACS 6478 (C)	MS	S	R	R	S	MS	S	S	MR	MS	MS	R	S	R	R	R	MS	R	*Yr2+*
116	MACS 6709	MS	S	R	R	S	S	S	S	MR	R	R	R	S	R	R	MS	R	R	*Yr2+*
117	HI 1625	MS	S	R	R	S	MS	MS	MR	MR	R	R	R	R	MS	R	R	R	R	-
118	UAS 428 (d) (C)	S	S	S	MS	S	S	S	S	S	R	R	MS	R	S	R	R	R	R	-
119	PBW 770	MS	S	MS	MS	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
120	GW 492	MS	S	S	MS	S	S	S	S	S	R	R	R	S	R	R	R	R	R	*Yr2+*
121	GW 1346 (d)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	MS	R	S	MS	-
122	HI 1605 (C)	R	S	R	R	S	S	R	R	MS	R	R	R	R	R	R	MR	R	R	*Yr2+*
123	AKDW 2997-16 (d) (C)	MS	MS	MS	S	S	S	S	S	MS	R	MS	MS	MS	S	R	R	R	R	-
124	MPO 1336 (d)	R	MS	MR	R	S	R	MS	R	R	R	MS	R	R	R	R	R	R	R	*Yr2+*
125	UAS 446 (d) (c)	R	MS	R	MS	R	MS	R	R	R	R	MS	S	R	S	NG	R	R	R	-
126	HI 8805 (d)	S	S	MS	MS	S	S	MS	MS	R	R	R	S	R	MS	R	R	R	R	-
127	MACS 4058 (d)	S	S	S	S	MS	S	S	MS	S	S	S	MS	S	S	R	R	S	R	-
128	MACS 6696	S	S	S	MS	S	S	S	S	S	S	R	S	S	S	R	R	MS	R	-
129	MACS 4059 (d)	R	R	R	S	R	S	S	S	S	MS	MS	MS	S	S	R	R	R	R	-
130	NIAW 3170	S	S	S	MS	S	S	S	S	S	S	R	MS	S	R	R	R	R	R	-
131	DBW 93 (c)	R	S	S	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
132	MACS 6695	MS	S	S	S	S	S	S	S	S	S	S	MS	S	MS	R	R	S	MS	-
133	HI 8802 (d)	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	-
VI. SPECIAL TRIAL (Dicoceum)																				
134	DDK 1029 (C)	MS	S	S	MS	S	MS	S	S	MS	MS	R	MS	MR	MS	R	R	R	R	-
135	MACS 6222 (Ae.) (C)	S	S	R	MS	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*-
136	MACS 5051	R	MS	MS	MS	S	MR	MS	MS	MS	R	R	R	MR	R	R	MS	MS	R	*Yr2+*
137	HW 4101	R	MS	MS	R	MR	S	MR	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
138	DDK 1054	MS	MS	R	R	S	S	MS	MS	R	R	R	R	MR	R	R	R	R	R	*Yr2+*
139	HW 1098 (C)	R	S	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	-
VII. SPECIAL TRIAL- Very Late Sown																				
140	WR 544 (C)	S	S	S	MS	S	S	S	S	S	R	R	MS	S	MS	R	R	R	R	-
141	HD 3271	R	R	R	S	S	MS	R	R	R	R	R	R	R	R	R	R	R	R	-
142	DBW 71 (C)	S	S	R	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
143	PBW 797	MS	S	R	MS	S	S	R	R	MS	R	R	R	R	R	R	R	R	R	-
144	PBW 757	R	R	R	MS	R	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
145	DBW 278	MS	S	MS	R	S	S	S	S	MS	R	R	MS	R	MR	R	MS	R	R	-
146	HI 1621	S	S	MS	R	S	S	S	S	MS	MS	R	R	S	R	MS	MS	MS	R	*Yr2+*
147	DBW 14 (C)	MR	S	MS	MS	S	S	R	MR	S	R	R	R	MS	S	MS	MS	MS	R	-
148	PBW 777	S	S	S	MS	S	S	S	S	S	S	S	MS	S	R	R	S	S	MS	-
149	HD 3298	MS	S	R	R	S	S	S	S	MS	R	R	R	MS	R	R	R	R	R	*Yr2+*

ANNEXURE 1.4. Seedling Resistance Test of AVT against pathotypes of black rust (*Puccinia graminis tritici*) at Mahabaleshwar during 2017-18

S. No.	Genotypes	Reaction against Stem rust pathotypes												
		R-11	R-21-1	R-34-1	R-40 A	R-42	R-42 B	R-117	R-117 A	R-117-2	R-117-3	R-117-6	R-122	R-184
88	GW 1339 (d)	R	R	S	S	S	R	R	R	R	R	R	R	R
89	AKAW 4924	R	R	R	R	R	R	S	R	R	R	R	R	R
90	GW 322 (C)	S	R	S	R	R	R	R	R	R	R	S	R	R
91	HI 8713 (d) (C)	R	S	R	R	R	R	R	S	R	S	R	S	R
92	HI 8737 (d) (C)	R	R	NG	R	R	R	R	R	R	R	R	R	R
93	HI 1544 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R
94	GW 495	R	R	R	R	R	R	R	R	R	R	R	R	R
95	UAS 465 (d)	R	S	R	R	R	R	R	R	R	R	R	R	R
96	MPO 1343 (d)	R	S	R	R	R	R	R	R	S	R	R	R	R
97	DBW 110 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R
98	DDW 47 (d)	R	R	R	R	R	R	R	R	R	R	R	R	R
99	MP 1331	R	R	R	R	R	R	S	R	R	R	R	R	R
100	MP 3288 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R
101	HI 8627 (d) (C)	R	R	S	R	R	R	S	R	S	R	R	R	R
102	UAS 466 (d)	R	R	R	R	R	R	S	R	R	R	S	R	S
103	NIAW 3170	S	R	S	R	R	R	R	R	R	R	R	R	R
104	AKAW 4924	R	R	R	R	R	S	R	R	R	R	R	R	R
105	GW 491	R	R	R	R	R	R	R	R	R	R	R	R	R
106	GW 493	R	R	R	R	R	R	R	R	R	R	R	R	R
107	DBW 235	R	R	R	R	R	R	R	R	R	R	R	R	R
108	HI 1624	R	R	R	R	R	R	R	R	R	R	R	R	R
109	MACS 6222 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R
110	DBW 168 (I) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R
111	GW 495	R	R	R	R	R	R	R	R	R	R	R	R	R
112	MP 1338	R	R	R	R	R	R	S	R	R	R	R	R	S

113	MACS 3949 (d) (C)	R	R	R	R	R	S	R	R	R	R	R	R	R
114	HI 8800 (d)	R	R	R	R	R	R	S	R	R	R	R	R	R
115	MACS 6478 (C)	R	R	R	S	R	R	S	R	R	R	R	R	R
116	MACS 6709	R	S	S	R	R	R	S	R	R	R	R	R	R
117	HI 1625	R	R	R	R	R	R	R	R	R	R	R	R	R
118	UAS 428 (d) (C)	R	R	R	R	R	R	R	R	S	R	R	R	R
119	PBW 770	R	R	R	R	R	R	R	R	R	R	R	R	R
120	GW 492	R	R	R	R	R	R	R	R	R	R	R	R	R
121	GW 1346 (d)	R	R	R	R	R	R	R	S	R	R	R	R	S
122	HI 1605 (C)	R	S	R	R	R	R	S	R	R	R	S	R	R
123	AKDW 2997-16 (d)	S	S	R	S	R	R	R	R	S	R	S	R	R
124	MPO 1336 (d)	R	R	R	R	R	R	R	R	R	R	R	R	R
125	UAS 446 (d) (c)	S	R	R	R	R	R	R	R	R	R	R	R	S
126	HI 8805 (d)	R	R	R	R	S	R	R	R	R	R	R	R	R
127	MACS 4058 (d)	R	S	S	R	R	S	R	S	R	R	R	R	R
128	MACS 6696	R	R	S	R	R	R	S	R	R	R	R	R	S
129	MACS 4059 (d)	R	R	R	R	R	R	R	NG	R	R	R	R	S
130	NIAW 3170	R	R	R	R	R	R	R	NG	R	R	R	R	S
131	DBW 93 (c)	S	R	R	R	R	R	R	R	R	R	R	R	R
132	MACS 6695	R	R	R	R	R	R	R	R	R	R	R	R	R
133	HI 8802 (d)	R	S	S	R	R	R	R	R	R	R	R	R	R

ANNEXURE 1.5. Seedling Resistance Test of AVT against pathotypes of brown rust (*Puccinia triticina*) at Mahabaleshwar during 2017-18

S. No.	Genotypes	Reaction against Leaf rust pathotypes													
		R-77	R-77A1	R-77-4	R-77-5	R-77-9	R-104A	R-104-1	R-104-2	R-12A	R-12-2	R-12-3	R-12-5	R-162A	R-108
88	GW 1339 (d)	R	R	R	R	R	R	R	R	R	S	R	R	R	R
89	AKAW 4924	S	R	R	R	R	R	R	R	R	R	R	R	R	R
90	GW 322 (C)	S	R	S	S	S	R	S	S	S	R	R	S	R	S
91	HI 8713 (d) (C)	R	S	R	R	R	R	S	R	R	S	R	R	R	R
92	HI 8737 (d) (C)	R	R	R	R	R	R	R	R	S	S	R	R	R	R
93	HI 1544 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R
94	GW 495	R	R	R	R	R	R	R	R	R	R	R	R	R	R
95	UAS 465 (d)	R	R	R	R	R	R	R	R	R	S	R	R	R	R
96	MPO 1343 (d)	R	S	R	R	R	S	S	R	R	S	R	R	R	R
97	DBW 110 (C)	S	R	R	R	R	R	S	R	R	S	R	R	S	R
98	DDW 47 (d)	R	R	R	R	R	R	S	R	S	R	R	R	R	R
99	MP 1331	R	R	R	R	R	R	S	R	R	R	S	R	S	R
100	MP 3288 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R
101	HI 8627 (d) (C)	R	R	R	R	R	R	S	R	R	S	R	R	S	R
102	UAS 466 (d)	R	S	R	R	R	R	S	R	R	S	R	R	R	R
103	NIAW 3170	R	R	R	R	R	R	S	R	R	R	R	R	R	R
104	AKAW 4924	R	R	R	R	R	R	R	R	R	R	R	R	R	R
105	GW 491	R	R	R	R	R	R	R	R	R	R	R	R	R	R
106	GW 493	R	R	R	R	R	R	R	R	R	R	R	R	R	R
107	DBW 235	S	S	R	R	R	R	S	R	R	R	R	R	R	S
108	HI 1624	R	R	R	R	R	R	R	R	R	R	R	R	R	R
109	MACS 6222 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R

110	DBW 168 (I) (C)	R	R	S	R	R	R	R	R	R	R	S	R	R	R
111	GW 495	R	R	S	R	R	R	R	R	R	R	R	R	R	R
112	MP 1338	R	R	S	R	R	R	R	R	R	S	R	R	S	R
113	MACS 3949 (d) (C)	R	S	R	R	R	R	R	R	R	R	R	R	R	R
114	HI 8800 (d)	R	R	R	R	R	R	S	R	R	S	R	R	R	R
115	MACS 6478 (C)	R	R	S	R	R	R	R	R	R	R	R	R	R	R
116	MACS 6709	S	R	R	R	R	R	S	R	R	R	R	R	R	R
117	HI 1625	R	R	R	R	R	R	R	R	R	R	R	R	R	R
118	UAS 428 (d) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R
119	PBW 770	R	R	R	R	R	R	R	R	R	S	R	R	R	R
120	GW 492	R	R	R	R	R	R	R	R	R	R	R	R	R	R
121	GW 1346 (d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R
122	HI 1605 (C)	S	R	R	R	R	S	S	R	R	S	R	R	R	S
123	AKDW 2997-16 (d) C)	R	S	R	R	R	S	S	R	R	R	R	R	R	R
124	MPO 1336 (d)	R	R	NG	R	R	R	R	R	R	S	R	R	R	R
125	UAS 446 (d) (c)	R	S	R	R	R	R	S	R	R	R	R	R	R	R
126	HI 8805 (d)	R	R	R	R	R	R	R	R	R	S	R	R	R	R
127	MACS 4058 (d)	R	R	R	R	R	R	S	R	R	R	R	R	R	R
128	MACS 6696	S	S	R	R	R	S	S	R	S	S	S	R	S	S
129	MACS 4059 (d)	R	R	R	R	R	S	S	R	S	S	S	R	S	R
130	NIAW 3170	R	R	R	R	R	R	R	R	R	S	R	R	R	R
131	DBW 93 (c)	R	R	R	R	R	R	R	R	R	R	R	R	R	R
132	MACS 6695	S	R	S	R	R	R	S	R	S	S	S	R	S	R
133	HI 8802 (d)	R	R	R	R	R	R	R	R	S	R	R	R	R	R

Annexure Table 1.7 .Reactions of entries of IPPSN (2017-18) against rusts and leaf blight

S. No.	Entry	RUST SCORE								LEAF BLIGHT	
		STEM		LEAF				STRIPE		Score(0-9) dd	
		South		South		North		North			
		HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	Av.
1.Dr. Jeet Mal Dhakar, ARS, Ummedganj, Kota											
1	RKD-338	20MS	7.0	5MR	2.0	10MR	2.7	20S	13.0	67	46
2	RKD-339	10MS	3.1	20R	0.8	TR	0.1	20S	7.6	78	56
3	RKD-340	20S	6.7	5MS	1.7	TMS	0.3	5S	3.0	68	57
4	RKD-341	10MS	2.7	5MR	1.2	TMR	0.1	10S	3.5	78	57
5	RKD-342	20MS	5.1	10MS	2.5	5MR	0.7	5S	1.9	68	46
6	RKA-003	20MS	5.0	10R	0.4	TR	0.1	80S	47.5	68	57
7	RKA-004	10MS	3.7	5MS	2.4	10MS	2.7	60S	28.3	56	46
2.Dr. Dnyandeo A. Gadekar, MPKV, ARS , Niphad, Dist. Nashik -422 303 (Maharashtra)											
8	NIAW3559	10MR	2.1	60S*	15.2	5S	2.3	80S	60.0	67	57
9	NIAW3562	40S	19.5	60S	19.2	40S*	13.3	80S	60.0	57	45
10	NIAW3575	40S	29.0	60S	36.0	40S	20.0	80S	63.3	58	57
11	NIAW3578	20MR	3.6	40S	15.1	5MR	0.7	80S	66.7	78	57
12	NIAW3581	10R	0.6	20R	0.8	TR	0.1	60S	43.3	78	57
13	NIAW3583	TR	0.1	20R	0.8	TMR	0.1	80S	26.7	79	57
14	NIAW3584	10MS	4.0	40S	14.0	0	0.0	80S	35.2	56	46
15	NIAW3592	5MS	1.3	10R	0.4	0	0.0	80S	45.0	67	57
16	NIAW3624	5R	0.3	10R	0.5	20MS	5.3	80S	63.3	68	56
17	NIAW3643	40MR	8.0	5MR	0.9	10S	3.3	80S	63.3	68	46
18	NIDW1278	10S	6.5	10R	0.6	5S	1.7	10S	4.0	78	57
19	NIDW1281	10MS	4.1	20R	0.8	5MR	0.7	20MS	4.5	57	46
20	NIDW1293	10MS	2.6	20R	0.9	10S	3.3	40MS	8.1	67	56
20A		100S	74.0	100S	72.0	80S	60.0	100S	80.0	78	78
21	NIDW1302	10MS	3.0	20R	0.9	10S	3.3	10MS	2.3	78	56
22	NIDW1316	20S	8.1	10S	2.8	5S	1.7	10MS	2.5	79	46
3. Dr. C.P. Singh, Lokbharti Gramvidyapith, Bhavnagar (Gujarat)											
23	LOK-2017-1	10R	0.6	10R	0.4	5MR	0.7	60S	32.5	67	56
24	LOK-2017-2	5R	0.3	5MR	0.8	10MS	3.3	60S	31.7	99	57
25	LOK-2017-3	5R	0.3	20R	0.8	10MS	2.7	80S	73.3	89	68
26	LOK-2017-4	10R	0.6	TR	0.0	TMS	0.3	100S	73.3	89	68
27	LOK-2017-5	10R	0.6	5MR	0.7	0	0.0	80S	66.7	78	56
28	LOK-2017-6	20MS	9.0	80S	46.0	40S*	13.3	100S	80.0	78	56
29	LOK-2017-7	10R	0.6	10MS	1.8	TR	0.1	60S	36.7	68	56
30	LOK-2017-8	20R	1.1	5MR	0.5	0	0.0	80S	50.0	78	57
4. Dr. Vinod Singh, NDUA&T, Faizabad (UP)											
31	NW7053	30S	15.5	5R	0.2	0	0.0	40S	17.3	78	56
32	NW7054	20S	13.0	10MS	2.0	0	0.0	80S	46.7	67	46
33	NW7055	40S	24.0	60S	22.2	40S*	13.4	60S	40.0	78	57
34	NW7056	60S	34.0	10S	4.8	TMS	0.3	60S	32.5	68	46

35	NW7057	20S	9.1	10S	2.5	10S	3.3	40S	13.7	68	47
36	NW7058	60S	35.0	20MS	4.2	5S	1.7	60S	24.3	56	46
37	NW7059	60S	40.0	40S	14.2	40S*	13.3	60S	38.7	56	46
38	NW7060	40S	27.0	5MS	2.0	5MS	2.7	40S	15.0	57	45
39	NW7061	20MS	11.1	40S	11.4	10S	4.0	60S	46.7	57	46
40	NW7062	40S*	13.1	10R	0.8	20MS	5.4	40S	14.1	67	46
40A		100S	67.5	100S	80.0	80S	60.0	100S	76.7	89	78
41	NW7063	30S	18.5	30S	10.5	10S	6.7	60S	45.3	78	57
42	NW7064	40S	17.0	40MS	8.0	10S	3.4	10S	2.4	68	56
43	NW7065	40S	27.5	10S	2.6	TR	0.1	40S	10.9	68	46
44	NW7066	10MS	6.1	20MS	3.4	0	0.0	80S	53.3	79	56
45	NW7067	30S	12.0	5MR	0.6	20S	6.7	30S	15.0	78	56
46	NW7068	60S	24.5	5MS	1.0	0	0.0	20S	8.2	68	57
47	NW7069	40S	20.5	30S	8.9	40S*	13.5	40S	16.7	57	46
48	NW7070	10MS	3.2	30MS	9.0	20MS	7.0	80S	53.3	68	56
49	NW7071	20S	11.0	5S	1.2	0	0.0	80S	42.7	57	46
50	GW322	40S	17.1	40S	12.2	5MS	1.3	80S	51.7	46	35
51	NW7072	10MS	3.1	40S	20.8	40S	16.7	60S	35.0	68	46
52	NW7073	60S	26.0	5S	1.6	5MS	1.3	40S	28.3	56	45
53	NW7074	20MS	14.0	20MS	3.4	5S	1.7	80S	32.5	78	46
54	NW7075	40S	23.5	10S	5.6	5MS	1.3	5S	1.7	56	35
55	NW7076	20MR	6.5	20MS	4.0	40S*	13.3	80S	46.7	78	46
56	NW7077	10S	4.7	10S	2.3	20S	7.3	60S	43.3	47	46
5. Dr. A. A. Patel, SDAU, Vijapur, Gujarat											
57	VA2016-11	10MS	2.7	60S	30.0	60S	20.3	80S	56.7	78	57
58	VA2016-32	10R	0.6	5S	1.4	TR	0.1	80S	70.0	78	68
59	VA2016-01	20MS	8.1	80S	31.2	20MS	7.0	100S	76.7	78	57
60	VA2016-17	40R	3.1	5MR	1.0	0	0.0	100S	73.3	78	57
60A		100S	75.0	100S	78.0	80S	60.0	100S	80.0	79	78
61	VA2016-25	10MS	3.1	10MS	2.8	5S	3.0	100S	76.7	79	68
62	VA2016-02	10MS	2.8	100S	64.0	60S	20.1	80S	70.0	79	57
63	VA2016-30	5R	0.4	5R	0.2	0	0.0	80S	56.7	78	57
64	VA2016-20	10MR	2.1	10MS	2.4	5S	1.7	80S	63.3	78	67
65	VA2016-08	5R	0.3	10R	0.5	TMS	0.3	80S	66.7	78	68
66	VA2016-09	5MR	0.9	5R	0.4	10S	5.0	100S	61.7	78	67
67	VA2016-38	5R	0.3	60S	28.8	10S	8.3	80S	51.3	78	67
68	VA2016-47	10MS	2.3	10R	0.4	5MR	0.7	80S	60.0	67	57
69	VA2016-49	5MS	1.0	5R	0.2	20MS	5.3	80S	60.0	67	57
70	VA2016-37	10MR	1.3	5R	0.2	10MS	2.7	80S	56.7	78	68
71	VA2016-39	5MR	0.8	5R	0.2	TMR	0.1	80S	63.3	78	67
72	VA2017-01	10MS	2.6	10R	0.4	0	0.0	60S	36.7	78	57
73	VD16-8	10MS	4.0	20MR	2.0	5MR	0.7	10S	3.1	67	57
74	VD16-19	10MS	3.0	10MS	2.0	5MR	0.7	20MS	4.7	68	67
75	VD16-29	10MR	3.1	20MS	3.6	10MS	2.7	20MS	4.7	68	57
76	VD16-13	10S	4.5	60S	21.6	40S*	13.4	10MS	3.1	78	67

77	VD16-22	10MR	1.0	5MS	1.0	10MS	4.0	20MS	7.0	79	57
78	VD16-20	5R	0.4	5R	0.4	5MS	1.3	10S	3.0	78	57
79	VD16-30	10MR	2.5	20R	0.8	TR	0.1	20S	12.7	78	56
80	VD16-16	20S	12.1	5MR	0.6	5S	1.7	10S	1.7	78	57
80A		100S	65.0	100S	82.0	80S	60.0	100S	83.3	79	78
81	DR 16-13	20S	6.3	20R	0.8	10MS	2.7	100S	67.5	89	67
82	PYT 16-10	20S	8.0	20S	4.4	10S	3.3	100S	70.0	78	57
83	PYT 16-16	20MS	6.1	20MR	2.4	10MR	1.3	60S	38.3	78	57
84	J 16-11	40S	21.0	100S	46.0	40S	17.3	80S	60.0	78	57
85	J 16-01	10S	4.6	10R	0.4	5MR	0.8	100S	73.3	78	56
86	J 16-24	10MS	2.6	10R	0.4	TMS	0.3	80S	63.3	78	56
87	J 16-15	10R	0.6	60S	21.6	5MR	0.8	80S	46.7	78	56
88	J 16-19	5R	0.3	20R	0.9	5MR	0.8	80S	46.7	68	57
89	J 16-20	10MS	2.7	5R	0.4	5MS	1.3	80S	53.3	78	56
6. Dr. Ajay Prakash Agrawal, IGKV, TCB College of Agric. & Res. Stn, Bilaspur (C.G.)											
90	CG1701	10MS	2.6	80S	31.6	40S	14.7	80S	36.8	78	46
91	CG1702	20MS	5.4	10R	0.4	0	0.0	80S	60.0	67	46
92	CG1703	10MR	1.8	TR	0.1	10S	3.3	80S	63.3	78	46
93	CG1704	20MS	13.0	80S*	18.2	60S	27.0	60S	35.0	78	46
94	CG1705	20MS	12.0	80S*	17.8	60S	26.0	60S	40.0	78	46
95	CG1706	40S	31.5	20S	11.6	10S	4.7	100S	73.3	78	46
96	CG1707	20S	11.0	40S	8.8	60S	21.7	100S	60.0	67	35
97	CG1708	40S	24.5	60S	28.2	10S	3.3	60S	40.0	78	56
98	CG1709	20S	14.1	80S	56.0	60S	26.7	80S	48.3	56	35
99	CG1710	40S	35.0	40S	19.0	40S	17.3	60S	31.7	56	35
100	GW322	40S	17.0	20S	10.0	20MS	5.3	80S	40.0	67	56
100A		100S	71.0	100S	84.0	80S	66.7	100S	80.0	78	78
101	CG1711	20MS	12.0	60S*	15.6	40S	16.3	80S	50.0	78	56
102	CG1712	20S	17.0	40S	12.8	40S*	13.5	40S	10.1	67	46
103	CG1713	20MS	6.5	20S	4.5	TMS	0.3	80S	50.0	78	46
104	CG1714	20MS	9.2	40S	8.5	40S*	13.5	80S	63.3	56	35
105	CG1715	R	0.1	5R	0.3	TR	0.1	100S	76.7	78	56
7. Dr. Nitish De, Bihar Agricultural College, Sabour, Bhagalpur											
106	BRW3828/ BRW 3827 on packet	20S	13.1	80S	56.0	40S	16.7	60S	43.3	78	46
107	BRW3829	20MS	7.0	20S	6.4	10S	4.0	60S	21.0	78	45
108	BRW3830	20MS	13.5	60S	18.8	10MS	4.5	60S	43.3	37	35
109	BRW3831	20MR	2.6	40S	20.8	10S	6.0	60S	36.7	56	36
110	BRW3832	20S	16.5	20MS	6.8	5S	1.7	60S	53.3	78	57
111	BRW3833	10S	5.0	40S	21.2	40S	22.7	60S	40.0	46	24
112	BRW3834	40S	31.5	20S	8.8	5S	3.0	60S	34.2	47	35
113	BRW3835	10S	4.7	60S	28.8	40S*	14.7	60S	40.0	68	35
114	BRW3836	60S	32.6	60S	44.0	40S	13.3	60S	46.7	78	57
115	BRW3837	20MS	6.2	60S	40.0	40S	29.3	60S	36.7	68	46
116	BRW3838	5S	1.3	20S	6.4	10S	3.4	40S	15.3	68	46

117	BRW3839	60S	24.5	20S	4.6	TR	0.1	60S	28.7	68	35
118	BRW3840	10MS	4.2	40S	40.0	40S	13.3	80S	50.0	57	35
119	BRW3841	TR	0.1	5R	0.2	0	0.0	80S	45.0	58	57
120	BRW3842	20S	11.5	40S	20.9	10MS	2.7	60S	31.7	57	36
120A		100S	72.5	100S	66.4	80S	60.0	100S	76.7	78	68
121	BRW3843	40S	25.5	60S	21.6	5S	1.7	60S	39.3	78	67
122	BRW3844	20MS	8.5	80S	56.0	60S	26.9	80S	66.7	67	57
123	BRW3846	20MS	8.6	5MS	1.8	TR	0.1	60S	43.3	78	68
124	BRW3847	20S	15.0	10MS	3.0	TR	0.1	30S	15.7	68	57
8. Wheat Breeder, University of Agricultural Sciences, Dharwad.											
125	UASD 1701	40S	32.0	10S	3.6	TR	0.1	40S	13.0	68	56
126	UASD 1702	10MS	3.6	40S	22.4	10MR	1.3	80S	46.7	78	56
127	UASD 1703	10S	5.6	5R	0.4	0	0.0	10S	2.7	89	67
128	UASD 1704	10S	5.1	5MR	1.2	10MR	1.3	10S	3.7	78	57
129	UASD 1705	20MS	8.5	10MS	2.4	20MS	6.7	10MS	2.4	68	57
130	UASD 1706	5S	1.9	5MS	2.0	5MS	1.3	10MS	1.6	57	56
131	UASD 1707	5S	2.4	5MS	1.6	TMS	0.3	10MS	3.0	67	46
132	UASD 1708	5MS	2.1	10R	0.6	TMS	0.3	10S	2.5	78	57
133	UASD 1709	20S	6.2	5MR	0.4	5MR	0.7	5S	1.2	78	57
134	UASD 1710	20S	7.1	10R	0.5	5S	1.7	5S	2.3	78	57
135	UASD 1711	5R	0.3	20R	0.8	10MR	1.3	60S	41.7	67	57
136	UASD 1712	5R	0.3	20R	0.8	20MS	5.3	80S	44.3	67	56
137	UASD 1713	20R	1.0	20R	0.9	5S	1.7	60S	35.0	78	57
138	UASD 1714	5S	1.8	20R	0.8	20MR	2.7	80S	53.3	78	57
139	UASD 1715	20MS	10.1	20MS	3.4	0	0.0	60S	46.7	78	68
140	UASD 1716	40S	22.0	10S	3.4	10MR	1.3	40S	30.0	67	56
140A		100S	62.0	100S	74.0	80S	60.0	100S	66.7	78	78
141	UASD 1717	40S	26.0	10MS	3.6	20MS	10.0	80S	60.0	67	46
142	UASD 1718	5S	2.4	5S	1.2	TR	0.1	60S	30.7	67	46
143	UASD 1719	10S	4.8	10MS	1.7	0	0.0	80S	50.0	57	46
144	UASD 1720	10MS	5.1	40S	10.6	10S	3.3	60S	29.3	67	56
145	UASD 1721	30S	24.5	40S	9.0	5MS	1.3	60S	26.8	56	46
146	UASD 1722	100S	4.1	TMS	0.4	5MS	1.3	40S	33.3	76	46
147	UASD 1723	40MS	19.0	40S	16.8	40S*	13.4	80S	56.7	57	46
148	UASD 1724	10S	3.7	5R	0.2	TMR	0.1	80S	60.0	78	46
149	UASD 1725	20S	5.4	TR	0.0	0	0.0	60S	38.3	56	35
150	DBW 189	20S	13.5	10S	3.0	5MR	0.7	60S	26.0	37	25
151	UASD 1726	20S	8.6	20S	4.4	0	0.0	10S	5.0	57	46
152	UASD 1727	20MS	10.6	20S	6.4	10S	3.3	40S	24.0	78	57
153	UASD 1728	30S	10.6	5R	0.5	0	0.0	80S	46.7	67	46
154	UASD 1729	60S	25.1	40S	9.7	10MS	4.3	60S	43.3	78	57
155	UASD 1730	60S	25.0	40S	11.0	0	0.0	80S	50.0	78	56
9. Dr. Surya Prakash, BAU, Kanke, Ranchi											
156	JKW 257	10MR	3.5	20S	13.2	5S	1.7	80S	41.7	56	46
157	JKW 258	60S	34.5	10MR	1.6	20MS	7.0	60S	28.5	57	46

158	JKW 260	5MS	1.7	5R	0.2	5S	1.7	40S	24.2	68	46
159	JKW 261	80S	42.0	5MS	1.4	TMR	0.2	40S	15.5	68	46
160	JKW 262	40S	26.7	20S	10.9	10MS	4.4	60S	43.3	67	57
160A		100S	72.5	100S	74.0	80S	60.0	100S	73.3	78	78
161	JKW 264	10MS	4.6	20S	4.2	10S	5.0	60S	43.3	56	35
162	JKW 265	20S	8.1	5MS	1.8	0	0.0	60S	31.7	68	45
10. Dr. R. S. Shukla, JNKVV, Jabalpur (MP)											
163	JWS 620	30S	12.6	60S*	13.6	5MR	0.7	60S	41.7	69	46
164	JWS 723	40S	14.6	20MS	5.6	5S	1.7	60S	53.3	78	56
165	JWS 851	10MS	2.6	30MS	7.2	0	0.0	80S	63.3	56	34
166	JWS 908	40S	22.1	40S	20.4	TR	0.1	60S	46.7	78	46
167	JWS 917	10R	0.9	20MS	5.2	TR	0.1	60S	31.7	68	56
168	JWS 930	20MS	4.2	40S	29.2	30S	11.3	60S	32.3	76	56
169	JWS 938	10MS	3.6	40S	20.4	40S*	14.0	60S	53.3	67	46
170	JWS 940	10MS	4.0	30MS	7.6	TMR	0.1	80S	60.0	46	35
171	JWS 948	10MR	2.2	20S	11.6	5S	1.7	60S	30.3	67	46
172	JWS 973	40MS	15.0	20S	9.2	10MR	1.3	60S	46.7	78	46
11. Dr. S. Tamhankar, Agharkar Research Institute, Pune											
173	MACS 4087	40MS	16.0	20MS	4.3	10MS	4.0	40S	24.2	78	57
174	MACS 4088	40S	25.0	20S	7.4	10S	4.7	40S	16.3	78	57
175	MACS 4089	40S	22.0	20S	12.0	20S	6.7	80S	58.3	78	67
176	MACS 4090	5MS	2.1	20R	2.4	5MR	0.7	30MS	13.8	68	67
177	MACS 4091	10MS	5.1	20R	1.0	5S	1.8	10S	6.7	78	57
178	MACS 4092	10S	4.5	10MR	1.2	5MR	0.7	10S	2.5	57	56
179	MACS 4093	10MS	3.1	10R	0.4	TR	0.1	10S	4.4	78	67
180	MACS 4094	20MS	6.7	20MS	4.4	10MS	5.3	40S	27.7	78	57
180A		100S	67.5	100S	72.0	80S	60.0	100S	76.7	78	78
181	MACS 6734	40MR	9.0	40S	13.2	40S	18.0	80S	56.7	79	68
182	MACS 6735	40MS	17.0	20S	8.8	5MR	0.7	60S	32.7	89	78
183	MACS 6736	40MR	9.1	20S	20.0	60S	23.3	80S	63.3	89	68
184	MACS 6737	5MS	1.8	5R	0.2	0	0.0	80S	60.0	78	67
185	MACS 6738	20S	10.5	40S	16.8	TR	0.1	60S	50.0	78	67
186	MACS 6739	10S	3.6	5MS	1.0	0	0.0	20S	18.0	56	46
187	MACS 6740	10S	6.5	10S	7.2	0	0.0	60S	36.7	78	67
188	MACS 6741	5MS	1.6	40S	20.4	5MS	1.3	80S	66.7	78	67
189	MACS 6742	10MR	1.6	10R	0.4	0	0.0	60S	53.3	78	58
190	MACS 6743	10MR	2.1	40S	22.2	10MR	2.0	80S	66.7	78	67
191	MACS 6744	10MR	2.2	5MS	1.0	TR	0.1	80S	63.3	78	57
192	MACS 6745	10R	0.8	5MR	0.8	0	0.0	80S	56.7	78	57
193	MACS 6746	10MR	2.1	5S	1.3	10MS	2.7	20S	10.7	78	78
194	MACS 6747	10MR	3.5	5R	0.4	0	0.0	60S	40.0	79	67
195	MACS 6748	10MS	5.1	5R	0.2	TR	0.1	60S	17.5	78	57
196	MACS 6749	10MS	4.1	10R	0.4	TR	0.1	60S	50.0	68	57
197	MACS 6750	10MR	2.6	10R	0.4	0	0.0	40S	16.4	78	56
198	MACS 6751	5MS	1.3	10R	0.4	0	0.0	80S	66.7	78	67

199	MACS 6752	5MS	1.6	20R	0.8	10MS	2.7	80S	60.0	78	57
200	DBW 189	40S	27.5	10MR	2.2	20MS	6.0	60S	35.0	57	46
200A		100S	66.0	100S	74.0	80S	60.0	100S	73.3	78	78
201	MACS 5052	20MS	5.1	20R	1.0	20MS	5.4	80S	22.5	67	57
202	MACS 5053	10MS	3.0	20R	1.2	5MR	0.7	60S	17.5	47	46
12. Dr. V. D. Salunke, Wheat and Maize Reseach Unit, Parbhani											
203	PBN-4027-01	20S	9.5	60S	36.0	40S	20.1	60S	38.3	78	57
204	PBN-3958	40S	21.3	80S	56.0	60S	33.5	80S	60.0	78	56
205	PBN-4449	40S	22.0	60S	40.0	60S	33.3	40S	31.7	78	57
206	PBND-4825	10MS	3.0	60S	21.6	40S*	13.3	40S*	7.8	57	46
207	PBND-4545	5MS	1.1	20S	9.2	30S	10.3	10S	4.0	78	35
13. Dr. H. G. Prakash, CSAUA&T, Kanpur (U.P.)											
208	KA 1701	10MS	4.6	60S	20.8	40S	15.0	80S	60.0	58	36
209	KA 1702	10MS	5.1	20S	4.4	5MR	0.7	80S	50.0	47	36
210	KA 1703	40S	29.0	100S	58.0	60S	33.3	80S	63.3	78	57
211	KA 1704	10S	3.3	60S	24.0	20S	12.1	80S	60.0	78	68
212	KA 1705	20MS	5.2	20R	0.8	20MR	2.7	80S	53.3	56	46
213	KA 1706	10MS	5.1	40MS	14.4	0	0.0	60S	25.0	67	45
214	KA 1707	30S	13.0	40S	23.4	5MS	1.5	80S	46.7	57	45
215	KA 1708	20MR	5.5	60S	22.0	60S	20.7	80S	56.7	57	46
216	KA 1709	20MS	7.1	60S	22.0	40S	14.0	80S	56.7	78	46
217	KA 1710	20MR	5.1	40S	22.0	5MR	0.7	80S	43.3	78	46
218	KA 1711	10MS	2.1	40S	29.0	20S	8.0	40S	14.7	78	56
219	KA 1712	10MS	2.7	60S	35.0	20S	8.0	60S	21.2	78	57
220	KA 1713	10MS	4.1	60S	40.0	20S	10.1	60S	23.2	78	57
220A		100S	75.0	100S	74.0	80S	60.0	100S	73.3	78	68
221	KA 1714	40S	32.0	60S	22.8	40S	20.0	80S	46.7	68	57
222	KA 1715	60S	32.0	80S	48.0	40S	23.6	80S	50.0	67	46
223	KA 1716	10MS	5.1	80S	47.2	20MS	8.0	80S	53.3	78	57
224	KA 1717	20MS	7.1	50S	22.2	40S	14.8	60S	43.3	78	57
225	KA 1720	10MS	4.2	5S	1.4	TR	0.1	60S	35.0	57	46
226	KA 1721	20MR	3.2	60S	25.0	10MS	4.4	60S	36.7	78	57
227	KA 1722	20MS	7.0	40S	9.8	TR	0.1	60S	33.3	78	57
228	KA 1723	40MS	16.0	100S	64.0	60S	33.3	80S	73.3	79	68
229	KA 1724	10MS	4.1	60S	43.2	10S	6.7	80S	57.3	68	57
230	KA 1725	20MR	3.5	20S	8.0	TMS	0.3	60S	33.3	78	57
231	KA 1726	20S	10.1	80S	27.6	40S	16.7	80S*	53.3	57	46
232	KA 1727	40X	10.5	60S	26.2	40S	16.7	80S	53.3	78	57
233	KA 1728	20MR	3.2	10MS	2.8	20MS	5.3	60S	27.7	78	57
234	KA 1729	10MS	6.5	80S	41.0	20S	9.7	80S	63.3	78	67
235	KA 1730	20S	9.1	30S	9.2	20S	10.0	80S	56.7	57	46
236	KA 1731	20MS	11.0	40S	13.3	TMS	0.3	60S	24.2	57	46
237	KA 1733	10MS	4.6	30S	7.6	TR	0.1	40S	12.5	46	35
238	KA 1734	20MS	6.1	60S	26.4	40S	14.7	60S	38.3	78	57
239	KA 1735	40MR	15.0	30S	7.6	5MS	2.7	40S	16.2	78	57

240	KA 1736	40MS	12.1	5MS	1.2	5S	1.7	60S	30.0	67	46
240A		100S	72.5	100S	78.0	80S	60.0	100S	83.3	78	78
241	KA 1737	10MS	6.1	60S	35.3	5S	2.5	80S	50.0	78	57
242	KA 1738	30S	22.5	60S	18.8	5S	2.3	80S	35.8	78	46
243	KA 1739	10MR	2.6	60S	31.6	20S	8.0	80S	51.7	57	45
244	KA 1740	30S	17.5	10MS	3.0	TMS	0.3	40S	20.2	57	46
245	KA 1741	20R	2.1	80S	36.0	30S	14.7	80S	56.7	57	46
246	KA 1742	20S	10.0	40S	24.8	10S	4.0	80S	38.3	47	35
247	KA 1743	10MS	6.1	60S	31.6	5MR	0.9	80S	46.7	47	35
248	KA 1744	30S	12.0	10S	2.2	20MS	5.4	60S*	15.0	46	35
249	KA 1745	5MS	1.3	5R	0.2	10MS	2.7	80S	44.2	45	35
250	DBW 88	20S	7.5	30S	8.2	20MR	2.7	60S	28.3	67	46
14.Dr. H. K. Jaiswal, BHU, Varanasi											
251	HUWL-1701	40MR	8.1	60S*	13.0	20MS	6.7	80S	55.0	68	46
252	HUWL-1702	40MR	7.0	80S	18.8	5MS	1.3	80S	66.7	57	46
253	HUWL-1703	10MS	4.5	60S	28.8	30S	13.6	80S	66.7	47	46
254	HUWL-1704	20MS	10.0	10S	4.8	5MS	1.3	60S	38.3	56	35
255	HUWL-1705	10R	0.6	5MS	1.2	TR	0.1	60S	50.0	68	36
256	HUWL-1706	10MS	2.3	10S	3.2	TR	0.1	80S	44.2	56	45
257	HUWL-1707	20S	10.1	60S	30.0	10S	4.7	80S	53.3	57	56
258	HUWL-1708	10MS	5.6	40S	12.8	0	0.0	60S	29.5	67	57
259	HUWL-1709	10MS	5.1	40S	19.2	5MR	0.7	80S	66.7	78	58
260	HUWL-1710	20S	7.1	10S	4.2	5MR	0.7	60S	45.0	78	68
260A		100S	62.0	100S	74.0	80S	60.0	100S	76.7	78	78
261	HUWL-1711	10S	4.7	20S	10.8	20S	9.3	60S	50.0	78	67
262	HUWL-1712	20S	7.7	60S	39.6	5MS	1.3	80S	56.7	78	46
263	HUWL-1713	40S	16.5	80S	38.4	5MS	1.3	80S	50.0	78	67
264	HUWL-1714	40S	17.3	60S	40.8	5MS	1.3	80S	43.3	78	56
265	HUWL-1715	10R	0.8	5MR	1.4	0	0.0	80S	48.3	78	57
266	HUWL-1716	10MS	2.3	5R	0.2	0	0.0	80S	63.3	78	57
267	HUWL-1717	20S	12.1	10MS	2.2	5S	1.7	60S	45.0	57	46
268	HUWL-1718	20S	11.6	10S	2.6	20MS	5.3	60S	35.0	68	46
269	HUWL-1719	10S	6.5	5MS	1.3	TMR	0.1	60S	31.3	68	57
270	HUWL-1720	40S	16.1	40S	12.4	10S	7.7	80S	46.7	78	57
271	HUWL-1721	20S	7.5	40S	11.6	10S	3.3	80S	55.0	78	46
272	HUWL-1722	20MR	4.4	80S	54.0	30S	10.0	100S	66.7	56	56
273	HUWL-1723	20S	13.0	40S	11.8	20S	8.0	100S	63.3	67	57
274	HUWL-1724	10S	7.0	10MS	2.8	5S	1.7	60S	31.7	56	35
275	HUWL-1725	20MS	6.7	20MS	5.6	TR	0.1	60S	43.6	57	35
276	HUWL-1726	20MR	3.1	80S	21.0	10S	3.4	80S	56.7	57	45
277	HUWL-1727	5MS	2.1	30S	6.5	5S	1.7	60S	16.7	68	46
278	HUWL-1728	5MS	1.6	30MS	6.0	5S	3.1	20S	11.0	67	56
279	HUWL-1729	20MS	8.6	30S	7.0	5S	2.3	40S	21.3	67	46
280	HUWL-1730	10MS	5.1	5MS	2.1	10MS	3.3	40S	14.7	67	57
280A		100S	65.0	100S	76.0	80S	60.0	80S	73.3	68	68

15. Dr. Hoshiyar Singh, RARI, Durgapura, Jaipur (Raj.)											
281	WR 1915	20MS	7.0	20S	10.4	20MR	3.3	60S	15.7	68	56
282	WR 1916	30S	12.6	5S	2.2	TR	0.1	40S	10.7	47	46
283	WR 1917	10MS	5.1	40S	9.4	TR	1.7	60S	40.0	78	56
284	WR 1918	0	0.0	10R	0.4	0	0.0	60S	26.7	68	46
285	WR 1919	10S	7.5	100S	22.8	40S	14.3	80S	48.3	78	46
286	WR 1920	10S	4.7	60S	18.8	40S	14.7	80S	55.0	78	57
287	WR 1921	10MR	1.1	20S	4.8	0	0.0	80S	46.7	57	45
288	WR 1922	5S	2.5	10S	2.5	5MR	1.3	60S	25.0	78	56
289	WR 1923	30S	7.5	40S	8.4	10S	3.6	60S	18.2	78	57
290	WR 1925	10MR	1.3	40S	11.0	10S	3.4	80S	40.0	47	35
291	WR 1926	5MR	0.8	5R	0.3	10MR	1.3	80S	32.3	78	57
292	WR 1927	5R	0.5	20R	1.0	20MR	2.7	60S	18.0	37	35
293	WR 1928	10MR	1.5	20R	1.4	5S	2.3	80S	37.5	56	46
294	WR 1929	20S	12.0	10R	0.6	10S	5.0	80S	43.3	57	46
295	WR 1930	10MR	1.5	20S	7.0	TR	0.1	5S	0.9	68	45
296	WR 1931	40S	25.3	20R	1.6	5MR	1.0	40S	11.2	78	57
297	WR 1932	0	0.0	20S	11.0	TMR	0.1	40S	14.5	78	57
298	WR 1933	5MR	0.7	10R	0.5	5MR	0.7	40S	24.3	79	68
299	WR 1934	5R	0.4	20R	1.0	5S	1.7	40S	16.7	78	56
300	PBW 343	40MR	8.1	80S	26.5	20S	10.0	80S	63.3	68	46
300A		100S	66.0	100S	80.0	80S	60.0	100S	76.7	79	78
301	WR 1935	10MR	1.1	10MS	2.1	5MS	1.3	60S	43.3	57	46
302	WR 1936	10MS	3.6	10S	2.9	10MR	1.3	60S	35.0	57	46
303	WR 1937	5MS	1.3	20S	7.2	0	0.0	40S	20.8	57	46
304	WR 1938	10S	3.5	30S	6.9	0	0.0	10S	3.4	68	46
305	WR 1939	5MR	0.5	10MS	2.0	0	0.0	40S	19.0	46	46
306	WR 1940	10S	2.9	10S	2.4	0	0.0	10S	1.7	57	45
307	WR 1941	10S	5.1	20S	5.5	0	0.0	40S	8.2	37	35
308	WR 1942	60S	27.5	5MS	2.0	10MR	2.0	40S	12.2	68	35
309	WR 1943	40S	25.0	40S	9.6	10MS	5.0	40S	24.3	78	46
310	WR 1944	5MS	1.6	20MS	4.0	20S	6.9	60S	20.2	68	57
311	WR 1945	5S	2.3	20S	4.9	TR	0.1	40S	15.3	67	47
312	WR 1946	60S	31.0	5MS	1.2	0	0.0	60S	38.3	45	35
313	WR 1947	10S	3.6	5MR	1.0	5MR	0.7	40S	11.4	67	46
314	WR 1948	20MS	5.0	20MS	3.6	0	0.0	40S	9.9	78	46
315	WR 1949	10MS	4.1	10S	3.2	0	0.0	20S	8.2	67	46
316	WR 1950	40S	19.0	60S*	16.0	20S	7.3	10S	3.0	78	57
317	WR 1951	0	0.0	10R	0.6	5MR	0.7	5S	1.8	78	57
318	WR 1952	5R	0.3	10R	0.6	0	0.0	40S	8.4	78	57
319	WR 1953	10MS	2.6	20R	0.8	0	0.0	60S	36.7	78	46
320	WR 1954	10MR	1.0	30S	6.4	TMS	0.3	60S	35.0	56	46
320A		100S	65.2	100S	70.0	80S	60.0	100S	73.3	78	67
321	WR 1955	20S	14.5	20MS	6.8	10MS	4.0	60S	26.8	57	46
322	WR 1956	40S	21.0	40S	16.0	10S	6.0	60S	23.0	67	46

323	WR 1957	40S*	10.4	40S	16.8	TR	0.1	60S	38.3	57	46
324	WR 1958	40S	13.0	40S	23.2	10MS	2.7	60S	19.0	78	57
325	WR 1959	10S	3.6	40S	20.8	TR	0.1	40S	15.0	78	57
326	WR 1960	5R	0.5	20R	0.9	0	0.0	60S	25.0	78	67
327	WR 1961	5MS	1.3	10R	0.4	20MS	5.3	60S	29.0	78	57
328	WR 1962	20MS	4.3	10MS	2.4	0	0.0	60S	31.0	78	57
329	WR 1963	40S	21.5	60S	13.2	5S	1.7	40S*	8.4	78	57
330	WR 1964	10S	8.5	40S	8.4	60S	20.0	60S	21.8	57	46
16. Dr. Vaibhav K Singh, ICAR-IARI, New Delhi											
331	IARI-17-1	10MS	5.1	60S	20.4	5S	1.7	80S	50.0	47	36
332	IARI-17-2	40MS	8.5	5MS	2.3	10MR	1.6	40S	36.7	57	46
333	IARI-17-3	10S	4.6	20MS	5.2	TR	0.1	60S	30.0	78	57
334	IARI-17-4	30S	26.5	10MS	6.8	5MR	0.7	40S	25.3	78	56
335	IARI-17-5	5MS	1.6	60S	27.2	20S	8.0	20S	7.3	78	57
336	IARI-17-6	20MR	3.3	10MS	2.7	TR	0.1	40S	12.5	78	57
337	IARI-17-7	40S	26.0	5MS	2.8	5MR	0.7	40S	8.7	57	46
338	IARI-17-8	40S	14.1	40S	56.0	60S	36.7	60S	35.0	78	67
339	IARI-17-9	40MS	22.5	10S	2.4	5MS	1.3	40S	27.0	78	57
340	IARI-17-10	20S	7.3	10MS	1.8	20MS	5.7	60S	46.7	78	57
340A		100S	71.3	100S	80.0	80S	60.0	100S	80.0	78	67
341	IARI-17-11	40S	22.5	60S	21.2	40S	15.0	40S	10.7	78	57
342	IARI-17-12	40S	26.5	30S	10.0	20S	8.4	5S	0.8	58	47
343	IARI-17-13	20MR	5.0	5MS	2.4	TR	0.1	20S	3.5	78	57
344	IARI-17-14	10MS	4.1	5MS	2.6	0	0.0	5S	0.8	78	47
345	IARI-17-15	10S	3.5	5S	1.4	0	0.0	10S	2.6	68	46
346	IARI-17-16	20S	10.1	5S	1.6	5MS	1.6	60S	36.7	78	46
347	IARI-17-17	50S	17.3	30S	7.4	20MS	5.4	60S	22.0	37	24
348	IARI-17-18	40S	18.0	40S	9.2	20MS	5.4	60S	22.0	45	35
349	IARI-17-19	20S	12.5	40S	9.2	20MS	5.4	60S	21.0	47	46
350	DBW 88	10MS	3.1	20MS	4.4	0	0.0	60S	35.0	67	46
351	IARI-17-20	20S	10.2	10S	4.8	0	0.0	60S	28.7	47	35
352	IARI-17-21	20S	14.0	20S	4.4	TMR	0.1	80S	56.7	47	35
353	IARI-17-22	15MR	1.0	60S	12.0	20S	6.7	80S	38.3	45	35
354	IARI-17-23	10MS	2.8	5MS	1.5	TR	0.1	60S	41.7	56	46
355	IARI-17-24	20MS	5.1	5MS	1.0	TMS	0.3	40S	21.7	57	46
356	IARI-17-25	5R	0.3	5S	1.8	10MS	2.7	80S	43.3	78	56
357	IARI-17-26	20MS	5.1	40S	28.4	40S	18.7	60S	23.5	78	46
358	IARI-17-27	20MS	5.2	60S*	16.1	5S	1.7	60S	26.7	48	46
359	IARI-17-28	20MS	7.5	20S	4.3	5S	1.7	40S	31.7	57	35
360	IARI-17-29	5MS	1.4	20S	8.0	10S	5.0	60S	14.2	76	46
360A		100S	75.0	100S	76.0	80S	60.0	100S	76.7	78	67
361	IARI-17-30	10MS	4.5	20S	7.0	10MR	1.4	60S	27.7	78	57
362	IARI-17-31	20MR	3.0	10MS	3.6	5MR	0.7	10S	2.7	78	46
363	IARI-17-32	20MR	3.1	5MR	1.2	0	0.0	20S	4.8	78	46
364	IARI-17-33	20S	10.0	40S	15.0	5S	1.7	5S	2.3	67	45

365	IARI-17-34	10MS	4.1	10S	3.0	5MR	0.7	60S	35.0	67	46
366	IARI-17-35	20S	10.2	30MS	7.0	5MS	1.3	60S	25.0	46	35
367	IARI-17-36	20S	14.0	20S	6.2	0	0.0	60S	25.3	46	35
368	IARI-17-37	10MS	4.1	60S	36.2	20S	6.7	20S	6.7	78	57
369	IARI-17-38	0	0.0	10R	0.5	TMS	0.3	80S	58.3	78	57
370	IARI-17-39	0	0.0	5R	0.2	TR	0.1	80S	56.7	78	57
371	IARI-17-40	0	0.0	5R	0.2	10MR	1.3	80S	56.7	78	68
372	IARI-17-41	5MR	0.8	10R	0.6	5MR	0.7	80S	70.0	78	57
373	IARI-17-42	5MR	0.9	10R	0.4	20MR	2.7	60S	46.7	67	46
374	IARI-17-43	20MR	2.3	20S	13.2	10S	3.3	20S	6.7	78	57
375	IARI-17-44	20MR	3.5	60S	16.4	40S	16.7	80S	56.7	67	46
376	IARI-17-45	20S	13.5	80S	38.4	10S	3.5	40S	13.5	67	47
377	IARI-17-46	20MR	3.4	20MS	4.0	0	0.0	60S	36.7	56	46
378	IARI-17-47	40S	23.5	20S	9.8	5MR	0.7	40S	18.4	56	45
379	IARI-17-48	20MS	13.0	10MR	1.4	TMR	0.1	40S	19.0	58	46
380	IARI-17-49	60S	32.0	20MS	10.8	10MS	3.3	40S	10.0	78	57
380A		100S	72.5	100S	80.0	80S	60.0	100S	70.0	78	67
381	IARI-17-50	40S	23.0	20MS	10.0	10S	5.3	10S	4.0	67	56
382	IARI-17-51	20S	10.0	30S	17.6	0	0.0	40S	23.3	56	45
383	IARI-17-52	20MR	4.2	60S	29.0	10S	3.6	10S	6.7	67	46
384	IARI-17-53	40MS	18.1	20MS	7.6	TMS	0.3	40S	12.5	68	57
385	IARI-17-54	10MS	2.6	20S	7.4	0	0.0	60S	23.5	78	57
386	IARI-17-55	20MR	3.1	20S	14.0	5S	1.7	60S	32.7	67	56
387	IARI-17-56	20MS	12.5	60S	16.2	40S	15.0	40S	10.7	67	57
388	IARI-17-57	5R	0.6	10S	4.8	0	0.0	5S	2.3	68	46
389	IARI-17-58	30S	12.0	5R	0.3	5MS	1.3	40S	16.8	67	57
390	IARI-17-59	40MS	17.0	80S	22.5	10S	4.0	40S	10.7	78	57
391	IARI-17-60	20S	11.1	40S	24.8	20S	8.1	20S	6.0	67	46
392	IARI-17-61	10MS	4.2	20S	24.8	5MR	0.7	20S	5.0	56	46
393	IARI-17-62	40S	19.1	20S	14.4	5MR	0.7	40S	11.7	45	34
394	IARI-17-63	5MS	1.3	20R	0.8	TR	0.1	20S	10.0	57	35
395	IARI-17-64	5MS	1.6	20MS	4.4	TR	0.1	20S	5.3	78	46
396	IARI-17-65	20MS	9.0	60S	19.6	5MR	0.7	20S	9.3	78	46
397	IARI-17-66	40S	18.0	30S	8.2	TR	0.1	40S	19.5	68	46
398	IARI-17-67	40S	23.0	40S	9.2	5MR	0.7	5S	1.9	78	57
399	IARI-17-68	5MS	1.6	20R	0.8	0	0.0	80S	63.3	78	46
400	PBW343	40MR	6.5	80S	34.8	20S	8.7	80S	60.0	78	57
400A		100S	75.0	100S	74.0	80S	60.0	100S	73.3	78	68
401	IARI-17-69	10S	5.3	10S	4.8	40S	20.0	60S	28.0	78	57
402	IARI-17-70	5R	0.5	5MS	1.5	TR	0.1	80S	66.7	78	57
403	IARI-17-71	0	0.1	10R	0.6	0	0.0	40S	8.4	68	56
404	IARI-17-72	5MR	0.7	20R	1.0	0	0.0	40S	11.7	68	57
405	IARI-17-73	R	0.1	10R	0.5	0	0.1	60S	16.3	78	57
406	IARI-17-74	40S	16.7	20S	9.0	20S	7.3	60S	35.0	56	46
407	IARI-17-75	20MS	8.1	40S	35.1	10S	4.7	20MS	7.7	78	57

408	IARI-17-76	40MS	14.7	20S	10.0	10S	4.8	20S	7.2	78	46
409	IARI-17-77	20S	11.5	40S	20.0	0	0.0	5S	2.5	57	46
410	IARI-17-78	10MS	3.2	10S	6.9	5S	1.7	80S	45.0	57	57
411	IARI-17-79	5MS	1.4	20MR	1.6	10S	3.3	10S	5.9	68	67
412	IARI-17-80	10MS	2.3	5MS	2.0	5MR	0.7	10S	5.4	57	56
413	IARI-17-81	10MS	3.1	20R	1.2	5MS	2.0	10S	5.3	57	46
414	IARI-17-82	5MS	1.1	10R	0.6	TR	0.1	10MS	2.3	68	57
415	IARI-17-83	5MS	1.1	20R	0.8	0	0.0	5S	1.7	56	46
416	IARI-17-84	5MS	1.0	5MR	1.2	TR	0.1	40S	16.8	78	57
417	IARI-17-85	0	0.0	10MS	2.4	5MS	1.5	5S	1.0	78	56
418	IARI-17-86	10R	0.5	20R	0.8	TR	0.1	20MS	5.0	78	57
419	IARI-17-87	5MS	1.3	5MS	2.0	TR	0.1	10S	3.0	58	57
420	IARI-17-88	20MR	2.5	20R	0.8	10MS	2.7	5S	1.5	78	57
420A		100S	67.5	100S	74.0	80S	60.0	100S	70.0	78	68
421	IARI-17-89	40MS	17.0	40S	9.0	20MS	9.3	60S	38.3	56	46
422	IARI-17-90	40S	35.0	5MS	1.6	5MR	0.7	60S	30.0	67	46
423	IARI-17-91	10S	5.6	40S	15.2	0	0.0	60S	25.0	56	46
424	IARI-17-92	40S	32.0	10S	4.6	5MR	0.9	10MS	2.2	78	47
425	IARI-17-93	10MR	1.0	40S	10.6	5MS	1.3	80S	41.7	46	35
426	IARI-17-94	40MS	11.0	40S	21.8	40S*	13.4	10MS	3.0	78	47
427	IARI-17-95	40S	19.0	10S	4.0	10S	4.7	20S	4.7	67	35
428	IARI-17-96	20MR	2.1	40S	9.6	60S*	20.2	60S	19.7	56	46
429	IARI-17-97	20S	6.0	5MS	1.2	0	0.0	5S	1.5	68	46
430	IARI-17-98	10S	3.5	10S	3.7	20S	6.7	60S	35.0	56	36
431	IARI-17-99	40MS	20.0	5MS	1.2	10S	4.1	40S	13.3	68	57
432	IARI-17-100	40MS	12.0	60S	28.4	40S	14.1	5S	1.5	78	57
433	IARI-17-101	5MS	1.6	40S	16.4	20S	6.7	40S	15.2	78	57
434	IARI-17-102	10MS	2.3	30S	7.2	10S	4.1	10MS	3.7	78	46
435	IARI-17-103	20MS	7.0	20S	9.3	20MR	3.3	60S	40.0	78	57
436	IARI-17-104	40S	14.5	20S	4.1	40S*	13.3	40S	17.3	68	46
437	IARI-17-105	20MS	10.0	30S	7.0	TR	0.1	10S	5.3	68	57
438	IARI-17-106	0	0.0	5R	0.2	0	0.0	80S	56.7	78	57
439	IARI-17-107	5R	0.3	5R	0.2	TMS	0.3	80S	56.7	78	57
440	IARI-17-108	5MS	2.6	TR	0.1	10MR	1.4	60S	50.0	68	57
440A		100S	70.0	100S	72.0	80S	60.0	100S	73.3	79	78
441	IARI-17-109	0	0.0	10R	0.4	10MS	2.7	80S	48.3	78	68
442	IARI-17-110	5MR	0.8	10R	0.4	0	0.0	80S	63.3	57	46
443	IARI-17-111	5MR	0.8	20R	0.8	0	0.0	20S	5.7	58	47
444	IARI-17-112	5R	0.3	20R	1.2	TMR	0.2	20S	5.2	68	57
445	IARI-17-113	10MS	2.3	20R	0.8	TR	0.1	20S	11.3	68	46
446	IARI-17-114	5R	0.3	20R	0.8	TMR	0.1	20S	6.7	68	46
447	IARI-17-115	0	0.0	10R	0.4	20MS	5.3	40S	10.3	57	46
448	IARI-17-116	10MS	3.1	60S	25.0	0	0.0	10S	4.8	78	56
449	IARI-17-117	5R	0.4	10MR	1.6	0	0.0	5S	2.0	57	46
450	DBW 88	20S	6.5	20MS	4.5	20S	6.7	60S	36.7	57	46

451	IARI-17-118	5MR	1.2	10MS	2.0	TMS	0.3	10S	5.5	57	46
452	IARI-17-119	60S	35.1	30MS	6.0	TMS	13.4	60S	26.7	57	46
453	IARI-17-120	10S	4.5	5S	3.4	40S*	13.3	60S	34.2	57	46
454	IARI-17-121	5MR	0.8	40S	16.0	0	0.0	60S	38.3	68	46
455	IARI-17-122	20S	8.2	10MS	2.8	20S	6.8	10S	3.7	68	46
456	IARI-17-123	10MS	2.3	20S	9.5	10S	3.4	60S	23.0	78	57
457	IARI-17-124	10S	4.3	60S	21.0	0	0.0	60S	30.0	78	57
458	IARI-17-125	5MS	2.1	20S	8.8	0	0.0	60S	17.3	78	57
459	IARI-17-126	10MS	3.6	20S	12.0	20S	8.0	0	0.0	78	57
460	IARI-17-127	10MS	3.1	20R	1.6	5S	1.7	60S	15.7	67	56
460A		100S	65.5	100S	74.0	80S	60.0	100S	73.3	78	67
461	IARI-17-128	10MS	2.6	20S	11.7	10S	6.0	60S	26.0	57	46
462	IARI-17-129	10S	2.6	20R	0.8	10S	3.3	40S	18.3	57	46
463	IARI-17-130	20MR	2.6	60S	40.8	40S	25.3	60S	19.3	78	47
464	IARI-17-131	20MS	6.1	60S	45.6	60S	33.3	40S	10.5	78	57
465	IARI-17-132	0	0.0	20R	0.8	0	0.0	60S	27.3	56	46
466	IARI-17-133	5R	0.3	60S	38.0	40S*	13.4	20S	5.5	67	46
467	IARI-17-134	10S	5.0	40MS	18.5	20S	6.7	60S	24.7	56	35
468	IARI-17-135	20MR	2.8	60S	30.0	40S*	13.3	80S	45.0	57	35
469	IARI-17-136	40MS	13.0	10MS	3.0	20S	6.7	40S	20.7	68	57
470	IARI-17-137	20MR	2.2	60S	36.0	40S*	13.3	10S	4.7	68	56
471	IARI-17-138	20MS	5.3	40S	18.8	5MR	0.7	10S	2.8	78	57
472	IARI-17-139	20MS	4.3	10MS	3.4	0	0.0	20S	11.7	68	46
473	IARI-17-140	20S	14.5	10MS	2.3	10S	4.7	60S	24.7	78	56
474	IARI-17-141	20MS	6.1	40S	11.2	0	0.0	60MS	22.2	78	57
475	IARI-17-142	20MR	2.6	40S	8.9	5MR	0.7	20S	8.0	78	57
476	IARI-17-143	5R	0.3	10S	2.6	0	0.0	10S	4.9	57	46
477	IARI-17-144	0	0.0	20R	0.9	TMR	0.2	20S	7.2	68	46
478	IARI-17-145	0	0.0	10S	2.2	TR	0.1	40S	11.8	78	57
479	IARI-17-146	20MR	3.1	80S	47.2	40S	14.7	60S	35.0	78	47
480	IARI-17-147	20MR	3.4	60S	30.1	40S	16.1	60S	21.5	78	47
480A		100S	66.3	100S	80.0	80S	60.0	100S	73.3	78	68
481	IARI-17-148	20MS	9.0	30S	15.2	5S	3.7	40S	14.0	56	35
482	IARI-17-149	20MR	4.0	60S	26.8	5MR	0.7	60S	30.0	56	56
483	IARI-17-150	20MR	2.6	80S	48.0	30S	16.7	60S	27.5	78	46
484	IARI-17-151	5MS	2.1	5S	2.0	TR	0.1	10S	4.0	56	46
485	IARI-17-152	40S	30.0	40S	26.4	0	0.0	10S	3.5	56	46
486	IARI-17-153	10MR	2.0	5MR	0.6	0	0.0	TR	0.0	67	46
487	IARI-17-154	20MR	4.1	5MS	1.0	TR	0.1	0	0.0	56	46
488	IARI-17-155	20S	6.5	30S	7.6	TMR	0.1	20S	3.3	58	47
489	IARI-17-156	20S	13.0	60S*	13.2	5S	2.3	10S	3.8	56	46
490	IARI-17-157	20MR	2.5	20S	6.0	0	0.0	40S	26.7	57	46
491	IARI-17-158	20MS	7.0	20MS	8.4	TMR	0.1	60S	16.5	68	57
492	IARI-17-159	20MS	7.1	30MS	6.2	TMR	0.1	20S	11.7	68	47

493	IARI-17-160	40S	24.0	20S	6.4	10MS	4.3	60S	33.3	67	57
17. Wheat Breeder, CCS HAU, Hisar, Haryana											
494	P13343	20MS	10.0	40S	8.5	20S	12.0	5S	1.5	67	57
495	P13348	20MS	8.1	60S*	13.2	40S*	13.4	10S	7.0	67	57
496	P13517	10MS	4.0	40S	8.5	0	0.0	40S*	6.9	78	56
497	P13525	20MR	3.1	20S	12.4	10S	3.3	20S	8.2	78	57
498	P13554	20MS	8.8	30MS	6.0	5MR	1.3	20S	10.0	78	57
499	P13555	20MS	10.5	40S	8.4	20S	9.4	10MS	4.2	78	56
500	PBW 343	20MS	7.1	80S	28.9	40S	15.1	80S	63.3	67	46
500A		100S	65.0	100S	74.0	80S	60.0	100S	76.7	78	78
501	P12960	20MS	8.5	40S	10.5	20MS	9.3	20S	4.2	78	57
502	P12961	10R	0.6	20MS	5.6	40S*	13.4	20S	6.7	68	46
503	P12962	20MS	6.3	10S	3.6	10MR	2.0	5S	1.2	78	56
504	P12968	10R	0.6	10MS	2.4	TR	0.1	10S	1.7	78	57
505	P12969	10R	0.6	10R	0.4	0	0.0	10S	3.4	78	57
506	P13535	20MS	8.0	40S	8.8	5S	1.7	20MS	4.5	56	57
507	P13546	40MS	8.1	40S	16.8	5S	1.7	10S	3.3	68	47
508	P9144	10MS	2.5	60S	37.6	20S	10.7	20MS	5.2	67	46
509	P13568	40S	25.5	60S	29.6	10MR	1.4	10S	2.5	56	46
510	P13572	10MR	1.1	40S	19.8	10S	3.4	40S	15.7	56	46
511	P13573	40S	21.0	20MS	5.2	5S	3.1	20S	3.3	56	46
512	P13574	20MS	4.6	20S	5.6	TMR	0.1	5S	0.8	68	46
513	P13580	10MS	4.0	20S	6.5	0	0.0	20S	7.0	78	47
514	P13585	20S	6.6	20S	11.6	0	0.0	20S	4.0	45	35
515	P13559	10MS	6.0	40S	9.8	10MS	2.7	10MS	1.5	68	57
516	P13565	5R	0.3	20MS	4.0	20MS	5.3	5S	1.5	78	57
517	P13582	5MR	0.8	30S	8.0	10MS	2.7	10S	3.4	78	57
518	P13583	0	0.0	20S	6.0	0	0.0	20S	3.4	78	46
519	P13584	TMR	0.2	10S	4.0	0	0.0	10S	2.5	67	46
520	P13588	5R	0.4	20MR	2.5	10MR	1.3	20S	3.4	67	47
520A		100S	66.0	100S	76.0	80S	60.0	100S	73.3	78	67
521	P13589	10MS	5.1	20S	5.0	TMR	0.1	10S	2.5	78	56
522	P13633	40MS	19.5	10MR	0.8	TMR	0.1	40S	14.0	56	46
523	P13644	40S	24.0	20S	9.2	TR	0.1	10S	3.5	67	56
524	P13646	20MS	6.0	10R	0.4	0	0.0	5S	0.8	56	35
525	P13650	5R	0.5	5R	0.2	20MR	2.7	20S	3.3	68	47
526	P13653	10MR	1.3	5R	0.2	TR	0.1	20S	6.3	78	47
527	P13655	5R	0.4	10S	4.4	0	0.0	10S	4.0	67	46
528	P13774	10MR	1.1	20S	16.1	TR	1.7	5S	2.3	89	57
529	P13558	20S	12.0	10MS	4.8	5MR	0.7	40S	13.7	78	45
530	P13260	20S	8.5	10MS	1.8	10S	3.4	10S	2.5	68	46
531	P4149	20S	8.0	30S	23.2	10S	4.7	40S	16.3	78	47
532	P4271	10S	9.0	40S	9.8	0	0.0	20S	6.7	78	46
533	P4199	40S	21.6	10MR	1.2	5MR	0.7	40S	25.8	56	46
534	P4204	40MS	13.0	10MS	2.8	5MR	0.7	40S	11.3	68	46

535	P4179	20MS	9.5	40S	9.0	40S*	14.0	80S	56.7	67	56
536	P4195	40MS	15.1	10MR	1.1	0	0.0	40S	26.0	67	56
537	P4060	5MS	1.1	20MS	4.4	TMS	0.3	60S	26.3	47	45
538	P4177	10R	0.6	30S	13.6	40S*	13.3	60S	46.7	68	57
539	P4280	20MS	10.0	80S	18.2	60S*	20.1	40S	14.7	78	57
540	P4113	20MS	12.5	30S	6.3	5S	1.8	20S	5.5	78	47
540A		100S	66.3	100S	72.0	60S	50.0	100S	73.3	78	68
541	P4276	20MS	12.5	10MS	2.5	10S	3.4	40S	15.2	67	46
542	P12206	40S	28.0	60S	31.6	10MR	1.3	20S	7.6	68	46
543	P13320	20MS	9.5	20MS	6.4	10MS	2.7	20S	7.2	67	46
544	P13323	40MS	14.5	20MS	9.0	5MS	2.0	20S	6.3	57	46
545	P13604	10MS	4.3	5MS	1.6	10MR	1.3	TS	0.2	78	47
546	P13614	20MS	7.0	40S	17.7	10S	4.0	20S	4.2	78	46
547	P13775	20MS	4.5	40S	10.2	TR	0.1	TS	0.2	78	45
548	P13776	40MS	11.5	40S	22.8	5MR	0.8	5S	2.4	78	46
549	P8178	5MS	2.1	10R	0.4	0	0.0	10S	3.7	47	46
550	DBW 88	10MS	4.0	20MS	4.9	10S	3.3	60S	35.8	56	46
551	P8185	10MS	2.5	20MR	2.0	10MR	1.3	10S	2.0	58	57
552	P8192	10S	4.6	10R	0.4	0	0.0	5S	0.9	57	46
18. Dr. Vijay Rana, CSK HPKVV, Rice & Wheat Research Centre, Malan (H.P.)											
553	PW 1701	5MS	2.1	20MS	8.4	5MR	0.7	20S	6.5	78	57
554	PW 1702	5R	0.3	20S	12.0	10MR	1.3	10S	5.2	78	46
555	PW 1703	40MS	19.0	60S	29.2	10MS	2.7	0	0.0	78	46
556	PW 1704	5MR	1.3	20S	11.6	0	0.0	20S	6.2	78	57
557	PW 1705	5MR	0.9	20S	12.0	TMR	0.1	40S	10.0	78	46
558	PW 1706	10MS	5.1	40S	19.4	10MR	1.3	10S	2.5	68	46
559	PW 1707	5MS	1.6	60S	13.7	40S*	13.3	5MR	0.3	68	47
560	PW 1708	10MS	3.1	20MS	3.8	TMR	0.1	60S*	14.8	68	47
560A		100S	70.5	100S	70.0	80S	60.0	100S	73.3	79	68
561	PW 1709	10MS	5.1	40S	9.0	20S	6.9	20S	6.3	78	46
562	PW 1710	10MS	2.3	10MS	4.0	10MS	2.7	40S*	9.0	78	46
563	PW 1711	10MS	2.7	20S	8.4	10S	3.3	40S*	7.9	78	46
564	PW 1712	10MS	2.6	60S	32.2	40S	15.0	10S	4.0	56	35
565	PW 1713	20S	6.0	20MS	6.6	10MR	1.3	5S	2.3	56	35
566	PW 1714	10MS	4.6	20S	9.2	5S	2.3	20S	9.7	78	46
567	BW 255	5R	0.3	60S	30.0	5MS	1.3	20S	11.7	56	35
568	BW 257	5R	0.3	30S	6.3	0	0.0	10S	3.4	56	35
569	BW 258	20MS	6.2	20S	9.4	5MR	0.7	10S	3.4	67	45
570	BW 259	20MS	6.1	20MS	3.6	10S	3.4	20S	7.5	67	46
571	BW 260	20MR	2.6	40S	9.0	TR	0.1	40S	14.0	68	46
572	BW 261	10S	4.5	80S	44.0	60S	33.3	20S	13.0	57	46
573	BW 262	10S	4.5	20S	8.5	5S	1.7	5S	1.7	57	57
574	BW 263	10MR	1.0	10MS	3.0	TMS	0.3	10S	4.0	57	46
575	BW 264	5MR	1.1	60S*	15.5	5S	1.7	20S	5.8	57	46
576	BW 265	40MS	9.5	60S	35.2	10S	8.7	10MS	2.3	78	57

577	BW 266	10R	0.8	20MS	4.0	0	0.0	20S	9.5	56	46
578	DW 241	20MR	3.2	40S	8.8	20S	6.7	60S	24.3	67	46
579	DW 242	20R	2.1	40S	16.0	TR	0.1	60S	35.8	78	57
580	DW 243	20S	6.0	10MS	2.4	10MS	2.7	10S	4.0	78	46
580A		100S	67.5	100S	74.0	80S	60.0	100S	70.0	78	68
581	DW 244	20MS	5.0	20MR	1.8	5S	3.3	20S	8.3	78	46
582	DW 245	10MS	4.1	20S	8.0	5S	1.7	60S	31.7	78	46
583	DW 246	5R	0.3	20R	0.8	0	0.0	60S	29.3	78	57
584	DW 247	20S	5.1	20S	8.4	10MS	2.7	20S	7.8	57	45
585	DW 248	20S	6.0	40S	10.0	5MS	2.7	5S	0.9	78	57
586	DW 249	5R	0.4	40S	16.0	5MS	1.3	40S	16.3	78	56
587	DW 250	10S	4.0	20MS	4.1	0	0.0	40S	19.8	68	56
19. Dr. J.P. Jaiswal, GBPUA&T, Pantnagar, Uttarakhand											
588	UP 1	10MS	5.0	60S	33.6	5MS	1.3	10S	4.8	68	57
589	UP 2	20MS	10.0	40S	12.0	TR	0.1	0	0.0	68	57
590	UP 3	5R	0.3	20S	4.8	TR	0.1	60S	38.3	78	57
591	UP 4	20MS	6.0	60S	22.4	5MR	0.7	20S	6.7	78	45
592	UP 5	20MS	8.0	40S	20.1	20S	6.8	40S	20.0	78	46
593	UP 6	20MS	10.6	10MS	1.8	0	0.0	40S	26.2	67	57
594	UP 7	20MS	9.5	20S	11.2	TMR	0.1	10S	4.0	57	46
595	UP 8	20S	9.5	20MS	6.8	5MR	0.7	40S	20.3	56	45
596	UP 9	5MR	0.5	20S	4.8	TR	0.1	20MS	7.7	47	35
597	UP 10	20S	14.0	60S	18.4	0	0.0	40S	16.3	46	35
598	UP 11	20MS	9.5	60S	35.2	20S	9.3	10S	3.3	57	35
599	UP 12	5R	0.3	20MS	6.8	10MR	1.3	20S	4.2	67	45
600	DBW 196	20MS	9.0	10MS	2.5	20MS	5.4	40S	21.8	67	46
600A		100S	66.0	100S	72.0	80S	60.0	100S	76.7	78	68
601	UP 13	10MS	3.1	5MS	1.7	10MS	2.7	20S	8.3	78	57
602	UP 14	10S	6.7	10S	3.4	0	0.0	40S	15.5	57	34
603	UP 15	20S	16.0	60S	18.8	TR	0.1	40S	15.8	56	46
604	UP 16	20MS	13.2	30S	7.7	20S	6.7	40S	20.0	78	57
605	UP 17	40MS	11.7	5S	2.6	10S	4.0	60S	36.7	78	57
606	UP 18	20S	11.0	60S	20.8	0	0.0	20S	5.0	78	46
607	UP 19	10MS	2.5	5S	1.8	TMR	0.1	40S	16.0	47	45
608	UP 20	0	0.0	5R	0.2	10S	3.4	60S	21.7	45	45
609	UP 21	20MR	2.0	80S	22.2	60S*	20.0	40S	24.0	56	46
610	UP 22	10MS	4.0	80S	32.0	40S*	13.3	60S	30.0	45	35
611	UP 23	20MR	3.2	40S	8.5	0	0.0	40S	20.2	78	57
612	UP 25	20MR	3.1	20S	9.2	20S	9.3	60S	37.5	78	56
613	UP 28	40S	24.0	80S	23.6	10S	4.7	20S	8.7	47	46
614	UP 29	40MS	15.5	40S	18.4	10S	4.7	60S	28.4	68	57
615	UP 30	60S	34.0	60S	14.6	5S	3.0	80S	53.3	67	56
616	UP 31	20S	12.0	10MS	2.0	TR	0.1	40S	14.7	57	46
617	UP 32	5MS	1.5	20S	8.0	0	0.0	20S	5.8	46	45
618	UP 33	60S	45.0	20S	7.2	5S	1.7	10MS	3.0	56	46

619	UP 34	40S	25.6	40MS	11.8	10MS	2.7	60S	31.7	78	57
620	UP 36	40S	21.0	20MS	5.8	5MS	1.3	60S	30.0	78	57
620A		100S	72.0	100MS	76.0	80S	60.0	100S	73.3	78	67
621	UP 38	20MR	2.2	60S	40.4	60S	26.7	60S	30.0	67	57
622	UP 39	40MS	17.0	80S	27.6	10S	3.4	40S	10.1	78	57
623	UP 41	10MR	1.2	5MS	1.7	0	0.0	40S	19.2	78	57
624	UP 46	10S	3.5	5MR	0.8	0	0.0	40S	12.5	67	46
625	UP 47	40S	18.0	10MS	2.8	5MR	0.9	60S	31.7	56	46
626	UP 54	20MS	5.1	5R	8.3	TR	0.1	10MS	3.7	78	57
627	UP 55	10MR	1.0	10MS	3.2	TR	0.1	40S	21.5	68	57
628	UP 60	20MS	4.1	40S	16.4	5S	3.0	40S	12.2	68	57
20. Dr. M. K. Shrivastava, JNKVV, RARS, Sagar (M.P.)											
629	RVW 4264	40S	17.0	80S	76.0	80S	46.7	80S	56.7	78	57
630	RVW 4265	20MS	6.2	20R	0.9	0	0.0	20S	8.3	68	56
631	RVW 4266	0	0.0	10R	0.4	TR	0.1	80S	51.7	78	57
632	RVW 4269	5MS	1.4	40S	25.2	10S	6.0	60S	40.0	68	46
633	RVW 4276	20MR	2.0	20MR	1.7	5MS	1.3	60S	32.5	78	57
634	RVW 4278	10MR	1.1	80S	43.2	40S	14.7	80S	63.3	78	56
635	RVW 4279	0	0.0	60S	36.0	40S	14.7	80S	56.7	78	56
636	RVW 4280	40S*	10.1	30S	13.4	5S	1.7	60S	40.0	78	56
637	RVW 4281	20S	14.0	40S	20.0	20MS	10.0	60S	25.7	78	56
638	RVW 4286	20MS	4.6	40S	13.8	5S	1.7	40S	23.7	78	57
21. Dr. Tuhina Dey, SKUAS&T, Chatha, Jammu											
639	JAUW 665	40MR	4.4	60S	23.2	TMR	0.1	60S	26.7	67	56
640	JAUW 666	40MR	4.1	60S	22.4	40S	16.1	60S	32.5	78	57
640A		100S	70.0	100S	76.0	80S	60.0	100S	73.3	78	67
641	JAUW 667	10MS	5.5	40S	9.6	20MS	6.0	60S	36.7	56	46
642	JAUW 668	10MR	1.2	20S	5.0	5MR	2.3	80S	45.0	57	46
643	JAUW 669	10S	3.3	20S	6.4	TMR	0.1	40S	19.2	57	46
644	JAUW 670	10S	3.6	40S	26.4	20S	12.7	40S	19.7	57	46
645	JAUW 671	20MS	7.3	60S	23.2	5S	1.7	60S	22.8	67	46
646	JAUW 672	20MS	7.0	20S	15.3	10S	3.3	5S	1.7	67	46
647	JAUW 673	5MR	0.8	10S	3.4	0	0.0	20S	4.2	56	46
648	JAUW 674	20MS	10.0	60S	12.5	10S	3.3	60S	40.8	67	46
22. Dr. R. S. Shukla, JNKVV, Jabalpur (MP)											
649	MP 3508	20S	7.5	20S	8.2	10S	5.0	60S	33.3	67	46
650	DBW 189	40S	18.0	20R	1.2	0	0.0	60S	29.5	46	35
651	MP 3509	10MS	3.3	90S	64.4	40S	18.9	80S	66.7	78	57
652	MP 3510	10MR	1.6	60S	44.0	40S*	13.3	60S	40.0	78	57
653	MP 3511	5MR	0.8	80S	29.2	10S	3.4	10S	5.0	78	57
654	MP 3512	20MR	5.1	60S*	15.0	40S	18.7	80S	53.3	78	46
655	MP 3513	40MS	16.0	60S*	13.2	5S	2.0	10S	3.4	67	47
656	MP 3514	5MR	1.0	20S	7.6	0	0.0	60S	28.0	78	46
657	MP 3515	TMS	0.5	40S	17.8	0	0.0	60S	45.0	58	46

658	MP 3516	5R	0.4	40S	13.8	10MR	1.3	60S	45.0	68	46
659	MP 3517	20MR	3.5	40S	12.2	0	0.0	40S	24.2	67	45
660	MP 3518	40S	17.0	40S	15.6	10MS	3.3	40S	16.6	68	35
660A		100S	66.0	100S	72.0	80S	60.0	100S	70.0	78	67
661	MP 3519	40S	15.3	50S	11.3	5S	1.8	100S	66.7	68	56
662	MP 3520	40S	17.0	60S	19.4	40S*	13.4	60S	36.2	78	57
663	MP 3521	5MS	1.3	20R	0.8	0	0.0	60S	50.0	78	57
664	MP 3522	20MR	3.1	10MR	1.0	5MR	0.7	40S	18.4	78	56
23. Dr. U.S. Singh, Nuzideedu Seeds											
665	NWS 2118	10MS	5.4	5MS	1.3	10S	3.3	40S	24.3	67	46
666	NWS 2108	20MS	5.6	40S	11.6	5S	2.3	60S	42.0	67	56
667	NWS 2106	20MS	9.1	30S	8.6	20S	7.3	20S	7.0	78	57
668	NWS 4403	10MS	3.1	20MS	3.6	10S	3.3	60S	31.7	68	46
24. Dr. Mahabal Ram, SHUATS, Allahabad											
669	AAI-W20/MR-2020	20MS	2.7	10MS	2.4	10MR	1.3	60S	34.2	68	46
670	AAI-W21/MR-1003	20MS	4.2	80S	38.0	40S	23.3	60S	36.8	78	57
671	AAI-W24/MR-1010	60MS	6.7	40S	15.2	10S	3.3	10S	4.5	67	46
672	AAI-W28/MR-3014/10/4/11	20MS	8.0	20S	10.2	TR	0.1	10S	2.5	78	57
673	AAI-W29/MR-3012-1/4/3	10MR	1.7	40S	19.2	0	0.0	60S	27.5	56	46
674	GIM-20-9	5R	0.3	5R	0.2	0	0.0	80S	56.7	78	56
25. Dr. Monika Garg, NABI Mohali											
675	NABIMG III	20MS	7.5	10S	4.8	TMS	0.3	20S	8.2	68	46
676	NABIMG II	10MS	3.1	20S	6.3	TR	0.1	20S	6.5	68	46
26. Wheat Breeder, JNKVV, ZARS, Powarkheda (MP)											
677	MPO-18-01	10MS	2.1	5MS	2.4	5MR	0.7	10MS	2.2	78	67
678	MP-18-02	10MS	5.1	80S	36.0	20S	8.0	80S	70.0	78	46
679	MP-18-03	20MR	2.6	60S	21.6	5MS	1.3	60S	27.0	78	57
680	MP-18-04	10MS	4.5	40S	18.0	TMS	0.3	60S	26.7	78	46
680A		100S	70.0	100S	70.0	80S	60.0	100S	80.0	79	68
681	MP-18-05	20MR	2.6	40MS	19.2	10S	4.0	60S	31.7	78	56
682	MPO-18-06	20MS	4.2	10MR	1.7	5MS	2.0	10S	4.3	67	56
683	MP-18-07	20MR	2.1	20MS	8.5	5MS	2.7	60S	23.7	78	57
684	MP-18-08	20R	1.6	40S	8.3	40S	14.7	60S	21.5	78	57
685	MP-18-09	20MS	6.1	80S	60.0	60S	30.0	80S	56.7	78	67
686	MP-18-10	10MS	3.1	80S	49.6	20S	7.3	60S	37.5	78	57
687	MPO-18-11	20MS	4.0	40MR	4.0	10MR	1.6	10S	4.2	78	57
688	MP-18-12	40MR	5.0	10S	2.9	5MR	0.7	60S	28.7	58	57
689	MPO-18-13	20MS	7.0	10MS	4.0	5MR	0.7	20MS	5.8	67	57
690	MPO-18-14	10MR	1.0	20R	1.2	5MR	2.0	10S	2.4	68	58
691	MP-18-15	10MS	4.1	10S	2.0	0	0.0	60S	43.3	68	46
692	MPO-18-16	40MS	11.0	20MS	4.0	10MS	2.7	20S	9.0	67	56
693	MPO-18-17	20MS	8.0	20S	4.2	20MS	5.3	5S	1.6	67	56
694	MPO-18-18	10MS	4.1	5MS	1.6	10MR	1.4	5S	1.5	67	46
695	MP-18-19	10MR	1.0	10MS	2.6	20MS	5.3	10MS	4.0	78	45

696	MP-18-20	40MR	8.2	10MS	2.0	10MS	2.7	20S	5.8	67	46
697	MP-18-21	10MS	4.7	5MS	2.4	TMR	0.1	40S	17.5	67	45
698	MPO-18-22	40MS	14.1	40S	8.6	40S*	13.4	20S	5.2	56	46
699	MP-18-23	20MS	10.2	20R	0.8	0	0.0	10S	5.6	68	46
700	DBW 196	20MS	8.2	10MS	2.6	10MS	3.3	40S	24.0	68	46
700A		100S	67.0	100S	76.0	80S	60.0	100S	63.3	79	78
701	MP-18-24	20MS	14.1	10MS	3.1	10S	3.3	60S	30.7	78	57
702	MP-18-25	20MS	8.1	20R	0.8	TMR	0.1	20S	6.7	78	57
703	MPO-18-26	20S	7.0	20MR	1.7	20MR	2.7	5S	1.7	56	56
704	MP-18-27	20S	8.2	40S	9.6	10S	3.3	10MS	2.8	78	56
705	MP-18-28	10MS	5.1	80S	32.0	20S	8.0	80S	63.3	78	57
706	MP-18-29	10MS	4.0	30MS	7.2	40S	15.0	60S	38.3	78	57
707	MP-18-30	10MS	2.6	10MS	5.4	20S	8.3	60S	40.0	78	57
708	MP-18-31	20MR	2.3	40S	14.0	0	0.0	40S	13.2	78	46
27. Dr. S. C. Bhardwaj, ICAR-IIWBR RS Flowerdale Shimla											
709	S4	10MS	6.7	30S	8.2	5S	4.7	60S	26.7	78	45
710	S6	10R	0.6	5MS	1.8	10MS	2.7	20S	8.0	78	57
711	S7	5R	0.4	20R	0.8	0	0.0	20S	5.7	78	46
712	S8	5MR	0.9	20MS	11.4	0	0.0	20S	6.4	78	57
713	S9	10MR	1.2	20S	7.6	TMR	0.1	60S	28.0	78	57
714	S10	5R	0.3	10R	0.4	20MS	5.3	40S	19.2	56	46
715	FLW 36	10MR	1.0	80S*	16.8	20S	8.0	10S	4.7	56	35
716	FLW 37	10MS	3.0	40R	8.0	5MR	0.7	40S	25.0	67	45
717	FLW 38	10MS	2.3	20R	0.8	5MS	1.3	40S	31.7	67	46
28. Dr. B. K. Das, BARC Mumbai											
718	TAW 150	40S	21.1	10MS	2.8	0	0.0	60S	32.0	67	45
719	TAW 151	10S	3.2	20S	12.8	0	0.0	10S	5.0	72	55
720	TAW 152	20S	5.6	60S*	13.6	10MS	4.0	40S	15.0	68	57
720A		100S	65.5	100S	72.0	80S	60.0	100S	66.7	78	68
721	TAW 153	40S*	13.0	10MS	4.1	10MS	4.1	40S	20.0	68	46
722	TAW 154	10MS	4.0	5MS	1.0	TR	0.1	40S	25.0	67	56
723	TAW 155	10MS	5.1	20S	4.8	0	0.0	40S	18.0	68	57
29. Dr. V. S. Sohu, PAU, Ludhiana											
724	PAU 1	60S	40.0	30S	7.6	10MR	1.3	TR	0.0	89	46
725	PAU 2	20MR	3.1	30S	7.3	5S	1.7	5S	2.3	78	57
726	PAU 3	5R	0.3	20S	7.0	TMS	0.3	10MS	2.2	78	46
727	PAU 4	10R	0.6	10MS	3.0	0	0.0	5S	1.7	67	46
728	PAU 5	10MS	2.3	20MS	4.4	10MR	1.3	10S	4.2	78	46
729	PAU 6	10MS	5.0	10S	2.8	0	0.0	20S	5.5	78	56
730	PAU 7	5R	0.5	20MS	4.3	5MR	0.7	10S	3.2	78	57
731	PAU 8	5R	0.3	10MR	1.0	0	0.0	20S	3.7	78	56
732	PAU 9	20MR	3.3	10MR	0.9	0	0.0	5MS	1.4	78	46
733	PAU 10	0	0.0	10MS	2.1	0	0.0	5S	0.8	78	45
734	PAU 11	10MS	4.1	5MS	1.7	5MR	0.7	10S	1.7	67	46
735	PAU 12	20MR	2.1	20S	8.6	0	0.0	10MS	3.7	78	46

736	PAU 13	40S	20.0	40S	12.1	10S	4.1	5S	0.8	78	46
737	PAU 14	40S	32.5	40S	9.6	5MR	0.7	5MR	0.3	68	46
738	PAU 15	20S	7.1	5MS	1.6	TR	0.1	5S	0.8	56	46
739	PAU 16	20MR	2.2	60S	25.0	5MS	2.7	10S	1.9	78	56
740	PAU 17	20MS	7.1	40S	12.2	10MS	2.7	20S	4.7	56	45
740A		100S	70.5	100S	74.0	80S	60.0	100S	73.3	78	68
741	PAU 18	40S	23.0	40S	24.0	10S	6.7	5S	0.8	47	46
742	PAU 19	40S	18.5	40S	30.0	20S	10.0	5S	1.7	47	46
743	PAU 20	40S	26.0	60S	21.0	20S	6.9	5MS	0.7	56	46
744	PAU 21	20S	12.0	40S	34.0	10S	5.3	5S	2.0	56	45
745	PAU 22	40S	26.3	20MS	5.6	5MR	0.7	5S	0.8	67	46
746	PAU 23	TMR	0.2	60S	23.2	20MS	5.3	20S	4.2	68	46
747	PAU 24	20MR	2.2	10S	2.2	5MR	0.7	20S	4.8	68	57
748	PAU 25	40MS	10.2	30S	7.8	10S	6.0	10S	4.0	78	46
749	PAU 26	5R	0.3	10S	2.9	0	0.0	20MS	3.5	78	46
750	DBW 196	10MS	5.1	5MS	1.2	0	0.0	40S	23.3	68	46
751	PAU 27	20MS	8.5	40S	26.4	10S	4.0	10S	2.5	67	46
752	PAU 28	40S	21.3	60S	30.0	40S*	13.3	5S	0.8	78	46
753	PAU 29	40S	24.0	20R	1.0	20S	7.3	5R	0.2	78	56
754	PAU 30	40S	25.0	20S	9.6	20S	14.7	5S	0.8	78	56
755	PAU 31	20MS	9.5	40S	17.6	30S	10.0	10S	6.2	78	47
756	PAU 32	40S	14.6	10MS	4.2	TMS	0.3	10MS	5.0	78	46
757	PAU 33	20MS	7.5	40R	8.5	0	0.0	5S	3.1	68	46
758	PAU 34	20S	14.0	20MS	5.4	TR	0.1	40S	13.0	67	46
759	PAU 35	20S	11.0	20MS	11.4	20MR	2.7	40S	20.7	78	57
760	PAU 36	20MS	8.2	20MS	4.3	10S	3.3	20S	6.7	78	56
760A		100S	66.0	100S	70.0	80S	60.0	100S	66.7	79	78
761	PAU 37	40MR	7.5	20S	12.2	10MS	2.7	10S	2.7	85	55
762	PAU 38	20MR	3.1	60S	32.0	20S	6.8	20S	6.2	57	46
763	PAU 39	40S	17.0	5MS	0.9	5MS	1.3	40S	14.0	57	46
764	PAU 40	40MS	12.3	5MR	0.8	0	0.0	10S	2.5	67	46
765	PAU 41	20MS	10.5	20R	1.2	5MR	0.7	5S	1.8	67	46
766	PAU 42	5MS	1.6	5MR	0.8	0	0.0	5S	1.7	67	46
767	PAU 43	20MR	3.0	10S	2.0	0	0.0	40S	17.4	67	46
768	PAU 44	20MS	9.5	5MR	0.5	5MR	0.9	10S	5.7	78	57
769	PAU 45	20S	24.0	20S	6.8	0	0.0	10S	4.8	67	46
770	PAU 46	20MS	9.5	60S	40.0	40S*	13.3	10S	4.7	67	35
771	PAU 47	20MS	8.7	20MS	5.0	0	0.0	10S	2.6	78	46
772	PAU 48	40MS	12.2	60S*	15.8	10MR	1.4	5S	2.5	46	45
773	PAU 49	40S	23.5	5MS	1.6	0	0.0	10S	4.9	56	46
774	PAU 50	20MS	4.6	80S	40.0	40S*	13.3	10S	2.5	57	46
775	PAU 51	10MR	1.2	10MS	2.2	0	0.0	20S	14.7	67	56
776	PAU 52	20MR	3.1	40S	8.4	10MR	1.3	5S	1.7	67	45
777	PAU 53	20MR	2.1	40S	13.1	40S	13.5	20S	6.4	67	57
778	PAU 54	10MS	4.1	40S	8.2	TR	0.1	60S	38.3	56	46

779	PAU 55	40S	19.0	5MR	1.0	TR	0.1	40S	12.4	68	56
780	PAU 56	20S	11.0	40S	8.6	10MS	4.4	80S	53.3	68	46
780A		100S	69.0	100S	70.0	80S	60.0	100S	70.0	78	68
781	PAU 57	20S	12.0	10R	0.8	20MS	6.0	60S	27.7	78	56
782	PAU 58	40MS	11.5	10MS	2.6	0	0.0	60S	22.7	56	35
783	PAU 59	40S	22.0	5MS	2.8	5MS	1.3	10S	4.7	67	46
784	PAU 60	40S	32.0	40R	9.0	5MR	0.9	40S	10.0	68	56
785	PAU 61	40S	26.0	10R	0.8	5MR	0.7	20S	5.9	78	46
786	PAU 62	5R	0.3	20R	0.8	0	0.0	40S	7.5	47	46
787	PAU 63	20MS	4.2	20R	1.3	10S	4.0	40S	18.9	78	56
788	PAU 64	20MS	4.2	10MS	3.2	5MR	0.7	10S	5.2	68	46
789	PAU 65	40S	27.5	40R	12.2	10MS	3.3	TR	0.0	56	45
790	PAU 66	40S	21.3	5MS	1.6	5MR	0.7	TR	0.0	67	56
791	PAU 67	10S	5.7	20R	0.8	0	0.0	5MS	0.7	56	34
792	PAU 68	40MS	16.5	5MS	1.8	5MR	0.8	10S	1.7	46	35
793	PAU 69	5MS	1.3	10R	0.4	TR	0.1	5S	1.7	57	34
794	PAU 70	20MS	6.0	20MS	3.8	TR	0.1	40S	13.5	68	46
795	PAU 71	20MS	10.2	5MS	2.2	5MR	0.7	60S	22.7	67	35
796	PAU 72	5MS	1.3	20R	0.8	0	0.0	10S	2.5	78	46
797	PAU 73	5MR	0.7	5MR	0.8	5MR	0.7	20S	10.7	68	46
798	PAU 74	20S	11.5	10R	0.5	10MR	2.0	5S	1.7	78	47
799	PAU 75	40S	21.0	40S	26.8	10S	5.7	60S	32.5	78	46
800	DBW 196	20S	9.1	20MR	2.4	40S*	13.3	40S	30.0	46	35
800A		100S	65.2	100S	70.0	80S	50.0	100S	80.0	78	78
801	PAU 76	5MS	2.2	40S	9.7	10S	3.4	60S*	11.5	67	56
802	PAU 77	10MS	4.5	5MR	0.8	10MS	2.7	60S*	10.0	78	46
803	PAU 78	10MS	2.0	5MR	0.6	5MS	1.3	60S	31.5	56	45
804	PAU 79	20MS	8.4	10MS	2.9	20MR	4.4	60S	28.0	67	45
805	PAU 80	20MS	7.2	40S	15.6	0	0.0	40S	11.5	56	46
806	PAU 81	5MS	2.3	30MS	10.4	20S	6.7	20S	13.5	68	57
807	PAU 82	10MS	3.0	40S	8.8	5MR	0.7	40S	17.5	68	57
808	PAU 83	10MS	3.2	40S	8.4	0	0.0	40S	18.3	78	57
809	PAU 84	20S	10.0	5MS	2.4	5MR	0.7	80S*	15.9	78	57
810	PAU 85	20MS	5.0	30S	6.8	40S*	13.5	40S	14.2	78	56
811	PAU 86	40S	12.0	40R	9.7	5MS	2.0	20S	6.7	78	56
812	PAU 87	40S	17.8	5MS	2.0	5MS	1.3	20S	10.0	78	57
813	PAU 88	40S	18.0	40S	13.0	10MS	2.7	80S	23.7	78	57
814	PAU 89	20MR	2.2	5MR	1.2	TMS	0.3	80S*	16.5	78	46
815	PAU 90	20MR	2.7	10MS	3.2	5S	1.7	20S	5.8	78	57
816	PAU 91	20MS	7.1	10R	0.6	10S	3.3	5S	1.7	67	46
817	PAU 92	10MS	3.1	5S	1.4	10MS	2.7	30S	8.9	47	45
818	PAU 93	20MS	6.1	5MR	0.9	0	0.0	60S*	11.7	56	35
819	PAU 94	20MR	2.1	5R	0.2	0	0.0	30S	5.0	68	45
820	PAU 95	40S	27.0	10MR	2.4	10MS	4.0	40S*	6.8	67	45
820A		100S	67.5	100S	72.0	80S	60.0	100S	70.0	78	68

821	PAU 96	40MS	14.5	10MS	3.0	40S	20.7	80S*	14.8	78	46
822	PAU 97	40S	14.5	20S	8.8	40S	13.6	10S	4.5	78	56
823	PAU 98	20MR	3.6	5MR	0.8	TMR	0.1	20S	6.7	68	46
824	PAU 99	20S	12.1	20MS	3.8	0	0.0	10S	6.4	68	56
825	PAU 100	10MS	5.0	10MR	1.2	0	0.0	20S	10.7	57	46
826	PAU 101	40MS	17.0	10MS	2.4	0	0.0	20S	9.7	56	46
827	PAU 102	40S	18.5	5MS	1.6	5MR	0.7	40S	13.4	67	35
828	PAU 103	60S	31.0	10MS	4.0	5MR	0.7	80S	18.5	67	46
829	PAU 104	20MR	3.3	40S	8.8	20S	6.7	60S	34.0	78	35
830	PAU 105	10S	2.8	5MS	1.7	TMR	0.1	40S	29.2	78	47
831	PAU 106	20MR	2.1	20MS	3.6	10MR	1.3	40S	26.0	78	36
832	PAU 107	20MR	2.6	20S	10.9	TR	0.1	40S	23.0	78	46
833	PAU 108	20MR	2.2	20MS	4.5	20	6.7	60S	28.7	78	56
834	PAU 109	20MR	2.2	10S	2.8	10S	3.3	60S	30.0	78	56
835	PAU 110	20S	10.0	5MS	1.8	5MR	0.9	60S	28.2	68	56
836	PAU 111	10MR	1.2	5MS	1.3	10MS	2.7	40S	24.3	67	57
837	PAU 112	10MR	1.3	10R	0.4	10MR	1.3	40S	18.5	56	46
838	PAU 113	10MS	3.1	10R	0.5	0	0.0	60S	31.7	67	45
839	PAU 114	10MR	1.1	10R	0.6	20MS	5.3	40S	18.3	68	57
840	PAU 115	40S	18.0	5MS	2.0	TMS	0.5	20S	10.7	56	46
840A		100S	67.0	100S	82.0	80S	60.0	100S	83.3	79	78
841	PAU 116	40MR	8.0	10MS	2.6	10MS	3.3	40S	18.3	67	46
842	PAU 117	60X	20.5	20S	6.6	5S	3.0	TR	0.0	78	56
843	PAU 118	20MS	6.0	5MR	0.6	0	0.0	10MS	1.3	47	35
844	PAU 119	20MR	2.6	10R	0.4	TMR	0.1	10S	3.3	56	35
845	PAU 120	20MR	3.1	10MR	2.4	TMS	0.3	20S	5.0	79	56
846	PAU 121	20MS	6.1	10MS	2.0	0	0.0	10S	3.4	68	45
847	PAU 122	20MR	2.6	5MS	1.2	0	0.0	20S	6.3	46	46
848	PAU 123	20MS	6.0	20MR	2.6	10MR	1.3	40S*	6.7	56	46
849	PAU 124	40S	15.6	20MS	3.7	10MR	1.3	10S	3.8	56	46
850	DBW 196	20MR	3.2	10MS	2.0	0	0.0	80S	34.8	56	34
851	PAU 125	20MS	6.1	20MS	6.4	10MS	2.7	40S	9.0	67	46
852	PAU 126	40S	14.5	20MS	3.4	10MS	4.3	60S*	11.5	67	46
853	PAU 127	10MS	5.1	20MS	6.8	10MS	4.0	20S	5.7	67	46
854	PAU 128	40MR	6.5	20MR	2.6	20MR	2.8	10S	3.2	56	46
855	PAU 129	20MS	5.0	10R	0.4	0	0.0	40S	8.9	78	56
856	PAU 130	40MR	6.5	10MS	2.5	0	0.0	15S	5.3	78	46
857	PAU 131	10MS	3.0	20S	9.2	0	0.0	10MS	3.1	47	46
858	PAU 132	20S	10.3	5MR	1.1	5MR	0.7	5S	1.0	57	46
859	PAU 133	40S	21.0	10MS	2.0	0	0.0	40S*	8.2	57	46
860	PAU 134	20S	12.0	30S	9.0	40S*	13.5	10S	3.9	68	57
860A		100S	65.0	100S	68.0	80S	60.0	100S	70.0	79	78
861	PAU 135	10MR	1.0	20S	12.5	10MS	2.7	20S	5.9	57	46
862	PAU 136	40S	23.5	20S	11.6	5MS	1.3	80S*	15.7	68	47
863	PAU 137	40S	19.0	10MS	3.6	0	0.0	20S	6.3	67	46

864	PAU 138	20S	10.0	40R	9.0	0	0.0	5S	0.9	68	57
865	PAU 139	20S	8.4	20MS	4.2	0	0.0	40S	13.3	57	46
866	PAU 140	40X	11.5	80S	35.8	5MR	0.7	20S	4.7	56	45
867	PAU 141	40MS	16.5	5MR	1.0	0	0.0	10S	3.0	56	45
868	PAU 142	20MS	4.0	20S	8.5	0	0.0	40S	10.4	67	56
869	PAU 143	10MS	2.1	5MS	1.4	5MS	1.3	10MS	1.4	67	46
870	PAU 144	20MS	6.6	10S	2.8	TR	0.1	5MS	1.3	47	46
871	PAU 145	40S	13.0	40S	10.8	TR	0.1	20S	5.0	67	56
872	PAU 146	5R	0.3	5S	1.4	TMR	0.1	10S	3.1	56	46
873	PAU 147	10MR	1.2	10MS	3.1	TMS	0.3	5MS	0.7	67	56
874	PAU 148	40S	13.0	10MS	3.1	10S	4.0	40S	9.7	58	57
875	PAU 149	10MR	1.2	40S	10.4	20MS	5.3	40S	22.7	46	35
876	PAU 150	10MR	1.0	10MS	2.2	5MR	0.7	20S	5.9	47	46
877	PAU 151	20MS	7.5	10MS	2.8	0	0.0	10S	8.0	67	47
878	PAU 152	20MS	7.0	10MS	4.2	5MR	0.7	40S	20.7	56	47
879	PAU 153	20MS	7.0	20S	5.0	TR	0.1	0	0.0	67	56
880	PAU 154	40MR	5.0	20S	4.5	10MS	2.7	5MS	0.7	78	57
880A		100S	70.0	100S	62.0	80S	60.0	100S	80.0	78	68
30. PI (CI), ICAR-IIWBR Karnal											
881	CI 1	10MS	3.2	5MS	2.1	10MS	2.7	60S	38.2	45	45
882	CI 2	40S	28.0	60S	28.0	60S	24.7	80S	42.7	68	57
883	CI 3	40MS	19.0	5S	1.8	TR	0.1	40S	13.0	46	35
884	CI 4	40S	22.0	30MS	7.2	TR	0.1	60S	21.7	57	46
885	CI 5	60S	35.0	80S	35.2	60S	33.3	80S	38.2	78	57
886	CI 6	20MR	2.0	10S	2.2	0	0.0	60S	37.3	58	46
887	CI 7	20MR	2.6	60S	27.6	40S	16.0	40S	28.4	68	57
888	CI 8	5R	0.3	20S	7.0	TR	0.1	40S	14.7	67	57
889	CI 9	20MS	5.5	30S	15.8	10S	4.7	60S	17.5	78	57
890	CI 10	40S	26.0	40S	19.6	5MR	0.7	20S	4.0	78	56
891	CI 11	5MR	0.5	20S	9.6	10S	6.0	60S	26.3	67	56
892	CI 12	20MR	2.1	60S	12.2	20S	6.9	60S	29.3	67	45
893	CI 13	20MR	2.6	20R	0.4	TR	0.1	20S	8.0	78	57
894	CI 14	40S	22.1	40S	10.0	40S*	13.3	10MS	2.0	78	45
895	CI 15	0	0.0	30S	6.8	0	0.0	60S	36.7	78	45
896	CI 16	TMS	0.3	40S	11.4	20MS	8.7	80S	31.5	68	56
897	CI 17	20S	9.3	20MS	6.4	10S	4.7	60S	23.8	78	46
898	CI 18	5R	0.3	20S	9.2	0	0.0	20S	5.1	57	56
899	CI 19	20MR	2.2	40S	18.0	20S	8.3	80S	37.5	67	46
900	DBW 196	20MS	6.5	10MS	2.0	10MS	2.7	40S	22.5	56	35
900A		100S	67.0	100S	64.0	80S	60.0	100S	80.0	79	78
901	CI 20	10S	4.5	10R	0.6	10S	4.0	60S	48.7	78	46
902	CI 21	10MR	1.0	10R	0.6	20MS	5.3	80S	56.7	78	46
903	CI 22	0	0.0	40S	12.0	5S	1.7	15S	6.5	46	24
904	CI 23	20MS	5.1	20S	13.3	10S	3.3	40S	26.3	68	45
905	CI 24	10MS	4.0	40MS	14.4	10S	5.0	40S	19.8	68	57

906	CI 25	20MR	2.1	10MS	2.4	10S	4.0	80S	39.0	78	45
907	CI 26	40S	26.5	10MS	2.5	10MR	2.0	60S	27.7	56	46
908	CI 27	40MS	16.5	20S	4.0	0	0.0	40S	12.3	67	46
909	CI 28	20S	10.2	20S	10.6	5S	3.0	40S	22.3	67	46
910	CI 29	40S	30.0	10MS	3.2	5MR	0.7	60S	28.3	68	35
911	CI 30	10MR	1.0	20MS	8.6	5MR	0.8	20S	4.9	78	56
912	CI 31	0	0.0	20S	5.8	TMS	0.3	40S	23.5	68	46
913	CI 32	40MR	5.1	60S*	13.6	20S	6.7	80S	58.3	78	57
914	CI 33	40S	20.0	60S	18.2	60S	22.7	80S	70.0	78	57
915	CI 34	20MS	9.0	10MS	2.4	0	0.0	80S	36.8	56	46
916	CI 35	40MR	6.6	30MS	5.7	10MR	1.3	40S	10.8	78	46
917	CI 36	40S	22.0	60S	28.0	60S	26.7	60S	46.7	78	56
918	CI 37	40MR	6.7	40S	9.8	0	0.0	60S	43.3	78	57
919	CI 38	40MR	5.2	40S	8.8	0	0.0	60S	36.0	78	46
920	CI 39	40S	20.7	20MS	7.0	10S	3.6	40S	28.8	67	46
920A		100S	67.5	100S	66.0	80S	60.0	100S	80.0	89	78
921	CI 40	0	0.0	20S	8.0	0	0.0	80S	56.7	78	57
922	CI 41	40S	24.5	30MS	6.0	5MR	0.7	20S	9.5	57	46
923	CI 42	40MS	10.0	80S	23.6	60S	20.7	60S	43.3	78	46
924	CI 43	20MR	2.1	10MS	2.0	0	0.0	40S	21.7	56	46
925	CI 44	40S	27.5	5MS	1.2	5MR	0.7	60S	37.7	47	34
926	CI 45	40MS	8.4	10S	2.8	TMS	0.3	20S	8.2	67	35
927	CI 46	10MS	2.6	20S	15.6	10S	6.8	60S	48.3	47	46
928	CI 47	0	0.0	10MS	1.8	0	0.0	80S	51.7	46	35
929	CI 48	20MS	9.5	10S	2.5	TR	0.1	40S	13.2	35	35
930	CI 49	40S	14.0	60S	31.0	40S	21.3	40S	27.7	78	45
931	CI 50	40S	15.0	40S	8.6	10MS	2.7	60S	34.3	78	46
932	CI 51	20S	8.1	20S	6.9	10S	3.4	40S	9.1	68	46
933	CI 52	40S	18.5	5MS	2.4	5MR	0.7	10S	2.4	67	47
934	CI 53	40S	26.0	20MS	5.6	0	0.0	40S	12.7	56	46
935	CI 54	40S	27.0	20MS	4.1	5MR	0.7	10S	1.7	67	46
936	CI 55	10R	0.5	10MS	1.7	0	0.0	40S	21.1	57	46
937	CI 56	20MS	6.1	30S	7.2	20MR	2.7	60S	40.0	78	57
938	CI 57	10MR	1.3	20MS	3.4	10MR	1.4	40S	18.3	56	45
939	CI 58	10MS	4.5	10MS	1.8	5MS	1.3	20S	4.7	47	45
940	CI 59	40MS	13.0	20MS	7.6	5S	4.7	20S	6.7	67	46
940A		100S	66.0	100S	76.0	80S	60.0	100S	80.0	78	68
941	CI 60	20MS	4.5	20MS	3.8	20MS	6.0	10S	5.6	78	56
942	CI 61	40S	11.1	30MS	7.3	5MS	2.7	5S	3.1	67	35
943	CI 62	10MR	1.3	20MS	6.4	TR	0.1	TS	0.2	67	46
944	CI 63	40MR	5.0	60S*	13.3	10S	3.4	40S	11.6	68	46
945	CI 64	40MS	11.0	20MS	4.4	10MS	4.0	60S	30.0	46	35
946	CI 65	20MS	4.6	20MS	3.6	10S	3.3	40S	7.5	68	57
947	CI 66	10R	0.5	20R	0.8	0	0.0	40S	26.8	56	45
948	CI 67	20MR	2.1	40S	9.8	20S	9.3	60S	40.8	56	46

949	CI 68	20MR	2.1	20S	5.7	0	0.0	5S	2.2	78	56
950	PBW 343	20MR	2.1	60S	27.6	10S	6.3	80S	63.3	56	46
951	CI 69	10MS	3.1	10S	5.7	TMR	0.1	40S	21.7	45	35
952	CI 70	20MS	4.5	40S	15.3	10S	4.7	80S	56.7	67	46
953	CI 71	20S	6.4	20S	9.4	5MR	0.7	40S	18.3	78	57
954	CI 72	20MS	6.0	20S	11.6	0	0.0	10S	6.5	68	35
955	CI 73	10MS	5.0	20S	8.0	10S	3.3	40S	30.0	78	56
956	CI 74	10MS	5.0	20MS	4.6	0	0.0	20S	9.5	67	45
957	CI 75	10R	0.7	20MS	3.6	10MS	2.7	20MS	6.3	78	46
958	CI 76	40S	18.0	30S	8.6	20S	8.0	5MS	0.7	78	57
959	CI 77	10MS	4.1	50S	15.0	0	0.0	60S	34.2	67	46
960	CI 78	40S	27.0	60S*	14.4	20S	13.3	5S	0.9	78	57
960A		100S	66.0	100S	70.0	80S	60.0	100S	76.7	79	78
961	CI 79	20MR	2.0	40S	11.5	0	0.0	40S	26.7	67	57
962	CI 80	20MR	5.1	10MS	3.4	10S	3.3	80S	48.3	56	35
963	CI 81	20MR	3.1	5S	2.7	0	0.0	40S	23.5	78	46
964	CI 82	5R	0.3	10MS	1.8	5MS	1.3	5S	2.3	67	46
965	CI 83	10MS	2.1	10R	0.4	10MR	1.3	0	0.0	78	46
966	CI 84	40MS	19.5	20MS	5.6	0	0.0	5S	1.5	67	35
967	CI 85	20MS	8.0	5MS	1.6	0	0.0	5MS	0.8	47	35
968	CI 86	40S	21.5	5MS	2.8	10S	4.7	40S	20.1	67	35
969	CI 87	40S	35.0	30MS	12.2	10S	5.0	20S	8.3	78	46
970	CI 88	10MR	2.0	20R	1.2	TMS	0.3	20S	4.0	78	46
971	CI 89	10MR	1.1	5MS	3.2	5S	1.7	10S	2.5	78	46
972	CI 90	5MS	2.0	40S	11.4	10S	3.3	0	0.0	67	46
973	CI 91	40S*	13.0	40S	20.2	10S	4.7	20S	7.5	78	56
974	CI 92	5R	0.3	20R	0.8	0	0.0	0	0.0	78	57
975	CI 93	5R	0.3	10R	0.4	0	0.0	0	0.0	78	57
976	CI 94	20MR	2.2	10R	0.4	TMS	0.3	5MS	0.7	78	57
977	CI 95	40S	19.0	40S	9.7	40S*	13.4	10MS	2.0	78	56
978	CI 96	10MS	2.1	20R	1.7	0	0.0	20S	6.8	67	57
979	CI 97	5R	0.3	20R	0.8	0	0.0	40S	8.5	78	57
980	CI 98	40S	19.0	5S	2.7	5S	1.7	20S	4.5	78	56
980A		100S	66.3	100S	64.0	80S	60.0	100S	83.3	78	68
981	CI 99	10MR	1.3	5S	1.4	10MS	2.7	10MS	1.6	68	46
982	CI 100	50S	18.7	40S	17.8	0	0.0	10S	1.7	67	46
983	CI 101	40MR	4.1	5MS	0.9	10S	3.3	20S	13.0	78	57
984	CI 102	40S	20.5	40S	28.8	10S	3.3	5S	0.9	37	35
985	CI 103	20MR	2.1	30S	6.2	20S	6.7	10S	2.3	56	46
986	CI 104	20MS	4.1	40S	10.2	10S	4.9	10S	4.3	67	46
987	CI 105	40S	14.5	20MS	4.8	10MS	2.7	5S	1.8	78	47
988	CI 106	20S	5.1	10MS	2.6	0	0.0	5S	0.9	45	35
989	CI 107	20MS	6.6	80S	33.0	5S	1.7	10MS	2.1	68	57
990	CI 108	40S	22.0	20S	8.8	5MS	1.5	5MS	0.7	78	57
991	CI 109	40MS	15.1	80S	35.6	10MS	2.7	5S	0.9	68	57

992	CI 110	5R	0.3	10S	4.2	5MS	1.3	10S	3.7	78	57
993	CI 111	20S	7.0	5MS	1.6	5MS	1.3	40S	14.7	78	57
994	CI 112	20S	7.8	5MR	0.8	TMS	0.3	10MS	3.5	57	56
995	CI 113	20S	10.1	5MR	0.5	5MR	0.8	5S	1.7	56	57
996	CI 114	20MS	5.1	10R	0.4	10MR	1.3	10S	4.0	78	57
997	CI 115	10MS	4.0	10R	0.5	TR	0.1	10MS	3.5	68	57
998	CI 116	20MS	6.0	5MR	0.8	TR	0.1	5MS	1.4	78	57
999	CI 117	20S	9.0	20MS	3.6	20MR	2.7	10MS	2.2	68	57
1000	DBW 196	20MS	7.1	20MS	3.6	5MS	1.3	40S	30.2	57	46
1000 A		100S	66.3	100S	68.0	80S	60.0	100S	76.7	78	68
1001	CI 118	10S	4.5	5MR	0.8	20MS	6.0	5MS	0.8	78	57
1002	CI 119	60S	25.0	10MS	2.1	10MS	4.0	10S	6.0	78	58
1003	CI 120	10MS	4.0	10R	0.5	TMS	0.3	10S	6.0	78	57
1004	CI 121	40MR	4.0	20S	8.2	0	0.0	10S	3.5	68	46
1005	CI 122	40S	12.6	30S	7.6	5MR	0.7	40S	18.7	56	46
1006	CI 123	40S	15.5	60S*	14.0	60S*	21.3	60S	40.8	56	36
1007	CI 124	20S	10.0	20S	8.2	TMS	0.3	60S	34.8	68	47
1008	CI 125	40MS	9.6	40S	21.0	20S	8.1	10MS	3.5	67	46
1009	CI 126	5MS	1.6	40S	8.4	0	0.0	10S	3.0	78	67
1010	CI 127	20MR	2.0	20S	8.0	5S	1.7	10S	2.7	67	57
1011	CI 128	10MS	2.0	10R	0.4	10S	3.3	10S	1.8	67	46
1012	CI 129	40S*	10.1	10MS	2.5	5MR	0.7	40S	19.0	56	46
1013	CI 130	10MR	1.7	40S	17.8	10S	4.7	40S	22.8	78	57
1014	CI 131	5MR	0.5	40S	18.9	40S*	15.3	40S	12.8	78	57
1015	CI 132	10MR	1.6	40S	11.8	10MS	2.7	10S	2.5	67	57
1016	CI 133	20S	5.0	10R	0.6	0	0.0	10S	5.7	56	46
31. Dr. Arvind Kumar, ICAR-CSSRI, Karnal											
1017	KRL 420	20MS	8.2	10MS	2.8	0	0.0	40S	26.8	68	47
1018	KRL 421	40MS	14.0	40S	9.6	5MS	1.3	10MS	2.8	68	46
1019	KRL 422	20S	6.6	40S	9.8	40S*	13.3	40S	30.0	68	46
1020	KRL 423	20S	6.0	5S	1.2	10MS	2.7	20S	4.5	67	56
1020 A		100S	71.0	100S	64.0	80S	60.0	100S	76.7	79	78
1021	KRL 424	40MS	10.1	40S	16.2	10S	4.7	60S	40.8	67	56
1022	KRL 425	40MR	4.1	80S	34.6	40S*	14.7	60S	46.7	78	57
1023	KRL 426	20MR	2.1	40S	9.9	40S*	14.0	60S	44.2	78	56
1024	KRL 427	40MR	4.0	20R	0.8	0	0.0	60S	37.5	67	46
1025	KRL 428	20MS	4.2	40S	8.4	5S	1.7	60S	28.2	78	46
1026	KRL 429	40MS	13.0	40S	9.8	10S	3.3	5MS	0.8	78	45
32. Dr. Lakshmi Kant, ICAR-VPKAS, Almora, Uttarakhand											
1027	VW 1801	40MS	9.5	20MS	5.6	10MS	2.7	20S	12.7	67	46
1028	VW 1802	40MR	4.2	10R	0.5	0	0.0	10MS	2.7	56	36
1029	VW 1803	40S	26.5	5S	3.4	TR	0.1	5MS	0.7	68	35
1030	VW 1804	40S	32.0	10MR	1.7	10MS	4.0	0	0.0	68	46
1031	VW 1805	60S	31.5	10MS	3.0	10MS	2.7	0	0.0	67	46

1032	VW 1806	20MS	4.1	30S	15.8	40S*	14.0	10MS	2.8	56	46
1033	VW 1807	20MR	2.6	10MS	2.6	0	0.0	5MR	0.5	67	57
1034	VW 1808	20MR	2.1	30S	10.6	10S	3.3	20S	3.7	68	57
1035	VW 1810	0	0.0	5S	3.0	0	0.0	40S	13.7	68	45
1036	VW 1811	40MR	4.1	80S	36.6	10S	3.3	5MS	0.7	78	46
1037	VW 1812	0	0.0	40S	12.0	5S	1.9	0	0.0	57	35
1038	VW 1813	20MS	6.6	20S	12.2	10MR	1.3	60S	14.8	58	35
1039	VW 1814	40S	11.1	40S	22.4	40S*	13.3	40S	13.8	67	45
1040	VW 1815	40S	13.1	40S	10.3	40S*	13.3	5MS	0.7	57	35
1040 A		100S	66.0	100S	70.0	80S	60.0	100S	63.3	79	78
1041	VW 1816	40S	14.0	20MS	8.0	5MS	1.3	10S	1.7	78	57
1042	VW 1817	20S	5.2	10S	2.4	TR	0.1	5MS	0.7	68	46
1043	VW 1818	40S	12.1	10MS	3.4	5S	3.3	TS	0.2	78	45
1044	VW 1819	20MS	6.1	30S	6.4	20S	6.7	5MS	0.7	67	46
1045	VW 1820	40S	18.5	10MS	5.2	5MS	1.3	10S	3.3	68	45
1046	VW 1821	40S	12.1	30S	9.8	5MR	0.7	10S	1.7	67	46
1047	VW 1822	0	0.0	10MR	1.6	0	0.0	5S	0.8	78	56
1048	VW 1823	10MR	1.0	20R	0.9	0	0.0	40S	12.7	78	56
1049	VW 1824	20MR	2.1	60S	21.8	10S	3.3	0	0.0	56	35
1050	DBW 88	20MS	4.1	5MS	1.8	10S	4.1	60S	35.0	67	45
1051	VW 1825	20MS	4.6	10MS	3.2	5R	0.3	40S	21.7	67	45
1052	VW 1827	40MR	6.3	5MS	1.2	0	0.0	5S	2.2	67	46
1053	VW 1828	40MS	12.0	5MR	1.2	5MR	0.7	10S	2.5	57	35
1054	VW 1829	40MS	13.4	80S	56.0	60S	38.0	40S	23.0	67	45
1055	VW 1830	20MS	4.2	40S	15.0	10S	3.3	TMR	0.1	78	46
1056	VW 1832	10MS	3.0	20S	8.1	10MS	2.7	0	0.0	67	56
1057	VW 1833	10MS	2.1	10MS	2.8	TR	0.1	0	0.0	68	45
1058	VW 1834	40S	28.1	40S	28.8	10S	3.5	0	0.0	47	46
1059	VW 1835	40S	14.4	40S	32.8	5S	1.7	5MS	0.7	46	35
1060	VW 1836	40S	22.0	20S	4.5	10MS	3.3	5MS	1.6	78	56
1060 A		100S	66.0	100S	64.0	80S	60.0	100S	76.7	79	68
1061	VW 1837	10MR	1.0	10S	3.6	10MR	1.3	15S	5.5	78	46
1062	VW 1838	40MS	8.1	10R	0.4	0	0.0	60S	21.8	78	68
1063	VW 1839	40S	15.0	10MS	4.2	5MR	0.9	60S	31.3	78	56
1064	VW 1840	60S	29.5	50S	26.4	40S*	16.0	40S	15.3	78	46
1065	VW 1841	20MR	2.0	40S	8.5	10S	3.3	20S	10.0	78	56
1066	VW 1842	20MS	5.0	10R	0.4	0	0.0	60S	16.0	78	45
1067	VW 1843	20MS	5.1	20MS	7.6	5S	2.3	10S	5.5	78	46
1068	VW 1844	40S	12.2	5MR	1.0	TR	0.1	40S	21.2	78	46
1069	VW 1845	5MR	0.5	5MS	1.6	0	0.0	15S	8.0	56	35
1070	VW 1846	40MS	9.5	5MS	2.4	0	0.0	10S	4.7	78	67
1071	VW 1847	40S	11.1	10MS	5.0	5S	3.0	20S	9.3	78	68
1072	VW 1848	60S	26.0	60S*	15.8	40S	17.7	20MS	4.2	78	57
1073	VW 1849	40S	25.5	90S	38.8	5S	4.7	0	0.0	67	46

1074	VW 1850	10MR	1.1	10R	0.4	TMR	0.1	10S	2.5	68	57
1075	VW 1851	20R	1.0	20R	0.8	TR	0.1	60S	24.3	78	57
1076	VW 1852	20S	5.1	20MS	8.0	10S	4.0	40S	13.0	78	56
1077	VW 1853	20MR	2.0	40S	15.6	20S	6.7	40S	24.0	78	57
33. PI (CI), ICAR-IIWBR Karnal											
1078	QBP -17 -11	40S	18.5	10MS	4.2	5MR	0.7	10S	5.3	57	56
1079	QBP -17 -14	20MR	2.1	10MS	2.8	10MS	2.7	10S	2.7	56	46
1080	BWL 6893	40S	16.7	20S	5.6	5MS	2.7	20S	6.7	47	35
1080 A		100S	66.0	100S	64.0	80S	60.0	80S	76.7	79	78
1081	QBP -17 -13	40S	21.5	10MS	2.6	20MS	6.0	20S	4.7	78	57
1082	QBP -17 -12	40S	20.0	10R	0.7	10MR	1.4	20S	7.7	56	46
1083	QBP -17 -09	40S	10.1	40S	8.6	5MR	1.1	60S	30.0	56	46
1084	QBP -17 -10	20MS	4.1	40S	8.6	40S*	13.3	60S	31.7	67	46
1085	QBP -17 -08	40S	15.0	50S	11.2	5S	2.3	80S	39.2	56	45
1086	QBP -17 -06	20MS	4.2	20S	5.4	0	0.0	40S	25.8	67	57
1087	HUWB 03	20MS	4.0	60S	12.9	40S	13.6	40S	26.0	78	67
1088	QBP -17 -07	20MR	2.3	20MS	4.4	0	0.0	10MS	3.0	78	45
1089	BWL 6891	20MS	4.6	20R	1.2	10S	4.0	20MS	5.5	78	46
1090	BWL 6896	40S	22.0	20S	9.4	5S	3.3	10S	3.3	67	46
1091	IC 427824(85)	20MS	4.3	5MS	1.6	10MS	2.7	80S	41.7	78	57
1092	BWL 6889	20MR	2.1	5MS	1.0	0	0.0	5MS	1.3	67	56
1093	HUWB 02	20S	7.7	10R	0.4	10MR	1.3	80S	40.0	67	46
1094	HTW 63	60S	32.5	40S	16.0	20S	8.0	60S	28.3	67	57
1095	HUWB 01	40MR	6.0	20S	5.8	5S	1.7	60S	36.0	57	46
1096	BWL 6895	20S	5.3	5MS	1.6	TMR	0.2	40S	10.7	58	46
1097	BWL 6894	40MR	5.1	20R	1.2	0	0.0	60S*	10.0	67	56
1098	DWAP 1722	TMR	0.2	5MS	1.0	TMS	0.3	80S	38.3	47	35
1099	HUWB 04	40S	17.3	20S	4.4	0	0.0	80S	33.3	68	46
1100	DBW 196	20S	9.2	10MS	2.8	5S	1.7	60S	25.8	68	47
1100 A		100S	65.0	100S	68.0	80S	60.0	100S	66.7	78	68
1101	HUWB 05	20S	11.0	20MS	4.8	TS	0.4	40S	27.5	57	46
1102	BWL 6890	20MS	6.0	20S	5.2	0	0.0	40S*	6.8	67	46
1103	WH 1228	40MS	13.0	40S	8.2	10S	3.3	20S	3.3	67	56
1104	IND 506	40S	26.5	5S	1.4	5S	1.7	10S	3.7	67	46
1105	BWL 6888	40MS	11.6	5MR	0.8	10S	4.0	40S	12.7	78	46
1106	RWP -2017- 22	10MS	4.3	60S	12.2	40S	16.0	10MS	4.2	67	46
1107	RWP -2017- 25	20MS	8.1	20S	6.2	TR	0.1	20S	11.7	56	45
1108	WH 1202	40S	16.0	40S	10.8	40S	14.7	10S	2.3	78	46
1109	HD -3086 (C)	40S	14.5	40S	8.8	40S	14.1	20S	4.7	78	46
1110	MACS - 6222 (C)	20MR	2.6	20S	12.0	10MR	1.3	20S	8.4	68	46
1111	GW - 322 (C)	20S	6.1	40S	15.0	0	0.0	60S	30.0	56	46
1112	K- 0307 (C)	40MR	6.6	60S	25.6	0	0.0	60S	31.3	56	45
1113	HPBW -01 (C)	20MS	5.2	30S	11.2	0	0.0	40S	25.0	67	56
1114	WB - 02 (C)	20MS	4.2	30S	10.8	10S	3.3	40S	20.7	68	57

34. Dr. V. Panchal, Ronak Seeds, Ahmedabad											
1115	Super Shakti 040	20MS	4.1	40S	19.4	TR	0.1	60S	46.7	78	46
35. Dr. R.K. Sharma, ICAR-IARI New Delhi											
1116	HD 3311	20MS	6.6	10S	4.6	10S	3.4	20MS	4.7	47	35
1117	HD 3312	10S	4.6	40S	8.5	10S	3.3	40S	12.5	67	46
1118	HD 3313	10MS	4.2	20R	0.8	0	0.0	5MS	1.3	56	46
1119	HD 3314	20MS	5.2	10R	0.5	5MS	1.3	20S	6.2	56	45
1120	HD 3315	40S*	21.0	20MS	4.4	10S	3.3	60S	30.0	47	36
1120 A		100S	65.0	100S	72.0	80S	60.0	100S	80.0	78	67
1121	HD 3316	60S	27.3	10S	3.8	5S	1.7	40S	20.7	47	46
1122	HD 3317	10MS	4.0	20S	12.2	10S	3.5	20S	9.7	46	45
36.PI (CI) ICAR-IIWBR Karnal											
1123	CI 134	40S*	10.2	40S	24.1	20S	6.7	60S	32.2	67	46
1124	CI 135	40S	13.0	10MS	3.6	5MR	0.7	60S	27.5	67	46
1125	CI 136	40S	12.2	20MS	9.2	5S	3.0	40S	26.7	68	57
1126	CI 137	20MR	2.2	30S	9.4	20MS	7.0	40S	30.0	78	46
1127	CI 138	40MR	4.2	40S	12.2	20S	6.7	20MS	6.5	78	57
37. PI (CI) ICAR-IIWBR Karnal											
1128	KRL 410	20MS	4.2	10MS	4.5	0	0.0	30MS	7.0	68	46
1129	KRL411	20MS	7.0	40S	17.6	10S	3.3	TR	0.0	78	46
1130	KRL412	60S	29.5	80S	37.6	10MS	3.3	5S	1.5	67	46
1131	KRL413	10S	4.6	40S	8.4	0	0.0	20S	11.7	78	46
1132	KRL414	5MR	1.8	5MS	1.6	TMS	0.3	0	0.0	56	56
1133	KRL415	20MR	4.3	20MS	3.7	5S	1.7	40S	16.3	56	46
1134	KRL416	40S*	21.5	10S	2.9	20MR	4.3	40S	22.7	56	46
1135	KRL417	20S	5.1	20MS	3.6	5S	1.7	60S	33.3	57	46
1136	KRL418	20MS	5.1	40S	8.3	10S	3.5	60S	32.7	68	46
1137	KRL419	40MS	14.0	40S	9.2	10S	5.7	60S*	11.7	67	46
1138	DWAP1720	40S	12.7	40S	9.0	10S	6.7	60S	16.7	68	46
1139	DWAP1721	20MS	5.1	20S	18.8	10S	3.3	60S	27.5	78	57
1140	RWP2017-29	40S	17.0	60S	37.8	10MS	4.0	40S	14.7	78	57
1140A		100S	66.0	100S	72.0	80S	60.0	100S	76.7	79	78
1141	RWP2017-30	40S	22.3	80S	32.0	10MS	5.7	40S	11.0	78	57
1142	LBP2017-18	20MR	2.1	40S	14.6	0	0.0	20S	13.3	89	56
1143	LBP2017-19	40S*	10.5	40S	13.0	20S	7.3	60S	30.0	78	57
1144	WS1701	40S	14.6	5MS	1.8	TMR	0.2	40S	15.7	57	47
1145	WS1702	40S	14.3	30S	7.0	5S	1.7	60S	27.7	78	46
1146	WS1703	20MS	6.6	30S	6.6	5MR	0.8	40S	18.4	47	35
1147	NW7060	40S	14.5	10MS	2.2	5MR	0.7	40MS	10.0	67	46
1148	NW7062	20MR	2.0	5MR	0.8	TMS	0.3	40S	20.0	78	57
1149	K1605	40S	11.2	20S	8.0	40S	15.7	20S	8.8	67	46
1150	DBW 196	40MR	4.1	60S*	14.6	60S	25.3	40S	22.3	78	46
1151	WH1228	40S	11.4	40S	16.3	20S	6.7	20S	9.7	78	46

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Wheat crop health was monitored during off season and crop season (October and November) 2017 by different cooperators of All India Coordinated Research Project on Wheat and Barley. The post harvest grain analysis of wheat samples collected from different 'mandies' was done for presence of Karnal bunt, black point and grain discolouration during 2017 and results are given in this newsletter. The Crop Protection Technologies' for different wheat growing zones for 2017-18 crop season were finalized in the 56th All India Wheat & Barley Workers' Meet held at BHU, Varanasi from 25-28 August, 2017 along with brief strategy planning meetings are also being presented in this issue.

Highlights

- **No yellow rust incidence reported from any part of North India in Nov. 2017.**
- **No wheat blast reported from West Bengal districts close to Indo-Bangladesh borders.**
- **The Karnal bunt incidence was 17.7% on an average in North India whereas Central and Peninisular zone wheat samples were free from Karnal bunt.**
- **Strategy planning meetings were held before onset of sowing of wheat to control yellow rust, Karnal bunt, smuts and to manage wheat blast threat.**
- **A skill up gradation course on ""Survey and surveillance, creation of epiphytotics and uniform recording of diseases in wheat & barley", will be held from December 18-20, 2017, at Crop Protection Programme, ICAR-IIWBR Karnal (Haryana)**
- **The crop protection technologies for 2016-17 crop season are given in the issue.**

Off season survey of rusts

To investigate the role of grasses in the epidemiology of wheat rusts, off seasonsurveys were undertaken by the staff of IIWBR,RS Flowedale, Shimla . The rust samples were collected from grasses growing in different parts of districts of Lahaul & Spiti, Shimla and Bilaspur of Himachal Pradesh during September to November, 2017. The rusts of 20 samples of different grass species were inoculated on different cereals. Wheat didn't get infection, however one grass sample from Shimla infected oat. It indicated that these grasses were not playing any role in the epidemiology of wheat rusts.
(Source: S. C. Bhardwaj and scientists of IIWBR RS Flowerdale)

Post harvest analysis of grains

KARNAL BUNT (KB)

A total of 7,144 grain samples collected from 2016-17 crop after harvest from various mandies in different zones, and were analyzed at cooperating centers (Table 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 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**	**16.51**	**0.00-1.99**
Haryana	1516	865	57.41	0.05-3.00
Delhi	130	0	0	-

State	Total samples	Infected samples	% infected samples	Range of infection
Rajasthan	**509**	**291**	**42.81**	**0.1-5.2**
Uttarakhand	920	62	6.74	0.25-10.00
Jammu	483	83	17.18	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**	**17.715**	0.1-20.0

Av. Range of infection

Strategy Planning Meetings

(i). Planning meeting on "Seed Treatment of Wheat" in the office of DG, Agriculture, Govt. of Haryana, Panchkula on 19 July 2017 under chairmanship of Hon. Shri . **Dusmanta Kumar Behera, Director, Agriculture, Govt. of Haryana, Krishi Bhavan, Sector 21, Panchkula on 19 July 2017:** The meeting was attended by senior addl. and deputy directors of Agriculture and MD of Haryana Beej Corporation as well as Dr. R.S. Beniwal of CCS HAU Hisar. The issue of seed treatment of wheat seed produced by public sector units in Haryana was discussed at length and I supported fungicidal seed treatment keeping in view of presence of loose smut and flag smut in Haryana. It was agreed to treat the seed of wheat with recommended fungicides like tebuconazole 2DS, Carbendazim 50 WP and Carboxin 75 WP and tender the procurement of these using chemical name. I suggested not mentioning seed treatment for Karnal bunt since it may not work until and unless seed crop is given foliar sprays of fungicides like propiconazole @0.1% at ear emergence stage.

(ii). Preparedness on occurrence of blast disease on wheat: Strategy planning meetings was also conducted on "Preparedness on occurrence of blast disease on wheat" on 07.9.2017 in Kolkata under Chairmanship of Additional Chief Secretary, Govt. of west Bengal. It was attended by Agriculture Commissioner and Joint Secretary (Crops) DAC & FW, ADG (PP&B), Director, IIWBR and other higher officials of Govt of West Bengal, ICAR officials and SAUs. It was decided to keep no wheat zone up to 5 km distance from Border of Bangladesh in Indian states, prevent entry of wheat seed and grains from Bangladesh, wheat holiday in Nadia and Murshidabad districts as well as planting of trap plot nurseries along Indo-Bangladesh borders.

(iii). 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 10 October 2017 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 1500 farmers attended the fair. The seed of rust resistant varieties like WB 02 and H 3086 was distributed. 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.

(iv). Management of yellow rust and Karnal bunt: Strategy planning meeting was conducted to "Evolving strategies for enhancing wheat production with special reference to management wheat rust and Karnal bunt disease"on 6.10.2017 at IISR Lucknow, U. P. under the chairmanship of hon. Secretary (AC &FW). The overview was given by Director, IIWBR and states and SAUs of UP, Bihar, MP, Haryana, H.P and Punjab. The participants were informed about the yellow rust resistant varieties for different states and arranging corrections in the literature prepared by UP Plant Protection department. The meeting was also addressed by ACP, U. P., Secretary Agric. and Director, U. P. Govt. The Secretary AC & FW stressed the need of proper management of wheat diseases and lauded the efforts of IIWBR on evaluation and identification of wheat blast resistant wheat varieties. He stressed the need to increase3 the productivity in wheat in U.P. and in India so that excess grains may be exported. JS (Crops) of DAC & FW stressed the need to replace older and susceptible varieties of wheat with newly released varieties and exchange of information on diseases for their proper management at farmers' fields. Director, IIWBR Karnal offered help to all the wheat growing states and particularly to Haryana and U. P. in replacing old varieties of wheat and adoption of new technology in wheat production and protection.

(v). Project proposal presentation Meeting on wheat blast on 14 Nov. 2017: Director, IIWBR Karnal made presentation and discussion of wheat blast project in the meeting chaired by Hon. Secretary, DAC & FW, Krishi Bhavan, New Delhi. It was also attended by Joint Director (Agric. Extension), Govt. of West Bengal.

(vi.) **Wheat Blast workshop in Bangladesh:** The workshop was held from 13-14 July 2017 in Dhaka, Bangladesh and was organized by CIMMYT- BARI. It was attended by ADG (FFC) and Dr. Dr. D. P. Singh, from ICAR-IIWBR, Karnal. The strategies were discussed for arranging evaluation of Indian wheat varieties against wheat blast in Bangladesh at its hot spot location, Jessore.

Evaluation of Indian wheat varieties against wheat blast: A total of 100 new Indian wheat varieties were sent for testing against wheat blast in Bolivia, Bangladesh and USA through CIMMYT.

Crop Protection Technologies for 2017-18 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 and NHZ, varieties like WB 02, PBW 723, HD 4728, DBW 90, PBW 644, WH 1080, WH 1142, DBW 71, TL 2942, TL 2969, HS 507, HS 542, VL 829, VL 892, KRL 210, HD 3171 and K1317 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 at least 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 Uttrakhand 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 PDW 223, PDW 291, PDW 314 (Durum) in Northern Western Plains Zones, HPW251, HS 490, HS 507 in Northern Hills Zone and GW 366, HD2864, MP 3336 and HI 8498 (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 **NHZ:** HS 490, VL 829, **NWPZ:** C 306, HD 3086, WH 1021, WH 1080, WH 1142, **NEPZ:** DBW 39, HD 2733, HD 2888, K 0307, K 8027, **CZ:** DBW 110, HD 8627 (d) 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

Aphids are present in almost all wheat growing areas in the country. The aphids exist in different stages, viz., winged (alates), wingless (apterous), sexual and asexual forms. The rapid spread takes place through asexual reproduction where females give rise directly to nymphs rather than eggs. Infestation occurs usually during January, till crop maturity. Their damage leads to discoloration of leaves.

Management

- Since the aphids first appear on borders of the crop, spray the infested border rows with Imidacloprid 200 SL @20g a.i./ha at the beginning of the aphid colonization to check their further spread.
- Install yellow stick traps (4-5/acre) for monitoring aphid population in the field.
- Conserve natural enemies of aphids i.e. coccinellid beetles, spiders, syrphid fly, lacewings etc. for managing the aphid population in field.
- Spray 1000 ml of Quinalphos 25% EC in 500 liters of water per hectare 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.
- Seed treatment with Chloropyriphos 20% EC (3–4 ml/kg seed) or Fipronil 5 SC @ 6 ml/kg and imidacloprid 17.8SL @ 3.5 ml/kg can be done to avoid termite damage
- In standing crop, apply Chloropyriphos 20 EC by mixing 3 liter of chemical in 50 kg soil per hectare and broadcast in field before irrigation.

Pink stem borer

The incidence of pink stem borer is observed more in fields of rice-wheat cropping system where wheat is sown in zero tillage fields. For its management, foliar spray of quinalphos (Ecalux) 800 ml /acre as soon as pink stem borer is seen. Irrigation also helps in reducing the pink stem borer damage.

Management

- Hand picking of infested tillers and their destruction reduces borer attack.
- Foliar spray of quinalphos (Ecalux) 800 ml /acre as soon as pink stem borer is observed.
- Irrigation also helps in reducing the pink stem borer damage.
- To avoid the infestation use of Nitrogen fertilizers in split doses.
- Complete destruction of crop residues from previous crop will significantly reduce pink stem borer infestation in field.

Yellow rust of wheat

First report of yellow rust occurrence during last five crop seasons

Crop year	First occurrence	Location	State
2016-17	29 Dec.2016	Bella Dhyani (Ropar)	Punjab

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

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.


Symptoms of yellow rust of wheat

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.

Crop health report

Maharashtra

Period: 1st - 30th November 2017

Wheat sowing has been completed in many of farmers' field in timely sown areas. The late sown crop will be in progress after sugarcane harvesting in Baramati area. Wheat crop reached at completion of seedling growth stage. There was no natural incidence of any rust, blight and other pests. Overall crop health status was good till today.

During the 4th week of November, weather was cloudy for few days and precipitation was received (29.2 mm), so the sowing was delayed in many of the farmer's fields. The information of the climatic parameters (1st - 30th Nov. 2017) has been presented as below:

Week	Temperature		Rains (mm)	Relative humidity		Remark
	Max.	Min.		Max.	Min.	
44	30.27	15.01	0.0	83.49	36.17	--
45	30.46	13.84	0.0	87.35	35.74	--
46	30.61	12.82	0.0	83.26	36.28	--
47	30.66	18.20	29.2	89.31	60.68	2 days rainy 4 days cloudy
48	29.49	12.13	0.0	88.13	36.58	--
Average mean	**30.30**	**14.40**	**29.2**	**86.31**	**41.09**	

(Source: B.K. Honrao)

Skill up gradation course entitled "Survey and surveillance, creation of epiphytotics and uniform recording of diseases in wheat and barley from 18 - 20 December 2017 at ICAR-IIWBR Karnal

Wheat and barley suffers from many biotic stresses. The diseases like rusts, foliar blights, powdery mildew, smuts and Karnal bunt and insect pest like aphid and nematodes are gaining importance due to changes in cropping system, tillage practices and environment. As a result newer pathotypes of existing diseases and new diseases are emerging and become a matter of concern to the production of wheat and barley. So far most of these are managed effectively mainly though deployment of resistant varieties.

For the development the resistant varieties which may adopt at larger areas, a continuous programme for identify the resistance sources and evaluation of breeding material at multi-location is prerequisite. To achieve this, it is important to use the latest technologies for monitoring of diseases, creation of artificial epiphytotics and uniform disease recording. This will increase the precision and improve the data quality thus evolve newer varieties of wheat and barley resistant to diseases and insect pests. Therefore, a skill up gradation course are being conducted mainly for co-operators of AICRP on Wheat and Barley, officials of other departments of GOI, State Agriculture Departments, Universities as well as seed producing governmental agencies. A total of 26 participants will be admitted. The last date of application is 3rd Dec. 2017. There will be no registration fee.

Acknowledgement:
Thanks to Drs.Honorao and S. C. Bhardwaj for contributions and computer section of IIWBR for uploading the newsletter on web page.

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गेहूं फसल स्वास्थ्य न्यूज़लेटर
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करनाल-132001(हरियाणा) भारत

दिसंबर, २०१७

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गेहूँ के फसल स्वास्थ्य की निगरानी दिसंबर 2017 के दौरान आई.आई.डब्लू.बी.आर. द्वारा और गेहूँ और जौ पर ऑल इंडिया कोऑर्डिनेटेड रिसर्च प्रोजेक्ट के विभिन्न सहयोगियों द्वारा की गई। इस महीने पंजाब, हरियाणा, एचपी, वेस्ट यू.पी., उत्तरांचल के तराई भाग और पहाड़ियों में पीला रतुआ और अन्य बीमारियों और कीटों के सर्वेक्षण और निगरानी के लिए दो टीमों का गठन किया गया। साथ ही भारत-बांग्लादेश सीमा पर गेहूँ के फसल स्वास्थ्य की निगरानी की गयी। दिसंबर 2017 के दौरान गेहूँ के फसल स्वास्थ्य पर इस न्यूज़लेटर में प्रकाश डाला गया है।

हाइलाइटस

- दिसंबर, 2017 में पीले रतुआ और अन्य बीमारियों और कीटों के लिए फसल स्वास्थ्य सर्वेक्षण आयोजित किए गए। दिसंबर 2017 में उत्तर भारत के किसी भी हिस्से से पीले रतूए की कोई सूचना नहीं मिली।
- केन्द्रीय और प्रायद्वीपीय क्षेत्र के किसानों के खेतों से भूरे रतुआ की रिपोर्ट केवल कर्नाटक से मिली जोकि 5 एमएस इंटेंसिटी तक पायी गयी।
- काले रतुआ आने की कोई रिपोर्ट नहीं मिली।
- भारत-बांग्लादेश सीमाओं के करीब, पश्चिम बंगाल के जिलों में गेहूं में ब्लास्ट रोग नहीं मिला।
- "गेहूँ का पीला रतुआ" विषय पर एक वीडियो फिल्म आई.आई.डब्लू.बी.आर. द्वारा बनायी गयी तथा इसका पहला प्रदर्शन 18 दिसंबर, 2017 को आई.आई.डब्लू.बी.आर. करनाल में हुआ। यह वीडियो फिल्म स्वतंत्र रूप से विभिन्न सरकारी एजेंसियों और किसानों को आई.ई.डब्लू.आर. (https://iiwbr.icar.gov.in/2017/12/movie-on-yellow-rust/) के वेबपेज पर उपलब्ध है।
- फसल सुरक्षा कार्यक्रम , आई.सी.ए.आर.- आई.आई.डब्लू.बी.आर. (हरियाणा) में " गेहूँ और जौ में फसल स्वास्थ सर्वेक्षण और निगरानी , रोगों की कृत्रिम महामारी पैदा करना तथा रिकॉर्डिंग की एकरूपता", विषय पर 18-20, दिसम्बर 2017 को एक "कौशल उन्नयन पाठ्यक्रम" का आयोजन किया गया। कुल 30 प्रतिभागियों ने भाग लिया। ये आई.सी.ए.आर., एस.ए.यूज., सी.आई.पी.एम.सी. (डी.पी.पी. एंड क्यू.एस.) कोलकाता, एन.एस.सी. , के.वी.के., आ.त्मा., यू.पी. एवं हरियाणा कृषि विभाग से थे।
- भोला पासवान शास्त्री कॉलेज ऑफ एग्रीकल्चर (बी.ए.यू.) , पूर्णिया, बिहार में 9 जनवरी 2018 को राज्य कृषि विभागों, एसएयू और किसानों के लिए "फसल रोग निगरानी और गेहूँ का स्वस्थ बीज

उत्पादन" नामक एक प्रशिक्षण कार्यक्रम आयोजित किया जाएगा। करीब 80 किसानों के भाग लेने की उम्मीद है।

- 29 दिसंबर 2017 तक किसानों के मैदानों पर पीले रतुआ की अनुपस्थिति को ध्यान में रखते हुए , उत्तरी पहाड़ियों पर सूखा की स्थिति , उत्तरी मैदानों में बारिश की कमी , उच्च प्रभाह वाली हवाओं की कमी, नवंबर और दिसंबर की शुरुआत में पहाड़ियों पर कम तापमान तथा साथ ही प्रतिरोधी किस्मों के तैनाती से यह अनुमान लगाया गया है कि पीले रतुआ का आगमन इस वर्ष (२०१८) में उत्तरी मैदानों में देर से होगा और इसलिए यह अपेक्षा की जाती है कि पीला रतुआ गेहूँ में ज्यादा नुकसान नहीं करेगा। लेकिन सभी सम्बंधित एजेंसीज को गेहूँ में पीले रतुए के लिए निगरानी रखनी चाहिए तथा रतुआ दिखने पर तुरंत फसल पर 'प्रोपिकोनाज़ोल' नामक दवा (0.1%) घोल का छिड़काव करना चाहिए। इससे रतुआ का फैलाव को खेत में और फैलने से रोका तथा अन्य खेतों में फ़ैलाने से विलंबित किया जा सकता है।

Wheat crop health was monitored during December, 2017 by IIWBR constituted teams and different cooperators of All India Coordinated Research Project on Wheat and Barley. Two teams were constituted to do the survey and surveillance for yellow rust and other diseases and insect pests diring the month and surveyed parts of Haryana, Punjab, H. P, West U. P. tarai and foot hills of Uttaranchal. Likewise one team visited West Bengal close to Bangladesh border to assess wheat crop health. The details along with highlights on wheat crop health during December 2017 are given in this issue of newsletter.

Highlights

- **Crop health survey tours for yellow rust and other diseases and insect pests were conducted in Decmber, 2017. No yellow rust incidence reported from any part of North India in December 2017.**
- **No report of brown and black rust was reported from farmers' fields from central and Peninsular zone except in two fields in Karnataka state where brown rust incidence was up to 5MS.**
- **No wheat blast reported from West Bengal districts close to Indo-Bangladesh borders.**
- **A video film on "Gehoon Ka Peela Ratuaa" was prepared, edited and screened on 18 Dec. 2017 at IIWBR Karnal. It is freely available to different government agencies and farmers on web page of IIWBR (https://iiwbr.icar.gov.in/2017/12/movie-on-yellow-rust/).**
- **A skill up gradation course on "Survey and surveillance, creation of epiphytotics and uniform recording of diseases in wheat & barley" was organized from December 18-20, 2017, under Crop Protection Programme, ICAR-IIWBR Karnal (Haryana). A total of 30 participants attended. These were from centres of AICRPW&B, SAUs, CIPMC (DPP&QS) Kolkata NSC, KVKs, ATMA, Agriculture departments of U.P and Haryana.**
- **A training programme entitled "Disease surveillance and wheat seed production" will be conducted for state agriculture departments, SAUs and farmers on 9 January 2018 at Bhola Paswan Shastri College of Agriculture (BAU), Purnea, Bihar. About 80 farmers are expected to participate.**
- **Keeping in view of no occurrence of yellow rust at farmers'fields till 29 Dec. 2017, prevailence of drought situation on Northern Hills, lack of rains in northern plains, lack of high winds and cooler weather on hills early in Nov. and Dec. 2017, as well as deploynment of resistant varieties, it is predicted that yellow rust will arrive late in Northern plains and hence not expected to cause losses in wheat. However regular monitoring and spray of infected fields with propiconazole (0.1%) is required till mid Feb. 2018.**

Wheat Crop Health Surveys:

1st Wheat blast survey along Indo Bangladesh Borders in West Bengal during 27-28 November, 2017

A Team comprised of Dr. Prem Lal Kashyap, Scientist (Plant Pathology), ICAR-IIWBR, Karnal, Dr. Amit Kumar Sharma, Sr. Scientist (Plant Breeding) IIWBR, Karnal, Dr. Dhiman Mukherjee, Associate Professor (Agronorny), AICW&BIP BCKV Kalyani Centre-Nadia, West Bengal and Dr. Saikat Das Scientist (Plant Breeding) AICW&BIP, UBKV, Centre, Coochbehar (WB) were conducted 1st Wheat blast (WB) survey along Indo Bangladesh Borders in West Bengal during 27-28 November, 2017. The WB survey was made in the area of Petrapol, Chakdaha, Tihatta, Jalangi, Lalgola, Baharampur etc. and information on the wheat sowing, avaiablity of wheat seeds in shops, WB like symptoms on other cereal crops (oat and barley) weeds and garsses were observed and detailed description of which is mentioned as below:

District	Location	Geograpgical location	Remarks
North 24-Parganas	Muragaccha	N 22°58′4.9728″ E 88°32′44.214″	Rice havesting going on, no wheat sown, no WB like symptoms observed on weeds and grasses.
	Chakdaha	N23°4′42.2328″ E 88°41′38.958″	Rice havesting going on, no wheat sown, no WB like symptoms observed on weeds and grasses.
	Petrapol	N 23°03′59.532″ E 88.87′68.989″	Rice havesting going on, no wheat sown, no WB like symptoms observed on weeds and grasses, Intercated with BSF officers Khem Ram and Sekhar Sani regarding exchange on wheat seeds from Bengaldesh to India. They informed that strict check on wheat seed exchanges across border has been made.
Nadia	Shuk Pukuria	N 23°4′528.3404″ E 88.49′25.2408″	Interacted with Arun Sarkar (Farmer), regarding sowing of wheat. He informed that he and people of village are aware ragrding the wheat holiday and they plan to sow mustard and jute instead of wheat. No symptoms of WBLD on weeds and grasses were observed.
	Gobrapur	N 23°13′0789″ E 88°81′4294″	No symptoms of WBLD on weeds and grasses were observed. No wheat sown
	Helencha	N 23°18′7881″ E 88°86′0128″	No symptoms of WBLD on weeds and grasses were observed. No wheat sown
	Chetla	N 22°51′8415″ E 88°33′1664″	No symptoms of WBLD on weeds and grasses were observed. No wheat sown
	Baranbaria	N 23°17′25.1664″ E 88°42′9.5976″	WBLD symptoms and *Pyriculria* infection was observed on baley and oats grown for animal fooder purpose. No wheat sown

Murshidabad	Karimpur , Krishna Nagar	N 23°32′41.8488″ E 88°32′19.5576″	WBLD symptoms and *Pyriculria* infection was observed on oats grown for animal fooder purpose. No wheat sown
	Muradpur (Jalangi)	N 24°5′20.724″ E 88°41′45.9852″	WBLD symptoms and *Pyriculria* infection was observed on oats grown for animal fooder purpose. No wheat sown. Also inreacted with BSF personell at Boshmari post regarding the cross border exchange of wheat seeds from Bengalesh and he informed that strict viginace is made on the good and materials came from Border.
	Madhubana	N 24°7′25.0716″ E 88°40′16.05″	Interacted with the farmer of village Sahib Rampur and he told that farmers in the village are awared about wheat holiday for two years. He planned to sow mustrard, some vegetables and jute after harvesting rice.
	Dhomkal	N 24°7′43.5504″ E 88°35′21.7896″	No symptoms of WBLD on weeds and grasses were observed. No wheat sown
	Islampur, Shaikpara	N 24°9′42.6996″ E 88°28′42.0204″	No symptoms of WBLD on weeds and grasses were observed. No wheat sown
	Bilchitra	N 24°14′26.7756″ E 88°30′12.2436″	Symptoms of WBLD on oats were observed. No wheat sown
	Akhiriganj	N 24°18′16.434″ E 88°23′37.4892″	Symptoms of WBLD on oats grown for animal fodder purpouse were observed. No wheat sown
	Kalukhai, Digha	N 24°16′45.3216″ E 88°17′27.1356″	No symptoms of WBLD on weeds and grasses were observed. No wheat sown



Wheat Blast like symptoms of barley and oats and weeds plants

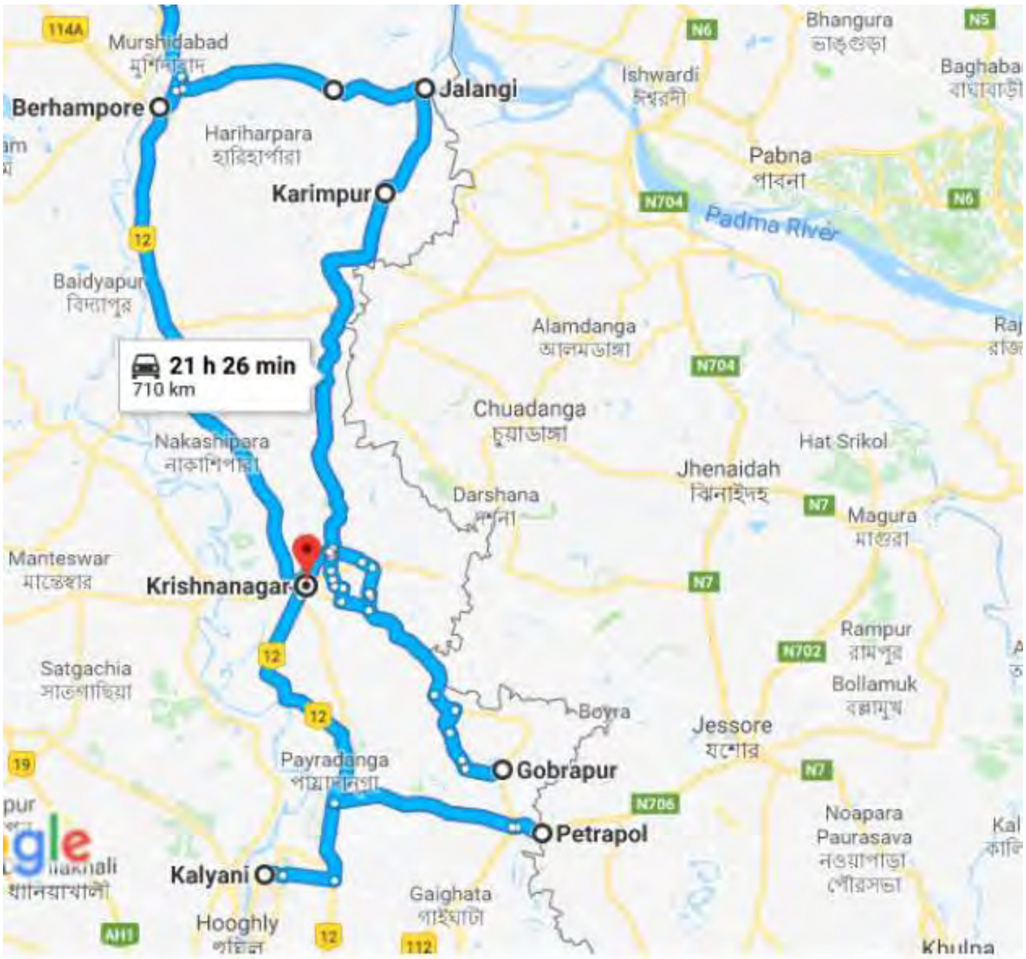



Interactions with farmers regarding wheat holiday and WB like diseae awareness



Awareness made pamphlents/holdings by District agricultural department, WB regarding wheat blast and wheat holiday


Interaction with BSF paersonnals posted on Indo-Bengladesh border regarding wheat seeds material exachnge



Survey routes

General observations:

1. Farmers are very well awared about the "**Wheat Holiday"** in Nadia and Murshdabad districts even at remote areas of the district.
2. Farmers and seed sellers of Indo-Bangladesh border in other district (North 24-Parganas) also awared about the "**No-wheat Zone"** within 5 kms area along Indo-Bangladesh border.
3. State agriculture department at district level creating awareness among the farmers through media, pamphlets, banners and hoardings
4. Due to unawareness of other hosts of wheat blast some of the farmers growing oat and barley for fodder purpose.
5. Farmers are growing alternate crops like mustard, lentil and vegetables.

(Prem Lal Kashyap & Amit Kumar Sharma,IIWBR Karnal; Saikat Das, UBKV, Coochbehar; Dhiman Mukherjee, BCKV Kalyani)

1st Yellow rust and wheat health crop survey in NWPZ, 2017-18

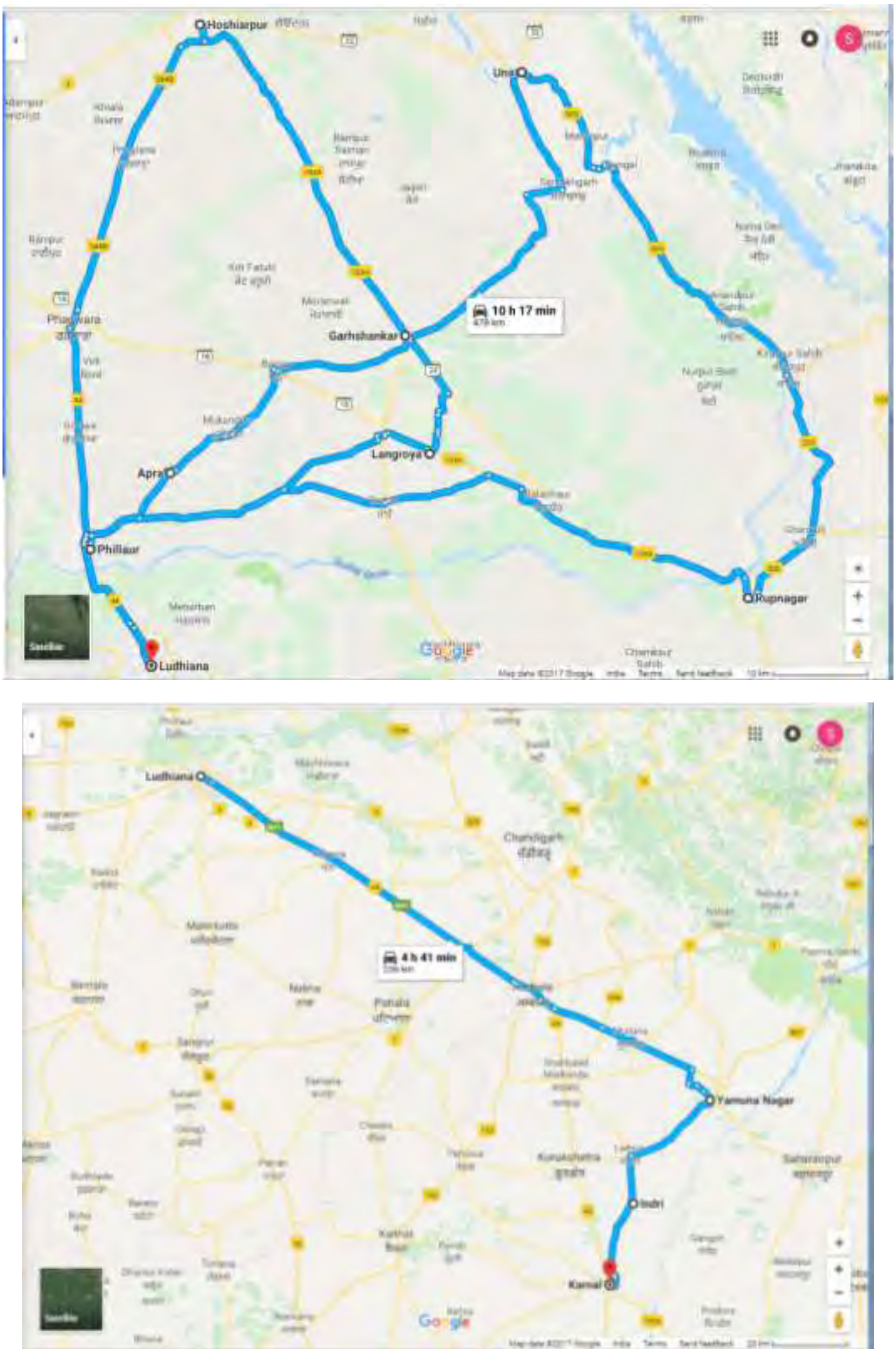
(13-15 Dec. 20-17)

1st Yellow rust and wheat health crop survey in NWPZ, 2017-18 was conducted from December 13-15, 2017 by a team comprised of Dr. Prem Lal Kashyap, Scientist (Plant Pathology), ICAR-IIWBR, Karnal, Dr. Poonam Jasrotia, Sr. Entomologist ICAR-IIWBR, Karnal and Dr. Jaspal Kaur, Plant Pathologist PAU, Ludhiana. We visited several farmers' fields in Ludhiana, Hoshiarpur, Una, Anandpur Sahib, Rupnagar, Yamunanagar and Karnal. No symptom of yellow rust was observed in any of the visited location. Wheat crop was at seedling stage. The team also interacted with the farmers during the survey and shared information regarding good wheat health management and tackling rust disease. In some fields, yellowing of wheat leaves was observed which may be due to abiotic stress or water logging. The detailed information of surveyed fields along with disease status is mentioned as follows:

Location	Geographical information	Disease status
Agampur, Ropar	N31°14′43.9548″ E76°28′24.0744″	No rust, Yellowing on leaf observed
Langmanjara, Ropar	N31°14′47.6628″ E76°28′31.1952″	No rust
Dadoli, Bhalowal	N31°19′3.6192″ E76°25′23.052″	No rust
Jandla	N31°19′31.3176″ E76°25′6.942″	No rust
Brahmpur	N31°19′46.0704″ E76°23′42.774″	No rust
Khwaja	N31°30′11.034″ E76°13′45.6276″	No rust
Fatehgarh Sahib	N31°30′32.9256″ E76°13′21.6444″	No rust
Burj Pukhta	N31°1′56.604″ E75°48′32.8932″	No rust
Nurewal	N31°2′20.1048″ E75°49′16.0464″	No rust
Kurdan, Phillaur	N31°2′49.21.08″ E75°56′38.1408″	No rust
Chotta Patta	N31°3′45.59.08″ E75°56′38.1408″	No rust
Sherpur Gill	N31°4′56.9028″ E76°15′52.8696″	No rust
Sibalmajra	N31°5′55.6332″ E76°14′32.7624″	No rust
Langroya	N31°6′40.9644″ E76°10′26.3136″	No rust
Mehandpur	N31°7′28.9272″ E76°11′3.3144″	No rust
Hiyatpur	N31°8′41.3808″ E76°13′26.562″	No rust
Mehtabpur	N31°12′27.5256″ E76°9′54.8964″	No rust
Hakimrpur Apra	N31°6′21.6036″ E75°54′26.3988″	No rust
Kauri	N30°43′32.3256″ E76°510′28.4124″	No rust
Khadukhera	N30°33′47.3652″ E76°27′49.4568″	No rust
Mithapur	N30°19′0.2172″ E76°55′48.5976″	No rust
Kalpi	N30°17′16.3464″ E76°59′59.6004″	No rust
Paplotha, Mullana	N30°16′6.76924″ E77°3′33.484″	No rust

Jorian	N30°6′47.286″ E77°14′31.722″	No rust
Aurangabad	N30°6′43.11724″ E77°14′31.6176″	No rust
Dhaodhang	N30°4′17.4072″ E77°11′45.7872″	No rust
Brahmanmajra, Indri	N29°57′4.6728″ E77°2′53.0232″	No rust
Samora	N29°48′56.5272″ E77°0′22.01004″	No rust

(Poonam Jasrotia, Jaspal Kaur, PAU and Prem Lal Kashyap)



Routes of 1st Yellow rust and wheat health crop survey in NWPZ (2017-18)

IInd yellow rust survey report (21-23 Dec. 2017) in parts of Haryana, West U. P. and Uttaranchal

A team comprised of Dr. D.P. Singh, PI (Crop Protection) and Dr. P.L. Kashyap, Scientist (Plant Pathology) from IIWBR Karnal surveyed yellow rust and other diseases of wheat at farmers' fields throughout the route of Karnal-Samli-Meerut, Garh, Moradabad, Rampur, Rudrapur and Pantnagar and lower foot hills of Nainital from 21-23 December, 2017. The wheat crop in fields looked quite healthy and it was at tillering stage where as late sown was at seedling stage. Met the farmers where ever possible and informed them about yellow rust, new varieties and time of first irrigation. No yellow rust or any disease or insect pest was found affecting the health of wheat crop in Haryana, West U. P. and tarai of Uttarakhand. The detailed description of various surveys sites is summarized as follows:

Survey routes

Location	Geographical Coordinates	Disease status
Manglaura Zadid, Shamli	N 29°37′29.37″ E 77°5′24.3672″	No yellow rust, other diseases or insect pests
Naunangli, Rajak Nagar	N 29°29′40.9524″ E 77°14′43.6480″	No yellow rust, other diseases or insect pests
Kapbadoth	N 29°23′44.5416″ E 77°21′17.4672″	No yellow rust, other diseases or insect pests
Gotaka	N 29°9′31.0644″ E 77°31′49.3248″	No yellow rust, other diseases or insect pests
Chotta Hasanpur	N 28°56′20.9688″ E 77°46′41.5704″	No yellow rust, other diseases or insect pests
Mahiranpur	N 28°49′35.0508″ E 78°1′15.7548″	No yellow rust, other diseases or insect pests
Mohamdabad, Mustkam	N 28°46′19.4448″ E 78°9′49.7232″	No yellow rust, other diseases or insect pests
Bagi	N 28°49′12.6624″ E 79°3′54.5112″	No yellow rust, other diseases or insect pests
Mankara	N 28°51′32.94″ E 79°10′48.432″	No yellow rust, other diseases or insect pests
Durga Bhagwanpur	N 29°8′45.9816″ E 79°31′17.2128″	No yellow rust, other diseases or insect pests
Nawarkhera	N 29°13′7.3128″ E 79°32′45.3624″	No yellow rust, other diseases or insect pests
Kisan Nagari	N 29°13′11.5464″ E 79°33′19.4544″	No yellow rust, other diseases or insect pests
Charketh	N 29°23′3.9552″ E 79°25′51.0456″	No yellow rust, other diseases or insect pests

Mangoli	N 29°20′53.0052″ E 79°23′30.1524″	No yellow rust, other diseases or insect pests
Tallamangoli	N 29°20′26.7324″ E 79°23′10.8276″	No yellow rust, other diseases or insect pests
Kaladungi	N 29°17′41.7264″ E 79°20′8.9268″	No yellow rust, other diseases or insect pests
Ushanganj	N 29°12′55.6308″ E 79°13′28.308″	No yellow rust, other diseases or insect pests
Kamaria, Bajpur	N 29°10′29.46″ E 79°13′28.308″	No yellow rust, other diseases or insect pests
Sahnkhera	N 29°10′35.6772″ E 79°0′56.8188″	No yellow rust, other diseases or insect pests
Jaspur	N 29°13′57.7704″ E 78°55′14.7732″	No yellow rust, other diseases or insect pests
Afzalgarh, Disaur	N 29°22′6.6468″ E 78°40′20.6436″	No yellow rust, other diseases or insect pests





(D. P. Singh & Prem Lal Kashyap)

Crop health report

J&K: Up to 28th Dec. 2017, no disease was observed on wheat crop, which is yet in juvenile phase in Kashmir valley.


(N. A. Bhat, MRCFC SKUAST-K, Khudwani)

H.P.: No incidence of yellow rust in Himachal Pradesh was observed in December 2017. Much of the crop was sown in time. However, a small fraction was sown after the rains in December. The crop health is good and no incidence of any disease was observed.

(S.C. Bhardwaj and team of scientists, IIWBR RS Flowerdale, Sachin Upmanyu, RWRC, Malan)

Uttarakhand: The wheat crop in tarai and lower hills up to Nainital was found free from any disease till 23 Dec. 2017.

Punjab

Yellow rust

A survey of wheat crop for stripe rust was conducted by Dr. Jaspal Kaur, Plant Pathologist along with Mr. Parminder Singh (PhD student, Plant pathology), and Dr. Sunil, Astt Prof (Plant Protection), KVK, Pathankot on 26.12.2017 on the Ludhiana-Jalandhar-Mukerian-Gurdaspur-Deenanagar-Pathankot route. No incidence of stripe rust was observed in surveyed wheat fields. Dr Ashok Kumar, Asstt. Prof. (Plant Pathology) conducted a survey in yellow rust pron area of Sri Anandpur Sahib block and visited wheat fields in villages namely, Agampur, Dher, Bhanupali, Daroli, Ajaouli, Jandala and Dabkhera on 27.12.17. It has been observed that crop was free from infection. Team has also inquired from different progressive farmers in the district regarding any report of yellow rust and report is nil for yellow rust. Till 28 December 2017 no disease was observed indistricts close to foot hills of HP in Punjab.

Insect pests

First survey on insect pests was conducted by a team of scientists PAU who visited villages Tungwali, Nathana, Lehra Dhorkot, Lehra Mohabbat, Bhucho in district Bhatinda and Tapa, Ghanus, Mehta in district Barnala and Jalaldiwal in district Ludhiana. The incidence of pink stem borer varied from 2-3 per cent in the fields of Jagjit Singh s/o Gurjant Singh and Lakhwinder Singh s/o Major Singh in village Tungwali. The farmers were advised to spray the crop with Ekalux 25 EC (quinalphos) @ 800 ml/acre where the pink stem borer attack was observed and they agreed to spray the recommended insecticides. In general, the wheat crop was healthy and free from all other insect pest and diseases.

Second survey by a team of scientists visited villages Kheri, Tarnji Khera, Mehlan, Sular Gharat, Kup Kalan, in districts of Sangrur and KVK Patiala on 21/12/2017. The incidence of Pink stem borer (PSB) in the fields of S. Sukhjinder Singh village Kheri, was 3-4 per cent (in patches) in two acres of wheat sown with roto seeder and germination was uneven in some patches in the field. However, no incidence of PSB was observed in the adjoining fields of another farmer. The farmers were advised to spray the crop with Ekalux 25 EC (quinalphos) @ 800 ml/acre in PSB affected patches.

The team visited 6 villages and made following observations:

Village	Date of sowing	Variety	Area (acre)	Method of sowing	Pink stem borer incidence (%)
KVK Kheri	2.11.17	PBW 725	2	Paddy straw incorporated + ZTD	2
KVK Kheri	3.11.17	PBW 725	7	Stubble shaver + Happy seeder	Nil
S. Sukhjinder Singh, Kheri	4.11.17	HD 3086	1.5	Paddy straw incorporated + Roto seeder	3-4 (in patches)
Pappi, Kheri	4.11.17	HD 3086	1.5	Paddy straw burnt + Roto seeder	Nil
Sular Gharat	5.11.17	PBW 725	15	Loose straw burnt + Happy seeder	Nil
Gurjeet Singh,Tarnji Khera	15.11.17	PBW 725	30	Paddy straw incorporated + Happy seeder	Nil
Bant Singh, Tarnji Khera -	13.11.17	HD 3086	20	-do-	Nil
Pal Singh, Tarnji Khera	12.11.17	PBW 725	4	-do-	Nil
Karam Singh, Mehlan	11.11.17	-do-	15	Paddy straw burnt + Roto seeder	0.5
Kup Kalan	10.11.17	HD 3086	4	Paddy straw burnt + Roto seeder	Nil
KVK Patiala	-	PBW 725	2	Stubble shaver + Happy seeder	0.5

A team of scientists comprising of Dr K S Suri, Senior Entomologist and Dr Beant Singh, Assistant Entomologist, Dr Parminder Singh, Assistant Professor (Animal Sci.), Rachna Singla (DES Fruit Sci), Jashanpreet Kaur, Assistant Professor KVK Rauni, Patiala visited villages Kamalpur, Gajewas, Chatehra, Dakla, Tare, Broei Kalan, in districts of Patiala on 27/12/2017. The incidence of pink stem borer (PSB) was 4-5 per cent in the fields of S. Devinder Singh village Kamalpur in village Kamalpur,. The crop sown by broadcasting of wheat seeds and was heavily infested with *Phalaris minor*. The farmer has not sprayed the recommended insecticides for the management of pink stem borer. The fields of S. Balbir Singh and S. Jaswant Singh in village Chatehra were also surveyed and 2-3 pataches of PSB infestation were observed. The farmers were advised to spray the crop with Ekalux 25 EC (quinalphos) @ 800 ml/acre where the pink stem borer attack was observed and they agreed to spray the recommended insecticides.

(Drs. Jaspal Kaur, Ashok Kumar, Beant Singh, Asssitant Entomologist, Ravinder Singh Chandi, PAU; Amarjit Singh Sandhu, DES (SM), Bhatinda, Baljit Singh, Assistant Entomologist, Harjit Singh Brar, Assistant Agronmist, RRS Bhatinda, Mahesh Narang, Agricultural Engineer and Pawan Kumar, Assistant Plant Pathologist, KVK Kheri, K S Suri, Senior Entomologist, Parminder Singh, Assistant Professor (Animal Sci.), Rachna Singla (DES Fruit Sci), Jashanpreet Kaur)

Haryana: The crop surveyed in the area of Karnal-Yamunanagar-UP borders up to Samli was found free from any disease toil 23 Dec. 2017.

U.P.: West U.P. crop surveyed on 23 Dec. 2017 was found free from diseases. In Eastern U.P. till now incidence of any rust was not observed in any variety. After first irrigation seedling blight was noted in some susceptible varieties. Initiation of spot blotch also observed in some varieties. In rice -wheat cropping system yellowing were noted in some fields. Overall weather was good for development of crop. No major outbreak of any insect pest and disease was observed. Around the Varanasi for the status of the crop and diseases was assessed on 26.12.2017. The crop was healthy and no occurrence of any of three wheat rusts. The crop age varied from seedling to tillering stage. Farmers were also educated about the diseases of wheat and their management in their fields.

(S.P. Singh, NDUAT, Faizabad, Dr. Shyam Saran Vaish, BHU Varanasi)

Rajasthan

The wheat and barley crop cultivated at farmers' fields is in tillering stage and crop is healthy in December 2017 as per information gathered from the Govt officials of Agriculture Extension. (Pradeep Shekhawat, RARI Durgapura)

M.P.: No report received

Maharashtra

Farmers have completed sowing of wheat crop in Niphad area. Regular farm operations are in progress. At majority of the sites crop is in tillering stage. During December 2017 the temperatures remained at slightly higher side as compared to average. Early heading is observed in early sown crop due to high temperature throughout the month. The maximum temperature recorded in first week of December was 29°C while minimum temperature was 11.8 °C. During second week maximum temperature recorded was 29.4°C while minimum was 10.2°C. In third week maximum temperature was 29.6°C while minimum was 9.4°C. The minimum temperature had dropped below 9°C during last week of December. At Niphad centre 4.6mm rainfall was recorded in first week of the month, though some of the parts of Maharashtra experienced heavy untimely rains during this period as a influence of *Okhi* cyclone. During this month maximum humidity was around 90% while minimum was around 40%. There is no report of any incidence of diseases on wheat crop in the jurisdiction. Wheat Disease monitoring Nursery planted at Pimpalgaon Baswant remained free from any disease till 26 Dec. 2017.

(B.C.Game and B.M.Ilhe, ARS Niphad)

RWR RS Mahabaleshwar

Timely sown wheat crop is in booting to heading stage whereas late sown crop is in seedling to tillering stage. No incidence of leaf rust or stem rust is observed till today on farmers' field. Overall crop is healthy and free from pest-disease in our locality.

(S.G. Sawasne, N. V. Savant and M. A. Gud)

Gujarat: No report

Karnataka: The survey was conducted from 22-28 Dec. 2017. The crop was healthy excent in two fields brown rust was up to 5MS on Amruth (Durum) wheat. Foot rot was also 1-4% in this variety. Stem rust was not observed in any field whereas leaf blight was in traces. In two fields termite damage was observed. Shoot fly was not observed.

Location(District and Village)& dates of surveys	Wheat Variety/ Species	Crop grown cond ition	Leaf rust	Leaf blight (DD)	Foot rot (%)	Ter m ites (%)	Stem borer (%)
22 Dec.							
Dharwad:Mangalagatti	BW	RF	0	01	-	-	-
Dharwad:Kurubagatti	Bijaga Yellow (d)	RF	0	01	1	-	-
Dharwad:Lokur	DWR 2006(d)	RF	0	01	3	-	-
Dharwad:Lokur	Amruth(d)	RF	0	00	-	1.0	-
Dharwad:Lokur	BW	RF	0	00	-	25-30	-
Dharwad:Garag	DWR 2006 (d)	RF	0	00	-	-	-
Dharwad:Tadakod	Amruth(d)	RF	5MS	00	-	-	-
Dharwad:Budarakatti	Amruth (d)	RF	0	00	3-4	-	1
Belgaum:Jalikoppa	BW	IR	0	01	-	-	-
Belgaum:Nayanagar	BW	IR	0	00	-	-	-
Belgaum:ARS, Bailhongal	AVT – RI	RI	0	00	-	-	-
Belgaum:Murakumbi	BW	RF	0	00	-	-	-
Belgaum:Muragod	BW	RF	0	00	-	-	-
Belgaum:Maladinni	BW	IR	0	00	-	-	-
Belgaum:Ugar	Trials	IR	0	00	-	-	-
Dharwad:Rayapur	Amruth (d)	RF	0	00	-	1	1
28 Dec. 2017							
Dharwad:rayapur	Amruth (d)	RF	0	00	-	-	-
Dharwad:Sainagar	Amruth (d)	RF	0	00	-	-	-
Dharwad:Bommapur	Amruth (d)	RF	0	00	1	-	-
Dharwad:Shiraguppi	Amruth (d)	RF	0	00	-	-	-
Dharwad: Shiraguppi	Amruth (d)	RF	0	00	-	-	-
Dharwad: Shiraguppi	Amruth (d)	RF	0	00	-	-	-
Dharwad:Nalawadi	Amruth (d)	RI	5MS	00	-	-	-
Gadag:Annigeri	DW	RF	0	00	-	-	-
Gadag:ARS, Annigeri	Trials	RF	0	00	-	-	-
Dharwad:Basapur	Amruth (d)	RI	0	00	-	-	1
Dharwad:Arekurahatti	Amruth (d)	RI	0	00	-	-	-

(P. V.Patil and S. V. Kulkarni, UAS Dharwad)

West Bengal

In general the wheat crop growth is very good and no disease incidence observed in West Bengal in Dec. 2017. Regarding Blast trap nursery, all the sets of supplied seed materials are already planted in scheduled govt. block farms of five districts (Cooch behar, Jalpaiguri, North

Dinajpur, South Dinajpur and Malda) adjacent to Bangladesh Boarder. Anticipatory blast screening seed material was also planted in above said districts except Jalpaiguri and Darjeeling districts.

(S. Hembram, UBKV Coochbehar, West Bengal)

Jharkhand: The crop growth has reached 6 to 8 leaf stage. Germination was more than 95%. The crop health was good and there was no appearance in foliar blight or brown rust symptoms till 29 Dec. 2017.
(H .C. Lal, BAU Ranchi)

Report on skill up gradation course entitled "Survey and surveillance, creation of epiphytotics and uniform recording of diseases in wheat and barley from 18 - 20 December 2017 at ICAR-IIWBR Karnal

- In total there are 30 officers dealing with crop protection from centres of AICWBIP, IARI, New Delhi and Indore, SAUs, CIPMC (DPP&Q) Kolkata, NSC Hisar, State Agric Departments, U. P., KVK, Saharanpur, U. P and State Agric. department Haryana. We could not accommodate another 20 participants applied this time and may be trained later.
- There were in total 14 lectures by eminent scientists and experts followed by practical classes and on hand trainings as well as field visits.
- The officers were exposed to three labs of IIWBR as well as with a progressive mushroom farmer and exporter of Kurukshetra district.
- There was one lecture and demonstration on *"Do you protect yourself from pesticides"*. It was keeping in view of human health and better efficacy of pesticides
- Hon. Director gave a lecture on expectations of a breeder from crop protection group.
- There was lecture on wheat blast and discussion on protocol to be followed in survey and surveillance and management in case of any emergency.
- The participants were shown two films on rusts of wheat.
- There was visit to museum also.
- The course material was distributed and link of yellow rust film was shared along with Toll free Number. The list of trainees and contact numbers were given. PDF copies of lectures and photos will be sent by e mail.
- The feedback forms were filled by participants.
  In summary the participants were briefed about new disease and pathotypes and possible threat of bioterrorism and means to tackle these. They were demonstrated how to create proper disease epiphytotics as well as screening against nematodes and insect pests. The uniform recording was emphasized to generate quality data for meaningful interpretation of level of resistance in yield trial entries. The techniques for survey and surveillance were also demonstrated. I found participants quite interested to learn, interactive, proactive and course is expected to upgrade their skills and in turns their productivity.

About the training course on ““Disease surveillance and wheat seed production” will be conducted for state agriculture departments, SAUs and farmers on 9 January 2018 at Bhola Paswan Shastri College of Agriculture (BAU), Purnea, Bihar”

A training programme for farmers and state agriculture department of Bihar will be conducted on survey and surveillance on wheat diseases with special reference to wheat blast like disease and production of healthy seeds of disease resistant and high yielding new wheat varieties at farmers' fields. It will be a joint programme of IIWBR with BAU, Sabour at BPS College of Agriculture, Purnea on 9th Dec. 2017. About 80 farmers are expected to participate. Survey for wheat blast like disease will also be conducted on 10th Dec. 2017 in Bihar and West Bengal.

Acknowledgement:

Thanks to Drs. S.C. Bhardwaj, Amit Kumar Sharma, Dhiman Mukherjee, Saikat Das, Sachin Upmanyu, Jaspal Kaur, Ashok Kumar, Mr. Parminder Singh, Sunil, Ravinder Singh Chandi, Amarjit Singh Sandhu, Baljit Singh, Harjit Singh Brar, Mahesh Narang, Pawan Kumar, Beant Singh, K S Suri, Parminder Singh, Rachna Singla, Jashanpreet Kaur, S. Hembram, B.C. Game, B.M. Ilhe, S.G.Sawasne, N. V. Savant, M. A. Gud and Pradeep Shekhawat for contributions and computer section of IIWBR for uploading the newsletter on web page.

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गेहूँ फसल स्वास्थ्य न्यूज़लेटर
भा.कृ.अनु.प.-भारतीय गेहूँ और जौ अनुसंधान संस्थान
करनाल-132001(हरियाणा) भारत
जनवरी, २०१८
WHEAT CROP HEALTH NEWSLETTER
ICAR-Indian Institute of Wheat and Barley Research, Karnal-132 001, Haryana, India
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गेहू के फसल स्वास्थ्य की निगरानी जनवरी 201८ के दौरान आई.आई.डब्लू.बी.आर. द्वारा और गेहूँ और जौ पर ऑल इंडिया कोऑर्डिनेटेड रिसर्च प्रोजेक्ट के विभिन्न सहयोगियों द्वारा की गई। जनवरी महीने में पंजाब के रोपर तथा एस बी एस नगर के दो खेतों को, एचपी में उना में एक जगह, और जम्मू में एक जगह को छोड़कर अन्य किसी राज्य जैसे हरियाणा , वेस्ट यू.पी., उत्तराखंड और में पीला रतुआ और अन्य बीमारियों और कीटों के प्रकोप की रिपोर्ट नहीं मिली है। साथ ही भारत-बांग्लादेश सीमा पर पश्चिम बंगाल तथा बिहार में गेहूँ के फसल स्वास्थ्य की निगरानी की गयी। इस भाग में भी गेहूँ की ब्लास्ट बीमारी नहीं मिली। जनवरी २०१८ के दौरान गेहूँ के फसल के स्वास्थ्य पर इस न्यूज़लेटर में प्रकाश डाला गया है।

हाइलाइटस

- जनवरी, २०१८ में पीले रतुआ, गेहूँ की ब्लास्ट बीमारी, अन्य बीमारियों और कीटों के लिए फसल स्वास्थ्य सर्वेक्षण आयोजित किए गए। उत्तर भारत के पंजाब के रोपर तथा एस बी एस नगर, एच पी के उना और जम्मू मे एक जगह को छोड़कर कहीं से भी पीले रतूए की कोई सूचना नहीं मिली। संक्रमित फसल पर प्रोपिकोनाजोल दवा का स्प्रे कर दिया है।
- केन्द्रीय और प्रायद्वीपीय क्षेत्र के किसानों के खेतों से भूरे रतुआ की रिपोर्ट केवल कर्नाटक से मिली।
- काला रतुआ आने की कोई रिपोर्ट नहीं मिली।
- भारत-बंगलादेश की सीमा के करीब, पश्चिम बंगाल तथा बिहार के के जिलों में गेहूँ में ब्लास्ट रोग नहीं मिला। सिफारिश की जाती है की सम्बंधित एजेंसीज गेहूँ ब्लास्ट जैसी बीमारी के लिए निगरानी रखें तथा कृषि विश्वविद्यालयों के संपर्क में रहें। रोगी बालियों की सैंपल लें तथा इनकी जाँच कृषि विश्वविद्यालयों की पादप रोग लैब में कराकर कवकनाशी दवा का छिड़काव सुनिश्चित करें।
- भोला पासवान शास्त्री कॉलेज ऑफ एग्रीकल्चर (बी.ए.यू.) , पूर्णिया, बिहार में 9 जनवरी 2018 को राज्य कृषि विभागों, एसएयू और किसानों के लिए "फसल रोग निगरानी और गेहूँ का स्वस्थ बीज उत्पादन" नामक विषय पर एक प्रशिक्षण कार्यक्रम का सफल आयोजन किया गया। करीब १६० किसानों जिनमें ज्यादा संख्या महिला किसानों की थी, ने भाग लिया।
- फसल २०१७-१८ में पीला रतुए का देर से, केवल पंजाब, जम्मू तथा एच पी में चार जगह पर ३० जनवरी २०१८ तक आना, इस वर्ष उत्तरी पहाड़ियों पर सूखा की स्थिति , उत्तरी मैदानों में बारिश की कमी, उच्च प्रभाह वाली हवाओं की कमी, नवंबर और दिसंबर की शुरुआत में पहाड़ियों पर कम तापमान तथा साथ ही प्रतिरोधी किस्मों के तैनाती से यह अनुमान लगाया गया है कि पीले रतुआ, वर्ष (२०१८) में उत्तरी मैदानों में देर से आएगा और इसलिए यह अपेक्षा की जाती है कि पीला रतुआ से गेहूँ में कोई नुकसान नहीं होगा। लेकिन २३-२४ जनवरी की बारिश को देखते हुए सभी सम्बंधित एजेंसीज को गेहूँ में पीले रतुए के लिए निगरानी रखने की सिफारिश की जाती है। पीला रतुआ दिखने पर तुरंत फसल पर 'प्रोपिकोनाज़ोल' नामक दवा (0.1%) के घोल का छिड़काव

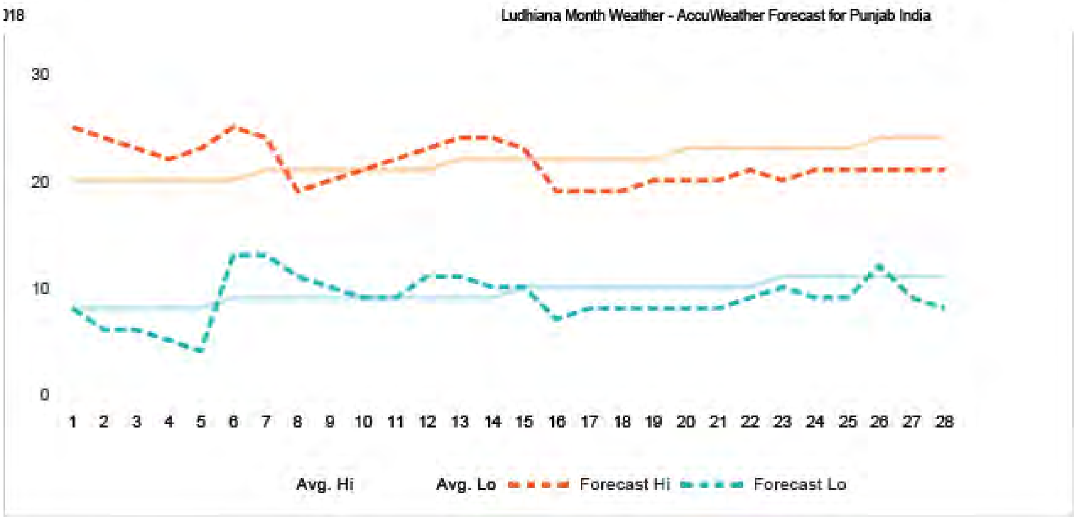
करना चाहिए। इससे रतुआ का फैलाव को खेत में तथा अन्य खेतों में फ़ैलाने से विलंबित किया जा सकता है। तापमान २३ डिग्री से. से उपर होने पर पीले रतुये का बढना एवं फैलना कम हो जाता है।

- बीज वाली फसल पर उत्तर भारत में कोथ में बाली आने की अवस्था में करनाल बंट बीमारी की रोकथाम के लिए 'प्रोपिकोनाज़ोल' नामक दवा (0.1%) के घोल का छिड़काव करना चाहिए।

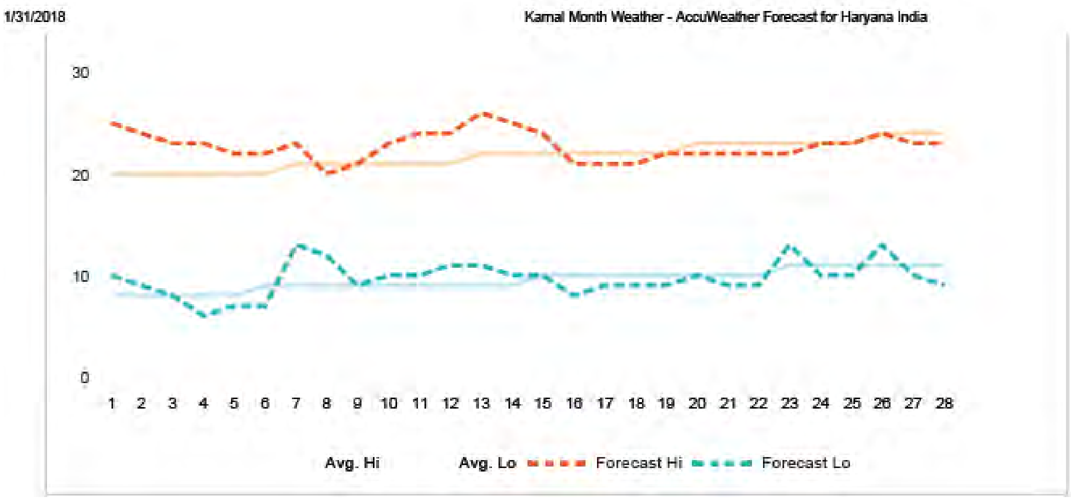
Wheat crop health was monitored during January, 2018 by IIWBR constituted teams and different cooperators of All India Coordinated Research Project on Wheat and Barley. One team was constituted to do the survey and surveillance for yellow rust and other diseases and insect pests during the month and surveyed parts of Haryana, Punjab and H. P. Likewise, two teams visited West Bengal and Bihar close to Bangladesh border to assess wheat blast situation and status of wheat crop health. The details along with highlights on wheat crop health during January 2018 are given in this issue of newsletter.

Highlights

- **Crop health survey tours for yellow rust and other diseases and insect pests were conducted revealed no yellow rust (stripe rust) incidence except at four fields (two in Punjab), one each in Jammu and Una in H. P. till 30 January 2018. The affected fields were sprayed with propiconazole fungicide @ 0.1%.**
- **Brown rust (Leaf rust) could only be found in few fields growing susceptible varieties in Karnataka.**
- **No report of black rust (Stem rust) was reported from farmers' fields from central and Peninsular zone.**
- **No wheat blast reported from West Bengal and Bihar districts close to Indo-Bangladesh borders. However, states in NEPZ are advised to keep vigil of wheat blast and advisories are issued. In case of any affected spike of leaf is seen, samples should be send to nearest agriculture university Plant Pathology lab for analysis and needful advise.**
- **Training cum awareness course on "Disease surveillance and healthy seed production in wheat "was organized on 9 January 2018 at Bhola Paswan Shastri College of Agriculture (BAU), Purnea, Bihar. About 160 farmers majority of which were female participated.**
- **Keeping in view of occurrence of yellow rust at farmers 'fields till 30 January 2018, only at four fields in Punjab, Jammu and H. P., prevalence of drought situation on Northern Hills, lack of rains in Northern plains, lack of high winds and cooler weather on hills during early in Nov. and Dec. 2017, as well as deployment of resistant varieties, it is predicted that yellow rust may arrive late in Northern plains and hence not expected to cause any losses in wheat. However due to wide spread rains on 23-24 January 2018 in NWPZ, it is advised to keep regular watch on yellow rust and if symptoms appear, spray of infected fields with propiconazole (0.1%) is suggested. Once temperature crosses 23 ^{0}C, the infection and spread of yellow rust is reduced.**
- **The crop meant for seed production in North India may be sprayed with propiconazole (0.1%) at boot leaf stage.**



Weather forecast (Feb. 2018, Ludhiana, Punjab,
(Source:
https://www.accuweather.com/en/india/ludhiana/a/month/205592?monyr=3/01/2018)



Weather forecast (Feb. 2018, Karnal, Haryana
(Source: https://www.accuweather.com/en/in/karnal/188417/march-weather/188417)

Wheat Crop Health Surveys: (Google maps)

IIrd Yellow rust survey, 5-6 January, 2018 in Haryana, H. P. and Punjab.
The farmer's fields were surveyed by Dr. Sudheer Kumar, Principal Scientist (Plant Pathology) and Dr. Rajendra Singh Beniwal (Plant Pathology), CCS HAU, Hisar on 5th Jan. 2018 for presence of rusts in the route starting from Karnal to Rupnagar via Yamunanagar, Bilaspur, Naraingarh, Baddi and Nalagarh. On 6th Jan. 2018 visited farmers field in route Rupnagar to Karnal via balachaur, Nawanshahar, Rahon, Machhiwada, Samrala, Khanna, Ambala, Pehowa, Krukshetra. The detail of observation points are given below.

Area Surveyed	State	GPS Location	Remarks
Indri	Haryana	N 29.53540 E 77.03051	No rust, Crop was in seedling stage.
Ladwa	Haryana	N 30.00131 E 77.04574	No rust, Crop was in seedling stage. Variety HD 2967
Jubbal Radaur	Haryana	N 30.03282 E 77.10431	No rust, Crop was in early tillering stage and in poplar plantation.
Chicharaulli	Haryana	N 30.12238 E 77.20009	No rust, Crop was in seedling stage.
Gandaula, Bilaspur	Haryana	N 30.15506 E 77.20526	No rust, Crop was in early tillering stage.
Danyapur Kalan	Haryana	N 30.17000 E 77.19477	No rust, Crop was in seedling stage. Crop in zero tillage practice, variety HD 2967
Sadhoura	Haryana	N 30.22458 E 77.12257	No rust, Crop was in seedling stage.
Ambli	Haryana	N 30.22462 E 77.12258	No rust, Crop was in early tillering stage.
Raipur Rani	Haryana	N 30.24180 E 77.09520	No rust, Crop was in seedling stage.
Badal	Haryana	N 30.33369 E 77.03368	No rust, Crop was in seedling stage. Variety WH 1105
Jengi, Baddi	Haryana	N 30.53053 E 76.50682	No rust, Crop was in seedling stage.
Nalagarh	Himachal Pradesh	N 31.02111 E 76.41102	No rust, Crop was in tillering stage and in popapar plantation.
Manjholi, Nalagarh	Himachal Pradesh	N 31.01412 E 76.38396	No rust, Crop was in seedling stage.

Ghanola Rupnagar	Punjab	N 31.01444 E 76.38406	No rust, Crop was in seedling stage.
Malikpur Rupnagar	Punjab	N 31.00113 E 76.33554	No rust, Crop was in tillering stage.
Rupnagar	Punjab	N 31.00306 E 76.33457	No rust, Crop was in early tillering stage.
Taunsa Rupnagar	Punjab	N 31.0005 E 76.26442	No rust, Crop was in seedling stage. Near canal high humidity.
Manewal Balachaur	Punjab	N 31.01089 E 76.21340	No rust, Crop was in seedling stage. Near canal high humidity and under poplar plantation
Uldani Balachaur	Punjab	N 31.0356 E 76.1614	No rust, Crop was in seedling stage.
Browal Nawanshahr	Punjab	N 31.0454 E 76.1423	No rust, Crop was in stem elongation stage. Farmer was spraying weedicide.
Langroyia Nawanshahr	Punjab	N 31.0656 E 76.0849	No rust, Crop was in seedling stage.
Hiala Nawnshahr	Punjab	N 31.0515 E 76.0656	No rust, Crop was in seedling stage. Variety PBW 550
Rahon	Punjab	N 31.0514 E 76.0656	No rust, Crop was in tillering stage. Variety DBW 621-50
Garhi Machhiwara	Punjab	N 31.0010 E 76.0833	No rust, Crop was in seedling stage.
Chidoodhi Ludhiana	Punjab	N 30.5710 E 76.0959	No rust, Crop was in seedling stage.
Lalmagra Samrala	Punjab	N 30.5711 E 76.0951	No rust, Crop was in tillering stage. Farmers are spraying weedicide. Variety HD 2967.
Otlian Samrala	Punjab	N 30.4120 E 76.1146	No rust, Crop was in seedling stage.
Kalal Majra Samrala	Punjab	N 30.4446 E 76.1227	No rust, Crop was in seedling stage.
Salodhi Kalalmajra Samrala	Punjab	N 30.4474 E 76.1230	No rust, Crop was in early tillering stage.
Harbanspura	Haryana	N 30.3812 E 76.2019	No rust, Crop was in seedling stage.
Rajpura	Haryana	N 30.3159 E 76.3057	No rust, Crop was in seedling stage. Variety HD 3086
Devnagar Ambala	Haryana	N 30.2412 E 76.4424	No rust, Crop was in seedling stage.
Balana Ambala	Haryana	N 30.1935 E 76.4358	No rust, Crop was in seedling stage.
Jalbera Jansu Ambala	Haryana	N 30.1218 E 76.4218	No rust, Crop was in seedling stage.
Thol Kurukshetra	Haryana	N 30.0943 E 76.4125	No rust, Crop was in seedling stage. Farmer spraying weedicide




Survey team visiting farmers'fields

The crop in the surveyed area were timely sown and in seedling to 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.

(Sudheer Kumar, ICAR-IIWBR Karnal and R. S. Beniwal, CCS HAU Hisar)

IInd Wheat blast survey, 8-10 Jan. 2018, Bagdogra, W.B.-Purnea, Bihar)

The wheat blast survey was conducted by Drs. D. P. Singh and Amit Kr. Sharma, IIWBR Karnal on 8 and 10th Jan. 2018 in West Bengal and Bihar. Most of the area on the routes was maize growing area. The farmers preferred maize since they get ready market and it more profitable and adaptable to low land. Wheat sowing gets late and thus yields low. However some farmers are growing wheat for their own consumption.

Following locations were examined:

Stop No.	Location (GPS data)	Location	Status of wheat blast
1	26.4825° N, 88.2486° E	Budharugaon, West Bengal	Not found
2	26.4352° N, 88.2587° E	Sonapur Hat, North Dinajpur W.B.	Not found
3	26.3770° N, 88.3118° E	Chopra , North Dinajpur, W.B.	Not found
4	26.2546° N, 88.1974° E	Islampur , North Dinajpur , W.B.	Not found
5	26.2220° N, 88.1852° E	Kutumposa West Bengal	Not found
6	26.2218° N, 88.1856° E	Bandrirampur, W.B.	Not found
7	26.0834° N, 87.9325° E	KVK Kisanganj (Bihar)	Not found
8	25.7771° N, 87.4753° E	Agriculture College Purnea Bihar	Not found

No wheat blast was found on wheat which was at seedling stage due to late sowing. The crop was found growing well. The farmers were advised to use new varieties, not to use see of Bangladesh or Nepal origin, follow seed treatment, zero seed drill and weedicides as well as mechanized harvesting and threshing. Training was conducted for farmers on disease surveillance, identification and management as well as production of healthy seeds on 9th Jan. 2018 at Bhola Paswan College of Agriculture, Purnea (Bihar). Visited KVK Kishan Ganj and North Dinajpur and sensitized the scientists and staff about wheat blast. Also sensitized DIG of BSF at Kishanganj about wheat blast and not to allow wheat grain movement from Bangladesh to India through Indo-Bangladesh borders without proper quarantine.


KRISHI VIGYAN KENDRA, KISHANGANJ


UTTAR DINAJPUR KRISHI VIGYAN KENDRA






(D. P. Singh and Amit Kumar Sharma, IIWBR Karnal)

IIIrd Wheat blast survey, 17-19 January, 2018 along Indo-Bangladesh Borders in West Bengal
A team comprised of Dr. Prem Lal Kashyap, Scientist (Plant Pathology), IIWBR, Karnal, Dr Vaibhav Kumar Singh, IARI, New Delhi, Dr Dhiman Mukherjee and Dr Sunita Mahapatra from BCKV, Kalyani conducted three days wheat blast survey along Indo-Bangladesh Border in West Bengal from 17-19 January, 2018. The team visited wheat blast trap plot nurseries and farmers' fields of six districts (namely, Nadia, North 24 Pargana, Murshidabad, Malda, Birbhum and Hooghli) adjoining to Indo-Bangladesh Borders. No symptom of Wheat blast and wheat blast like diseases were observed in any of the visited location. Farmers are very well aware about the wheat holiday. Due to unawareness of other hosts of wheat blast some of the farmers growing oat and barley for fodder purpose. Farmers are growing alternate crops like mustard, lentil, maize and vegetables etc. At Bhirbum, wheat crop was grown by farmers and is at tillering stage and looked healthy. The team also interacted with the farmers' during the survey and shared information regarding good wheat blast health management with KVK and state govt. officials and farmers. In some fields, yellowing of wheat leaves was observed which may be due to abiotic stress or water logging.

The detail description of visiting locations along with crop health status is mentioned as follows:

Location	Geographical Information	Crop health status
Bagdah	N 23°12′31.3488″ E 88°53′17.7972″	WB Trap plot nursery monitored and No symptoms of WB and like diseases observed
Jaypur, Chandan pukur	N 23°22′30.7236″ E 88°33′36.0216″	Wheat holiday strictly followed and no symptoms of WB and like diseases observed in weeds
Mahatpur, Krishnagar	N 23°28′42.8736″ E 88°32′26.0952″	No wheat crop, wheat holiday strictly followed, and symptoms of WB and like diseases were not observed in weeds
Karimpur	N 23°58′48.6228″ E 88°38′16.09872″	WB Trap plot nursery monitored and No symptoms of WB and like diseases observed
Madhubona, Jalangi	N 24°7′24.808″ E 88°40′16.086″	WB Trap plot nursery monitored and No symptoms of WB and like diseases observed
Islampur-Shaikhapara	N 24°9′55.9944″ E 88°29′3.4244″	No wheat crop, wheat holiday strictly followed, and no symptoms of WB and like diseases observed in weeds
Manikpur	N 24°37′0.0804″ E 87°59′56.6268″	No wheat crop, wheat holiday strictly followed, and no symptoms of WB and like diseases observed in weeds
Hathibadathom	N 24°54′34.326″ E 88°7′53.7276″	No wheat crop, wheat holiday strictly followed, and no symptoms of WB and like diseases observed in weeds
Gour	N 24°51′17.3016″	No wheat crop and symptoms of WB

	E 88°8′22.1316″	and like diseases were not observed in weeds
Sultanganj	N 24°50′51.6084″ E 87°59′18.8628″	Wheat was sown by farmers, although no symptom of WB and like disease observed.
Farakka	N 24°45′24.2496″ E 87°54′49.4532″	No wheat crop and symptoms of WB and like diseases were not observed in weeds
Tarapith, Bhirbhum	N 24°6′57.5136″ E 87°46′6. 3228″	Wheat was sown by farmers, although no symptom of WB and like disease observed in crop
Amba (Mullarpar)	N 24°5′34.458″ E 87°44′4. 9812″	Wheat was sown by farmers, although no symptom of WB and like disease observed in crop
Raypur (Morgram)	N 24°1′17.256″ E 87°34′58.3824″	Wheat crop was at boot leaf stage and free from any visible infection
Kazipara	N 23°51′6.6816″ E 87°29′18.9852″	Wheat crop was at tillering stage and free from any visible infection
Bhedia, Sekampur	N 23°35′1.2516″ E 87°43′7.6656″	Wheat crop was at 2-3 leaf stage and physiological yellowing on leaves was observed.
Dehagram	N 23°33′22.626″ E 87°44′33.324″	Wheat crop was at tillering stage and no symptom of WB and like disease observed in crop




Wheat crop survey and discussion with farmers regarding wheat health management and awareness on wheat holiday and wheat blast management preparedness


Monitoring wheat blast trap plot nurseries at Karimpur and Jalangi

(Prem Lal Kashyap, IIWBR, Karnal, Vaibhav Kumar Singh, IARI, New Delhi, Dhiman Mukherjee and Sunita Mahapatra, BCKV, Kalyani, W.B.)

Crop health report from states

J&K

The growth of wheat crop is stalled due to low temperatures (sinking upto minus 4 degree Celsius during night). There is no disease on the crop in Kashmir valley as on date. Sowing of wheat crop in Ladakh region (Kargil & Leh districts) and in Gurez valley of Bandipora district shall be conducted in March-April.

(N. A. Bhat, MRCFC SKUAST-K, Khudwani)

Survey Report of Jammu (J&K) January, 2018

A survey of wheat crop health was conducted by Dr. M.K. Pandey, Jr. Wheat Pathologist along with officers of department of Agriculture on 17 and 18 Jan., 2018. The survey was conducted the route starting from Satwari to Badi Bhrahmana via Satwari-Khandwal-RSPura-Chakari-Sai-Arnia-Bishna Badi Bhrahma (Jammu & Sambha districts). On 18th Janu., 2018 follow the route starting from Udhywalla to Bori via Udhaywalla-Marh-Gajansu-Ladiyal Camp- Pauni Check-Bori in Jammu district. No incidence of stripe rust was observed in surveyed wheat fields. Wheat crop was free from diseases and insects-pest. Dr. M. K. Pandey, Jr. Wheat Pathologist, Dr. Praveen Singh, Asstt. Prof. (PBG) and Dr. Bupash Kumar, Asstt. Prof. (PBG) were conducted a survey on 27th Jan., 2018. 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, Ghaumanasha and Sai Rakhwalan (Jammu). On 28th Jan., 2018 survey route via Domana, Chatha, Khandwal, Pirbaba, RS Pura, Dablehar, Quaderpur, Arnia, Saikalan (Jammu), Allah, Nanadpur, Ramghar, Check Salarian and Vijaypur (Sambha). Some pustules of stripe rust was observed in Tara Pur village, Tarawa, Jammu with 10S severity on HD-2967 on

3-4 plants (74.7675848, 32.5012200 230.313) and Check Arnia with 20S severity on unknown variety on 1 meter patch (74.8674565 32.5397046 243.687). Leaf Blight was also observed in some field but its severity and incidence was very low. Regarding to Insect pests, in some fields with very low incidence of termites was observed where no facility of irrigation. The detailed information of surveyed fields along with disease status is mentioned as follows:

Location	Geographical information	Remarks
17th January, 2018		
Raipur Satwari	E$74^0$8257 N$32^0$6877 243m	No disease and insect pests
Khandwall	E $74^0$7988345 N$32^0$6735398 228 m	Yellowing of leaf
RS Pura	E$74^0$7493165 N$32^0$5945354 249m	No disease and insect pests
Chakarohi Colony	E $74^0$7182050 N$32^0$5518512 227 m	No disease and insect pests
Diwan Garh	E $74^0$7316536 N$32^0$5281073 212 m	No disease and insect pests
sai	E $74^0$7275095 N$32^0$5078180 221 m	No disease and insect pests
Arnia	E $74^0$8078716 N$32^0$5229491 234 m	No disease and insect pests
Deoli	E $74^0$421203 N$32^0$5943112 221 m	Termites in some patches
Badi Brahamana	E $74^0$8648320 N$32^0$6382014 243 m	No disease and insect pests
18th January, 2018		
Udhaywalla	E $74^0$8213889 N$32^0$740738 295 m	No disease and insect pests
Sangrampur	E $74^0$7781354 N$32^0$740738 295 m	No disease and insect pests
Gajansu	E $74^0$7093331 N$32^0$7575351 268 m	No disease and insect pests
Gauhmanashan	E $74^0$7525948 N$32^0$7221767 267 m	No disease and insect pests
Bori	E $74^0$8123626 N$32^0$7596469 306 m	No disease and insect pests
27th January, 2018		
Udhaywalla	E $74^0$8168025 N$32^0$7685494 326 m	No disease and insect pests
Barnai	E $74^0$7889108 N$32^0$709161 275 m	No disease and insect pests
Marh	E $74^0$7596532 N$32^0$767673 276 m	No disease and insect pests
Jhiri	E $74^0$7503931 N$32^0$8311668 302 m	No disease and insect pests
Gauhmanashan	E $74^0$7915212 N$32^0$7251636 277 m	No disease and insect pests
Anand Nagar	E $74^0$9006227 N$32^0$5542115 284	Leaf blight in RAJ-3765
Domana	E $74^0$8044786 N$32^0$7740193 316 m	No disease and insect pests

Mishriwala	E 74^{0}758592 N32^{0}819378 299 m	No disease and insect pests
Ladiyal Camp	E 74^{0}8223905 N32^{0}7717063 347 m	No disease and insect pests
Gajansoo	E 74^{0}7155209 N32^{0}7634063 269 m	Termites in some patches
Sairakhwallan	E 74^{0}8168025 N32^{0}7685494 325 m	No disease and insect pests
28th January, 2018		
Chatha	E 74^{0}8229783 N32^{0}6629229 275 m	No disease and insect pests
Dablihar	E 74^{0}759729 N32^{0}5761201 271 m	No disease and insect pests
Tara Pur village, Tarawa	E 74^{0}7675848 N32^{0}5012200 230.313	10S severity on HD-2967 on 2-3 plants
Sai kalyan	E 74^{0}.7910191 N32^{0}5069054 263 m	No disease and insect pests
Arnia	E 74^{0}7986579 N32^{0}5122136 269 m	No disease and insect pests
Allah	E 74^{0}8416675 N32^{0}5054882 270 m	No disease and insect pests
Check Arnia	E 74^{0}8674565 N32^{0}5397046 243 m	20S severity on unknown variety in 1 meter patch
Ramghar	E 74^{0}9590997 N32^{0}5073984 298 m	No disease and insect pests
Check Salarian	E 74^{0}0070877 N32^{0}5561255 332 m	Leaf blight in RAJ-3765
Nand Pur	E 74^{0}928597 N32^{0}501534 291 m	No disease and insect pests

(M. K. Pandey, Praveen Singh, and Bupash Kumar, SKUAST Jammu and officers of State Agriculture department, Jammu)

H.P.

An extensive survey was conducted by a surveillance team for the appearance of yellow rust in wheat in Dehra and Pragpur blocks of district Kangra on 28.12.2017. The team included Dr. Atul Dogra, DPD, ATMA, Kangra; Dr. Ashok Kumar, Incharge, State Biocontrol Laboratory, Palampur; Dr. (Mrs.) Vijay Rana, Principal Wheat Breeder and Dr. Sachin Upmanyu, Plant Pathologist, RWRC, Malan. In Dehra block, survey was conducted at Baba Punja, Mohan Bhati, Dhanot, Adhwani and Ghallor areas where no yellow rust was observed. However, adults of aphids were seen in some places in traces. The crop stage ranged between 20-30 days. In Pragpur block, Koohna area was surveyed by the team where no yellow rust symptoms were observed on 30-45 days old crop. Farmers contacted during the survey were sensitized about this dreaded disease of wheat. Literature in the form of pamphlets was also distributed among the farmers for identification of symptoms and management of yellow rust. Besides this farmers were guided to collect Shine (propiconazole) fungicide from the concerned block office and to spray wheat crop just after the appearance of the symptoms for timely management of this disease. The survey was undertaken over 15 ha of area under wheat crop.

Extensive surveys in different blocks of district Kangra were conducted by a surveillance team for the appearance of yellow rust of wheat during the second fortnight of January, 2018. In Indora and Fatehpur blocks survey was conducted on 16.01.2018 and in Baijnath and Lambagaon blocks it was done on 18.01.2018. The surveillance team included Dr. Binta Sood, PD, ATMA, Kangra; Dr. Ashok Kumar, Incharge, State Biocontrol Laboratory, Palampur and Dr. Sachin Upmanyu, Plant Pathologist, RWRC, Malan. In Indora block, survey was mainly conducted at Gangath, Indora, Mand areas whereas in Fatehpur block, Rey and Badukhar areas were surveyed. The places covered under the survey programme are considered to be the hot spot for yellow rust of wheat nevertheless, yellow rust symptoms were neither observed in any of these places nor was there any report from anywhere. However, general yellowing in foliage due to frost injury or water stress was observed in almost all the fields. Traces of nymphs of aphids were seen in Mand and Lambagaon areas of Indora and Lambagaon blocks, respectively. Besides this, powdery mildew was also observed in Lower Lambagaon area in traces. The varieties grown by the farmers mainly included HD 2967, HD 3086, DBW 621-50, HPW 360, HPW 368 etc. The crop stage in all the areas surveyed ranged between CRI and tillering. Farmers contacted during the survey were sensitized about yellow rust and literature in the form of pamphlets was distributed among them for identification of symptoms and management of this disease. Farmers were also informed to collect Shine (propiconazole) fungicide from the concerned block office and to spray wheat crop just after the appearance of the symptoms for timely management of this disease. The survey was undertaken over 50 ha of area under wheat crop in these blocks.

However, of yellow rust incidence (40S) was observed in Chhaproh Kalan area of Bangana block of district Una on 18.01.2018 by the scientists of KVK, Una. The samples have been sent to Flowerdale Regional Station for further identification. Later surveys conducted in the month did not show any incidence of yellow rust.

(Sachin Upmany, RRS Malan, Atul Dogra, DPD, ATMA, Kangra; Ashok Kumar, Incharge, State Biocontrol Laboratory, Palampur; Vijay Rana, Principal Wheat Breeder RRS Malan, H. P. Director Agriculture, HP)

Uttarakhand

30th December 2017: The tarai/plains of Uttarakhand were surveyed for yellow rust of wheat by Dr. Anil Kumar, JRO, Genetics and Plant Breeding and Dr. Kanak Srivastava, Plant Pathology on **30th** December **201**7 in different wheat growing areas, en route Dineshpur, Gadarpur (Jhagadpuri, kelakheda), Kashipur (Hasanpur North, S.R.C., Kashipur) and Bazpur (Sultanpur Patti, Kanori, Doraha, Jagannathpur,) area. The dominant variety sown in these areas is HD 2967, but some other varieties like, PBW 343, PBW 373, UP 262 and PBW 550 were also sown by some farmers at some of the locations. The timely sown crop is in tillering stage, whereas the late sown crop is in seedling stage. The general crop health was good and crop was found free from yellow rust and other diseases at all the locations.

January 2018: Tarai/Plains of Uttarakhand were surveyed for yellow rust of wheat by Dr. Anil Kumar, JRO, Genetics and Plant Breeding and Dr. Kanak Srivastava, Plant Pathology on **27th** and **29th** January **2018** in different wheat growing areas, en route Bazpur (Vill. Pipalia, Bazpur, Doraha), Kashipur (Vill. Kundeshwari & Parmanandpur), Rudrapur (Mehtosh mor, Jafferpur), Dineshpur (Vill. Kalinagar, Chandipur, Narayanpur duaria), Gadarpur (Vill. Jhagerpuri), Kichcha(Vill. Uttam nagar, Sirsa Chowki, Barifarm, Kamanipul), Sitarganj (Vill. Manjeet Farm, Nakulia, Katanghari, Naya Gaon, Chaumala, Turkittisore, Doraha), Nanakmatta (Vill. Jungle jogidhar) and Khatima (Vill. Jhankat and Fulaiya).

The predominant varieties sown in the areas were HD 2967, PBW 226, PBW 550, PBW 502, PBW 343 and PBW 373. The timely sown crop is in boot stage whereas the late sown crop is in tillering stage. While early sown crop is in heading/flowering stage. Overall the crop health was good and crop was found free from yellow rust and other pest at all the locations. It was observed that small farmers of Sitarganj, Nanakmatta and Khatima are predominantly growing rust susceptible verities PBW 343 and PBW 373. However, big farmers of Rudrapur, Bazpur, Gadarpur and Kashipur are growing rust resistant varieties.

The report reeived from higher hills (Almora) said that so far on hills of Uttarakhand, no incidence of wheat rust was recorded/observed.

(Kanak Srivastava, Anil Kumar and J. Kumar, GBPUAT Pantnagar, K.K. Mishra, ICAR-VPKAS, Almora The yellow rust was reported from farmers' field on 9.1.2018 at one location each in Ropar and SBS Nagar districts of Punjab from village Begampura on likely variety HD2967 in a area of around 200 sq meter in timely sown crop (2nd week of November 2017) and village Kangad in only 2-3 feet patch in a crop sown in first week of November 2017.The infected fields have been sprayed with recommended dose of propiconazole and leaf samples were sent to Flowerdale Shimla.

Second survey in January was conducted by Dr. Jaspal Kaur of PAU Ludhiana on 29.1.18 on the Ludhiana –Ropar- Noorpur-Bedi -Balachour -Raho route. Most the fields visited were free from disease except three fields in village Kangar of Noorpur Bedi block in Ropar which were infected with stripe rust. Two fields were of HD 2967 and one field was of unknown variety. The disease severity ranged 5S-40S. Farmers were advised to spray affected crop with propiconazole@ 0.1%.
(Jaspal Kaur, PAU Ludhiana)

Haryana

The crop surveyed in the area of Karnal-Yamunanagar-Kurukshetra was found free from yellow rust and other diseases till 30 Jan.2018
(Sudheer Kumar,IIWBR Karnal and R. S. Beniwal, CCS HAU Hisar)

U.P.

Wheat fields were visited around the Varanasi by Dr. S. S. Vaish and team for knowing the status of the crop health and diseases along during 14-15 Jan. 2018. The crop was found growing healthy. It showed no occurrence of any of three wheat rusts. However, foot rot was observed at some places. The crop showed seedling, tillering and elongation stages. Farmers were also educated about the diseases of wheat and their management in their fields.

(S. S. Vaish and his team, BHU Varanasi)

Punjab

Foot rot of wheat

Rajasthan

Survey was conducted on 30th January 2018 by Dr. P. Shekhawat, of RARI in the area of Jaipur district to know the status of wheat and barley diseases on farmers' field.The details are as follows:

District	Location	Geographic location	Remark
Jaipur	Takarda (Chomu)	N 27.17622 E 75.66002 El: 459	**Wheat** cultivar: Raj 3765 Growth stage: Boot leaf Sowing: Timely sowing Disease: No Crop was healthy no disease was noticed Area: 2.0ha
	Nangal kallan	N 27.270234 E 75.608418 El:	**Wheat** cultivar: HD2967 Growth stage: Boot leaf Sowing: Timely sowing Disease: No Crop was healthy no disease was noticed Area: 1.7ha
	Chomu	N 27.160969 E 75.673556 El:	**Wheat** cultivar: Raj 4037 Growth stage: Ear head emergence Sowing: Timely sowing Disease: Loose smut *in traces* Over all crop was healthy Area: 1.5ha
	Dhodsar	N 27.292681 E 75.627441 El:466	**Wheat** cultivar: Raj 4037 Growth stage: Boot leaf Sowing: Timely sowing Disease: No Crop was healthy no disease was noticed Mild attack of termite was noticed Area: 2.5ha
	Narsingpura	N 27.217497 E 75.642104	**Wheat** cultivar: Raj 3077 Growth stage: Boot leaf

		El:453	Sowing: Timely sowing Disease: No Crop was healthy no disease was noticed Area: 1.75ha
	Takarda (Chomu)	N 27.17622 E 75.66002 El: 459	**Barley** cultivar: RD2660 Growth stage: complete ear head Sowing: 10 November Disease: Loose smut up to 2% *Drechslera stripe in traces* Area: 1.25ha
	Nangal kallan	N 27.270234 E 75.608418 El:	**Barley** cultivar: RD2660 Growth stage: complete ear head Sowing: 5 November Disease: Loose smut up to 5% Area: 1.25ha

M.P.

Survey was conducted by Dr. T. L. Prakash on 24.1.2018 on Indore Bhopal road covering a distance of 200 km. The wheat crop was good in Indore, Dewas, Sehore and Bhopal districts. HI 1544, Lok 1, HI 8663, HI 1531and HI 1500 were being cultivated by farmers. There was no incidence of rusts and other major diseases.

(T. L. Prakash, IARI RS Indore, M. P.)

Maharashtra

During this period, a survey was conducted on 09/01/2018 and 24-25/01/2018 in Pune District covering Baramati Taluka (Songaon, Gunwadi, Someshwar, Malwadi, Waki, Chaudharwadi, Murti villages) and Phaltan area in Satara District (Wathar-Nimbalkar village). The timely sown wheat crop is flowering to milk stage and late sown crop is reached tillering to stem elongation stage (after harvesting of sugarcane crop). The restricted irrigation fields are towards dough to maturity stage. In most of wheat growing areas, overall crop is in good condition. No natural incidence of black and brown rust in any of the location till date. The trap plot nursery at Experimental Songaon Farm, Taluka Baramati was also free from rust incidence.

The foliar blight was observed in few farmer's fields, only on lower leaves and flag leaves (F-2) on varieties viz. Gold 23, local varieties, ARI breeding material at Hol Farm (APT 1488, PRT 121) and MACS 6719 with severity ranging from 00 to 02 %. The aphid incidence was also observed on farmer's fields, Hol Farm, and trap plot nursery with low to medium population during first monitoring. The varieties sown in the areas were viz. Lok 1, HD 2189, Gold 23, Gold 28, MACS 6222, MACS 6478, HD 3090 and MACS 2971 (dic), etc. Overall, the climate was dry and cool except there was hike in minimum as well as maximum temperature from 11-16 January, 2018 due to cloudy weather.

The climate was dry and cool, Weekly information of climate parameters has been given below,

Week	Temperature		Rains (mm)	Relative humidity		Remark
	Max.	Min.		Max.	Min.	
1	29.11	10.19	-	93.78	36.87	-
2	29.81	12.21	-	90.98	46.81	Partial cloudy at end of week
3	31.10	12.37	-	93.84	41.24	Dense fog one day
Average mean	30.00	11.59	-	92.86	41.64	

Details of rust survey of 30.12.2017 conducted by GBPUAT, Pantnagar

Sl. No.	Location	variety	Area(ha)	Sowing time	Growth stage	Disease condition	Longitude	Latitude	Eleva tion(m)	Remarks
1.	Dineshpur	HD 2967	1.5	Timely sown	Tillering	No rust	79.30	29.05	220	Yellowing of leaf tip
2.	Dineshpur	HD 2967	4.0	Timely sown	Tillering	No rust	-	-	-	Crop condition is good
3.	Gadarpur	HD 2967	7.0	Timely sown	Tillering	No rust	79.28	29.05	217	Crop condition is good
4.	Jhagarpuri (Gadarpur)	PBW 343	5.0	Timely sown	Tillering	No rust	79.21	29.06	217	Crop condition is good
5.	Jhagarpuri (Gadarpur)	PBW 373	0.75	Late sown	Seedling	No rust	79.21	29.06	217	Crop condition is good
6.	Kelakheda (Gadarpur)	HD 2967	3.0	Timely sown	Tillering	No rust	79.16	29.10	220	Crop condition is good
7.	Hasanpur (Kashipur)	PBW 343	1.0	Timely sown	Tillering	No rust	79.01	29.18	229	Crop condition is good
8.	SRC Kashipur	AVT, SVT	0.25	Timely/ late sown	Tillering/ seedling	No rust	78.93	29.17	225	Crop condition is good
9.	SRC Kashipur	HD 2967	6.0	Timely sown	Tillering	No rust	78.93	29.17	225	Crop condition good
10.	SRC Kashipur	UP 262	3.0	Late sown	Seedling	No rust	78.93	29.17	225	Crop condition is good
11.	Sultanpur Patti (Bazpur)	PBW 343	7.0	Late sown	Seedling	No rust	79.06	29.15	222	Crop condition is good
12.	Kanauri (Bazpur)	HD 2967	1.5	Timely sown	Tillering	No rust	79.08	29.14	223	Crop condition is good
13.	Doraha (Bazpur)	HD 2967	2.0	Late sown	Seedling	No rust	79.13	29.13	221	Crop condition medium
14.	Jagannathpur (Bazpur)	PBW 550	6.0	Timely sown	Tillering	No rust	79.14	29.12	223	Poor tillering

(Pradeep Shekhawat, RARI Durgapura)

During first fortnight of January 2018 the temperatures remained at slightly higher side as compared to average in this area. But, there was sudden drop in temperature during second fortnight. Lowest temperature of the season i.e. 4.8 ^{o}C was recorded on 25th January. Wheat crop remained free from leaf and stem rust till-date in the jurisdiction. Leaf blight was observed in traces on farmers field. Wheat Disease monitoring Nursery planted at Pimpalgaon Baswant remained free from any disease till 30 Jan. 2018.

Normal sown wheat crop is in flowering to milking stage whereas later sown crop is in booting to heading stage. Wheat crop is free from rust disease in the surveyed area of Mahabaleshwar tahasil and around it during this week. Also no rust disease report is received from any locality to this station. Overall wheat crop is healthy in locality.

(B.C.Game and B.M.Ilhe, Agricultural Research Station, Niphad- 422 303, Dist. Nashik, B. K. Honrao, ARI Pune, Wheat Rust Mycologist & his team, RWRRS, Mahabaleshwar)

Gujarat

The wheat crop was surveyed in Gandhinagar, Mehsana and Banaskantha districts of Gujarat state. The wheat crop in these areas is free from any major pests except termite and aphid at few punctuated pockets. The sporadic incidence of Army worm was reported from some areas of Saurashtra region for which advisory was issued. No any report of rusts (brown or black) is noticed till date in the state. The daily mean temperature was recorded in the range of 17.9- 24^{0}C during last fortnight.

(S.I. Patel, Wheat Research Station, S. D. Agricultural University, Vijapur, Gujarat)

Karnataka

The survey was conducted by Drs. P. V. Patil, Principal Scientist (Wheat Pathology), S.V. Kulkarni, Technical Assistant and Uday G., Asst. Prof.(GPB), of AICRP on Wheat and Barley, MARS, UAS, Dharwad in Dharwad,Bagalkot, Vijayapur and Belgaum districts on 06.01.2018, 07.01.2018 and 24.01.2018. The details are as follows:

District	Village	Wheat Variety/ Species	Latitude (N)	Longitude (E)	Elev ation (m)	Leaf rust
06.01.2018					667	
Dharwad	Hebballi/ Govanakoppa	DW	1527.881	07504.213	640	10MS on mixture
Dharwad	Shivalli	AMRUTH	1527.467	07509.762	600	5MS
Dharwad	Sandikoppa	AMRUTH	1527.234	07514.593	574	20MS
Dharwad	Navalgund	ANKUR	1533.862	07522.267	571	20MS on mixture
Gadag	Navalgund	AMRUTH	1533.854	07522.264	586	5MS
Gadag	Bhairanahalli	DWR 162	1545.000	7525.851	557	0
Bagalkot	Govanakoppa	DWR 162	1552.749	7529887	539	0
Bagalkot	KVK, bagalkote	TRIALS	1610.509	7541.813	542	0
Bagalkot	Bagalkote	DWR 162	1610.248	7541.911	554	0
Bagalkot	Sunaga	DWR 162	1618.350	7538.065	532	0
Bagalkot	Goyanadinni	BW	1622.786	7539.823	586	0
Vijaypur	Ronihal	DWR 162	1632.140	07541.423	626	0
Vijaypur	Mulawad	BW	1637.275	07543.919	589	0
Vijaypur	Honaganahalli	BANSI	1639.608	7543.922	582	0
07.01.2018						
Vijaypur	ARS, vijayapura	TRIALS	1646.398	7545.082	-	0

District	Village	Wheat Variety/ Species	Latitude (N)	Longitude (E)	Elev ation (m)	Leaf rust
24.01.2017						
Kavalgeri	Dharwad	DW	-	-	665	5S-10S
Marewad	Dharwad	BW	1531.855	07503.064	696	5S
Karadigudda	Dharwad	DW	1534.272	07501.805	625	80S
Uppin Betageri	Dharwad	DW	1536.267	0700.526	637	80S
Jalikoppa	Belgaum	DWR 39	1544.451	07452.670	656	10S-20S
Nayanagar	Belgaum	BW (KW 51)	1546.220	07452.188	634	5S-10S on Mixture
ARS, Bailhongal	Belgaum	TRIAL	1549.504	07451.271	721	0
Murgod	Belgaum	BW	1553.416	07455.540	725	80S
Halaki	Belgaum	BW	1555.856	07456.202	654	5S on Mixture
Yaragatti	Belgaum	DIC	1600.752	07500.011	562	0
Maladinni	Belgaum	BW	1607.405	07453.501	558	80S-100S on Mixture
Maladinni	Belgaum	BW	1608.331	07452.474	563	20S-40S
Byali Basappa	Belgaum	DWR 162	1613.150	07450.381	561	TMS
ARS, Kallolli	Belgaum	TRIAL	1616.002	07452.599	653	0
Rakshi	Belgaum	BW	1614.311	07438.172	653	0
Hukkeri	Belgaum	BW	1614.288	07436.572	651	0
Sankeshwar	Belgaum	BW	1616.002	07428.100	600	0
ARS, Nippani	Belgaum	TRIAL	1624.310	07422.259		0

Leaf rust severity(80S to 100S) in different farmers fields of Northern Karnataka

The crop was grown under different conditions (Rainfed, Restricted Irrigations and Irrigated conditions) in different areas. In all the areas the crop was between flowering to grain filling stage. The survey conducted during 06.01.2018 and 07.01.2018 revealed that, the leaf rust severity was ranged between 5MS to 20MS. However, survey conducted on 24.01.2018 indicated very high leaf rust severity in few farmer's fields grown with susceptible varieties like Amruth, Kiran, DWR 162 and parrot green earhead bread wheat mixture in which leaf rust severity was ranged between 20S to 80S. However moderate infestation of aphid was observed in few farmer's field but severe infestation of aphid was observed in breeding trials at ARS, Nippani.

Severe aphid infestation at ARS, Nippani, Leaf rust at Maladinni village of Belgaum district

(P. V. Patil, Principal Scientist (Wheat Pathology), S.V. Kulkarni, Technical Assistant and Uday G., Asst. Prof.(GPB), of AICRP on Wheat and Barley, MARS, UAS, Dharwad)

West Bengal

Survey for wheat blast was conducted by IIWBR, IARI and BCKV scientists from 19.01.1018 to 21.01.2018 and on 8-10 Jan. 2018. The survey teams touched seven districts of W.B. like Nadia, Murshidabad, Malda, Birbhum, Burdhaman, North Dinajpur and Darjeeling. Over all crop growth, germination of wheat crop is well in all the trials even in the farmers' fields of Malda, Birbhum, Bardhaman North Dinajpur and Darjeeling. As the plant are at only 30 days old seedling stage so only few spots of *Bipolaris sorokiniana* and *Alternaria* sp. have found. In some farmers fields of Nadia and Murshidabad also collected samples from fodder oat. The spots were due to *Cladosporium* sp. confirmed after microscopic view. No wheat blast was found.

Dr. Satyajit Hembram, Plant Pathologist of UBKV Coochbehar conducted survey in North Bengal area. Wheat sowing has been completed in many of farmers' field in late sown areas. In some fields, wheat crop reached at completion of tillering stage in. There was no natural incidence of any blast like disease, rust, blight and other pests in surveyed areas. Overall crop health status was good up to 31st January, 2018.

During the last week of this month, weather was cloudy for most of the days and no rainfall was received during this period. The areas surveyed were as follows:

Cooch Behar (CoB) to DINHATA block -Tufanganj block-Alipuduar district- Mathabhanga block-Mahitnagar-Dhupguri-Falakata of Jalpaiguri district. For Darjeeling, Uttar Dinajpur, Dakshin Dinajpur, Malda districs informations of some places are collected from Block Agriculture Offices and Assistant Director Of Agriculture, line department, govt. of West Bengal through telephone.

The next survey tour for above mentioned remaining districts will be done during first fortnight of February,2018 in Malda and adjoining other districts.

(D. P. Singh, Amit Kumar and P.L. Kashyap of IIWBR Karnal, Sunita Mahapatra, Dhiman Mukherjee, of BCKVV, Vaibhav K Singh, IARI, New Delhi, S. Hemram, UBKV Coochbehar)

Bihar

No leaf rust or wheat blast was found in Bhagalpur, Purnea and Kishanganj areas of Bihar.

(D. P. Singh, Amit Kumar Sharma of IIWBR Karnal, C.S. Azad of BAU, Sabour)

Jharkhand: No report received

Assam
Dr. C.K. Deka, Sr. Scientist & Head, KVK,Dhubri, AAU, Bilasipara reported on 9th Jan. 2018 that no wheat blast disease was observed in the field in that area. Dr T. P. Saikia, Wheat Agronomist reported that a survey was conducted in five villages of Barpeta district for wheat blast incidence. There was no incidence of wheat blast in Barpeta, Assam. No wheat blast has been reported from KVK of Sonitpur, Chrang, Karmaganj and Shillongani RRS of AAU, Jorhat.

(T. P. Saikia, Ranjana Chakraborty, RARS, Shillongani, Safiqur Rahman, CS, RARS, Karmganj, Chandan K Deka, SS & Head, KVK, Dhubri, P.C.Deka, PS & Head, KVK, Sonitpur, K.Das, PS & Head, KVK, Chirang, and Arup Deka, SS & Head, KVK, Barpeta)

Report on training course on ""Disease surveillance and wheat seed production" conducted for state agriculture departments, SAUs and farmers on 9 January 2018 at Bhola Paswan Shastri College of Agriculture (BAU), Purnea, Bihar"

A training programme for farmers and state agriculture department of Bihar was conducted on survey and surveillance on wheat diseases with special reference to wheat blast like disease and production of healthy seeds of disease resistant and high yielding new wheat varieties at farmers' fields. It was a joint programme of IIWBR with BAU, Sabour at BPS College of Agriculture, Purnea on 9th January, 2018. About 160 farmers, majority of whom were female attended the training programme. Representative of state agriulture department and private seed companies were also present.


- The inaugural session was graced with the presence of Dr. G. P. Singh, Director IIWBR Karnal as Chief guest. Dr. P. K. Singh, Head, PBG, RAU Sabour and Dr. Rajesh Kumar, Assoc. Dean, BPS College of Agriculture, Drs. D. P. Singh (Course Director), R. Chatrath and Amit Kumar Sharma (Course Coordinator) from IIWBR Karnal and Dr. Jai Prakash of BPS College of Agriculture and Co-cordinator were also present.
- There were in total seven lectures by eminent scientists and experts of IIWBR Karnal, BPS College of Agriculture, BAU Purnea and BAU Sabour followed by discussions with farmers.
- There was lecture on wheat blast and discussion on protocol to be followed in survey and surveillance and management in case of any emergency.
- The participants were shown two films on Makhana cultivation.

In summary the participants were briefed about new wheat blast disease of wheat and were advised not to use seeds from Bangladesh and Nepal for sowing. The names of new wheat varieties suitable for low lying areas of Bihar were given to farmers.

Acknowledgement:
Thanks to Drs. Amit Kumar Sharma, Dhiman Mukherjee, Sunita Mahapatra, Vaibhav K Singh, S. Hembram, N. A. Bhat, MRCFC SKUAST-K, Khudwani, Sachin Upmany, RRS Malan, Atul Dogra, DPD, ATMA, Kangra; Ashok Kumar, Incharge, State Biocontrol Laboratory, Palampur; Vijay Rana, Principal Wheat Breeder RRS Malan, H. P. Director Agriculture, HP, M. K. Pandey, Praveen Singh, and Bupash Kumar, SKUAST Jammu and officers of State Agriculture department, Jammu, Jaspal

Kaur, S. S. Vaish, T.L. Prakash, Kanak Srivastava, Anil Kumar, J. Kumar of GBPUAT Pantnagar, K.K. Mishra, ICAR-VPKAS, Almora B.C. Game, B.M. Ilhe, Pradeep Shekhawat M. K. Pandey, Praveen Singh, Bupash Kumar, T. P. Saikia, Ranjana Chakraborty, RARS, Shillongani, Safiqur Rahman, CS, RARS, Karmganj, Chandan K Deka, SS & Head, KVK, Dhubri, P.C.Deka, PS & Head, KVK, Sonitpur, K.Das, PS & Head, KVK, Chirang, and Arup Deka, SS & Head, KVK, Barpeta, C.S. Azad of BAU, Sabour, P. V. Patil, Principal Scientist (Wheat Pathology), S.V. Kulkarni, Technical Assistant and Uday G., Asst. Prof.(GPB), of AICRP on Wheat and Barley, MARS, UAS, Dharwad, S.I. Patel, Wheat Research Station, S. D. Agricultural University, Vijapur, Gujarat, B. K. Honrao, ARI Pune, Wheat Rust Mycologist & his team, RWRRS, Mahabaleshwar for contributions and computer section of IIWBR for uploading the newsletter on web page.

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गेहूँ फसल स्वास्थ्य न्यूज़लेटर
भा.कृ.अनु.प.-भारतीय गेहूँ और जौ अनुसंधान संस्थान
करनाल-132001(हरियाणा) भारत
फरवरी, २०१८
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गेहूँ के फसल स्वास्थ्य की निगरानी फरवरी, २०१८ के दौरान आई.आई.डब्लू.बी.आर. और गेहूँ और जौ पर ऑल इंडिया कोऑर्डिनेटेड रिसर्च प्रोजेक्ट के विभिन्न सहयोगियों द्वारा की गई। फरवरी महीने में गेहूँ की फसल का स्वास्थ काफी अच्छा रहा तथा कंही से भी किसी बीमारी तथा कीटों के द्वारा फसल पर हानि की सूचना नहीं मिली। उत्तर भारत में पीले रतुए रोग को शानदार तरीके से रोका गया तथा इससे फसल पर बिल्कुल भी हानि नहीं हुई। साथ ही भारत-बंगलादेश सीमा पर पश्चिम बंगाल में गेहूँ के फसल स्वास्थ्य की निगरानी की गयी। गेहूँ की ब्लास्ट बीमारी जोकि पड़ोसी बंगलादेश में मौजूद है भारत में अभी तक नहीं मिली। फरवरी माह के दौरान गेहूँ के फसल के स्वास्थ्य पर इस न्यूज़लेटर में प्रकाश डाला गया है।

विशिष्ट बातें

- फरवरी, २०१८ में पीले रतुआ, गेहूँ की ब्लास्ट बीमारी, अन्य बीमारियों और कीटों के लिए फसल स्वास्थ्य सर्वेक्षण आयोजित किए गए। उत्तर भारत के पंजाब, हरियाणा और जम्मू मे एक दो जगहों को छोड़कर कहीं से भी पीले रतूए की कोई सूचना नहीं मिली। संक्रमित फसल पर प्रोपिकोनाजोल दवा का स्प्रे किया गया। २०१७-१८ गेहूँ फसल वर्ष को पीला रतुआ रहित घोषित किया जा रहा है।
- केन्द्रीय और प्रायद्वीपीय क्षेत्र के किसानों के खेतों से भूरे रतुए से कोई हनी नहीं हुई। काला रतुआ आने की कोई रिपोर्ट नहीं मिली।
- भारत-बंगलादेश की सीमा के करीब, पश्चिम बंगाल के जिलों में गेहूँ में ब्लास्ट रोग नहीं मिला। रोगी पतियों तथा बालियों की सैंपल ले कर जाँच की गयी।
- में २४ फरवरी 2018 को यूपी राज्य किसानों के लिए "गेहूँ की नवीन किस्मों का स्वस्थ बीज उत्पादन" नामक विषय पर के वी के मुज़फ्फरनगर में एक प्रशिक्षण कार्यक्रम का सफल आयोजन किया गया। करीब ८० किसानों ने भाग लिया।

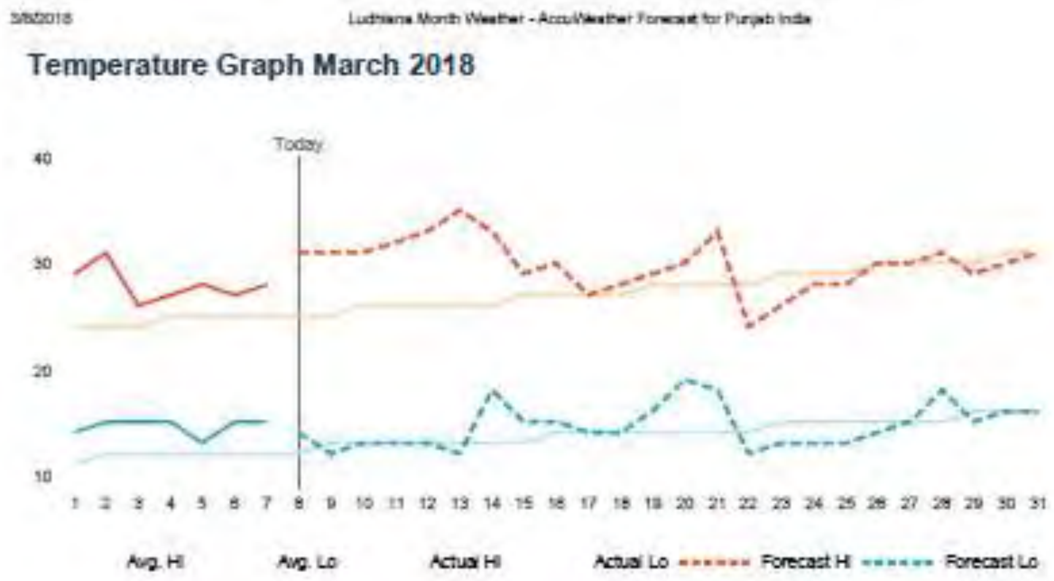
Wheat crop health was monitored during February, 2018 by IIWBR constituted teams and different cooperators of All India Coordinated Research Project on Wheat and Barley. The Crop year 2017-18 is now declared yellow rust free year. No wheat blast is so far reported from West Bengal or any other state of India. The details along with highlights on wheat crop health during February 2018 are given in this issue of newsletter.

Highlights

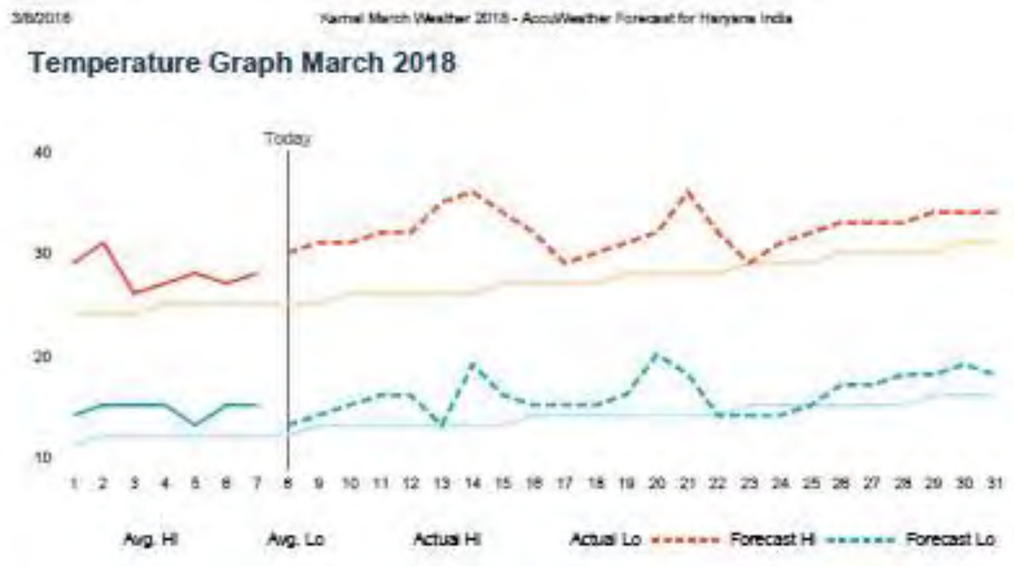
- **Crop health survey tours for yellow rust and other diseases and insect pests were conducted. No yellow rust (stripe rust) incidence was reported from different states except at one-two places in Punjab, Haryana and Jammu. The affected fields were sprayed with propiconazole fungicide @ 0.1%. The crop year 2017-18 is now declared yellow rust free year.**
- **Brown rust (Leaf rust) could not affect wheat crop in Central and Peninsular India.**
- **No report of black rust (Stem rust) was reported from farmers' fields.**

- **No wheat blast reported from West Bengal close to Indo-Bangladesh borders. The samples of leaf and spike were analysed and found free from wheat blast. So far wheat blast is not reported in India from any state including West Bengal. .**
- **Training cum awareness course on "Healthy seed production of new varieties of wheat" was organized on 24 February 2018 at KVK Muzzafarnagar, U.P. in which about 80 farmers participated.**

Weather forecast (March 2018, Ludhiana, Punjab)
(Source: https://www.accuweather.com/en/india/ludhiana/a/month/205592?monyr=3/01/2018:)



Weather forecast (March 2018, Karnal, Haryana)
(Source: https://www.accuweather.com/en/in/karnal/188417/march-weather/188417)



Yellow rust resistant varieties HD 3086, WB 02 and DBW 173

Wheat Crop Health Surveys

IVth Wheat blast survey, 11-15 Feb. 2018 along Indo-Bangladesh Borders in West Bengal

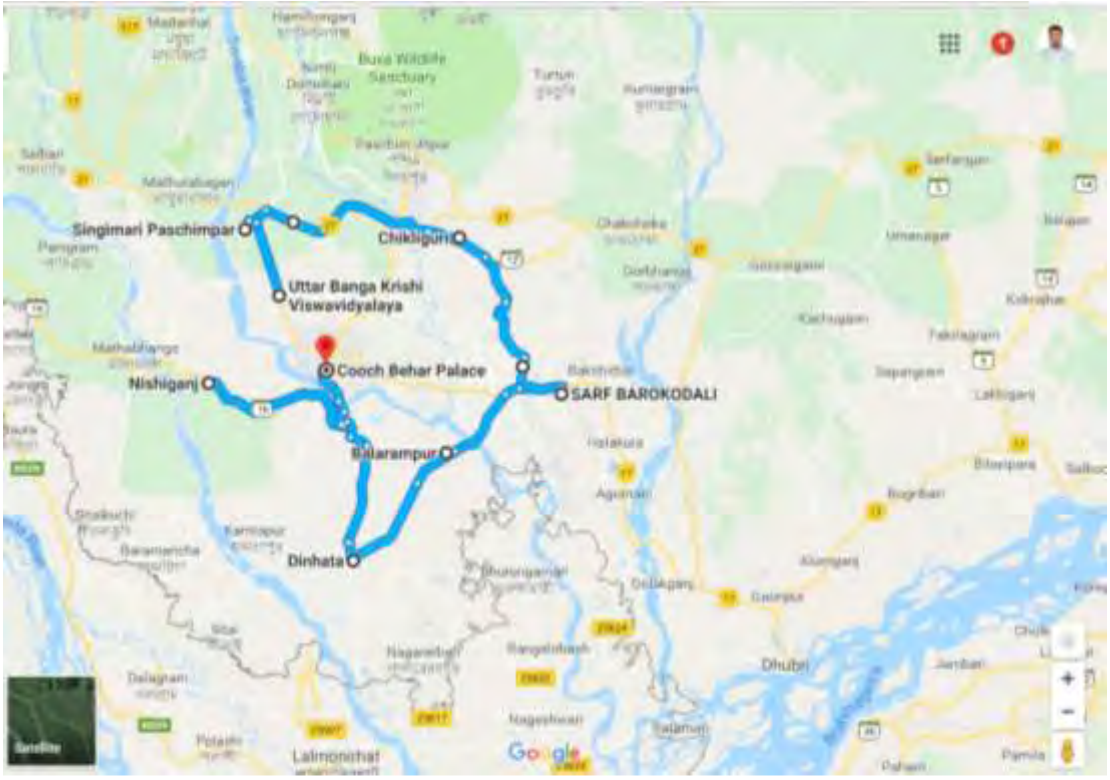
The wheat blast survey was done by a team comprised of Dr. Saikat Das, In-charge, AICW&BIP (Plant Breeder) and Dr. Satyajit Hembram (Plant Pathology), UBKV, Cooch Behar on the route from Pundibari to Mathabanga, Cooch Behar via Ghimari, Alipurduar, Chilkiguri, Tufanganj, Boxirhat, Borokodali, Balarampur, Dinhata, Nishiganj in West Bengal on 11-12th February, 2018. During 13-15th February, 2018 team visited farmers' fields in route Cooch Behar to Malda, West Bengal via Mathabhnga, Changrabandha, Mohitnagar, Kharibari, Chopra, Islampur, Dalkhola, Raiganj, Bamangola, Mabarakpur, Kaliachak-I,II,III.

The detail of observation points are given below.

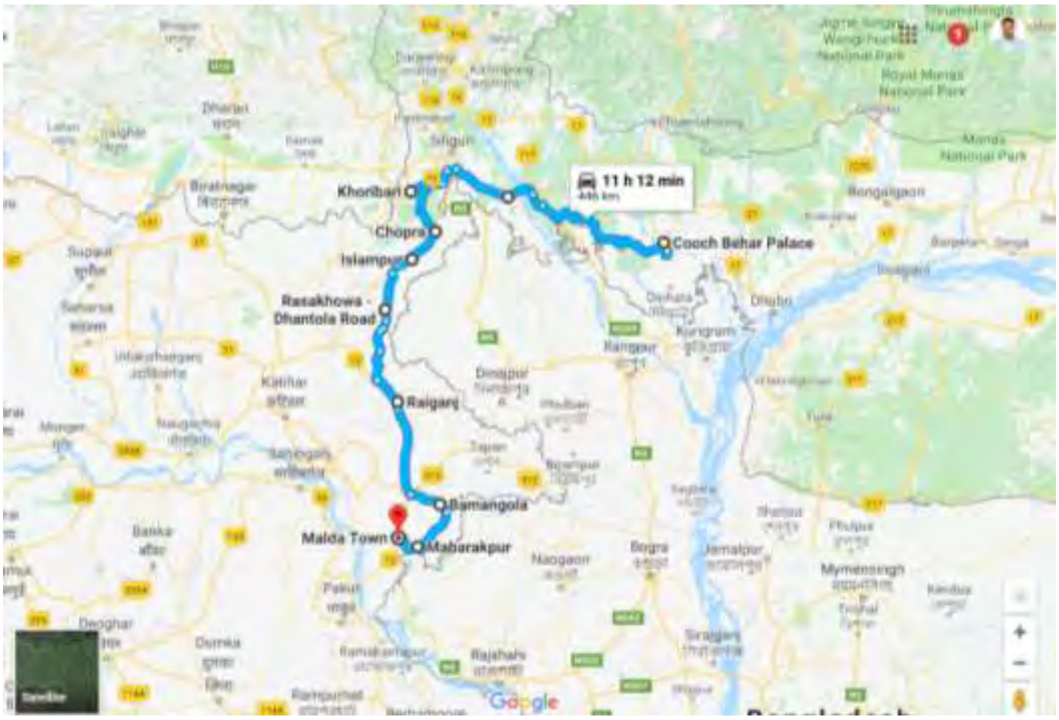
Location	Geographical Coordinates	Disease Status
Gunjaria	N 26°12′49 E 88°7′36	No wheat blast, rust and other diseases or insect pests
Barokadali	N 26°30′23 E 89°71′52	No blast, rust and other diseases or insect pests

Mainaguri Singijani	N 26°17′30 E 88°22′0	No blast, rust and other diseases or insect pests
Kukurkachua	N 26°12′11 E 88°32′30	No blast, rust and other diseases or insect pests
Bhareya	N 26°17′39 E 88°42′16	Wheat cultivation restricted
Bara Ghariamohanpur	N 26°20′39 E 89°9′39	Wheat cultivation not allowed
Bara Gopalpur	N 26°27′80 E 88°3′59	Wheat cultivation not allowed
Purba Kamat Changrabandha	N 26°27′31 E 88°57′18	Wheat cultivation not allowed
Panisala	N 26°44′16 E 88°93′55	Wheat cultivation restricted
Balasan	N 26°28′17 E 88°51′46	Wheat not cultivated due to blast campaign
Maynaguri	N 26°33′11 E 88°49′34	No blast, rust and other diseases or insect pests
Mohitnagar	N 26°52′05 E 88°65′52	No blast, rust and other diseases or insect pests
Kharibari	N 26°55′59 E 88°19′58	No blast, rust but spot blotch (01 disease) and aphid population observed
Jiakhori	N 26°25′59 E 88°16′40	Wheat cultivation restricted
Iluabar	N 26°16′54 E 88°13′27	No blast, rust and other diseases or insect pests
Paschim Pachhurasia	N 26°25′59 E 88°16′40	Wheat cultivation restricted
Chhatish	N 26°13′45 E 88°8′49	No blast, rust and other diseases or insect pests
Gunjaria	N 26°12′49 E 88°7′36	No blast, rust and other diseases or insect pests
Gaisal	N 26°11′30 E 88°5′33	No blast, rust and other diseases or insect pests
Dauapara	N 26°38′8 E 88°5′26	No blast, rust and other diseases or insect pests
Pokharia	N 26°7′34 E 88°5′14	No blast, rust and other diseases or insect pests
Agoi	N 25°58′23 E 88°4′0	No blast, rust and other diseases or insect pests
Bangaon	N 25°54′44 E 88°1′58	No blast, rust and other diseases or insect pests
Raiganj	N 25°61′85 E 88°12′55	No blast, rust and other diseases but aphid population observed
Mahadebpur	N 25°64′08 E 88°30′51	No blast, rust and other diseases but aphid population observed
Kasba	N 25°51′56 E 88°37′28	No blast, rust and other diseases or insect pests

Chandmukh	N 25°42′76 E 88°39′82	No blast, rust and other diseases or insect pests
Ramkrishnapur	N 25°16′16 E 88°34′90	No blast, rust and other diseases or insect pests
Mobarakpur	N 24°57′58 E 88°12′52	Wheat not cultivated due to blast campaign
Nageshwarpur	N 24°59′57 E 88°9′18	Wheat not cultivated this year due to blast campaign
BSF cantonment, Baishnabnagar	N 24°49′45 E 88°58′32	No blast, rust but spot blotch (01 disease) and aphid population observed
Chak Seherdi	N 24°49′29 E 88°58′12	No blast, rust ,spot blotch and aphid population observed
Baishnabnagar	N 24°50′0 E 88°58′31	No blast, rust but spot blotch (01 disease) and aphid population observed
Bedrabad	N 24°49′3 E 88°59′27	No blast, rust and other diseases or insect pests
Dharampur	N 24°56′54 E 88°5′56	Wheat cultivation restricted area
Madhugram	N 24°55′28 E 88°5′44	No blast, rust and other diseases or insect pests observed
Gangaprasad	N 24°55′28 E 88°4′80	No blast, rust and other diseases or insect pests observed
Soharai	N 25°38′14 E 88°6′40	No blast, rust and other diseases or insect pests observed
Paschim Mohanpur	N 25°48′58 E 88°55′37	No blast, rust and other diseases or insect pests observed
Bagela	N 25°51′58 E 88°53′40	No blast, rust and other diseases or insect pests observed
Sarnabari	N 26°9′33 E 88°3′21	No blast, rust and other diseases or insect pests observed
Bhagabati	N 26°21′59 E 88°18′30	No blast, rust and other diseases or insect pests observed



Routes of 4th wheat blast, rust, leaf blight and wheat health crop survey in Northern part of West Bengal adjoining to Bangladesh (2017-18)

Routes of 4th wheat blast, rust, leaf blight and wheat health crop survey in Northern part of West Bengal adjoining to Bangladesh (2017-18)


Satyajit Hembram and Saikat Das, UBKV, Cooch Behar, West Bengal


Satyajit Hembram and Saikat Das, UBKV, Cooch Behar, West Bengal

Satyajit Hembram and Saikat Das, UBKV, Cooch Behar, West Bengal

(Satyajit Hembram and Saikat Das, UBKV, Cooch Behar, W.B.)

Crop health report from states

J&K

Prolonged dry spell persisted in Kashmir valley up to 12th February 2018. In most of the places all of the *Rabi* crops including wheat had a poor growth owing to the moisture stress. In spite of lack of precipitation, night temperatures were sub-zero, as a consequence crop growth was stalled. However, there was a light to medium snow fall in mid of February, which brought a great relief to farmers as for the moisture stress was concerned.

So far, no disease on wheat crop was observed in Kashmir. However, wheat sown timely (in the month of October) after giving a pre-sowing irrigation had comparatively picked up good growth. Such crop also exhibited tip burning on a small percentage of plants. After microscopic examination no pathogen was found associated with such symptoms, which obviously were because of the frost damage.

As the snow fall was only medium to light, it did not persist long, only for three days. Day and night temperatures improved afterwards and moisture stress was also over due to the light snowfall. Crop has now picked up growth. Pictures above clearly depict the growth stage of wheat by end of February in Kashmir valley.

(Dr. Nazir A. Bhat, Senior Scientist Plant Pathology, MRCFC, SKUAST-K, Khudwani-Kashmir)

Wheat crop under snow cover **Frost damage to wheat crop**

Survey Report of Jammu (J&K) February, 2018

A survey of wheat crop health was conducted by Dr. M.K. Pandey, Jr. Wheat Pathologist along with officers of department of Agriculture on 24th and 25th Feb., 2018. On 24th Feb., 2018, survey was conducted the route starting from Satwari (Jammu) to Ramghar (Sambha) via Satwari- Chatha-Khandwal More- Pir baba (RSPura)- Dablehar- Quderpur- Palli more (Sambha)- Check Salarian – Ramgragh. On 25th Feb., 2018 follow the route starting from Udhywalla to Pauni check via Udhaywalla- Barnai- Kalyanpur- Kana ckeck- Domana- Pauni check in Jammu district. Some foci of stripe rust were observed in surveyed route but its severity and intensity was low. No severe attack of yellow rust observed in surveyed route wheat field. Leaf Blight was observed in some field but not on flag and F-1 leaf. Powdery mildew was also observed in some fields with low severity. Regarding to Insect pests, in some fields with very low incidence of aphid was observed. The detailed information of surveyed fields along with disease status is mentioned as follows:

Location	Geographical information	**Remarks**
24th Feb., 2018		
Satwari	E 74^{0}8313107 N 32^{0}7371897 297 m	No disease and insect pests
Chatha	E 74^{0}7998789 N 32^{0}6399433 283 m	10S severity on HD-2967 on 2-3 meter patch
Khandwal more	E 74^{0}82204519 N 32^{0}1667956 280 m	No disease and insect pests
Pir baba (RSPura)	E 74^{0}8301616 N 32^{0}736376 269 m	Some pustules of stripe Rust on DPW621-50 (5S) and aphids on lower leaf.
Dablehar	E 74^{0}759729 N 32^{0}.5761201 271 m	No disease and insect pests
Quderpur	E 74^{0}759727 N 32^{0}5781207 273 m	Some 1-2 meter foci of stripe rust on PBW-175 (5S)
Palli more (Sambha)	E 74^{0}759727 N 32^{0}5781207 273 m	Leaf blight was observed in RAJ-3765
Ramgragh	E 74^{0}9006227 N 32^{0}5542115 296 m	Powdery mildew was observed
Saikalan	E 74^{0}7910191 N 32^{0}5069054 263 m	No disease and insect pests
Ramghar	E 74^{0}9590997 N 32^{0}5073984 298 m	Powdery mildew and leaf blight were observed with low

		intensity
Check Salarian	E 74^{0}0070877 N 32^{0}5561255 332 m	No disease and insect pests
25^{th} Feb., 2018		
Udhaywalla	E 74^{0}8213889 N 32^{0}740738 295 m	No disease and insect pests
Barnai	E 74^{0}7889108 N 32^{0}709161 275 m	No disease and insect pests
Kalyanpur	E 74^{0}7311184 N 32^{0}8232792 295 m	Powdery mildew was observed
Kana ckeck	E 74^{0}8485316 N 32^{0}7570012 341 m	**40S severity on PBW-175 in 3-4 meter area**
Domana	E 74^{0}8168025 N 32^{0}7685494 326 m	No disease and insect pests
Pauni check	E 74^{0}7993092 N 32^{0}7356505 281 m	No disease and insect pests

(M. K. Pandey, SKUAST Jammu)

H.P.

Survey in hotspots of Dehra block of district Kangra was conducted by a surveillance team for the appearance of yellow rust of wheat on February 9, 2018. The team included Dr. Binta Sood, PD, ATMA, Kangra; Dr. Ashok Kumar, Incharge, State Biocontrol Laboratory, Palampur and Dr. Sachin Upmanyu, Plant Pathologist, RWRC, Malan. The places considered to be the hot spost for yellow rust included Baba Punja, Dohab Dehrian, Bohan Bhati, Adhwani, Chaniara, Lower Ghallour etc. covering an area of around 20 ha. However, yellow rust was restricted to foci of small area (25-50 m^2) but intensity in terms of disease reaction was as high as 80S. In Dohab Dehrian and Bohan Bhati areas 'telial stage' had also appeared on the leaves and stems. The variety infected was VL 616 locally called as '*Khablu*' besides HD 2967. The crop stage in all the areas surveyed ranged between tillering to panicle formation. The samples of all the isolates have been sent to Flowerdale Regional Station for further identification. Yellow rust incidence was reported in Kangra district also in an area of 0.75 ha only.

Besides this, powdery mildew was also observed in some fields of Dohab Dehrian, Bohan Bhati and Chaniara area of Dehra block in moderate forms.

(Binta Sood, PD, ATMA, Kangra; Ashok Kumar, Incharge, State Biocontrol Laboratory, Palampur and Sachin Upmanyu, Plant Pathologist, RWRC, Malan, Director Agriculture, HP)

Uttarakhand

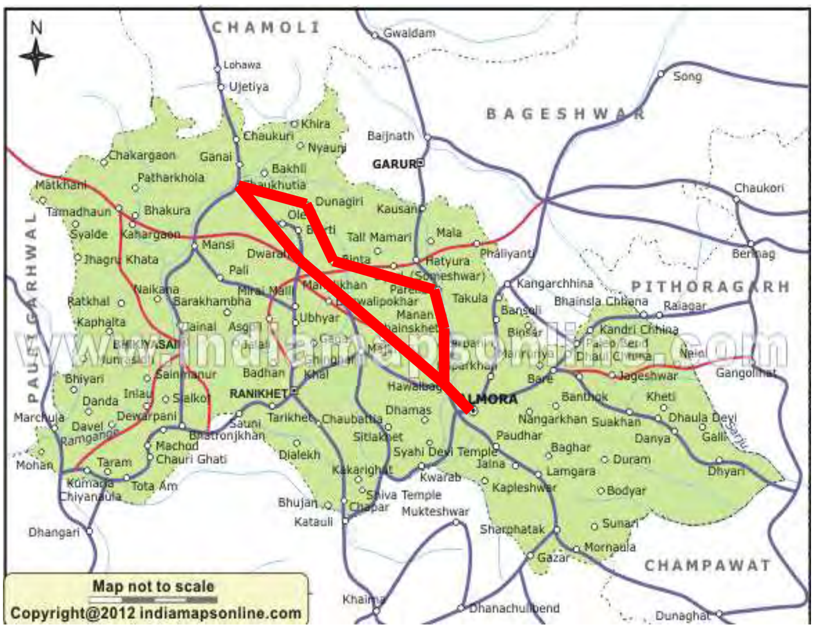
A survey was conducted in the hilly region of Uttarakhand on 7th February 2018. Dr. Lakshmi Kant, Head, Crop Improvement Division, Dr. K.K. Mishra, Principal Scientist (Plant Pathology) and Dr. Renu Jethi, Scientist, Social Science from ICAR-VPKAS, Almora were the members of the team. The following observations were made:

1. At village Chhani near Badechina (N 29°64', E 79°74'), Almora, around 10 hactare area has been planted with VL *Gehun* 892 and the fields were free from yellow rust. However, yellowing of leaves was observed which was due to water stagnation in the field and application of high seed rate as well.
2. At village Bajauli (N 29°61', E 79°73'), Almora, wheat variety VL *Gehun* 953 has been planted around 1.50 ha area and the fields were free from yellow rust. At village Supai (N 29°64', E 79°74'), Almora, VL *Gehun* 953 and VL *Gehun* 907 were planted at around >3.0 ha area and no symptoms of yellow rust was observed.

Second survey was conducted in the hilly region of Uttarakhand on 12th February 2018. Dr. Lakshmi Kant, Head, Crop Improvement Division, Dr. K.K. Mishra, Principal Scientist (Plant Pathology) and Dr. Rajesh Khulbe, Senior Scientist from ICAR-VPKAS, Almora were the members of the team. The following observations were made:

1. At village 'Baralgaon', Ganai (N 29°52' 46", E 79°21'56"), Almora, around 70% area has been planted with VL *Gehun* 907 and VL *Gehun* 953 and the crop was at tillering stage. In these fields, no yellow rust symptom was observed.

2. At village 'Chandikhet', Chaukhutiya (N 29°53′ 02″, E 79°20′55″), Almora most of the fields were planted with VL 804 and no symptom of rust was observed.
3. At 'Basbheeda', (N 29°50′ 42″, E 79°22′46″), Almora most of the farmers planted VL *Gehun* 953. These fields as well as other fields were free from rust.
4. In 'Mahalchaura' (N 29°50′ 15″, E 79°23′33″), Almora where VL *Gehun* 907 and VL *Gehun* 953 were grown in majority of the area whereas some other non recommended varieties were also observed. No rust was noticed.
5. In 'Binta' (N 29°46′ 40″, E 79°29′43″), Almora farmers were planted their local materials and crops were at initial tillering stage. No symptoms of yellow rust were seen.
6. In village 'Lodh' (N 29°47′ 28″, E 79°32′09″), Almora farmers planted VL *Gehun* 953 and no rust symptoms was seen.
7. In village 'Barley' (N 29°47′ 24″, E 79°32′59″), Almora VL *Gehun* 907 were plated in 10 ha area and crop was at initial tillering stage. Here also no rust was recorded.



Punjab

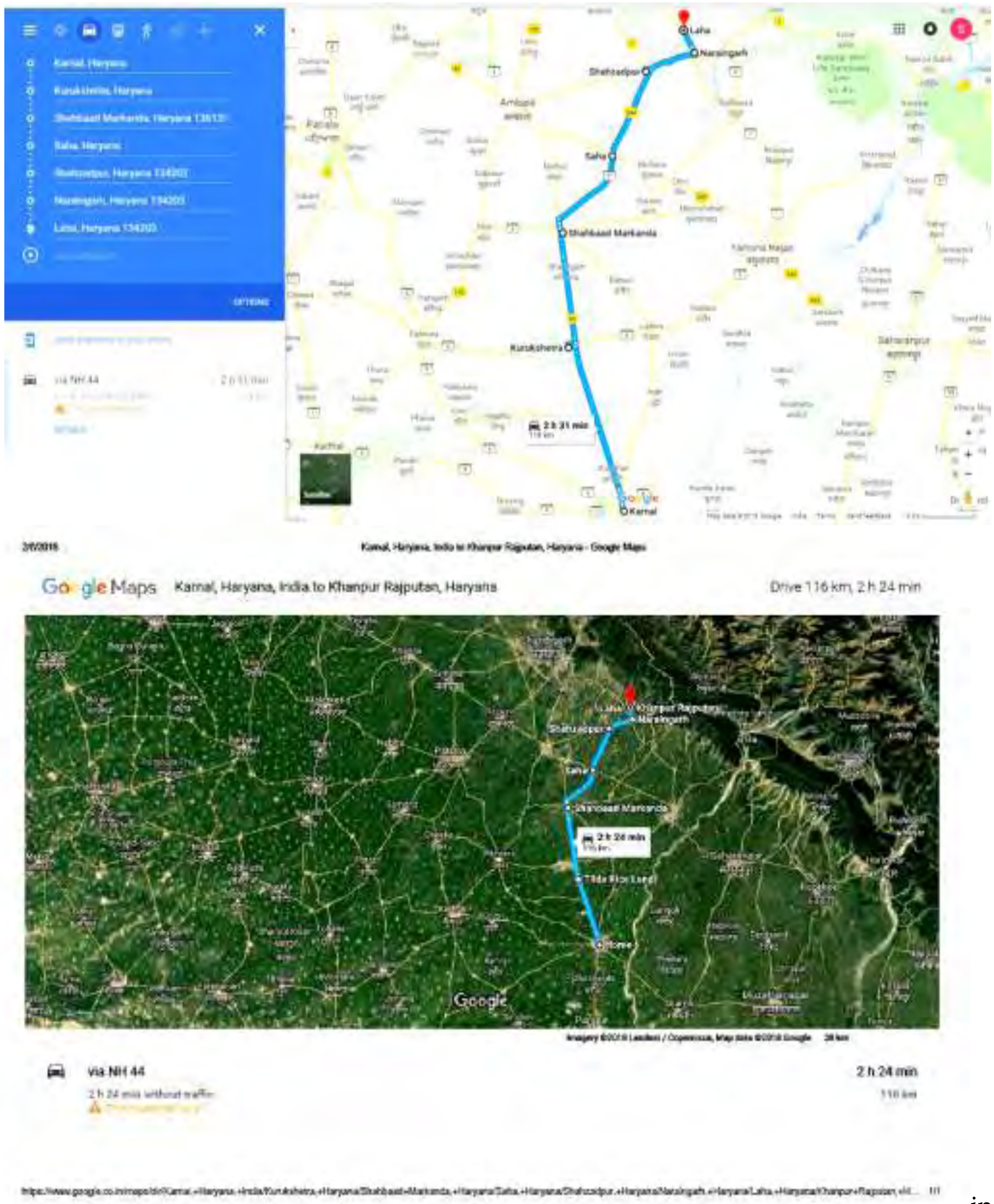
Place	District	Block	Date	Var.	Affected area
Kangar	Ropar	Noorpur Bedi	9.1.2018	HD2967	200m²
Begampur	SBS Nagar	Saroya	9.1.2018	HD2967	200m²
Bhattheri	Fatehgarh Sahib	Bassi Pathana	28.1.18	Barbett, HD2967	1 acre each
Kangar	Ropar	Noorpur Bedi	29.1.2018	HD2967	200m²
Ajouli	Ropar	Noorpur Bedi	2.2.2018	Local	1.5 acre
Upper Darouli	Ropar	Sh. Anandpur Sahib Block	2.2.2018	HD2967	200m²
Soharah	Ropar	Sh. Anandpur Sahib Block	2.2.2018	HD2967	200m²
Bhajla	Hoshiarpur	Gharshankar	6.2.2018	PBW621	200m²
Bhattheri	Fatehgarh Sahib	Bassi Pathana	8.2.18	HD2967	200 m²
Lolenangal	Gurdaspur	Dorangla	8.2.2018	HD2967	100 m²
Sarna	Pathankot	Pathankot	9.2.2018	HD2967	200m²
Gunpur	Gurdaspur	Dorangla	8.2.2018	HD2967	100 m²
Chaloa	Pathankot			PBW550	On few plants
Mirzapur	Pathankot			PBW550	On few plants
Mali Majra & Jalalabad	Patiala	Bhunerieri	27.2.2018	HD2967 PBW677	200 m²
Begampura	SBS Nagar	Saroya	27.2.2018	PBW550 and HD2967	5 acres
Hyattpur	SBS Nagar	Saroya	27.2.2018	PBW550	1 Acre
Surewal	Ropar	Sh Anandpur Sahib	19.2.2018	PBW677	250 m²
Ferozapur	Ropar	Chamkaur Sahib	9.2.2018	HD2967	25 m²
Gajpur	Ropar	Sh Anandpur Sahib	23.2.2018	local	100 m²
Rangia	Ropar	Morinda	23.2.2018	HD2967	100 m²
Brahampur	Ropar	Sh Anandpur Sahib	20.2.2018	HD2967	Only few plants
Dasgarian	Ropar	Sh Anandpur Sahib	19.2.2018	HD2967	Only few plants

(Jaspal Kaur and her team, PAU Ludhiana, State govt. agric. officers)

Haryana

Report on yellow rust in village Laha, Naraingarh, Ambala, Haryana, 5.2.2018

Survey was conducted on 5.2.2018 in the area of village Laha and nearby area by Dr. D.P. Singh, PI, Crop protection Programme, IIWBR, Dr. Sudheer Kumar, Principal Scientist (Plant Pathology), IIWBR and Dr. J.N. Bhatia, Principal Scientist, CCSHAU, KVK, Kurukshetra. The survey route Kurukshetra-Shahbaad-Saha-Shahzanpur-Naraingarh and Laha. The yellow rust was observed in Laha area in around 40 acres in villages, Raipur Rani, Laha, Khanpur Rajputana of Naraingarh Block of Ambala district, Haryana, on variety of Shriram seeds (SR 3122) which is highly susceptible to yellow rust and acting as infector and spreader variety for yellow rust. The yellow rust was also spreading on adjacent fields of HD 2967. The area is low lying, near foot hills and having popular trees around. The farmers are using flood irrigation and stagnant water was found in field. However, the incidence was



in the form of foci and on an average the score was TS-20S in fields with highest severity in foci up to 80S and therefore it is right time to spray the fields with propiconazole. Met the farmers and given names of newly released varieties, and propiconazole and newly released varieties. KVK authorities and DAO office was advised to go for campaign in the area and arrange spraying of affected crop. These villages are at foot hills close to H. P. and therefore varieties like HD 2967 and SR 3122 and local seed from market should be replaced with rust resistant varieties. Two fields were also found infected with powdery mildew. The varieties like WH 1105 and HD 3086 were free from yellow rust.

On the way surveyed the wheat crop but could not get symptoms of any diseases and crop health was very good. Farmers were advised to use newly released varieties and purchase seed from reliable agencies.

The detail of observation points are given below.

Area Surveyed	GPS Location	Remarks
Dhanoli, Ambala	N 30.2320 E 77.0541	No rust, Crop was in early tillering stage. Varieties HD 2967, HD 3086
Laha, Naraingarh	N 30.3129 E 77.0656 N 303134 E 770650	The farmers in that area sown variety SR 3122 (from Shriram group), HD 2967 and other varieties. The yellow rust foci was first developed on the variety SR 3122 which is highly susceptible to yellow rust and further spread to HD 2967 and other varieties in nearby fields. Some of initial foci of infection in SR 3122 variety severity were around 60 - 80S. The yellow rust was also observed in nearby fields (about 40 acres) from traces to 10S severity on some isolated plants.
Naraingarh	N 30.2740 E 77.0454	No rust, Crop was in early tillering stage
Pathreri	N 30.2540 E 77.0156	No rust, Crop was in early tillering stage. Varieties HD 2967, WH 1105

The farmers in Laha village area sown variety SR 3122 (from Shriram seeds), HD 2967 and other varieties. The area is low lying, near foot hills and having popular trees around. The farmers are using flood irrigation and stagnant water was found in some fields. The sowing was done by broadcasting and some farmers used higher seed rate of 50 kg/acre. The yellow rust foci was first developed on the variety SR 3122 which is highly susceptible to yellow rust and further spread to HD 2967 and other varieties in nearby fields. Some of initial foci of infection in SR 3122 variety showed severity around 60 - 80S. The yellow rust was also observed in nearby fields (about 40 acres) from traces to 10S severity on some isolated plants. The farmer has been advised to spray propiconazole 25EC @ 0.1% in his fields. We met the farmers and given names of newly released varieties. KVK authorities and DAO office was advised to go for campaign in the area and arrange spraying of affected crop. These villages are at foot hills close to Himachal Pradesh and therefore varieties like HD 2967 and SR 3122 and local seed from market should be replaced with rust resistant varieties. Two fields were also found infected with powdery mildew. The varieties like WH 1105 and HD 3086 were free from yellow rust.




The team of scientist that include Dr. Sudheer Kumar, IIWBR, Karnal, Dr. Vikram Singh, CCSHAU, Hisar and Dr M.K. Pandley, SKUAST, Jammu visited field of Shri Bhupendra Singh village Ghisarpadi, block Babain, Krukshetra on 19.2.2008. Yellow rust infection has been reported from in his field. Only one patch of 2-3 meters of 40-60S in variety HD2967 was observed. Farmers are advised to spray Propiconezole @0.1%. Yellow rust infected samples were collected for race analysis. State officials Dr Virendra Singh (BO), Dr Amilal (ADO) and Sh. Rampal (ADO, PP) also accompanied the team.

The incidence of yellow rust in wheat was observed on 9th Feb. 2018 in small patch in Damla village of distt. Yamunanagar. Scientists of KVK alongwith DOA & FW Yamunanagar team visited the affected field. 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.


Yellow rust was also recorded up to 20S in Road Chhapar (E30 05 57.3,N77 13 33.7),10S in Aryianwali (E 30 18.01.5, N77 32 20.6) village of Yamunanagar. No rust was observed in Munda Khera, Urdani, Bhilpura and Tajewala village of Aamunanagar.

(D. P. Singh, Sudheer Kumar, J.N. Bhatia, Principal Scientist, CCSHAU, KVK, Kurukshetra, Vikram Singh, R. S. Beniwal, CCSHAU, Hisar and M.K. Pandley, SKUAST, Jammu, Dr Virendra Singh (BO), Dr Amilal (ADO) and Sh. Rampal (ADO, PP of state agric. department, BR Kamboj, Sr. Coordinator, KVK Yamunanagar)

U.P.

No rust was in Bijnore and Muzzafarnagar distt of U.P. Wheat fields were surveyed and monitored around the Varanasi for the status of wheat health and diseases 18-19.02.2018. The crop was found to be healthy. It showed no occurrence of any of three wheat rusts. However, foot rot and spot blotch were observed at some places. The development of spot blotch seems to be less as the region did not receive winter rain. The crop was at booting, heading to flowering stages. Farmers were also educated about the diseases of wheat and their management in their fields.

(Rajender Singh Beniwal and Charan Singh, S. S. Vaish)

Rajasthan

No report received

M.P.

No report received

Maharashtra

Survey was undertaken on 7th Feb. 2018

Dr. B.C. Game and team of Agricultural Research Station, Niphad, Dist. Nashik **(Maharashtra)** conducted survey in Dindori, Surgana and Kalvan tehsils of Nashik districts. The villages covered during survey were Chinchkhed, Jopul, Lokhandewadi, Palkhed, Dindori, Ozarkhed, Saag Pada, Pandane, Sarad, Borgaon, Sukapur, Palasdar, Tirhal, Abhona and Nanduri. Majority of the fields were timely sown and were in dough stage. Majority of the farms remained free from leaf rust and stem rust. First incidence of brown rust was found in farmers' field from Sarad village. It was just initiation with 2 to 3 pustules on few plants of Lok-1 variety. The reaction observed was TMS. Leaf rust was also found at Abhona in Kalvan tehsil with TMS reaction reaction on Ajit 102 variety. Stem rust was not found in the surveyed area.

On 22nd Feb. 2018 survey was undertaken in Deola and Satana tehsils of Nashik District in villages, Vadala phata, Rameshwar, Lohoner, Thengode, Satana, Shemali, Brahmangaon, Lakhmapur, Pandhrun, Talwade, Deolana, Laxmiwadi and Vadali bhoi. Majority of the farms were found free from leaf rust and stem rust. Leaf rust incidence was found in farmers' field from Thengode, Shemali and Brahmangaon villages. Leaf rust intensity was upto 40S on few plants. Incidence of stem rust was not found in the surveyed area.

Natural incidence of leaf rust in Maharashtra state has been reported on 3rd February, 2018 in trap nursery located at Agril. Research Station, Radhanagri, Kolhapur on variety Agra Local. Wheat crop was in boot to dough stage in this region. On an average crop is healthy and free from the pest and diseases.

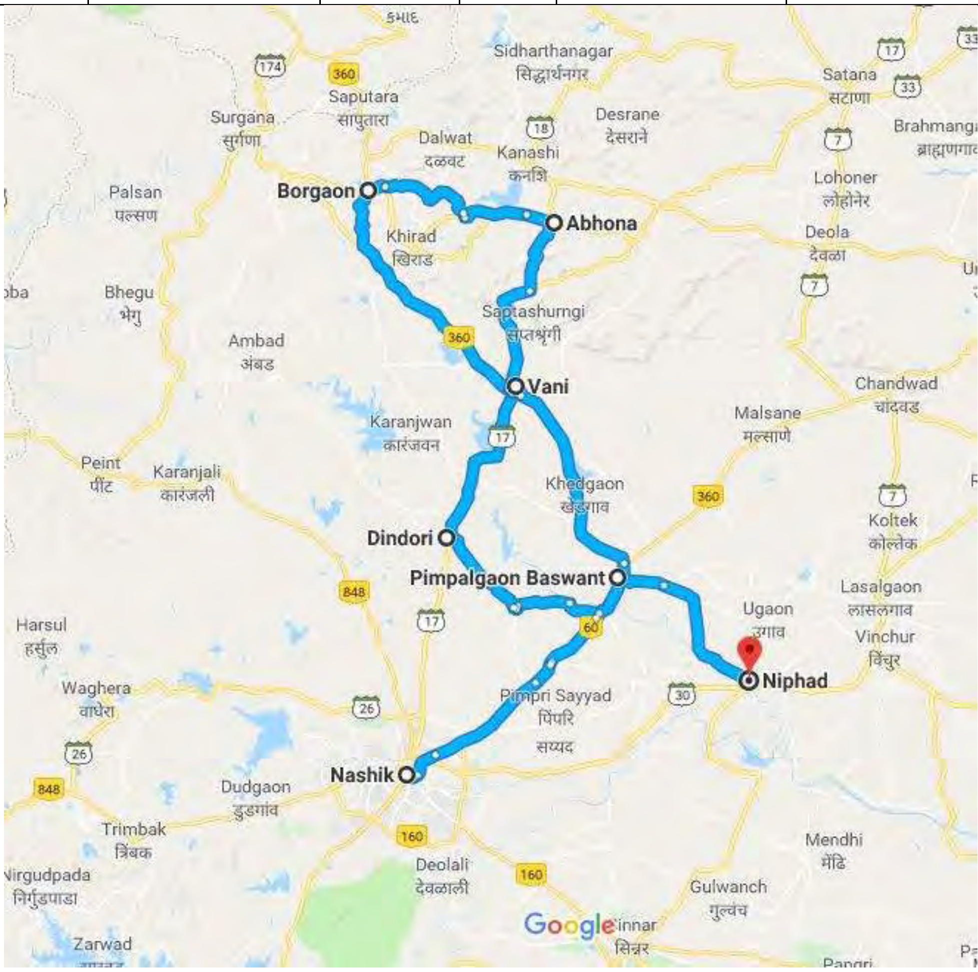
Survey was conducted on 14th February, 2018 covering Songaon, Gunwadi, Shirshe, Korale, Sangvi, Late villages under Baramati Taluka in Pune district. The survey revealed that leaf rust severity ranged between TS to 80 S mostly on off type mixture in HD 2189, Lok 1, Gold 23 and ARI breeding material at Songaon experimental farm.The first natural leaf rust incidence was found on 2/02/2018 on varieties viz. Lalbahadur, Agra local in trap plot nursery planted at Songaon experimental farm. No natural incidence of black rust observed under field as well as TPN nursery. Some traces of stem borer was observed in late sown farmer's field.

The foliar blight was observed in few farmers field and coordinated trials viz, Lok 1, Gold 21, PZ-TS-103, N-316, N-318,N-801,N-822 and VLS-101 etc,.with severity ranging from 01 to 57%. The early sown crop is ready for harvesting where as timely sown crop reached at physiological maturity stage. The late sown crop is reaching to tillering to flowering stage. Overall the crop health was good but weather was dry with rising temperatures

Survey report conducted on 7th Feb. 2018

S.No.	Location	Variety	Area (Ha.)	Geographical Information	Remarks
1	Chinchkhed	Ajit 102	0.40	Lat: 20.185 °N Long: 73.949 °E	Free from leaf and stem rust. Leaf blight in traces.
2	Jopul	Lok-1	0.60	Lat: 20.190 °N Long: 73.933 °E	Free from leaf and stem rust. Loose smut on some plants. Leaf blight in traces.
3	Lokhandewadi	Lok-1	0.50	Lat: 20.180 °N Long: 73.879 °E	Free from leaf and stem rust. Good plant stand.
4	Palkhed	Mohan Wonder	0.80	Lat: 20.185 °N Long: 73.949 °E	Free from leaf and stem rust. Offtypes upto 50%. Heavy aphid infestation.
5	Dindori	Ajay 72	0.80	Lat: 20.353 °N Long: 73.860 °E	Free from leaf and stem rust. Rat damage, Leaf blight in traces.
6	Saag Pada	Ajay 72	0.70	Lat: 20.185 °N Long: 73.949 °E	Free from leaf and stem rust. Crop under moisture stress.
7	Sarad	Lok-1	0.50	Lat: 20.460 °N Long: 73.750 °E	Leaf rust in traces with MS reaction. Free from stem rust. Offtypes upto 15-20%.
8	Borgaon	Super 222	0.20	Lat: 20.509 °N Long: 73.760 °E	Free from leaf and stem rust. Offtypes upto 5-10%.
9	Sukapur	Lok-1	0.15	Lat: 20.471 °N Long: 73.777 °E	Free from leaf and stem rust. Offtypes upto 5-10%. Aphid infestation observed.
10	Palasdar	Lok-1	0.40	Lat: 20.478 °N Long: 73.818 °E	Free from leaf and stem rust. Offtypes upto 10-15%. Weedy

					plot.
11	Abhona	Ajit 102	0.30	Lat: 20.482 °N Long: 73.916 °E	Leaf rust in traces with MS reaction. Free from stem rust. Good crop stand. Aphid infestation observed.



Survey report conducted on 22nd Feb. 2018

S.No.	Location	Variety	Area (Ha.)	Geographical Information	Remarks
1	Vadala Phata (Deola)	Arjun	0.30	Lat: 20.390 °N Long: 74.159 °E	Free from leaf and stem rust. Crop was under moisture stress.
2	Rameshwar	Lok-1	0.40	Lat: 20.435 °N Long: 74.174 °E	Free from leaf and stem rust. Offtypes upto 5%.
3	Thengode	Gold wheat	0.30	Lat: 20.524 °N Long: 74.196 °E	Free from stem rust. Leaf rust was upto 40S on initial foci.
4	Satana	Lok-1	0.60	Lat: 20.586 °N Long: 74.220 °E	Free from leaf and stem rust. Offtypes upto 10-15%. Weedy plot.
5	Shemali	Lok-1	2.00	Lat: 20.571 °N Long: 74.240 °E	Free from stem rust. Leaf rust reaction was 40S on offtypes and in traces on main variety with susceptible reaction.
6	Brahmangaon	Lok-1	0.15	Lat: 20.552 °N Long: 74.302 °E	Free from stem rust. Leaf rust was upto 40S on initial foci.
7	Pandhrun	Lok-1	0.20	Lat: 20.588 °N Long: 74.355 °E	Free from leaf and stem rust. Crop was under moisture stress.
8	Laxmiwadi	Arjun	0.20	Lat: 20.591 °N Long: 74.230 °E	Free from stem rust. Leaf rust was found in traces with moderately susceptible reaction. Offtypes upto 15-20%.
9	Vadali Bhoi	Ajit 102	0.70	Lat: 20.297 °N Long: 74.131 °E	Free from leaf and stem rust. Offtypes upto 5-10%. Leaf blight was found in traces.

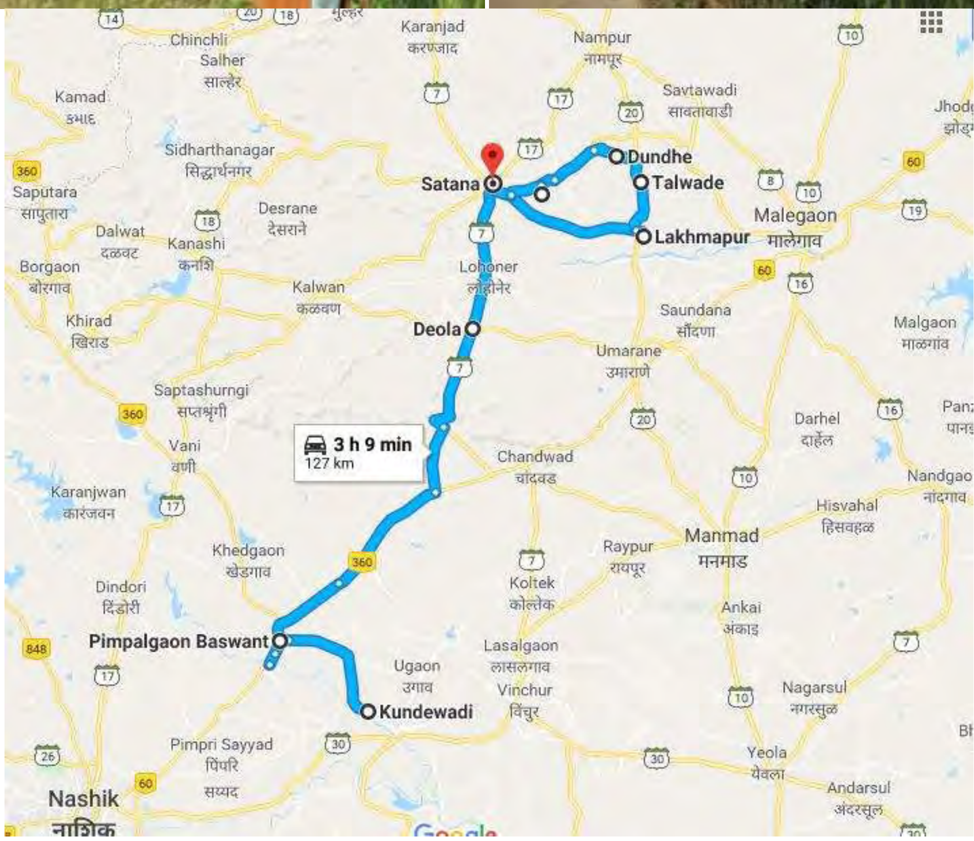
(B.C. Game and B.M. Ilhe)

Map of Survey route:
1. Survey conducted on 7th Feb. 2018

1. Survey conducted on 22nd Feb. 2018







The weekly information of climatic parameters has been given below

Week	Temperature		Rains (mm)	Relative humidity		Remark
	Max.	Min.		Max.	Min.	
5	30.84	9.96	-	93.9	39.37	-
6	30.04	11.87	-	94.8	45.3	Partial cloudy 4 days
7	31.71	13.4	-	94.8	45.5	Partial cloudy 3 days
8	33.64	13.94	-	90.5	37.99	Partial cloudy one day
Average mean	31.5	12.29	-	93.47	42.04	

About 20 leaf rust sample collected from farmer's field and TPN nursery send to Regional Research Station Floweradale, Shimla for pathogen analysis.

Leaf rust on Lok 1

Details of leaf rust samples collected during Baramati tour on 14th February 2018

S. No.	Taluka / District	Village	Wheat Variety	Lattitude (N)	Longitude (E)	Elevation (m)	Severity of Leaf Rust
1	Baramati, Pune	Gunwadi	Off-types in Lok 1	18.1419871	74.5742640	550	40S
2	Baramati, Pune	Songaon	Off-types in HD 2189	18.1390681	74.5742640	550	TS
3	Baramati, Pune	Songaon	MP Lok 1	18.1390681	74.5742640	550	5S
4	Baramati, Pune	Songaon	Lok 1	18.1390681	74.5742640	550	TS

5	Baramati, Pune	Sirshane	Off-types in Lok 1	18.1506630	74.5767820	552	TS
6	Baramati, Pune	Gite Wasti	Off-types in Lok 1	18.1390681	74.5742640	550	30S
7	Baramati, Pune	Korhale Bk	Off-types in Gold 21	18.1392670	74.4676912	550	20S
8	Baramati, Pune	Korhale Bk	Off-types in Gold 23	18.1392670	74.4676912	550	40S
9	Baramati, Pune	Korhale Bk	Off-types in Gold 23	18.1392670	74.4676912	550	40S
10	Baramati, Pune	Late	Off-types in Lok 1	18.0781773	74.4085929	550	60S
11	Baramati, Pune	Late	Off-types in Lok 1	18.0781773	74.4085929	550	80S
12	Baramati, Pune	Sangavi	Gold 23	18.1390681	74.5742640	550	TS
13	Baramati, Pune	Sangavi	Gold 23	18.0605987	74.4825947	550	TS
14	Baramati, Pune	Kala Odha	Off-types in Local Variety	18.0781773	74.4085929	550	40S
15	Baramati, Pune	TPN Songaon	Lal Bahadur	18.1390681	74.5742640	550	40S
16	Baramati, Pune	TPN Songaon	MACS 2496	18.1390681	74.5742640	550	TS
17	Baramati, Pune	TPN Songaon	Agra Local	18.1390681	74.5742640	550	TS
18	Baramati, Pune	TPN Songaon	Pusa 4 (IR)	18.1390681	74.5742640	550	20S
19	Baramati, Pune	Songaon	Gulab (Breeding Material)	18.1390681	74.5742640	550	40S
20	Baramati, Pune	Songaon	Offtype in Lok 1	18.1390681	74.5742640	550	TS

(B.C. Game and B.M.Ilhe, Agricultural Research Station, Niphad- 422 303, Dist. Nashik, B. K. Honrao, ARI Pune, Wheat Rust Mycologist & his team, RWRRS, Mahabaleshwar)

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. Elangbam Premabati Devi, Assistant Research Scientist (Plant Pathology) of Wheat Research Station, SDAU, Vijapur on 14th, 20th, 21st, 27th and 28th February of 2018 for presence of various diseases and insect pest with special focus on rusts encompassing various areas of Sabarkantha, Arvalli, Kutch, Patan and Banaskantha districts. The farmers' fields surveyed in a route covered and names of villages are given in Table.

The timely sown wheat crop in these areas is likely at harvesting stage while late sown crop in some of the fields was in dough stage.The leaf rust samples collected from farmers' fields were sent for race analyses. Overall the crop condition was satisfactory in the areas surveyed.

(A. A. Patel, S. I. Patel, Ms. Elangbam Premabati Devi, Wheat Research Station, SDAU, Vijapur)

District	Taluka	Villages	Status of disease and pests
14/02/2018			
Patan	Patan	Balisena, Dharpur, Baspa, Junakalana,	➢ Low infestation of aphid. ➢ Sporadic termite infection ➢ No Rust
	Harij	Adiya	
	Radhanpur	Thara, Sihori	
	Siddhpur	Amriwada, Mandali	
	Sami	Anvarpura, Tarora	
20/02/2018			
Mehsana	Vijapur	Sundarpur, Ransipur, Sudrasana	➢ Sporadic infestation of termite, Stem borer and Aphid ➢ No rust
Arvalli	Bhiloda	Ghanti, Rajendranagar	➢ Foliar blight in trace ➢ Sporadic incidence of termite and aphid
	Modasa	Limbhoi	Moderate Foliar blight
	Dhansura	Dolpur	Sporadic incidence of termite and aphid
Sabarkantha	Idar	Idar	➢ Low infestation of Stem borer and Aphid ➢ No rust
	Talod	Talod	Sporadic incidence of termite and aphid
21/02/2018			
Banaskantha	Deodar	Kotada, Lunava	Low infestation of aphid and stem borer
	Tharad	Paurashan, Uspa	
	Dhanera	Siniwadi	
	Pothanwada	Keemat,	
	SKnagar,	Dantiwada, Palanpur	
	Vadgam	Chhapi	
27-28/02/2018			
Kutch	Anjar	--	Low infestation of Aphid and stem borer
	Mundra	Bhujpur	Leaf rust in Trace on off-type plants
	Mandvi	Bidada	Low infestation of Aphid
		Layza	Stem borer in Lok 1 variety

		Batot	➢ Leaf rust in trace on off-type plants in a field of GW 496. ➢ Leaf rust also observed on weed *Serratia glauca*.
		Dumra	➢ Low infestation of Aphid ➢ Foliar blight in trace in late sowing crop
	Abdasa	Kothara	➢ Low infestation of Aphid ➢ Leaf rust in trace on off type plants in a field of GW 496.
		Dhavda	Leaf rust in trace on off-type plants
	Bhuj	Deshalpar	Moderate infestation of Aphid

Karnataka

Dr. P. V. Patil, Principal Scientist (Wheat Pathology) and S.V. Kulkarni, Technical Assistant conducted the Wheat crop health survey in Dharwad, Bagalkot and Belgaum districts on 09.02.2018. The crop was grown under different conditions (Rainfed, Restricted Irrigations and Irrigated conditions) in different areas. In all the areas the crop was between flowering to grain filling stage. The leaf rust severity was ranged between 0 to 100S. It was more severe on Amruth, Keerti, DWR 162 and parrot green earhead bread wheat mixture in which leaf rust severity was ranged between 60S to 80S. Leaf rust samples have been collected and sent to Shimla and Mahabaleshwar for virulence studies. Moderate infestation of aphid was observed in few farmers' field.


Monitoring team visited Hebbal plot Leaf rust severity in Shirol (Bagalkot district)

(P. V. Patil, Principal Scientist (Wheat Pathology), S.V. Kulkarni, Technical Assistant and Uday G., Asst. Prof.(GPB), of AICRP on Wheat and Barley, MARS, UAS, Dharwad)

West Bengal

No wheat blast like disease found in West Bengal.

(Sunita Mahapatra, Dhiman Mukherjee, of BCKVV, S. Hemram, and Saikat Das, UBKV Coochbehar)

Bihar

No report received

Jharkhand:

No report received

Stem rust was not observed in any of the fields visited; however leaf rust was more severe on some of the bread wheat genotypes.

Low to moderate infestation of aphids was observed in all the fields visited.

Report on training course on "Quality seed production in wheat and barley for enhancing adoption of new varieties " on 24 Feb 2018 at KVK Muzzafarnagar, UP.

A training programme for farmers and state agriculture department of Western UP was conducted on 24 Feb 2018. About 80 farmers participated. The farmers were briefed about seed production in wheat and barley and to increase quantity of seed given in mini kits of new varieties of wheat and barley.

WHEAT CROP HEALTH SURVEY REPORT (FEBRUARY, 2018)
Centre: AICRP on Wheat and Barley, UAS, Dharwad

District	Village	Latitude (N)	Longitude (E)	Elevation (m)	Wheat Variety/ Species	Crop grown condition	Leaf rust	Stem rust	Leaf blight (DD)
09.02.2018									
Dharwad	Kavalgeri	1529.874	07501.873	686	BW	IR	10S	0	00
Dharwad	Amminbhavi	1532.694	07503.722	647	DWR 162	IR	40S	0	00
Dharwad	Harobelavadi	1536.948	07504.150	619	AMRUTH	RF	5MS	0	00
Belgaum	Inamhongal	01538.098	07504.536	622	AMRUTH	RF	20S	0	00
Belgaum	Saundatti	01544.586	07506.659	660	BW	RI	20S on mixture	0	00
Belgaum	Goravanakolla	01546.882	07508.424	658	DWR 162	IR	40MS	0	00
Belgaum	Goravanakolla	01546.882	07508.424	658	DWR 162	IR	40S on mixture	0	00
Belgaum	Benakatti	01553.935	07504.597	619	DWR 162	IR	40 MS	0	00
Belgaum	Benakatti	01553.935	07504.597	619	DWR 162	IR	Parrot green earhead mixture in DWR 162	0	00
Belgaum	Jevapur	01556.950	07502.178	662	DWR 162	RI	5MS	0	00
Belgaum	Jevapur	01556.950	07502.178	662	DWR 162	RI	10-20S on mixture	0	00
Belgaum	Soplad	01601.031	07504.752	648	BW	IR	TMS	0	00
Belgaum	Salahalli	01604.006	07512.674	639	DWR 162	IR	60S	0	00
Belgaum	Dadanatti	01607.377	07518.384	629	BW	IR	10S	0	00
Bagalkot	Lokapur	01609.236	07521.144	572	BW	IR	30S	0	00
Bagalkot	Lokapur	01609.236	07521.144	572	Parrot green earhead mixture	IR	60S	0	00
Bagalkot	Hebbal	01612.865	07521.103	529	BW	IR	100S	0	00
Bagalkot	Jergal	01617.194	07518.879	535	BW	IR	60S	0	00
Bagalkot	Shirol	01623.768	07516.550	566	Keerti, DWR 162	IR	40S	0	00
Bagalkot	Madarkhandi	01630.104	07513.962	565	BW	IR	40S	0	00
Bagalkot	Yellatti	01629.595	07509.856	537	BW	IR	TMS	0	00
Bagalkot	Rabakavi	1628.176	07507.690	546	BW	IR	5S	0	00
Bagalkot	Rabakavi	1628.176	07507.690	546	BW	IR	40S on parrot green mixture	0	00
Bagalkot	Mahalingpur	01624.700	07506.489	591	BW	IR	10S	0	00
Bagalkot	Mahalingpur	01624.700	07506.489	591	BW	IR	40S on mixture	0	00
Bagalkot	Rannabelagali	1623.142	07507.986	560	BW	IR	10S	0	00
Bagalkot	Mudhol	01620.508	07516.084	536	BW	IR	10S	0	00
Bagalkot	Lakshanatti	01609.081	07521.855	559	BW	IR	5MS	0	00
Bagalkot	Lakshanatti	01609.081	07521.855	559	BW	IR	40S on parrot green mixture	0	00
Belgaum	Rankalkoppa	01556.520	07517.352	570	BW	IR	80S	0	00
Belgaum	Kallapur	01551.573	07515.828	610	DWR 162	IR	80S	0	00
District	Village	Latitude (N)	Longitude (E)	Elevation (m)	Wheat Variety/ Species	Crop grown condition	Leaf rust	Aphids (%)	
24.02.2018									
Belgaum	Hirebagewadi	1546.596	07437.982	687	Keerti	IR	80S	Low infestation	
Belgaum	Kamalapur	1615.222	07430.949	656	BW	IR	10S	Low infestation	

District	Village	Latitude (N)	Longitude (E)	Elevation (m)	Wheat Variety/ Species	Crop grown condition	Leaf rust	Stem rust	Leaf blight (DD)
Belgaum	Nidasoshi	1617.116	07431.597	685	BW	IR	0	Low infestation	
Belgaum	Toranahalli	1622.340	07433.291	706	BW	IR	0 80S on mixture	Low infestation	
Belgaum	Chikkodi	1624.257	07435.022	661	BW	IR	20S	Low infestation	
Belgaum	Kerurawadi	1629.445	07437.923	573	DW	RI	0	Low infestation	
Belgaum	Rupinal	1630.130	07438.458	556	BW	IR	0	Low infestation	
Belgaum	Rupinal	1630.130	07438.447	553	BW	IR	10S	Low infestation	
Belgaum	Manjari	1635.181	07441.803	539	BW	IR	80S on tall mixture	Low infestation	
Belgaum	Shiraguppi	1637.246	07443.303	543	BW	IR	5S	Low infestation	

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गेहूँ फसल स्वास्थ्य न्यूज़लेटर
भा.कृ.अनु.प.-भारतीय गेहूँ और जौ अनुसंधान संस्थान,
करनाल-132001(हरियाणा) भारत
मार्च, २०१८
WHEAT CROP HEALTH NEWSLETTER
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March, 2018

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गेहूँ के फसल स्वास्थ्य की निगरानी मार्च, २०१८ के दौरान आई.आई.डब्लू.बी.आर. और गेहूँ और जौ पर ऑल इंडिया कोऑर्डिनेटेड रिसर्च प्रोजेक्ट के विभिन्न सहयोगियों द्वारा की गई। मार्च महीने में गेहूँ की फसल का स्वास्थ काफी अच्छा रहा तथा कहीं से भी किसी बीमारी तथा कीटों के द्वारा फसल पर हानि की सूचना नहीं मिली। भारत-बंगलादेश सीमा पर पश्चिम बंगाल में गेहूँ के फसल स्वास्थ्य की निगरानी की गयी। गेहूँ की ब्लास्ट बीमारी जोकि पड़ोसी बंगलादेश में मौजूद है भारत में अभी तक नहीं मिली। मार्च माह के दौरान गेहूँ के फसल के स्वास्थ्य पर इस न्यूज़लेटर में प्रकाश डाला गया है।

विशिष्ट बातें

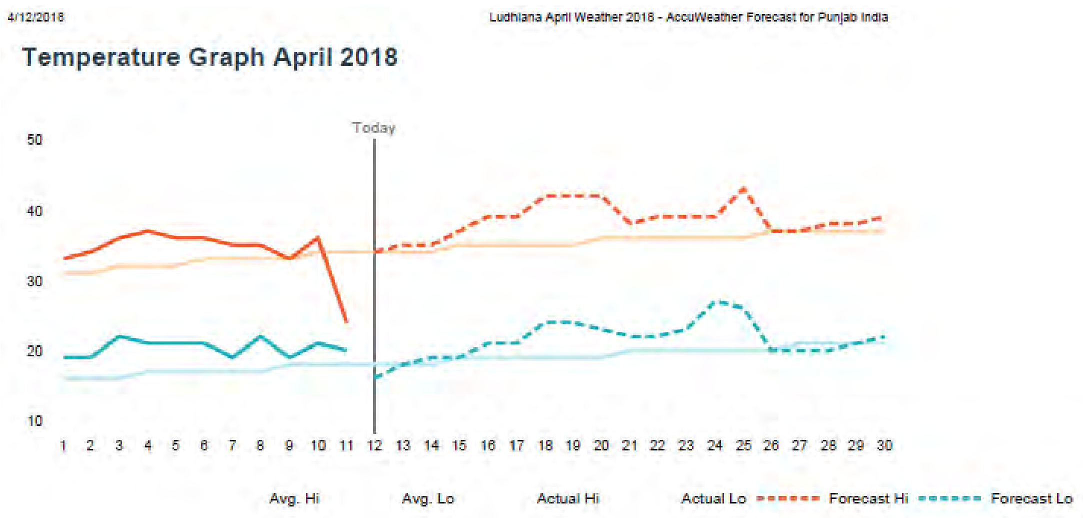
- मार्च, २०१८ में पीले रतुआ, गेहूँ की ब्लास्ट बीमारी, अन्य बीमारियों और कीटों के लिए फसल स्वास्थ्य सर्वेक्षण आयोजित किए गए। उत्तर भारत मे एक दो जगहों को छोड़कर कहीं से भी पीले रतूए की कोई सूचना नहीं मिली।
- भारत-बंगलादेश की सीमा के करीब, पश्चिम बंगाल के जिलों में गेहूँ में ब्लास्ट रोग नहीं मिला। रोगी पत्तियों तथा बालियों की सैंपल ले कर जाँच की गयी। हालांकि पश्चिम बंगाल के नादिया जिले में ८-१० खेतों में गेहूँ ब्लास्ट जैसी दिखायी देने वाली बीमारी के लक्षण मिले।

Wheat crop health was monitored during March, 2018 by IIWBR constituted teams and different cooperators of All India Coordinated Research Project on Wheat and Barley. No wheat blast is so far reported from West Bengal or any other state of India. The details along with highlights on wheat crop health during March 2018 are given in this issue of newsletter.

Highlights

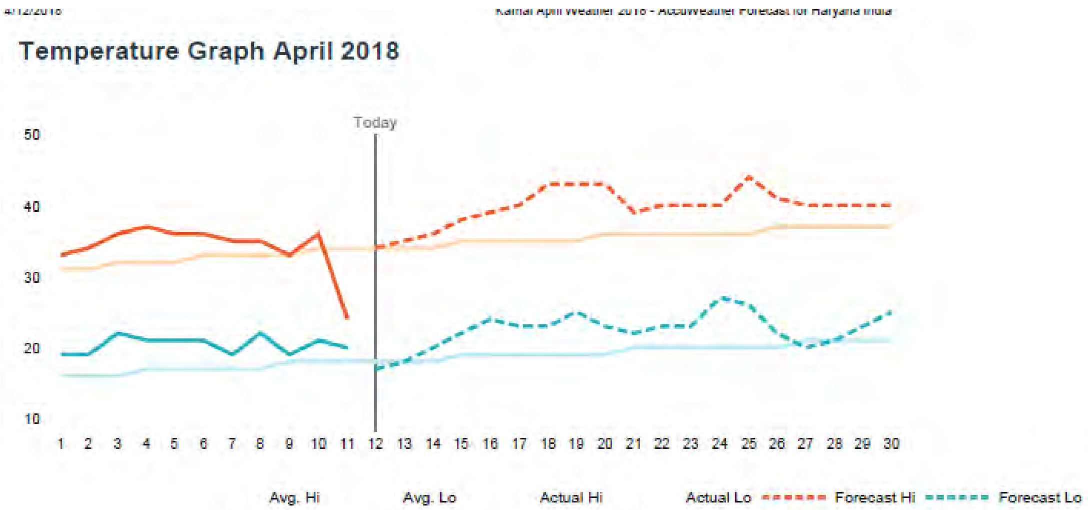
- **Crop health survey tours for yellow rust and other diseases and insect pests were conducted. Yellow rust (stripe rust) incidence was negligible in North India with no losses to wheat yields.**
- **No wheat blast reported from West Bengal close to Indo-Bangladesh borders. The samples of leaf and spike were analysed and found free from wheat blast. However wheat blast like symptoms reported in patches in 8-10 fields in Nadia district of West Bengal.**

Weather forecast (April 2018, Ludhiana, Punjab)
(Source: https://www.accuweather.com/en/in/ludhiana/205592/april-weather/205592)



Weather forecast (April 2018, Karnal, Haryana)

(Source: https://www.accuweather.com/en/in/karnal/188417/weather-forecast/188417)



Crop health report from states

H.P.

The yellow rust incidence was sporadic in few fields.
(Director Agriculture, HP)

Uttarakhand

A survey was conducted on 22nd February 2018. Dr. Lakshmi Kant, Head, Crop Improvement Division and Dr. K.K. Mishra, Principal Scientist, Plant pathology from ICAR-VPKAS, Almora surveyed districts Almora and Dehradun, respectively. The following observations were made:

3. At Pechuni (Prempuri), Ganai (N 29°52′52″, E 79°22′22″, amsl 963 M), Almora around 70% area has been planted with VL *Gehun* 907 and the crop was at early booting stage. Few plants of VL *Gehun* 907 plants got yellow rust upto 10S. However, yellow rust upto 30S was found in some unknown non recommended variety. The farmer was advised to spray Propiconazole @ 0.1%. It was ensured on the next day that the farmer could spray the same. The samples were collected and sent to IIWBR, RS Flowerdale.

4. In village Quano (N 30°40′ 38″, E 77°45′52″), Dehradun local barley variety was planted and crop was at early tillering stage. Here yellow rust upto 40S was recorded. Farmers also planted 10ha of wheat variety VL 804 and these fields were free of rust.

5. At Domet, Vikas nagar (N 30°30′ 41″, E 77°51′16″), Dehradun, farmers planted VL *Gehun* 829 and crop was at early tillering stage and no rust was observed.

Barley rust at Quano, Dehradun | Crop of VL 804 at Quano

Non recommended wheat variety infested with yellow rust at *Mehalcahuri, Chaukhutiya* | VL *Gehun*953 crop at free from rust *Mehalcahuri, Chaukhutiya*

(Lakshmi Kant, K.K. Mishra, Renu Jethi, and Rajesh Khulbe, ICAR-VPKAS, Almora)

Punjab

Insect pests in wheat

A survey was conducted on 16.03.2018 enroute Mullanpur, Jagraon, Ajitwal Talwandi Bhai ke, Mudki, Kotkapura Bajakhana, Bhagata bhai ke, Salabatpur, Barnala, Raikot in different district of Punjab. Minor incidence of termite (1-2%) was also observed in villages Chonikmaan (Ludhiana), Mudaki and Bajakhana (Faridkot). Pink stem borer damage (< 1%) was recorded in villages viz. Ajitwal (Moga) and Dadahur (Barnala). The aphid incidence was above economic threshold level in most of the places visited. The *Phalaris minor* was also recorded in some of villages in district Faridkot (Bajakhana, Bhagata Bhia ke) and Barnala (Bhadaur). In general, the crop was healthy.

(Beant Singh, PAU Ludhiana)

U.P.

Wheat and barley crop growth is very good in the season. Termite infestation was observed in wheat rainfed trials @ 10-15 per cent and in irrigated trials 5 per cent while it was 15 per cent in barley crop. Leaf Blight first time observed in TPN on 28/02/18 Yellow Rust on 02/03/18 and Brawn Rust on 10/03/18.

The survey of wheat fields for their health status during18-19.03.2018 around the Varanasi revealed no occurrence of any of three wheat rusts. Foot rot and spot blotch were observed at some places. This year expression of foliar blight was to be less prominent as the region did not receive any winter rain and heavy due formation. The crop was showed late milking (77) to mid-dough (85) stages. Due to less moisture and dry weather, the crop was found to have stress maturity. Farmers in the area were also educated about the diseases of wheat and their management in their fields.

(Javed B. Khan, CSAUAT Kanpur, S. S. Vaish, BHU Varanasi)

Rajasthan

The survey was conducted on 21-22, March 2018 in the Bassi and Jobner areas of district Jaipur to know the status of wheat diseases on farmers' field.

District	Location	Geographic location	Remark
Jaipur	Rajpura (Bassi)	Longitude: 76.0022436 Latitude: 26.7952669 Elevation: 349	Wheat cultivar: Local Growth stage: Daugh Sowing: Timely sowing Disease: Yellow Rust: 5S-40S Loose smut: In traces Area: 1.0 ha Cultivar: C 306 as mixed plants in Raj 3765 Diseases: Leaf Rust: TS-10S
	Goner	Longitude: 75.930109 Latitude: 26.823298 Elevation: 343	Wheat cultivar: Raj 3077 Growth stage: Daugh Sowing: Timely sowing Disease: Flag smut 2 per cent Area: 2.5ha
	Muhana (Sanganer)	Longitude: 75.735211 Latitude: 26.780766 Elevation: 374	Wheat cultivar: Raj 4120 Growth stage: Daugh Sowing: Timely sowing Disease: Flag smut 5-25per cent Area: 4.5 ha
	Boraj (Jobner)	Longitude: 75.447529 Latitude: 26.862297 Elevation: 358	Wheat cultivar: Local Growth stage: Daugh Sowing: Timely sowing Disease: : Yellow Rust: 5S-20S on few plants Loose smut: In traces Area: 1.0ha
	Ramsinghpura (Bagus)	Longitude: 75.5419110 Latitude: 26.868504 Elevation: 386	Wheat cultivar: seed of private company Growth stage: Daugh Sowing: Timely sowing Disease: Yellow Rust: 10S-60S Area: 1.25 ha
	Badh Fatehpura (Bagus)	Longitude: 75.558944 Latitude: 26.887653 Elevation: 401	Wheat cultivar: Raj 3077 Growth stage: Daugh Sowing: Timely sowing Disease: Loose smut in traces Area: 2.0 ha
	Sarangwas	Longitude:	Wheat cultivar: Mixed

		75.580907 Latitude: 26.932127 Elevation: 414	Growth stage: Daugh Sowing: Timely sowing Disease: Yellow Rust: 5S-40S Loose smut: In traces Area: 2.25ha
	Ramkui (Pachar)	Longitude: 75.549805 Latitude: 26.959669 Elevation: 396	Wheat cultivar: Raj 3077 Growth stage: Daugh Sowing: Timely sowing Disease: Yellow Rust: 10S (Raj 3077), 40S (Mixed plants) Flag smut: In traces Area: 2.0 ha
	Pipla Bharat Singh (Sanganer)	Longitude: 75.695595 Latitude: 26.818655 Elevation: 371	Wheat cultivar: Raj 3077 Growth stage: Daugh Sowing: Timely sowing Disease: Yellow Rust: 5S (Raj 3077), 60S (Mixed plants) Area: 1.75 ha

The crop was dough to maturity stage. Yellow rust was noticed in most of the fields but it was observed only on those plants which were cultivating under the tree shade and otherwise on some of-type plants. As the yellow rust was appeared late in the season and the wheat crop has almost matured, therefore, its impact on yield will be negligible. Leaf rust was noticed only at one location. High incidence of flag smut was noticed at one location. Loose smut in traces was noticed at some areas. The samples of both yellow and brown rusts have been sent to Flowerdale, Shimla for pathotype analysis. The heat stress will be adversely effected the wheat crop in the state.

(Pradeep Singh Shekhawat, RARI (SKNAU), Durgapura, Jaipur)

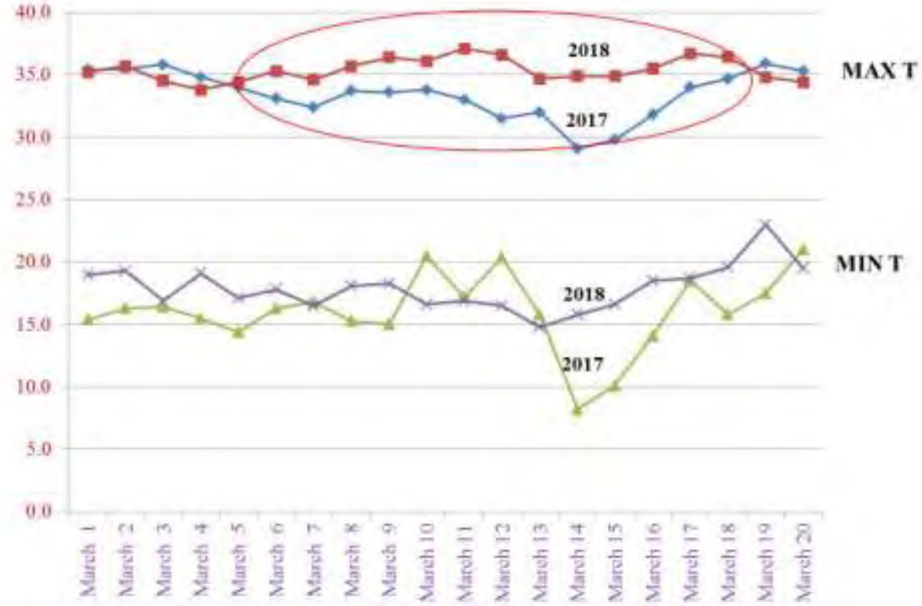
M.P.
Crop matured

Maharashtra
Crop matured

Gujarat
The wheat crop in Gujarat is free from any major pests. No any report of severe rusts (brown or black) is noticed till date in the state. The maximum temperatures remained higher during the month of March compared to previous year. This is evident from the daily weather data recorded and presented graphically for the years 2017 and 2018 for the same period. This leads to forced maturity especially of late sown wheat crop. The harvesting of wheat crop in the state is in progress.

(S.I. Patel, SDAU, Vijapur)

Karnataka
Crop harvested.



DAILY TEMPERATURES RECORDED AT WRS, SDAU, VIJAPUR, GUJARAT

West Bengal
Drs. Dhiman Mukherjee and S. Mahapatra of BCKV Kalyani along with West Bengal state gov. officers visited and surveyed Karimpur area of Nadia district during last week of March 2018.

***Wheat area grown in Nadia and Murshidanbad district during current season*:**
Instead of wheat holiday in two districts, mainly Nadia and Murshidabad farmers cultivate wheat only in few pockets. In Nadia district, wheat cultivation was mainly confined in Karimpur and Kadamgachi region. Approximately 4 ha grow in Karimpur Blok I, 13 ha in Karimpur Block II (border area of Murshidabad and Nadia) and 0.3 ha in Kadamghachi.Further in Murshidabad few farmers cultivate wheat mainly in Domkol area approximately 45 ha.

Wheat blast like disease reported so far in these districts:
Wheat blast like disease could only be found in Karimpur block I (approximately 3 acre land area affected in patches). The samples were collected on 22.03.2018 for study in BCKV laboratory.

***Surveys made in any other district after heading and status of WBLD*:**
Survey in North 24 paraganas, Hoogly, Bardhaman and Birbhum districts were conducted on 23 to 24th March, 2018. There was no incidence of wheat blast. Further, mostly farmers used improved wheat cultivar in this region. The FLD seed of HD 2967 was given in Hooghly, Bardhaman and Birbhum district (10 ha area), and no infection of WBLD reported till date.

During the visit on 16.03.2018 and 22.03.18, mostly farmers cultivate wheat as mixed crop mainly with Mustard, Maize and Barley. On 22.03.18, team visited interior pockets of Karimpur block I with the help of two state officials (KPS) from Karimpur. The state government helped the team to reach sensitive area for disease reporting etc. In this area farmers used last year store wheat seed materials (Variety: Janak). Few area of Karimpur Block II mainly in Phajli Nagar and Lal Nagar (Near B.Ed college) entry into wheat field was very difficult, as these areas are very sensitive.

(Sunita Mahapatra, Dhiman Mukherjee, of BCKV, Kalyani)

UBKV, Centre, W.B.

During this month total four survey work was done for wheat blast and other diseases along Indo-Bangladesh Borders of northern district of West Bengal on following dates:

Date	Name of the scientists/ Technical person	Places surveyed
5-6th March, 2018	Dr. S. Hembram Mr. M. Hansda	Different places of Jalpaiguri, Darjeeling, Uttar Dinajpur and Dakshin Dinajpur districts of West Bengal adjoining to Indo-Bangladesh Borders.
20-21stMarch, 2018	Dr. S. Hembram, Dr. S. Das	Different blocks of Cooch behar and Jalpaiguri districts of West Bengal
24-26th March, 2018	Dr. S. Hembram Mr. M. Hansda	Indo-Bangladesh Borders of Jalpaiguri, Darjeeling, Uttar Dinajpur, Dakshin Dinajpur and Malda districts of West Bengal
28th March, 2018	Dr. S. Hembram, Dr. S. Das	Different adjoining area of Indo-Bangladesh Borders with Cooch behar, Darjeeling and Jalpaiguri district of West Bengal

The team visited wheat blast trap plot nurseries and farmers' fields of different northern districts West Bengal (namely Malda, Uttar Dinajpur, Dakshin Dinajpur, Darjeeling, Jalpaiguri, Alipurduar and Coochbehar) adjoining to Indo-Bangladesh Borders. Farmers were found well aware about the no wheat zone (within 5 km from the boarder). Due to unawareness/ non availability recommended variety of wheat for other places of the different districts some farmers are unable to sow wheat crop during this season. Farmers are growing alternate crops like mustard, lentil, maize and vegetables and other pulses etc. as the state government gives effort to increase the pulse production in the state. Upto end of February, no symptom of Wheat blast and wheat blast like diseases were observed in any of the visited location and weather was also found dry and unfavourable for disease development during the period. But from the first week of March, with the increase of temperature almost all wheat crop in the farmer's field started to attain late flowering/dough stage and thus surveillance programme was also intensified. During the survey, (23-67 in 0-9 scale) and aphid infestation (3-6) spot blotch was mostly observed in the visited farmer's field and also in trap nursery planted in different districts. In some farmer's fields and trap nursery leaf rust (10-30S) along with wheat blast like disease symptom was observed. Disease samples have been collected from different areas surveyed and investigation for identification of pathogen is being continued.

. The detail of observation points are given below:

Location	Geographical Coordinates	Disease Status
Hili	N 25°26′03 E 88°88′90	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.
Majhian	N 25°31′31 E 88°76′64	Spot blotch, Loose smut, leaf rust and Wheat blast like symptoms observed and Aphid also present.
Daulatpur	N 25°33′13 E 88°32′78	Spot blotch and Wheat blast like symptoms observed and Aphid also present in farmer's field.
Purba Kamat Changrabandha	N 26°27′31 E 88°57′18	Wheat cultivation not allowed
Chakpara	N 25°33′93 E 88°71′36	Spot blotch and Wheat blast like symptoms observed and Aphid also present.
Rampur	N 25°34′18 E 88°64′42	Spot blotch, leaf rust and Wheat blast like symptoms observed and Aphid also present.
Panjapara	N 25°35′21 E 88°34′62	Spot blotch and Wheat blast like symptoms observed and Aphid also present.
Khord Deotala	N 25°29′22 E 88°30′01	Spot blotch and Wheat blast like symptoms observed and Aphid also present.
Barhatti	N 25°37′82 E 88°16′31	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.

Soharai	N 25°38′14 E 88°6′40	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.
Suliapara	N 25°43′41 E 88°17′50	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.
Kukrakunda	N 25°49′64 E 88°17′27	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.
Raiganj	N 25°61′85 E 88°12′55	Spot blotch, Loose smut, leaf rust and Wheat blast like symptoms and aphid population observed
Krishna Kumari	N 25°68′64 E 88°06′57	Leaf rust, spot blotch symptom and aphid population observed
Dwipanagar	N 25°66′75 E 88°08′21	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.
Bazitpur	N 25°86′37 E 88°03′95	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.
Goagoan, Nayahat	N 25°91′55 E 88°03′03	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.
BSF cantonment, Baishnabnagar	N 24°49′45 E 88°58′32	Spot blotch, leaf rust and Wheat blast like symptoms observed and aphid population observed
Madhugram	N 24°56′29 E 88°05′42	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.
Gangaprasad	N 24°57′30 E 88°04′780	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.
Chak Seherdi	N 24°49′29 E 88°58′12	Leaf rust ,spot blotch and aphid population observed
Baishnabnagar	N 24°50′0 E 88°58′31	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.
Purbbagoti	N 26°03′42 E 88°06′92	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.
Kachna	N 26°18′10 E 88°10′48	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.
Mainaguri Singijani	N 26°17′30 E 88°22′0	Spot blotch symptoms observed and Aphid infestation also present.
Jiakhori	N 26°26′61 E 88°16′39	Wheat cultivation restricted
Paschim Pachhurasia	N 26°26′60 E 88°16′38	Wheat cultivation restricted
Kharibari	N 26°55′59 E 88°19′58	Spot blotch, leaf rust, Wheat blast like disease and aphid population observed
Barokadali	N 26°30′23 E 89°71′52	Spot blotch and leaf rust symptoms observed and Aphid infestation also present.
Pundibari	N 26°40′07 E 89°38′81	Leaf rust, Spot blotch and Aphid also observed.
Tapurhat	N 26°30′19 E 89°42′68	Spot blotch symptoms observed and Aphid also present.
Mohitnagar	N 26°52′05 E 88°65′52	Spot blotch and leaf rust and Aphid infestation observed.

Table; 02. Different survey rout followed to observed wheat diseases status for the month of March, 2018 (A To D)

A.

First wheat blast and other diseases survey were conducted along Indo-Bangladesh Borders of Jalpaiguri, Darjeeling, Uttar Dinajpur and Dakshin Dinajpur districts of West Bengal on **05-06th March, 2018.**

B.

Second wheat blast and other diseases survey were conducted along Indo-Bangladesh Borders of Cooch behar and Jalpaiguri districts of West Bengal on **20-21st March, 2018.**

C.

Third wheat blast and other diseases survey were conducted along Indo-Bangladesh Borders of Jalpaiguri, Darjeeling, Uttar Dinajpur, Dakshin Dinajpur and Malda districts of West Bengal on **24-26th March, 2018.**

D.

Fourth wheat blast and other diseases survey were conducted along Indo-Bangladesh Borders of Cooch behar, Darjeeling and Jalpaiguri districts of West Bengal on **28th March, 2018.**

Disease symptoms observed during the March month survey




Satyajit Hembram, Manmatha Hansda and Saikat Das, UBKV, Cooch Behar, West Bengal


Different pest status photograph for the month of March, 2018

Bihar
No report received

Jharkhand:
No report received

Assam
No report received

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