प्रगति प्रतिवेदन
PROGRESS REPORT
2019-20

फसल सुरक्षा
CROP PROTECTION

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

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

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ALL INDIA COORDINATED WHEAT AND BARLEY IMPROVEMENT PROJECT

PROGRESS REPORT
2019-20

CROP PROTECTION

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(Sudheer Kumar)
Principal Investigator
(Crop Protection Programme)

ICAR-IIWBR, Karnal
Dated: 29th July 2020

C O N T E N T S

ANNEXURES

PROGRAMME OF WORK, 2019-2020

The programme for the crop year 2019-2020 was discussed in the 58th All India Wheat and Barley Research Workers Meet will be held at IARI, RS, Indore during August 24-26, 2019. The various activities to be executed at respective centers are given below:

PROGRAMME 1: Host resistance - IPPSN and PPSN

Adult Plant Resistance for rusts & other diseases

1. **Initial Plant Pathological Screening Nursery (IPPSN)**

   Objectives

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

(a) Rusts:

North:

Yellow Rust: Gurdaspur, Dhaulakuan, Malan, Karnal, Durgapura, Ludhiana, Hisar and Jammu (8)

Leaf Rust: Delhi, Karnal, Durgapura, Ludhiana, Faizabad, Kanpur (6)

South:

Stem Rust + Leaf Rust: Dharwad**,** Mahabaleshwar, Wellington, Powarkheda, Niphad and Indore (6)

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

2. **Plant Pathological Screening Nursery (PPSN)**

   Objectives

   Evaluation of breeding material for 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, Kudwani and Hisar (12)

Leaf Rust: Delhi, Hisar, Jammu, Kanpur, Karnal, Ludhiana, Pantnagar, Durgapura, Faizabad (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 entries and varieties (checks) in PPSN showed resistance in the past but now showing rust severity of 40S or more at any centre, 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.

3. **Monitoring of PPSN**

   The teams of plant pathologists and breeders will be constituted for effective monitoring and data recording in PPSN at various locations in different zones. The Plant Pathologists and Breeders of other zones will monitor PPSN during Zonal monitoring tours.

4. **AUDPC based identification of slow rusters in AVT material:**

   Leaf and Stripe rusts – Karnal, Ludhiana
   Stem and leaf rusts -Mahabaleshwar
   Leaf rust: Faizabad
   Stem rust -Indore

PROGRAMME 2: Seedling rust resistance and rust gene postulation

1. Race specific and slow rusting

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

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

(c) Stripe rust: AVT entries of NWPZ and NHZ alongwith the checks of the respective zones.
Centres: Ludhiana and 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 in North.

- **(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

2. Seedling Resistance Tests and postulation of Rust Resistance Genes

(a) 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.

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

PROGRAMME 3: Leaf Blight

Leaf Blight Screening Nursery (LBSN):

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 also.

Centers: 14

NWPZ: Pantnagar, Ludhiana, Karnal and Hisar.
NEPZ: Varanasi, Faizabad, IARI Pusa, Coochbehar, Shillongani, Ranchi, Kalyani and Nauni (Allahbad)
PZ: Dharwad, Wellington

PROGRAMME 4: Karnal Bunt

Karnal Bunt Screening Nursery (KBSN):

This nursery will consist of the earlier identified resistant materials, released varieties along with AVT entries under artificially inoculated conditions.
Centers: Ludhiana, New Delhi, Pantnagar, Hisar, Karnal and Jammu (6).

PROGRAMME 5: Loose Smut

Loose Smut Screening Nursery (LSSN): It will contain resistant materials identified in the past released varieties and AVT entries of NHZ, NWPZ and NEPZ
Centres: Ludhiana, Almora, Durgapura and Hisar (4)

PROGRAMME 6: Powdery Mildew

Powdery Mildew Screening Nursery (PMSN): All entries of AVT, previously identified resistant material and released varieties (NHZ, NWPZ)
Centres: Almora, Pantnagar, Shimla, Malan, Bajaura, Dhaulakuan, Wellington and Jammu (8)

PROGRAMME 7: Region specific diseases

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

2. **Foot rot:** Dharwad (AVT entries)
3. **Head scab:** Delhi, Dhulakuan, Gurdaspur
4. **Hill bunt:** Malan, Bajaura and Almora (AVT entries NHZ).

PROGRAMME 8: Crop Health

1. **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 2019 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 surveys will be included in first issue.

Monitoring of new virulences of yellow rusts in NWPZ by specially constituted teams:
Specially constituted teams will visit the areas as per the need 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. Teams will be constituted as per the need for survey

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. Teams will be constituted as per the need for survey. If any suspected samples of wheat blast like disease found will be analyzed at Kalyani and Coochbehar centre.

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 centers 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).

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. (Inclusion of PBW 757 in place of WL 711)

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.

2. **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 PI (CP), IIWBR, Karnal for analysis.

PROGRAMME 9: Integrated disease management

1. **Elite Plant Pathological Screening Nursery (EPPSN):** The sources of resistance to three or two rusts identified in PPSN will be retested to confirm their resistance to rusts:
   North: Delhi, Malan, Karnal, Ludhiana, Pantnagar, Durgapura, Hisar, Jammu and Almora (9)
   South: Wellington, Mahabaleshwar, Dharwad Niphad, and Indore (5).

2. **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:
   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, Kalyani,
   Loose smut: Hisar, Durgapura, Ludhiana, Almora
   Flag smut: Hisar, Durgapura, Ludhiana
   Head scab: New Delhi, Dhulakuan, Gurdaspur
   South:
   Leaf and Stem rust: Mahabaleshwar, Indore Dharwad, Niphad and Wellington
   Nematodes (CCN) : Durgapura, Hisar, and Ludhiana

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

3. **Chemical control**

(a) Chemical management of stripe rust: New chemicals will be tested at Karnal, Hisar, Ludhiana, Durgapura, Pantnagar and Jammu. The chemicals will be tested are:
Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, with standard chemicals (Propiconezole and Tebuconazole) and without chemicals.
The chemical will be evaluated under artificial inoculated condition and doses will be @ 0.1% and repeated once after 15 days. Design – RBD, Plot size – 6 rows of 3 meters, replications - 3.

(b) Chemical management of powdery mildew:
New chemicals will be tested at Almora, Pantnagar, Shimla, Malan, Bajaura, Dhaulakuan, Wellington and Jammu. The chemicals will be tested are:
Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC, Tebuconazole 50% + Trifloxystrobin 25% WG with standard chemical (Propiconezole and Tebuconazole) and without chemicals.
The chemical will be evaluated under artificial inoculated condition and doses will be @ 0.1% and repeated once after 15 days. Design – RBD, Plot size – 6 rows of 3 meters, replications - 3.

PROGRAMME 10. Entomology

1. **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

(a) Entomological screening nurseries (ESN)- In these nurseries, AVT entries along with those found resistant during previous years will be screened for
   (i) Shoot fly (Centres: Dharwad, Ludhiana, Kanpur, Niphad)
   (ii) Brown wheat mite (Centres: Durgapura and Ludhiana)

(iii) Wheat Aphids (Centres: Niphad, Ludhiana, Karnal, Shillongani and Kharibari)
(iv) Root aphid (Centres: Karnal and Ludhiana)
The NIVT entries will also be screened against foliar aphids at Niphad, Ludhiana and Karnal

(b) Multiple pest screening nurseries (MPSN)- In these nurseries, the germplasm having resistance to multiple diseases and insect-pests will be screened for
(i) Shoot fly (Centres: Dharwad, Ludhiana, Kanpur and Niphad)
(ii) Brown wheat mite (Centres: Durgapura and Ludhiana)
(iii) Foliar aphids (Centres: Niphad, Ludhiana, Karnal, Shillongani and Kharibari)
(iv) Root aphid (Centres: Karnal and Ludhiana)

2. Integrated Pest Management

(a) 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.

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

(c) Evaluation of trapping efficiency of sticky traps for monitoring aphid population in wheat(Centres: Niphad, Ludhiana, Karnal)
Studies will be conducted on evaluation of trapping efficiency of sticky traps for monitoring of aphid population in wheat. The population of alate (winged) and wingless forms of aphids captured in traps will be recorded during the season. Moreover, population of aphids will also be recorded on plants per plot basis to determine its relationship with the insect counts obtained on sticky traps.

(c) Effect of effect of Zinc sulphate application on aphid incidence in wheat (**Centres:** Karnal, Ludhiana, Niphad)
Effect of zinc sulphate application in soil as well as foliar application will be tested to determine its effect on aphid abundance in wheat. Soil application rate of zinc sulphate will be kept as 25 kg/hand foliar application rate will be 0.5%. Observations will be recorded on population of aphids per plant, natural enemies (adult and grubs) per plot, yield per treatment and nutrient status of soil as well as of plants before the treatment and at the time of harvest. The treatment details are as under:-

S.no.	Treatments
1.	RDF(Recommended date) of NPK
2.	RDF(Recommended date) of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage
3.	RDF(Recommended date) of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage
4.	RDF(Recommended date) of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage mixed with Actra 25 WG (thiamethxam) @ 50 g/ha
5.	RDF(Recommended date) of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage mixed with Actra 25 WG (thiamethoxam) @ 50 g/ha
6.	RDF(Recommended date) of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage

	mixed with Actra 25 WG (thiamethoxam) @ 50 g/ha and propiconazole @ 500 ml/ha
7.	RDF(Recommended date) of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage mixed with Actra 25 WG (thiamethoxam) @ 50 g/ha and propiconazole @ 500 ml/ha
8.	Untreated control (No application)
	Variety: HD 2967
	Design: RBD
	Replication: 03
	Plot Size: 6m × 6 rows
Fertilizers :	(Recommended dose of fertilizer)
NHZ, CZ and PZ : 10:60:40 Kg, N, P_2O_5 and K_2O/ ha **NWPZ and NEPZ:** 150:60:40 kg, N, P_2O_5 and K_2O/ ha Apply 1/3rd nitrogen, full phosphorus and potash as basal, 1/3rd at first irrigation and the remaining 1/3rd at second irrigation	
Observations:	
I.	Aphid incidence at peak period of its activity
II.	Nutrient status of soil before and after harvest
III.	Nutrient status of plants and grains at harvest
IV.	Yield attributes, Grain and biological yield

(d) 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.

(e) Zone specific IPM modules (**Centres:** Karnal, Ludhiana, 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.

(f) Effect of organic treatments on the incidence of major insect-pests and natural enemies (**Centres:** Karnal and Ludhiana)

Keeping in view of the interest of farmers about zero budget farming, effect of organic treatments viz., Neemastra, Bramhastra, Agniastra, Deshparni, Fermented butter milk and Cow urine will be evaluated against major insect-pests of wheat and natural enemies. The treatment details are as under:-

S.No	Treatment	Dosage
1.	Neemastra	2.5 litre/acre
2.	Neemastra	5.0 litre/acre
3.	Neemastra	7.5 litre/acre
4.	Bramhastra	2.5 litre/acre
5.	Bramhastra	5.0 litre/acre
6.	Bramhastra	7.0 litre/acre
7.	Fermented butter milk	8.0 litre/acre
8.	Fermented butter milk	10.0 litre/acre
9.	Fermented butter milk	12 .0 litre/acre
10.	Imidacloprid 17.8 SL/ Thiamethoxam 25 WG	100 ml/50 g
11.	Untreated control	-

(g) Management of aphids through foliar application of new chemical molecules (Centres: Karnal, Ludhiana, Niphad and Kharibari)

New chemicals molecules 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.

S. No	Treatment	Dosage g ai/ha	Formal Dose ml/ha
1.	Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC(Alika)	33.15 (18.9+14.25)	150 ml
2.	Thiamethoxam 25% WG	12.5	50
3.	Lambda cyhalothrin 5% EC	25	500
4.	Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon)	(8.49 + 19.81 % w/w)	400
5.	Imidacloprid 17.8 SL	20	400
6.	Beta-cyfluthrin 25 SC	18.75	1450
7.	Sulfoxaflor 12% SC	30	250 ml
8.	Untreated control	-	

(h) Management of termites, aphids and seed borne diseases of wheat through seed treatment of chemical molecules combinations (**Centres:** Durgapura, Kanpur, Ludhiana and Vijapur)

Few selected insecticides and their combination with fungicides will be tested as seed treatment against termites. The observations on insect population counts before and after the treatment will be recorded along with yield in each treatment..

S. No	Treatment	ml or g/kg of seed
1.	Imidacloprid 600FS + Tebuconazole	1 ml + 2 ml
2.	Thiamethoxam 25 WG+ Tebuconazole	3 g +2 ml
3.	Thiamethoxam 25WG	3 gm
4.	Tebuconazole	2 ml
5.	Imidacloprid 600 FS	2 ml
6.	Imidacloprid 18.5%+ Hexaconazole 1.5% FS (neonix)	2 ml
7.	Hexaconazole 1.5% FS	4 ml + 2 ml
8.	Untreated control	-

3. Stored Grain Pest Management

(a) Studies on different type of packing bags on seed viability during storage under ambient condition against store grain pests, *Trogoderma granarium or Rhizopertha dominica*

(Centres: Karnal,Ludhiana, Kharibari,Niphad **)**

Different types of storage bags viz., jute bags, High density polyethylene bags (HDPE) and Biaxially Oriented Polypropylene (BOPP) bags will be evaluated for storage insect-pest infestation and its effect on wheat seed quality will be determined.

PROGRAMME 11. Nematology

1. Monitoring of Nematodes: *Anguina tritici, Tylenchus* spp. *Pretylenchus* spp. *& Heterodera avenae*: All centres of Nematology

2. Evaluation of resistance against nematodes parasitizing wheat

(a) ***Heterodera avenae*:** Hisar, Durgapura and New Delhi

(b) ***Heterodera filipjevi*:** Ludhiana

3. Eco-friendly management of CCN nematodes in wheat:

Centres: Durgapura, Hisar, Ludhiana and New Delhi

List of Cooperators

PLANT PATHOLOGY PROGRAMME

NHZ

ICAR-IIWBR, Regional Station, Flowerdale, Shimla.
S.C. Bhardwaj, O.P. Gangwar, Pramod Prasad, Subodh Kumar

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ENTOMOLOGY PROGRAMME

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ARS, Niphad
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NEMATOLOGY PROGRAMME

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S.P. Bishnoi

CCS HAU, Hisar
Priyanka Duggal

Summary of trials and nurseries allotted and conducted at different cooperating centres during 2019-20 in Crop Protection Programme

S. No.	Name of Centre	Name of co-operators	No. nurseries/ trials allotted	Data not received	Data not considered
	Pathology				
1	Almora	DR.K.K.Mishra	6	1	
2	Allahbad	DR.Sunil Zacharia	1		1
3	Bajaura	Dr Rakesh Devlash	4		1
4	Coochbehar	Dr. Satyajit Hembram	4		
5	Delhi	Dr. Vaibhav Kumar Singh,	5		
6	Delhi	Dr. M.S.Saharan	3		
7	Dharwad	Dr. Gurudatt.M.Hegde	6		
8	Dhaulakuan	Dr. A.K.Singh	7		
9	Durgapura	Dr. P.S. Shekhawat	9		
10	Faizabad	Dr. Shiv Pratap Singh	6		
11	Hisar	Dr Rajender Singh Beniwal	10		
12	IARI Pusa (Bihar)	Dr. Ashish Kumar Gupta	3		
13	Indore	Dr. Prakasha T.L.	6		
14	Jammu	DR.M.K. Panday	9		
15	Junagarh	Dr. I. B. Kapadiya	1		1
16	Kalyani (Nadia)	Dr. Sunita Mahapatra	2		
17	Kanpur	Dr. Javed Bahar Khan	1		
18	Kudwani	Dr. Nazir A.Bhat	Could no sent*		
19	Karnal	Dr. Sudheer Kumar	10		
20	Ludhiana	DR. Jaspal Kaur, Ritu Bala	12		
21	Ludhiana (gurdaspur)	DR. Jaspal Kaur	4	1	
22	Mahabaleshwar	Dr. S.G. Sawashe	5		
23	Malan	Dr. Sachin Upmanyu	7		
24	Niphad	Dr. B.C. Game	4		
25	Pantnagar	Dr. Deep Shikha	9		
26	Powerkheda	Dr. K. K. Mishra	3		1
27	Pune	Dr. Sudhir Navathe	2	1	
28	Ranchi	Dr. H. C. Lal	1		
29	Sabour	Dr. C.S. Azad	3		
30	Shillongani	Mrs. R. Chakravarty	2		
31	Shimla	Dr. S.C. Bhardwaj	4		
32	Varanasi	Dr. S.S. Vaish	4		1
33	Vijapur	Dr. S.I. Patel	1		1
34	Wellington	Dr. P. Nallathambi	4		1
	Entomology				
1	Dharwad	Dr. Gurudatt M. Hegde	2		
2	Duragupra	Dr. A.S. Baloda	4		
3	Kanpur	Dr. J.K.Singh	7		
4	Karnal	Dr. Poonam Jasrotia	12		
5	Kharibari	Dr. Wasim Reza	6		
6	Ludhiana	Dr. Beant Singh	11		
7	Niphad	Dr. Bhalchandra Mhaske	10		
8	Shillongani	Dr. K.K.Samra	3		
9	Vijapur	Dr. A.A. Patel	4		
	Nematology				
1	Delhi	Dr. Pankaj	1	1	
2	Ludhiana	Dr.Ramanna Koulagi	2		
3	Durgapura	Dr. S.P.Bishnoi	2		
4	Hisar	Dr. Priyanka Duggal	2		
	Total		**224**	**4**	**7**

*due to some postal issues trials could not be sent

SUMMARY

The wheat is adversely affected by many pathogens, insect pests and nematodes result in significant yield losses. Crop protection programme aimed to minimise losses cause by biotic stresses through keeping strict surveillance, identification of resistance sources and development of management strategies. Resistant varieties are very effective and economical way to manage the biotic stresses. For that crop protection programme also worked hand in hand with wheat breeders to evaluate status of resistance to biotic stresses in initial and advanced breeding material with check varieties aiming to help breeders for promotions their entries in yield trials and identification of proposing variety for release. Additionally, keep vigil on new pathotypes of rusts and occurrence of any exotic diseases, as well as status of Karnal bunt and other diseases and insect pests. Coordination and sharing of knowledge among different agencies like DAC & FW, ICAR, SAUs, State Agriculture Departments, KVKs, and Farmers etc. about the potent diseases and insect pests and their management through regular strategy planning meetings, trainings, field days, discussions and distributions of literature and using IT tools. The achievements during 2019-20 are summarised below:

PATHOLOGY

Survey and surveillance for diseases

To monitor the wheat and barley crop health during the crop season 2019-20, regular surveys were conducted with major emphasis on occurrence of yellow rust in NWPZ and surveillance for wheat blast. However, due to spread of COVID-19 and consequent lockdown surveys were not conducted in end of March and April 2020. The extensive surveys were conducted by the wheat crop protection scientists of different cooperating centers including ICAR-IIWBR Karnal and information was share among through the *"Wheat Crop Health Newsletter"*, Vol. 25 (Issues 1 to 4) which was issued during the crop season and also uploaded on ICAR-IIWBR website (www.iiwbr.org). The first occurrence of yellow rust in crop season 2019-20 is reported from the three fields in Anandpur Sahib block of district Rupnagar in villages Chandesar and Darolli (hethlii) on verities HD 3086, PBW 677 and WH 711 on 26.12.2019. This year the temperature become persistently low with intermittent rains yellow rust spread in few pockets of Punjab, Haryana and Jammu while minor occurrence was also reported from Rajasthan, Uttar Pradesh, Madhya Pradesh etc. 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. The overall crop health status was excellent in the country.

Host resistance

Advance breeding material was evaluated against disease and insect pests to support the breeding programme at various hot spot locations under artificially inoculated conditions. The major nurseries were: Initial Plant Pathological Nursery (IPPSN), Plant Pathological Nursery (PPSN), Elite PPSN, Multiple Disease Screening Nursery (MDSN), Multiple Pest Screening Nursery (MPSN), and disease / insect pest specific nurseries. About 3000 entries were screened against different diseases and insect pests at hot spot multilocations.

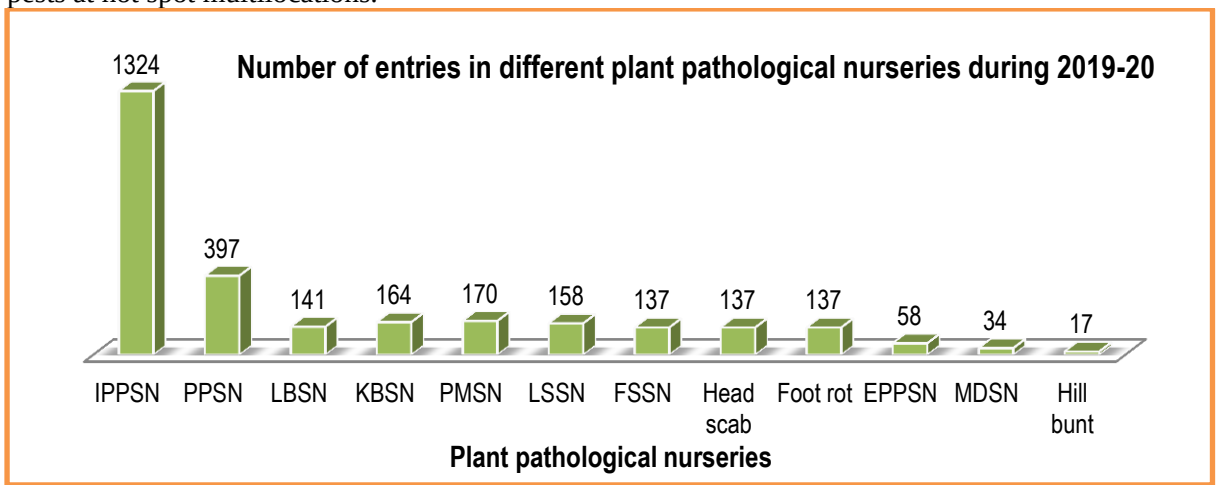

Fig. Constitution of different plant pathological nurseries during 2019-20

Entries and check varieties identified resistant against rusts in PPSN:
Rust resistance materials in AVT entries (2019-20) with ACI upto 10.0 are given below:

Stem, Leaf and Stripe rusts
DBW187 (C), DBW252(I) (C), DBW303*, DBW328, DDW47(d)(I), HD3249(I) (C), HD3334, HI 8823(d), HI8627(d), HI8805(d)(I) (C), HI8818(d), HS 507 (C), HS 679, HS 681, MACS3949(d) (C), MP 1358, MP1361, MPO 1357(d), NIDW 1149(d)*, PBW804, TAW155, UAS 472(d), UAS466(d)(I), VL 3024 and WH1252

Leaf and Stripe rusts
DBW332, DBW333, DDW48 (d)*, DDW49 (d)*, HS 680, JKW261, UAS428(d) (C), UAS446(d)(C), VL 3022 and WHD964(d)

Leaf and Stem rusts
CG1029*, DBW173 (C), DBW296, DBW329, DBW39 (C), DDK1029 (C), DDK1058, DDK1059, GW513, GW519, HD2864, HD3059 (C), HD3090 (C), HD3377, HI1544, HI1628(I) (C), HI1633*, HI1634*, HI1636, HUW838, HW1098 (C), MACS5054, MACS5055, MACS6222 (aest.) (C), MACS6747, MACS6749, MACS6752, MP3288, NIAW3170(I) (C), PBW550 (C), PBW771(I) (C), PBW840, RAJ4541, UP3033, VL 2036, VL 892 (C) and VL 907 (C)

Identification of multiple diseases resistant entries:
Based on rigorous screening of under Multiple Diseases Screening Nursery (MDSN) at multilocations the following genotypes have been identified as conformed source of resistance for multiple diseases:

A. Resistant to stem, leaf and stripe rusts +
Resistant to all three + KB+PM+FS+FHB: HS660, GW 1339, HI 8800 (d), PBW 757, DWB 187, DBW 237
Resistant to all three rusts +LB+ KB+FS+FHB: PBW 800, PBW 763
Resistant to all three rusts +PM+FS+FHB: HS 661

B. Resistant to Stem and Leaf rust +
Resistant to Stem and Leaf rust + KB+PM+FS+FHB: GW 1346 (d), GW 492, HPW 459, MACS4059 (d), MACS 5051, GW 491, HPW 451
Resistant to Stem and Leaf rust: +LB+ KB+PM+FS+FHB: NIAW 3171, UP 3016, HI1628
Resistant to Stem and Leaf rust + LB+ KB+FS+FHB: DDK 1054
Resistant to Stem and Leaf rust + KB+FS+FHB: AKW4924, HI 1624

C. Resistant to leaf and stripe rust +
Resistant to leaf and stripe rust +KB+FS+ HB: PBW 797, PBW 801
Resistant to leaf and stripe rust +KB+PM+FS+FHB: MPO 1336

Utilization of resistance sources
The NGSN comprising 27 entries with confirmed sources of multiple disease resistance were planted at 20 breeding centers across different agro climatic zones of country for their utilization in breeding for resistance to biotic stresses. All 27 entries were utilized in the range of 0.0 – 50.0% by the breeding centres (Fig. 9.1). The most utilized entries at many centers were PBW 777, HS 611 and HS 645(Table 9.4). Malan and Ludhiana centers, utilized maximum 12 entries in their breeding programme followed by Pune.

Pathotype distribution of rust pathogens in India and Nepal during 2019-20
All the rusts of wheat and barley were observed in India and Nepal during 2019-20. A total of 897 samples of three rusts of wheat and barley have been pathotyped so far from India and Nepal during the year.

Yellow or stripe rust of wheat and Barley (*Puccinia striiformis*)
During the year 305 samples of wheat stripe rust were analyzed from seven states of India and Nepal on the sets of differentials. Pathotype 238S119 was the most predominant among the seven pathotypes occurring on wheat and was observed in 44.06% samples. This pathotype is virulent on *Yr2*, *Yr3*, *Yr4*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr18*, *Yr19*, *Yr21*, *Yr22*, *Yr23*, *Yr25*, *YrA* and Riebesel 47/51. The population of 46S119 has declined to 33.2% followed by 110S119 in 18.98% of the samples.

Black rust of wheat (*Puccinia graminis* f. sp. *tritici*)
Seven pathotypes were identified in 127 samples of stem rust pathotyped from six states (Tamil Nadu, Karnataka, Maharashtra, Gujarat, Madhya Pradesh and Uttarakhand) and Nepal. Pathotype 11 (79G31) was most predominant and was recorded in 88.2% of the samples. While pathotype 62G29(40A) occurred in 4.7%, pt. 58G15-3(40-2) was observed in 3.9% of the samples. Remaining 4 pathotypes were detected in 0.78% samples each.

Brown rust of wheat (*Puccinia triticina*)
A total of 465 samples of wheat leaf rust were pathotyped during 2019-20 from 14 states of India and Nepal. Twenty three pathotype of *Puccinia triticina* were observed in varying frequencies. Pathotype 77-9 (121R60-1) followed by 77-5 (121R63-1) were the most widely distributes pathotypes and were found to occur in 14 and 11 states of India, respectively and Nepal. Pathotype 77-9 was identified in 50.3% of pathotyped samples followed by 77-5(28.2%), 77-1(109R63) in 7.1% and 104-2(21R55) in 3.2% samples.

Rust resistance genes in AVT lines (Gene postulation)
***Yr*-genes**
Among the 137 lines of AVT, *Yr* genes were characterized in 95 lines. *Yr* genes were postulated in lines where differential interactions were observed and in other cases tight linkage of *Yr* genes to resistance genes to other rusts also facilitated to infer the presence of a resistance gene. Four *Yr* genes viz. *Yr2*, *Yr9*, *YrA* and *Yr18* contributed for yellow rust resistance in India. Among the postulated *Yr* genes *Yr2* was most common and was characterized in more than half of the lines. *Yr9* on the other hand occurred in 25, *YrA* in 16 and *Yr18* in one line only.

***Lr*-genes**
Ten *Lr* genes viz. *Lr1*, *Lr2a*, *Lr3*, *Lr10*, *Lr13*, *Lr18*, *Lr23*, *Lr24*, *Lr26* and *Lr34* were characterized in 112 lines. *Lr10* was the most commonly occurring leaf rust resistance and was characterized in highest number of lines (37) followed by *Lr13* (30 lines), *Lr1* (29 lines) and *Lr26* (25 lines). *Lr24* was also postulated in 12 lines. Among these Lr13 becomes effective at higher temperature. While *Lr2a*/*Sr30* and *Lr3* were inferred in 6 lines each, *Lr18* was postulated in 2, *Lr34* in 1 line only. *Lr2a*/*Sr30* are closely linked and we have differentiating pathotypes for both the resistance genes. Most of the genes occurred in combination and many of the lines have leaf rust resistance derived from 3 or more *Lr* genes.

***Sr*-genes**
Thirteen stem rust resistance genes (*Sr2*, *Sr5*, *Sr7b*, *Sr8a*, *Sr8b*, *Sr9b*, *Sr9e*, *Sr11*, *Sr13*, *Sr24*, *Sr28*, *Sr30* and *Sr31*) were characterized in 120 AVT lines. *Sr* genes *Sr2* and *Sr11* were postulated in 43 AVT entries. *Sr31*, linked with *Lr26* and *Yr9* and conferring resistance to all the known Pgt pathotypes in Indian subcontinent, was postulated in 25 AVT entries. *Sr*-genes *Sr24*, *Sr28*, *Sr5*, *Sr13* and *Sr7b* were characterized in 12, 4, 18, 12 and 31 entries, respectively. *Sr30*, *Sr9b*, *Sr8a* were inferred in seven entries each. Most of the *Sr* genes occurred in the combination of other genes. Entry DBW252 possessed a combination of maximum four genes i.e. *Sr5+8a+11+2+*.

Management of diseases through chemicals
Yellow rust management
Five different fungicides were evaluated for management of yellow rust of wheat during 2019-20 at seven different locations indicated that all the fungicides were effective in managing the disease in comparison to unsprayed control check. The fungicide provided maximum disease protection against

yellow rust in different locations include: Tebuconazole 50 % + Trifloxystrobin 25 % WG @ 0.06%, Propiconazole@0.1% and Picoxystrobin 7.05 % + Propiconazole 11.7 % SC @ 0.1%. Moreover, no phytotoxicity was recorded with any of the tested concentration of fungicides on wheat plants.

Powdery mildew management

Experimental trials were carried out during 2019-20 at five different locations for the evaluation of different fungicides for management of powdery mildew of wheat. The results revealed that all the fungicides were effective in controlling the disease in comparison to unsprayed control check. Maximum disease protection against powdery mildew infection was provided by Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% in Almora, Jammu and Karnal locations, while Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1% was observed as highly effective at Dhaulakuan and Pantnagar location.

Strategy Planning Meetings

For the effective implementation of crop protection technologies first strategy planning meeting on "Evolving strategies for enhancing wheat production with special reference to management of wheat rusts and Karnal bunt disease" on 18th October, 2019 at Krishi Bhawan. The status of yellow rust and Karnal bunt and the varietal advancement made during the cropping season 2018-19 was presented in the meeting. Second strategy planning meetings was also conducted on "Alternate crop plan to combat the occurrence of wheat blast like disease in the state of West Bengal" on 21.10.2019 at Kolkata. Secretary (Agriculture), West Bengal presented the efforts made to combat the wheat blast threat like wheat holiday, no wheat zone, strict quarantine on Bangladesh boarder and its affects. PI Crop Improvement and PI Crop Protection from IIWBR attended the meeting. It was discussed that resistant varieties need to be promoted in the disease prone areas. Five resistant varieties identified namely DBW 187, HD 3249 and HD 2967 (irrigated and timely sown) and DBW 252 and HD 3171 (restricted irrigation and timely sown) have been recommended to be grown in disease prone areas of West Bengal. It was suggested that continuous monitoring of wheat crop is required and if any suspected symptoms are observed, it should be reported to the IIWBR immediately.

Advisory for stripe rust management: Need based advisory for stripe rust management was issued. Awareness among farmers for stripe rust management especially in Punjab, Haryana and Jammu was created through mobile, internet, toll free number, newspapers, discussions and delivering lectures in farmers training programmes.

Preparedness to wheat blast

Survey were conducted in North and South West Bengal near Indo-Bangladesh boarder by team of scientist from ICAR-IIWBR, Karnal, UBKV, Cooch Behar, West Bengal and BCKV, Kalyani, Nadia, West Bengal and no wheat blast was observed. A strategy planning meeting was conducted on 21.10.2019 at Kolkata. Alternate crop plan has been implemented to combat the occurrence of wheat blast like disease in the state of West Bengal. For identification of wheat blast resistant sources, a total of 353 Indian wheat varieties and advance breeding material were screened at Jessore, Bangladesh through CIMMYT. Five resistant varieties identified namely DBW 187, HD 3249 and HD 2967 (irrigated and timely sown) and DBW 252 and HD 3171 (restricted irrigation and timely sown) have been recommended to be grown in disease prone areas of West Bengal. Besides this during the 2019-20, a total 350 advance breeding material and promising wheat lines were screened at Jessore, Bangladesh through CIMMYT. Out of these, a number of lines showed the resistance against wheat blast disease. Awareness was also created in farmers to take all preventive measures available against blast and to grow the resistant varieties identified.

Post harvest surveys for Karnal bunt

A total of 2438 grain samples collected from various mandies in different zones and were analyzed at cooperating centers. This year very limited samples have been collected due to lockdown in the country during the harvesting time because of COVID-19 outspread. The overall 50.5% samples were found infected. The samples from Haryana showed maximum infection (57.8%). In general the

Karnal bunt infection was higher in comparison to previous year because of intermittent rains during the booting and grain formation stages.

Training for wheat health management

Training was organized on "Identification and preventive measures of wheat blast and adoption strategies of resistant varieties" at BCKV, Kalyani on 17.12.2019. About hundreds farmers and state agriculture officers were participated in the training programme especially from Mrshidabad and Nadia district which is prone to wheat blast.

ENTOMOLOGY

Survey and surveillance for insect pests

- In Punjab, the moderate incidence of wheat aphid was observed in the month of second fortnight of February and first fortnight of March. Intensive surveys carried out in the state of Punjab revealed the presence of pink stem borer and armyworm infestation in south western districts of Punjab particularly in residue managed wheat fields in the month of December. The severe incidence of pink stem borer and armyworm was observed in some of the fields in district Sangrur and Patiala where farmers had ploughed their field and re-sown the crop. It was observed that the damage of these insects was particularly high in early sown wheat crop (October sown). Another important observation from the surveillance programme was that pink stem borer and armyworm damage was higher in those fields where long duration rice varieties were cultivated in previous crop season in rice-wheat cropping system.
- In Maharashtra, survey was carried out in the villages of Nasik and adjoining district Ahemednagar and Aurangabad at different crop stages. Heavy incidence of aphids was recorded during the survey. The *Coccinellid* and *Chrysoperla carnea* predator, grubs and beetles feeding on the aphid were also observed. The incidence of jassids was recorded in medium intensity.
- In Gujarat state, the termite damage in wheat fields remained low throughout the crop season. While, the incidence of aphids was low to moderate during ear head stage of the crop. The population of *H. armigera*, pink stem borer and surface grasshopper were very low. The appearance of minor pests like spodoptera, 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.
- In Kanpur, the incidence of shootfly was observed 2 per cent for wheat variety PBW-343 and HD-2967. The incidence of termite was observed 8 per cent in same varieties of wheat. At Arol (Kanpur), the termite infestation was observed 10% in wheat varieties namely, DBW 39 and HUW 234. Moderate infestation of foliar aphid was on barley variety namely, 'Barley Local' while the shootfly infestation was observed 2% at the village Arol (Kanpur). The moderate incidence of pink stem borer was observed in irrigated crop one per cent in variety HD-2967.
- In Haryana, many reports of attack of pink stem borer and army worm came in the month of December from Yamunanagar, Ambala, Krushestra, Kunjpura, Ladwa etc.The incidence of these lepidopterous pests was reported around 5-7% in these areas. Termites and rot aphid was also reported during November and December which was around 2-5%. Starting from January, incidence of aphids started and it was minimal in the beginning with 5-6 aphids/tiller but in February, higher infestation of aphids (60-85 aphids/tiller on an average) was observed in the fields. Natural enemies, wasps, spiders and the grubs and adults of coccinellid beetles were seen during February and March frequently in the fields.

Resistance against insect pests

Shoot fly: Amongst 137 AVT entries tested at three locations, 96 entries showed infestation index of shoot fly infestation below 10%. Based on the average infestation of three locations, entry DDK1059 had the lowest infestation index (3.61 %). of shootfly. Entry HD3090 (C) had lowest infestation of

2.85% at Ludhiana whereas at Kanpur entry DBW303 had lowest infestation of 1.42%. Two entries viz., DDK1059 recorded lowest infestation of 3.57% at Dharwad.

Brown wheat mite: At Ludhiana, entry HPW 349 (C) recorded the minimum mite population of 4.67/10 cm^2 area while at Durgapura location, three entries viz., HS 681, MACS3949 (d)(C) and DDK1058 recorded the minimum mite population of 9.0/10 cm^2. Based on the average of two locations, entry HPW 349 (C) recorded minimum mite population of 7.5/10 cm^2.

Foliar aphid: Four entries viz., PBW550 (C), HUW838, UAS472(d) and DBW327 at Ludhiana and eight entries HD3334, DDW47(d)(I), DDW49(d), DBW327, HD3086 (C), DBW332, DBW303 and DBW329 at Karnal showed moderately resistance to foliar aphid (grade 3). At Kharibari, four entries (PBW771(I) (C),PBW813,HD3331,WH1124 (C)) and ten entries viz., HD2967 (C),WH1021 (C), PBW644 (C), DBW296, WH1080 (C), HD3249(I) (C), MACS3949(d) (C), MACS5055, MACS6222 (aest.) (C) and DBW327 were found to be moderately resistant (grade 3). At Niphad, all the entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category.

Root aphid: Out of total 137 entries, four entries viz., GW513, GW322, HI1646 and HD3086 (C) showed the moderately resistance (grade 3) reaction at Ludhiana.

Screening against multiple pests

The average infestation index of shootfly recorded at three locations was to be lowest (5.3%) in entry DDK1054 and the maximum score of 16.4% was recorded for GW 173 (C). The lowest population of 8.3 brown wheat mites/10 cm^2 was recorded in entry UP301610 at Ludhiana while entry PBW763 had lowest population of 9.7 mites/10 cm^2 at Durgapura. Based on average score of three locations, five entries MACS4059 (d), PBW800, UP3016, DBW 237 and DDK1054 showed moderately resistance to foliar aphid. At Ludhiana, one entry HI8800(d) was found to be moderately resistant (grade 3) to root aphid.

Integrated pest management

- Influence of sowing time on the incidence and population build-up of major insect pests of wheat was studied at two locations. The termite damage recorded at seedling stage in different dates of sowing indicated that early sown crop (first week of Nov. 2019) suffered more termite damage as compared to timely, late and very late sown crop. The pink stem borer damage was higher in early and timely sown crop as compared to late and very late sown crop. The aphid incidence was noticed in first week of January in early sown crop and in second week of January in 15 Nov. sown crop while it appeared in third week of January in other two sowing times. The data recorded indicated that the aphid incidence got delayed with the delay in sowing time.
- Effect of zinc sulphate as foliar application was investigated at two centres; Karnal and Ludhiana to determine its effect on aphid abundance and their coccinellid predators in wheat. The data revealed that one or two sprays of $ZnSo_4$ mixed with thiamethoxam effectively reduced the aphid population. Although some reduction in aphid control was observed when thiamethoxam was mixed with $ZnSo_4$ but statistically it was not significant. Similarly, $ZnSo_4$ can also be mixed with propiconazole + thiamethoxam without any adverse effect. The coccinellid predators were also not adversely affected by application of one or two sprays of $ZnSo_4$ mixed with insecticides and fungicides at reproductive stages of wheat crop.
- The integrated pest modules were tested at four centres viz., Karnal, Ludhiana, Niphad, Kanpur against major pests of wheat viz., foliar aphids, shootfly, termites and pink stem borer revealed comparatively lower pest population in IPM module treatment as compared to the Farmer practice (FP). However, in FP treatment the population of natural enemies was little higher than IPM treatment.
- Keeping in view of the interest of farmers about zero budget farming, effect of organic treatments viz., Neemastra, Bramhastra, Agniastra, Deshparni, Fermented butter milk and Cow urine were evaluated against major insect-pests of wheat and natural enemies at two centres: Karnal and Ludhiana. The data revealed that Bramastra @7.5% was found to be the most effective treatment

as compared to other organic treatments recorded fewer aphids. The organic treatments were found safer to natural enemies and little effect was seen on their population as compared to check of insecticide spray with Thiamethoxam 25 WG.

- Efficacy of various insecticides and their combinations against foliar aphid was determined at various centres. Overall, treatment of Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon) was more effective in checking aphid population. Besides, Lambda cyhalothrin 5% EC @ 500 ml/ha, Imidacloprid 17.8 SL @ 400 ml/ha and Beta-cyfluthrin 25 SC @ 1450 ml/ha were also found equally effective against it.
- In case of termite management through seed treatment, lowest termite damage was recorded in pre-mixed insecticide imidacloprid 18.5%+ hexaconazole 1.5% FS followed by tank mixture of Imidacloprid 600FS + Tebuconazole at Ludhina. However, at Vijapur, treatment of fipronil 5 SC @ 0.3 g a.i./kg seed was most effective followed by thiamethoxam 25 WG @ 0.8 g a.i./kg and thiamethoxam 30 FS @ 0.72 g a.i./kg.
- Population dynamics studies of foliar aphids on wheat and barley crops revealed comparatively higher population of aphid on barley as compared to wheat crop. The coccinellid beetle appeared after the peak period of aphid infestation on wheat and barley crop.

NEMATOLOGY

Resistance against *Heterodera avenae*

One hundred thirty seven entries of AVT were screened for resistance against *H. avenae* (CCN) under sick plot conditions. No entry showed resistance across all the locations. Out of these, seven entries namely, HS 681, WH1124, WH1080, DBW39, WHD964 (d), MACS6752 and DBW303 showed moderate resistant reaction at Ludhiana. Whereas, only two entries VL907 (C) and PBW812 showed moderate level of resistance at Hisar centre.

Management of cereal cyst nematode

Different formulation of Chalcone with different doses of Carbofuran was tried for nematicidal properties against CCN. The maximum reduction of population was observed in Chalcone C2 @40 ppm conc. +half dose of Carbofuran (67.8 %) with high grain yield. Half dose of carbofuran with Chalcone C2 @40 ppm conc. showed its overall superiority by preventing larval penetration/infection and better plant growth.

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: 1324
No. of breeding centers: 33

Test Locations
Rusts:
North:
Yellow Rust: Gurdaspur, Dhaulakuan, Malan, Karnal, Durgapura, Ludhiana, Hisar and Jammu (8)
Leaf Rust: Delhi, Durgapura, Karnal, Faizabad, Kanpur and Ludhiana (6)
South:
Leaf Rust and Stem Rust: Dharwad, Mahabaleshwar, Wellington, Powarkheda, Niphad and Indore (6)
Leaf Blight: Faizabad, Pusa (Bihar), Varanasi, Kalyani, Sabour and Coochbehar (6)

Data of leaf rust from Durgapura center was not considered due to poor disease development.

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

The entriest found resistant (ACI>10) and qualify for promotion (ACI>20) to three rusts are given in Table 1.1. A total 1324 entries were screened for rusts at multilocation under artificially inoculated condition. Out of these, 632, 950, 1094 and 350 entries found resistant against stem rust, leaf rust (S), leaf rust (N) and stripe rust, respectively (Fig. 1.1). The center wise per cent entries in each zone found resistant were represented by Fig. 1.2 to 1.7. The disease data of IPPSN entries was also uploaded on IIWBR website in last week of June 2020.

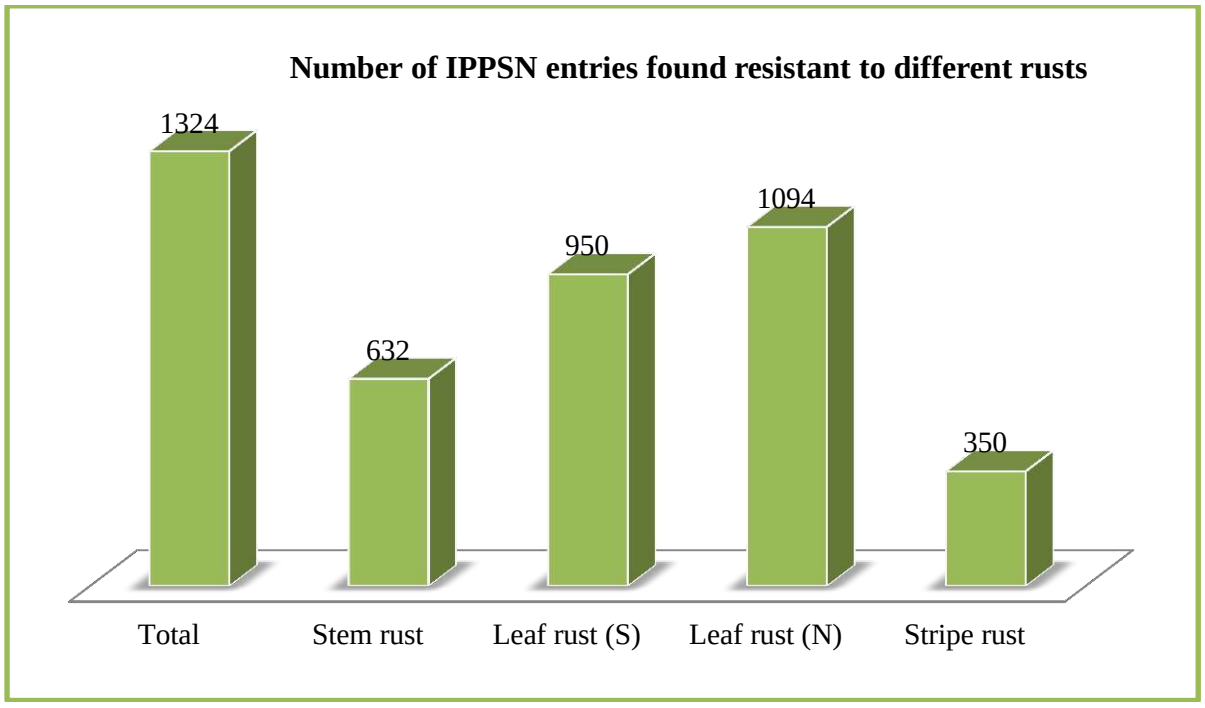

Fig. 1.1 Number of IPPSN entries found resistant to different rusts.

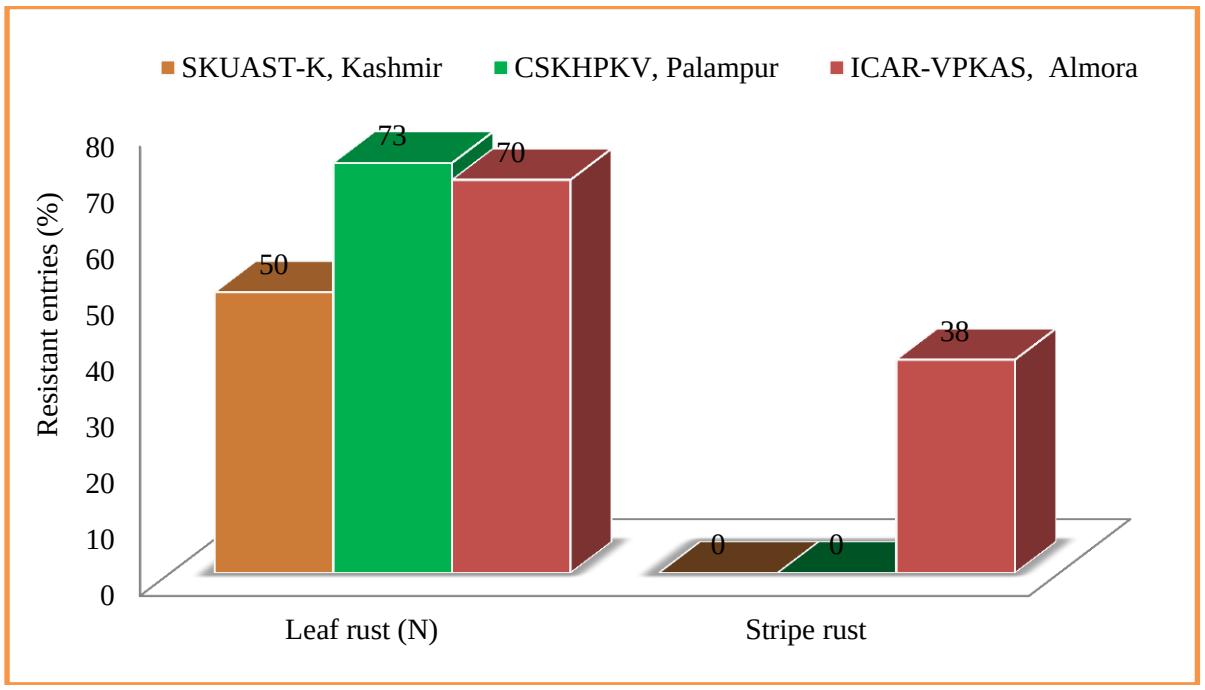

Fig. 1.2. Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of NHZ (Leaf and Stripe rust)

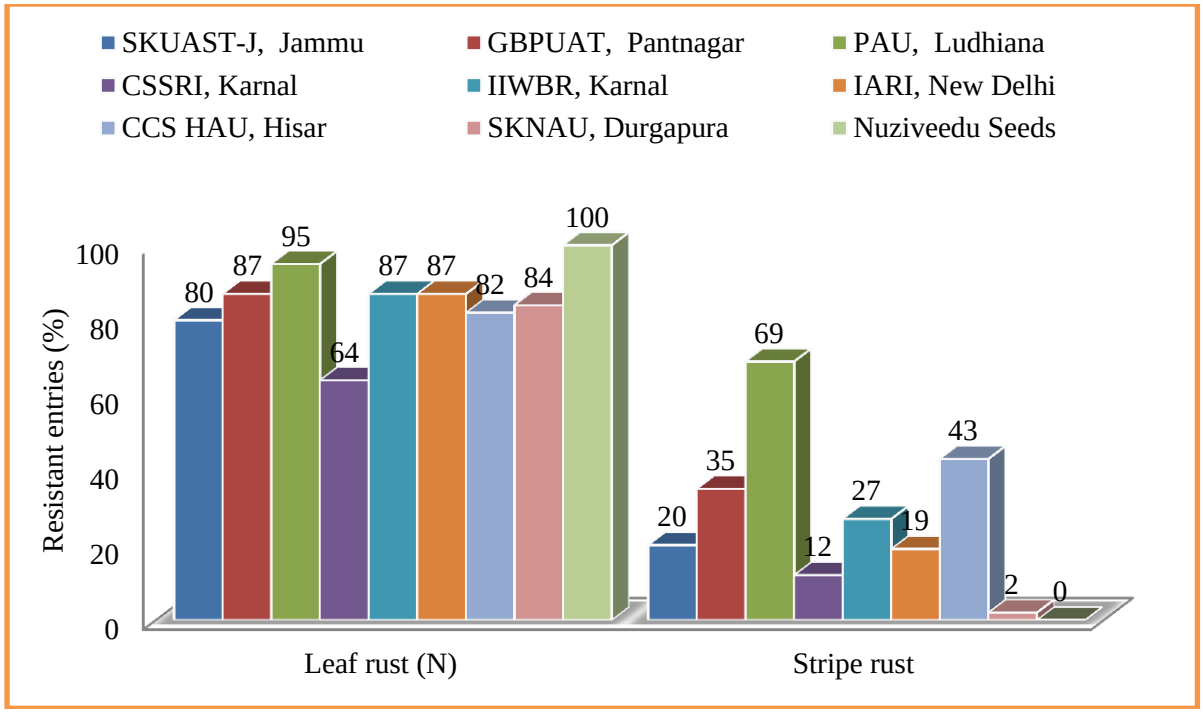

Fig. 1.3 Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of NWPZ (Leaf and Stripe rust)

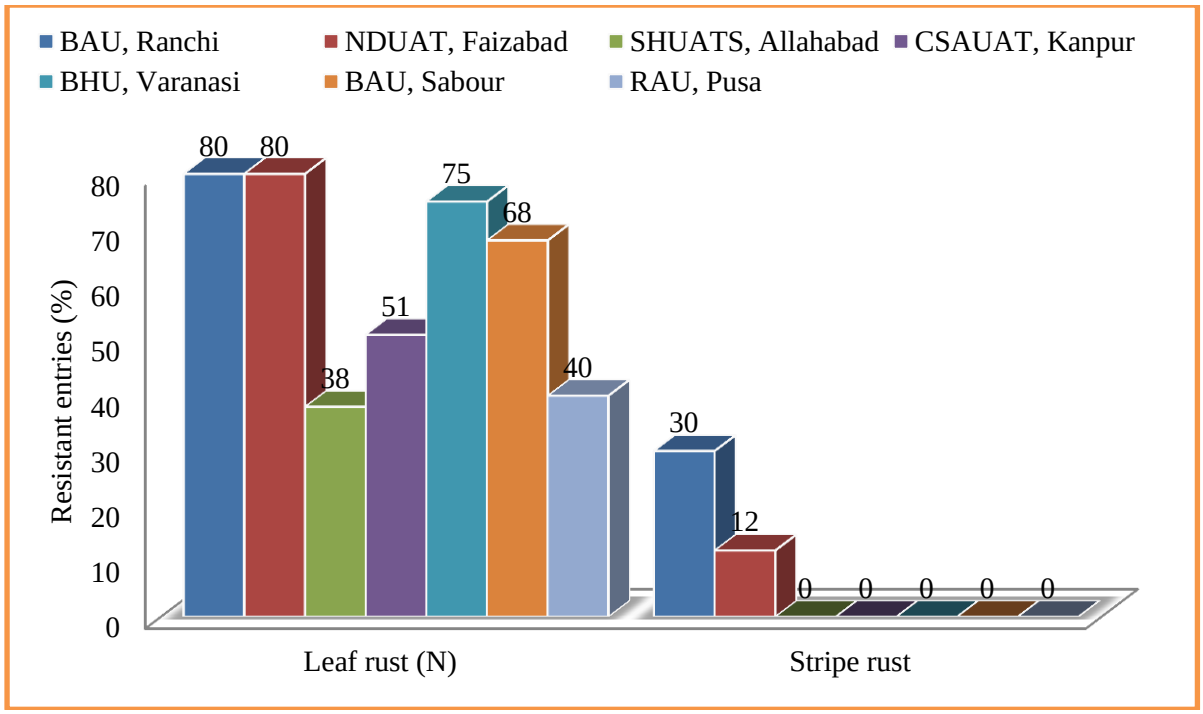

Fig. 1.4 Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of NEPZ (Leaf and Stripe rust)

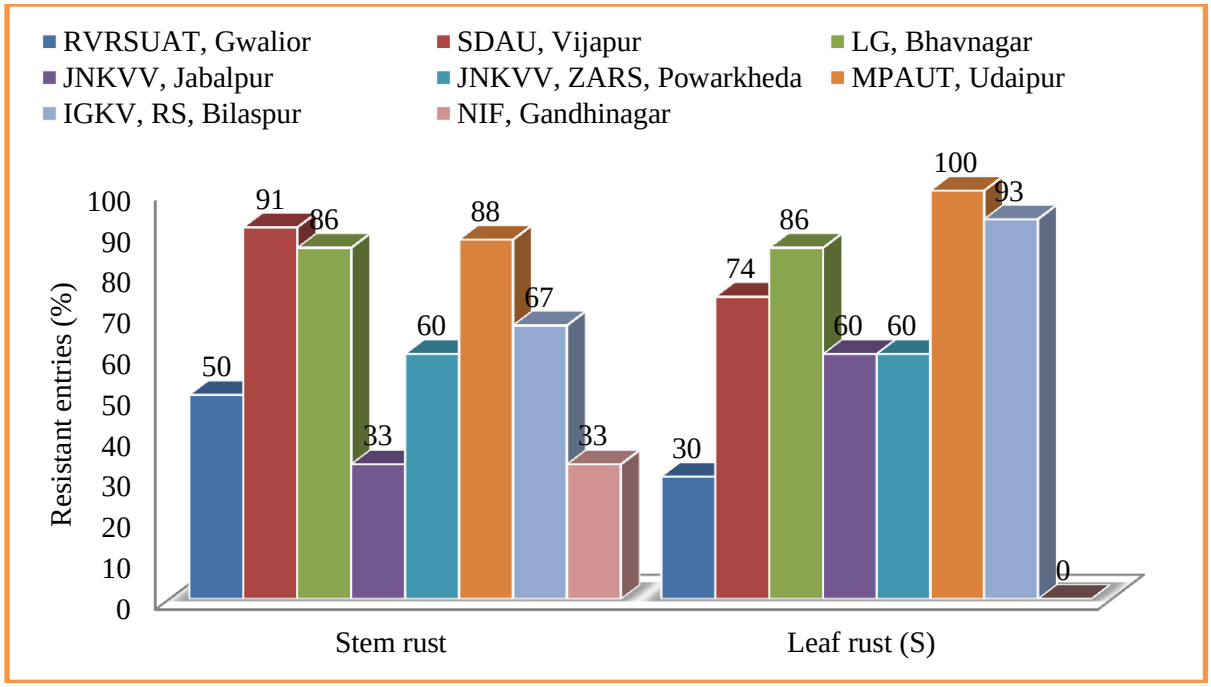

Fig. 1. 5. Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of CZ (Stem and Leaf rust)

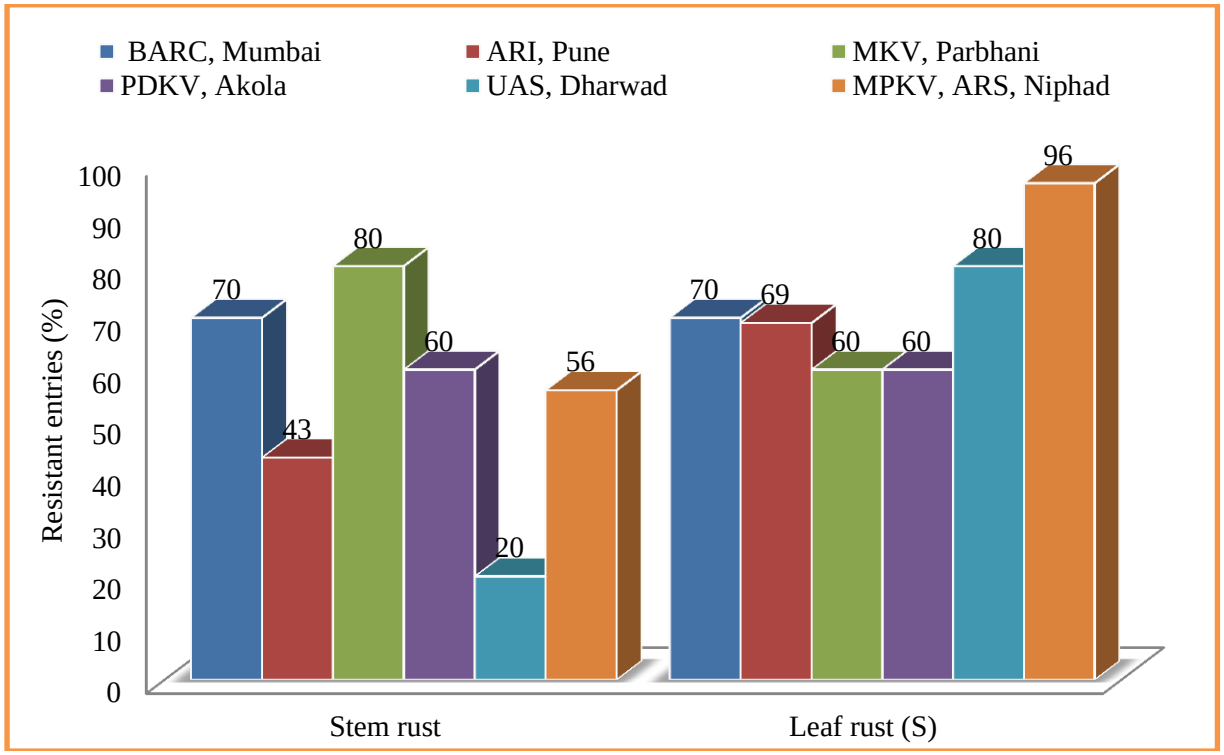

Fig. 1.6. Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of PZ (Stem and Leaf rust)

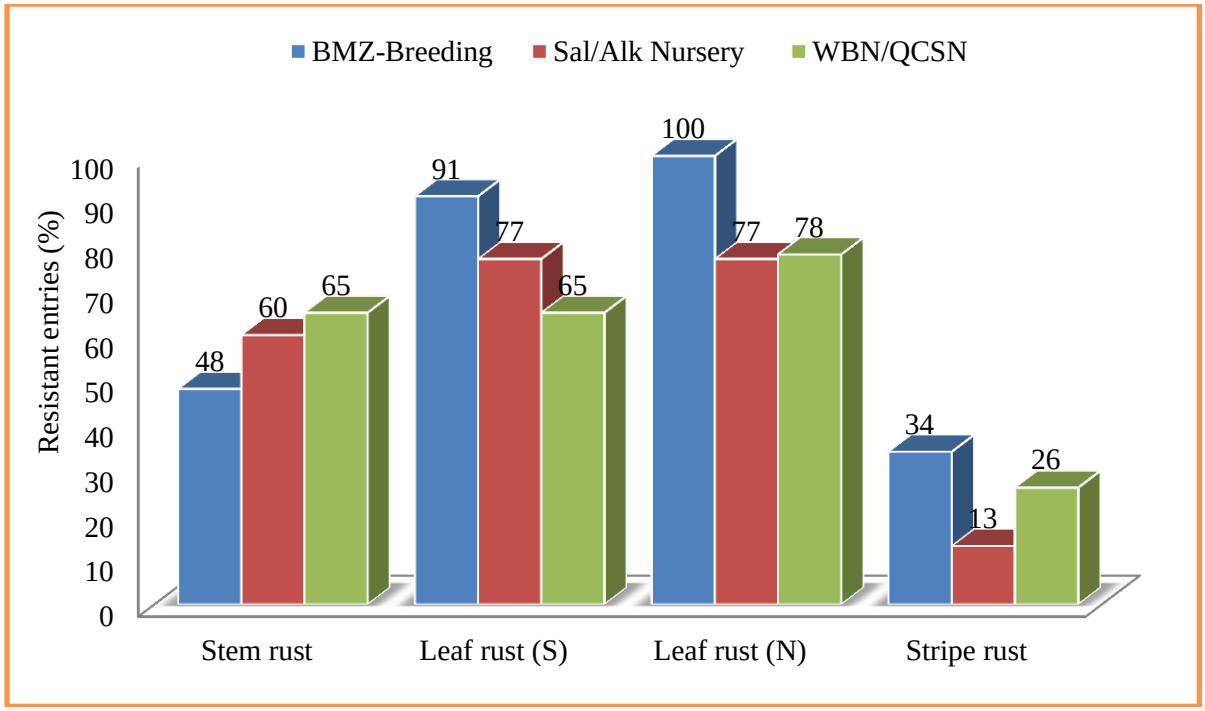

Fig. 1.7. Per cent of rust resistant entries in IPPSN slots belonging to different special trials (Stem, Leaf and stripe rust)

Table 1.1: Number to resistant entries (ACI<10) and entries qualify for promotion (ACI <20) in IPPSN slots of different centres during 2019-20.

Centers	Total Entries	Resistant entries (ACI<10)				Promotional entries (ACI<20)			
		Stem rust	Leaf rust (S)	Leaf rust (N)	Stripe rust	Stem rust	Leaf rust (S)	Leaf rust (N)	Stripe rust
NHZ									
SKUAST-K, Khudwani, Kashmir	4	1	0	2	0	2	2	4	1
CSKHPKV, Palampur	30	12	8	22	0	22	25	27	13
ICAR-VPKAS, Almora	50	32	43	35	19	44	48	47	42
NWPZ									
SKUAST-J, Jammu	10	8	8	8	2	10	8	9	7
GBPUAT, Pantnagar	60	27	48	52	21	43	56	57	48
PAU, Ludhiana	170	76	143	161	118	121	165	169	169
CSSRI, Karnal	25	13	13	16	3	20	18	19	3
IIWBR, Karnal	172	80	139	150	47	125	156	165	134
IARI, New Delhi	170	74	118	148	33	112	153	165	82
CCS HAU, Hisar	60	19	50	49	26	45	58	59	56
SKNAU, Durgapura	50	40	38	42	1	44	43	49	16
Nuziveedu Seeds	2	1	1	2	0	1	2	2	0
NEPZ									
BAU, Ranchi	10	5	8	8	3	9	8	9	7
NDUAT, Faizabad	25	4	15	20	3	13	18	24	9
SHUATS, Allahabad	8	2	3	3	0	7	5	4	1
CSAUAT, Kanpur	45	3	10	23	0	14	30	34	6
BHU, Varanasi	40	19	25	30	0	27	34	35	9
BAU, Sabour	25	7	10	17	0	18	16	21	4
RAU, Pusa	5	1	2	2	0	4	4	2	1
CZ									
RVRSUAT, Gwalior	10	5	3	5	0	9	6	8	0
SDAU, Vijapur	35	32	26	31	6	35	33	34	7
LG, Bhavnagar	7	6	6	6	0	7	6	6	0
JNKVV, Jabalpur	15	5	9	12	1	12	13	13	5
JNKVV, ZARS, Powarkheda	30	18	18	24	8	27	28	29	14
MPAUT, Udaipur	8	7	8	8	5	8	8	8	5
IGKV, RS, Bilaspur	15	10	14	13	0	12	14	14	0
NIF, Gandhinagar	3	1	0	1	0	1	2	2	0
PZ									
BARC, Mumbai	10	7	7	10	3	8	9	10	10
ARI, Pune	35	15	24	25	5	27	30	31	9
MKV, Parbhani	5	4	3	3	1	5	3	5	2
PDKV, Akola	15	9	9	10	0	14	13	13	1
UAS, Dharwad	30	6	24	30	9	24	29	30	17
MPKV, ARS, Niphad	25	14	24	23	5	19	24	24	8
Special trials									
BMZ-Breeding	44	21	40	44	15	35	43	44	36
Sal/Alk Nursery	30	18	23	23	4	26	28	29	11
WBN/QCSN	46	30	30	36	12	41	41	42	24
Total	**1324**	**632**	**950**	**1094**	**350**	**991**	**1179**	**1243**	**757**

1.2 Plant Pathological Screening Nursery (PPSN)

Objective
Evaluation of entries for promotion from one stage to 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 have 397 entries that comprise AVT, NIVT and special trials including checks during 2019-20. 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. 1.7).

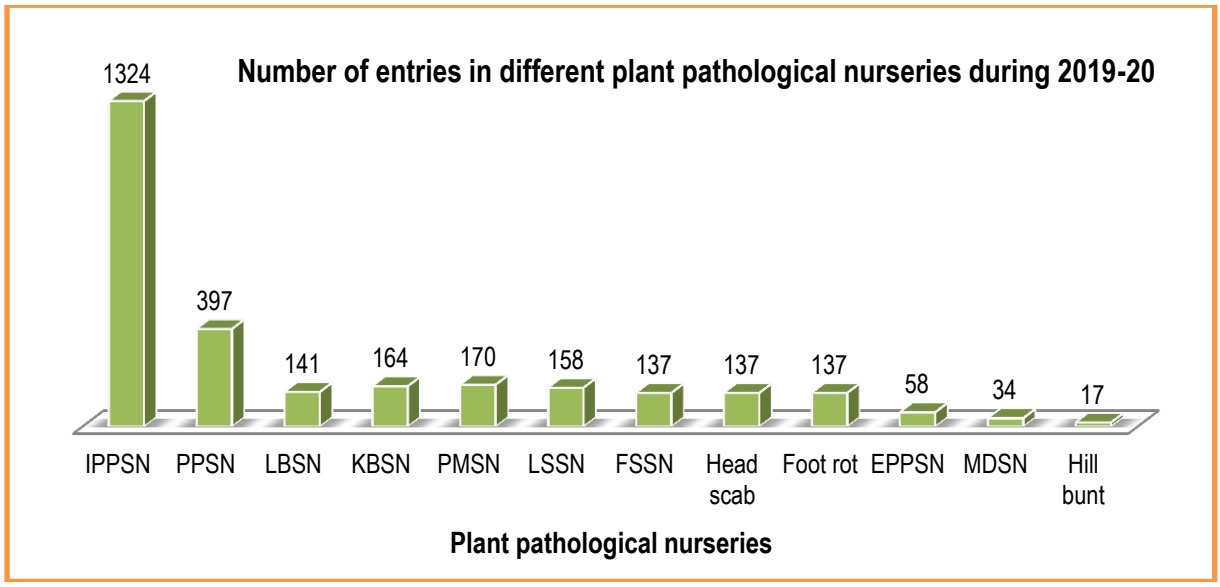

Fig. 1.7. Constitution of different plant pathological nurseries during 2019-20

Test Locations

North:
Yellow Rust: Dhaulakuan, Gurdaspur, Malan, Bajaura, Karnal, Delhi, Ludhiana, Pantnagar, Durgapura, Jammu Hisar and Kudwani (J&K) (12)
Leaf Rust: Delhi, Hisar, Jammu, Kanpur, Karnal, Ludhiana, Pantnagar, Durgapura and Faizabad (9)
South:
Leaf and Stem Rusts: Wellington, Mahabaleshwar, Niphad, Vijapur, Pune, Junagarh, Powarkheda, Dharwad and Indore (9)
Leaf blight (NIVT1A, 1B, 3A): Kalayani, Coochbehar, Pusa (Bihar), Faizabad, Varanasi, Sabour, Shillongani (7)

Data was not considered due to poor/erratic disease development from the following centres:
Leaf rust: Vijapur, Durgapura
Stem rust: Junagarh

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 rust severity and gene postulation of AVT material have been given in the Tables 1.2. The data on other then rust disease of AVT entries are given in Table 1.3. The performance of AVT final year entries with check for last three years has been given in Table 1.4. The reaction of NIVT entries against rusts are depicted in table 1.5.

Rust resistance materials in AVT (2019-20) with ACI upto 10.0 are given below:

Stem, Leaf and Stripe rusts
DBW187 (C), DBW252(I) (C), DBW303*, DBW328, DDW47(d)(I), HD3249(I) (C), HD3334, HI 8823(d), HI8627(d), HI8805(d)(I) (C), HI8818(d), HS 507 (C), HS 679, HS 681, MACS3949(d) (C), MP 1358, MP1361, MPO 1357(d), NIDW 1149(d)*, PBW804, TAW155, UAS 472(d), UAS466(d)(I), VL 3024 and WH1252

Leaf and Stripe rusts
DBW332, DBW333, DDW48(d)*, DDW49(d)*, HS 680, JKW261, UAS428(d) (C), UAS446(d)(C), VL 3022 and WHD964(d)

Leaf and Stem rusts
CG1029*, DBW173 (C), DBW296, DBW329, DBW39 (C), DDK1029 (C), DDK1058, DDK1059, GW513, GW519, HD2864, HD3059 (C), HD3090 (C), HD3377, HI1544, HI1628(I) (C), HI1633*, HI1634*, HI1636, HUW838, HW1098 (C), MACS5054, MACS5055, MACS6222 (aest.) (C), MACS6747, MACS6749, MACS6752, MP3288, NIAW3170(I) (C), PBW550 (C), PBW771(I) (C), PBW840, RAJ4541, UP3033, VL 2036, VL 892 (C) and VL 907 (C)

Table 1.2. Adult plant response of AVT entries against three rusts under epiphytotic conditions at hot spot locations in field during 2019-20

AVT No.	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Stripe rust		Postulated genes		
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	*Sr*	*Lr*	*Yr*
I. North Hill Zone (NHZ)												
1	HS 507 (C)	0.8	10MR	3.7	20MS	7.5	30S	5.0	10S	*Sr31+5+*	*Lr*26+1+	*Yr9+*
2	HS 562 (C)	29.1	80S	4.5	20S	7.4	30S	15.5	60S	*Sr8a+9b+2+*	*Lr*23+	*YrA+*
3	HPW 349 (C)	24.1	60S	7.4	40MS	5.2	30S	11.8	40S	*Sr7b+2+*	*Lr*13+10+	*Yr2+*
4	HS 668	4.5	10MS	11.4	60S*	5.2	40S	27.4	60S	*Sr31+*	*Lr*26+23+1+3+	*Yr9+*
5	VL 907 (C)	0.6	5MR	4.8	20S	8.2	20S	22.4	60S	*Sr31+2+*	*Lr*26+	*Yr9+*
6	VL 2036	6.8	30MS	3.7	15MS	5.4	20S	15.2	40S	*Sr30+5+*	*Lr*23+10+2a+	*Yr2+*
7	HS 681	0.8	5MR	0.4	5MR	6.9	20S	4.4	10S	*Sr31+5+*	*Lr*26+23+1+	*Yr9+*
8	VL 3022	16.2	40S	3.0	10MS	6.9	20S	9.0	40S	*Sr31+*	*Lr*26+23+1+	*Yr9+A+*
9	HS 680	22.8	40S	2.0	15MS	2.9	10S	6.3	20S	*Sr31+*	*Lr*26+23+10+1+	*Yr9+*
10	VL 3023	2.6	10MS	14.7	40S	22.8	40S	17.7	60S	*Sr31+*	*Lr*26+23+	*Yr9+A+*
11	HPW 474	20.4	60S	4.1	20MS	5.7	20S	20.0	80S	*Sr30+5+*	*Lr*13+10+3+2a+	*Yr2+*
12	UP 3069	25.0	40S	12.5	40S	7.4	20MS	14.5	40S	*Sr7b+*	-	*YrA+*
13	HPW 473	50.5	100S	28.5	80S	10.6	50S	21.2	60S	*Sr7b+*	*Lr*13+3+	*YrA+*
14	VL 892 (C)	9.6	60S*	5.2	20S	6.8	20S	26.4	80S	*Sr30+11+*	*Lr*13+10+	*Yr2+*
15	VL 3024	6.9	40S	7.1	40S	7.0	20S	3.8	20S	*Sr31+5+*	*Lr*26+23+10+1+	*Yr9+*
16	HS 490 (C)	17.6	40S	11.4	60S	4.7	10S	15.7	60S	*Sr28+9b+*	*Lr*23+10+3+	*YrA+*
17	HS 679	0.6	5MR	2.8	20S	8.5	20S	7.5	40S	*Sr31+5+*	*Lr*26+23+1+	*Yr9+*
II. North Western Plain Zone (NWPZ)												
18	DBW88 (C)	11.5	40S	3.4	10MS	8.9	20S	21.8	60S	*Sr11+2+*	*Lr*13+10+3+	*Yr2+*
19	DBW187(I) (C)	7.8	20S	6.0	30MS	4.9	20S	6.7	15S	*Sr5+11+*	*Lr*23+10+1+	*Yr2+*
20	HD2967 (C)	7.6	40S	4.1	20MS	13.9	40S	37.6	80S	*Sr8a+11+2*	*Lr*23+	*Yr2+*
20A	**Infector**	**85.0**	**100S**	**87.5**	**100S**	**73.8**	**100S**	**74.5**	**100S**			
21	WH1105 (C)	26.0	80S	15.9	80S	15.5	40S	9.4	30S	*Sr11+2+*	*Lr*13+	*Yr2+*
22	DBW222(I) (C)	22.9	60S	4.0	20S	3.9	15S	14.2	60S	*Sr31+*	*Lr*26+23+	*Yr9+*
23	HD3086 (C)	31.0	60S	19.5	80S	22.5	50S	14.3	60S	*Sr7b+2+*	*Lr*13+10+3+	*Yr2+*
24	PBW840M	7.3	20MS	4.9	10MS	5.6	20S	26.0	60S	*Sr31+5+*	*Lr*26+	*Yr9+A+*
25	PBW803	26.8	60S	14.3	60S	5.0	20S	16.1	60S	*Sr30+5+*	*Lr*23+3+2a	*Yr2+*
26	PBW550 (C)	1.6	5MS	4.3	20MS	8.9	20MS	39.5	80S	*Sr31+2+*	*Lr*26+	*Yr9+*
27	HD3334	2.1	5MS	6.9	40MS	3.8	15S	6.5	20MS	*Sr31+5+*	*Lr*26+23+1+	*Yr9+A+*

AVT No.	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Stripe rust		Postulated genes		
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	*Sr*	*Lr*	*Yr*
28	HD3059 (C)	6.4	20MS	4.0	10S	3.3	10S	15.3	60S	*Sr11+2+*	*Lr*13+3+	*Yr2+*
29	HD3332	28.5	40S	15.1	60S	17.5	40S	17.1	40S	*Sr13+7b+*	*Lr*13+10+	*Yr2+*
30	DBW173 (C)	1.1	5MS	5.5	40MS	4.8	20S	11.5	40S	*Sr31+*	*Lr*26+10+3+	*Yr9+*
31	WH1021 (C)	4.2	20MS	19.5	60S	9.9	40S	41.8	80S	*Sr31+5+2+*	*Lr*26+1+	*Yr9+*
32	PBW811	18.8	40S	18.5	60S	6.5	20S	11.8	40S	*Sr9b+11+*	*Lr*13+	*Yr2+*
33	DBW291	17.3	60S	10.4	40S	15.1	40S	6.5	40S	*Sr5+11+7b+*	*Lr*13+10+1+	*Yr2+*
34	WH1264	23.5	40S	16.4	60S	3.9	15S	17.7	40S	*Sr7b+*	*Lr*13+10+	*Yr2+*
35	PBW812	30.3	60S	11.1	40S	8.6	30S	12.6	40S	*Sr30+11+*	*Lr*23+3+2a	*Yr2+*
36	JKW261	36.8	60S	9.3	30S	1.3	5S	7.7	20MS	*Sr13+7b+*	*Lr23+13+*	-
37	DBW290	22.3	80S	13.7	60S	6.6	20S	17.2	60S	*Sr13+9b+*	*Lr*13+10+	*Yr2+*
38	PBW771(I) (C)	6.6	20MS	2.2	5S	3.4	10S	11.3	40S	*Sr31+*	*Lr*26+23+1+	*Yr9+A+*
39	PBW813	42.5	100S	14.6	60S	1.3	5S	0.5	5S	*Sr8a+11+*	-	Resistant
40	HD3331	19.4	60S	17.3	60S	8.6	20S	6.3	40S	*Sr13+7b+*	*Lr23+13+3+*	*Yr2+*
40A	**Infector**	**80.0**	**100S**	**87.5**	**100S**	**76.3**	**100S**	**75.5**	**100S**			
41	HD3298*	19.5	60S	5.6	20S	13.3	20S	17.3	60S	*Sr30+*	*Lr23+2a*	*Yr2+*
42	WH1124 (C)	39.0	80S	19.0	80S	17.0	40S	20.9	60S	*Sr7b+2+*	*Lr*13+10+3+	*Yr2+*
43	UP3033	0.6	10R	2.4	10S	3.0	10S	21.4	60S	*Sr31+5+*	*Lr*26+10+3+	*Yr9+*
44	HUW838	2.4	10MS	2.6	15MS	8.1	50S	11.1	40S	*Sr5+8a+11+*	*Lr*13+10+3+	*Yr2+*
45	HD3043 (C)	5.6	20MS	39.5	80S	41.9	80S	18.2	60S	*Sr31+2+*	*Lr*26+23+	*Yr9+A+*
46	PBW644 (C)	18.0	40S	17.8	60S	17.6	60S	33.2	60S	*Sr11+2+*	*Lr*13+1+	*Yr2+*
47	DBW296	4.4	10MS	5.4	20S	5.8	15S	10.3	40S	*Sr13+7b+*	*Lr*23+13+10+	*Yr2+*
48	HI1628(I) (C)	6.0	20MS	8.5	40S	3.8	15S	18.4	40S	*Sr2*+R	*Lr*13+10+	*Yr2+*
49	WH1080 (C)	15.9	40S	8.0	40S	11.2	40S	19.5	40S	*Sr9e+2+*	*Lr*13+3+	*Yr2+*
50	JAUW672	18.5	40S	9.8	20S	13.0	60S	8.1	20S	*Sr9b+13*	*Lr*23+13+	*YrA+*
51	WH1142 (C)	3.8	10MS	16.0	60S	9.3	50S	19.3	60S	*Sr31+2+*	*Lr*26+23+10+3+	*Yr9+*
52	NIAW3170(I) (C)	7.0	20MS	6.0	30S	1.5	5S	28.6	60S	*Sr8a+2+*	*Lr*13+10+1+	-
III. North Eastern Plain Zone (NEPZ)												
53	PBW804	4.6	10MS	4.2	20MS	1.4	5S	8.5	20S	*Sr13+7b+*	*Lr*13+	-
54	DBW187 (C)	6.5	20S	6.3	40S	3.4	20MS	2.6	10S	*Sr5+11+*	*Lr*23+10+1+	*Yr2+*
55	K1006 (C)	10.8	40S	16.0	40S	12.0	50S	23.6	60S	*Sr8a+9b+11+*	*Lr*13+1+	-
56	DBW39 (C)	0.8	10MR	0.6	10MR	4.3	10S	32.3	60S	*Sr31+2+*	*Lr*26+23+10+	*Yr9+*

AVT No.	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Stripe rust		Postulated genes		
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	*Sr*	*Lr*	*Yr*
57	HD3249(I) (C)	3.3	10MS	9.4	60S	3.1	10S	8.0	20MS	*Sr11+2+*	*Lr*13+10+	*Yr2+*
58	HD2733 (C)	2.2	10S	11.6	40S	22.5	50S	49.1	80S	*Sr31+2+*	*Lr*26+34+	*Yr9+18+*
59	HD3171 (C)	20.8	40S	31.3	80S	40.0	70S	18.6	60S	*Sr11+7b+2+*	*Lr*23+13+10+	*Yr2+*
60	HD2888 (C)	2.5	20MS	1.3	10MS	16.0	60S	27.6	80S	-*	Seed*	-
60A	**Infector**	**77.5**	**100S**	**80.0**	**100S**	**73.8**	**100S**	**75.5**	**100S**			
61	HD3293*	25.4	60S	19.8	60S	21.4	40S	7.0	20MS	*Sr13+*	*Lr*13+10+	*Yr2+*
62	K1317 (C)	12.3	40S	18.0	40S	6.0	20S	11.5	40S	*Sr31+2+*	*Lr*26+1+	*Yr9+A+*
63	HI1612 (C)	41.0	80S	4.8	20S	3.0	10S	20.8	60S	*Sr7b+2+*	*Lr*23+	*Yr2+*
64	DBW252(I) (C)	7.4	20S	7.3	40S	8.1	20S	7.5	20S	*Sr8a+5+11+2+*	*Lr*13+10+	*Yr2+*
IV. Central Zone (CZ)												
65	TAW155	6.9	20MS	5.1	40S	2.8	20S	5.9	20MS	*Sr30+5+*	*Lr*13+10+1+2a+	*Yr2+*
66	HI1636	0.5	5MR	8.0	60S*	1.9	10MS	56.4	80S	*Sr24+*	*Lr*24+	-
67	MP1361	4.3	40MR	5.2	30S	1.4	5S	9.3	20S	*Sr28+*	*Lr*13+10+1+	*Yr2+*
68	MACS6747	7.3	20MS	8.9	60S*	1.3	5S	43.2	80S	*Sr24+*	*Lr*24+	-
69	HD3377	3.1	20S	1.0	5MS	6.8	15S	16.3	60S	*Sr7b+*	*Lr*23+1+	*Yr2+*
70	HI1637	1.8	10S	8.0	60S*	11.3	40S	50.5	80S	*Sr24+*	*Lr*24+	-
71	RAJ4541	2.6	20MR	4.3	20S	2.9	10S	31.2	80S	*Sr24+*	*Lr*24+	*Yr2+*
72	GW513	2.3	5MS	8.8	60S	5.8	20S	61.8	80S	*Sr24+*	*Lr*24+	*Yr2+*
73	GW322	15.8	40S	14.6	80S	22.4	50S	45.5	80S	*Sr11+2+*	*Lr*13+1+	-
74	HI1544	2.8	10S	5.1	40S	3.6	10S	54.1	80S	*Sr24+2+*R	*Lr*24+	-
75	HI1634*	0.3	5MR	3.1	20S	5.6	20S	49.5	80S	*Sr31+*	*Lr*26+	*Yr9+*
76	HD2932	11.3	20S	38.8	80S	35.0	70S	51.4	80S	*Sr11+*	*Lr*13+	-
77	MP3336	9.4	30MS	26.5	80S	28.8	50S	51.8	80S	*Sr11+2+*	*Lr*13+	-
78	HD2864	2.5	10S	7.6	60S*	5.6	20MS	57.7	80S	*Sr24+*	*Lr*24+	*Yr2+*
79	CG1029*	4.2	10MS	2.7	20MS	5.0	20S	62.7	80S	*Sr24+*	*Lr*24+	*Yr2+*
80	MPO1357(d)	2.5	20MR	1.1	15MR	1.4	10S	5.3	20MS	*Sr11+7b+*	*Lr*23+	*Yr2+*
80A	**Infector**	**75.0**	**100S**	**80.0**	**100S**	**76.3**	**100S**	**77.3**	**100S**			
81	HI8627(d)	2.2	40MR	1.6	5MS	2.6	10S	5.3	20MS	*Sr9e+2+*	*Lr*13+	*Yr2+*
82	UAS466(d)(I)	2.9	10S	4.8	30S	3.4	15S	4.7	20MS	*Sr11+2+*	*Lr*13+	-
83	UAS472(d)	1.0	5MS	1.6	20MR	4.9	10S	6.6	20MS	*Sr7b+*	-	*Yr2+*
84	DBW110	10.0	20S	10.3	40S	9.1	20S	34.5	80S	R	*Lr*23+10+	*Yr2+*

AVT No.	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Stripe rust		Postulated genes		
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	*Sr*	*Lr*	*Yr*
85	MP3288	5.9	20S	7.7	40S	8.4	40S	29.6	80S	*Sr24+2+*R	*Lr*24+	*Yr2+*
86	HI 8823(d)	1.2	5MS	2.3	10S	6.6	30S	7.1	20MS	*Sr11+*	-	-
87	DDW47(d)(I)	1.9	5MS	1.2	10MR	5.8	20S	2.1	20MS	*Sr11+7b+2+*	R	-
IV. Peninsular Zone (PZ)												
88	WHD964(d)	26.0	100S	8.7	40S	1.4	10MS	6.9	40S	*Sr7b+*	*Lr*23+13+	-
89	DDW48(d) *	18.1	100S*	5.6	20MS	6.6	40S	8.7	40S	*Sr7b+2+*	-	*Yr2+*
90	MACS6222 (C)	5.0	10S	7.2	40S	2.0	10S	28.3	80S	*Sr24+*R	*Lr*24+	*Yr2+*
91	MACS3949(d) (C)	9.8	40S	6.1	20MS	1.8	10MS	2.5	20S	*Sr7b+2+*	R	*Yr2+*
92	HI8818(d)	1.1	5MR	2.7	20MS	1.9	10S	3.4	20MS	*Sr11+7b+*	*Lr*23+10+	*Yr2+*
93	UAS428(d) (C)	15.0	80S	8.8	40S	2.1	10S	3.5	20MS	*Sr7b+*	*Lr*23+	-
94	DDW49(d) *	40.8	100S	8.4	20S	8.9	30S	5.8	20S	*Sr7b+2+*	*Lr*18+	-
95	GW322 (C)	20.5	60S	8.8	20S	14.5	40S	45.8	80S	*Sr11+2+*	*Lr*13+1+	-
96	GW519	6.5	40MR	9.2	40S	7.6	20S	49.5	80S	*Sr24+*	*Lr*24+	*Yr2+*
97	HI1646	15.5	40S	22.8	80S	18.1	50S	26.4	60S	*Sr5+8a+11+*	*Lr*13+10+1+	*Yr2+*
98	HD3090 (C)	3.8	20MR	3.1	30MS	5.8	15S	47.7	80S	*Sr31+2+*	*Lr*26+	*Yr9+*
99	RAJ4083 (C)	4.4	20S	16.6	80S	10.8	40S	35.5	80S	*Sr11+*	*Lr*13+	*Yr2+*
100	UAS3008	13.8	40S	8.8	40S	7.6	30S	42.3	80S	*Sr5+11+*	*Lr*13+1+	*Yr2+*
100A	**Infector**	**82.5**	**100S**	**80.0**	**100S**	**77.5**	**100S**	**75.5**	**100S**			
101	MACS6749	1.7	10MR	3.2	20MS	8.8	60S*	48.6	80S	*Sr24+*	*Lr*24+	-
102	HD2932 (C)	15.8	40S	38.5	80S	32.8	60S	46.5	80S	*Sr11+*	*Lr*13+	-
103	HI1641	4.0	20MS	2.8	20S	17.5	60S	61.8	80S	R	R	-
104	HI1642	2.9	20MR	3.1	20S	12.0	30S	67.3	80S	R	R	*YrA+*
105	HI1633*	2.0	10S	10.0	80S*	7.0	20S	48.6	80S	*Sr31+*	*Lr*26+	*Yr9+*
106	MACS6752	2.6	20MR	1.0	10MS	9.6	60S	60.0	80S	R	R	-
107	NIDW 1149(d)*	2.9	10MS	2.3	20MS	2.6	10S	4.6	10S	*Sr11+2+*	*Lr*23+	*Yr2+*
108	UAS446(d) (C)	16.8	100S	5.1	20S	2.8	10S	2.8	10S	*Sr11+2+*	R	-
109	HI 1605 (C)	5.3	20S	19.0	80S	5.0	20S	15.2	40MS	*Sr11+*	*Lr*13+	*Yr2+*
110	MACS 4087(d)	20.5	60S	7.8	40S	3.4	10S	16.5	60S	*Sr11+7b+*	-	-
111	MP 1358	4.1	15MS	3.3	20MS	2.4	10MS	5.7	15S	*Sr11+*	*Lr*23+10+	*YrA+*
112	AKDW 2997-16(d) (C)	28.5	80S	10.6	60S	5.9	20S	12.1	60S	*Sr7b+2+*	*Lr*23+	-

AVT No.	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Stripe rust		Postulated genes		
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	*Sr*	*Lr*	*Yr*
113	HI8805(d)(I) (C)	5.5	20S	9.8	60S	3.6	20S	4.6	20S	*Sr13+11+2+*	*Lr*23+	-
114	UAS 472(d)	2.1	10MS	2.2	10MS	2.9	10S	7.1	20MS	*Sr11+2+*	-	-
115	MPO 1357(d)	3.5	40MR	1.8	10S	1.9	10S	5.6	20S	*Sr11+7b+*	*Lr*23+	*Yr2+*
116	NIAW3170(I) (C)	13.0	60S	0.9	15MR	4.3	10S	26.0	60S	*Sr2+*R	*Lr*13+10+1+	-
V. Special Trial (Dicoccum)												
117	MACS5055	1.1	5MS	0.8	5MS	1.4	10S	25.6	80S	*Sr13+7b+*	*Lr*23+	-
118	MACS6222 (aest.) (C)	4.2	10S	5.7	40S	2.5	10S	35.7	80S	*Sr24+* R	*Lr*24+	*Yr2+*
119	DDK1029 (C)	1.5	10MS	0.3	5MR	4.5	40MR	35.7	60S	*Sr11+2+*	*Lr*13+	-
120	MACS5054	1.2	10MS	0.6	5MR	5.3	20S	30.2	60S	*Sr11+7b+*	-	-
120A	**Infector**	**85.0**	**100S**	**82.5**	**100S**	**72.5**	**100S**	**70.9**	**100S**			
121	DDK1058	1.0	5S	0.1	TMR	4.7	15S	25.5	60S	*Sr11+7b+*	-	-
122	HW1098 (C)	1.8	10S	0.3	5MR	3.9	30MR	26.7	60S	*Sr11+2+*	*Lr*18+	*Yr2+*
123	DDK1059	3.3	10S	0.3	5MR	5.6	50MR	28.5	60S	*Sr7b+*	-	-
VI. Special Trial (SPL-HYPT)												
124	DBW327	15.3	40S	11.0	60S	11.3	50S	6.1	20MS	*Sr13+5+*	*Lr*23+1+	*Yr2+*
125	HD3086 (C)	43.0	80S	17.4	80S	30.0	60S	21.4	60S	*Sr7b+2+*	*Lr*13+10+3+	*Yr2+*
126	DBW332	16.0	40S	6.3	40S	10.0	30S	6.9	20S	R	*Lr*13+1+	*YrA+*
127	DBW303*	7.0	20MS	1.6	10MS	0.6	10MR	6.7	20S	R	*Lr*13+	*Yr2+*
128	HD2967 (C)	6.8	20S	1.6	10S	14.0	40S	31.4	60S	*Sr8a+11+2+*	*Lr*23+	*Yr2+*
129	DBW187*	10.8	40S	3.9	15MS	1.5	10S	12.9	60S*	*Sr5+11+*	*Lr*23+10+1+	*Yr2+*
130	DBW329	6.3	20MS	5.2	20S	6.4	20S	22.9	60S	*Sr9b+11+*	*Lr*13+1+	*Yr2+*
131	WH1252	3.5	10MS	4.5	20MS	3.4	10S	4.9	10S	*Sr9e+7b+*	*Lr*13+	*Yr2+*
132	HD3378	21.1	60S	10.0	40MS	6.4	20S	20.6	60S	*Sr7b+11+*	*Lr*23+1+	-
133	WH1270*	12.5	40S	10.4	60S	3.5	10S	13.8	40S	*Sr13+*	*Lr*23+	*Yr2+*
134	DBW333	25.0	80S	9.8	60S	2.4	20MR	7.7	20S	*Sr28+11+*	*Lr*13+10+1+	*Yr2+*
135	DBW330	21.8	40S	20.4	80S	18.9	40S	20.5	60S	*Sr28+11+*	*Lr*13+10+	*Yr2+*
136	DBW328	6.4	20MS	6.0	40S	3.6	15S	5.7	10S	*Sr5+11+*	*Lr*23+10+1+	*Yr2+*
137	DBW331	13.8	40MS	9.8	60S	3.0	10S	11.4	40S	*Sr9e+*	*Lr*23+10+1+	-

Abbreviations: ACI = Average Coefficient of Infection, HS = Highest Score, Avg. = Mean, *Indicates high rust score (more than 40S) at one location only, Sr = Stem rust resistance genes, Lr = Leaf rust resistance genes, Yr = stem rust resistance genes.

Table 1.3. Performance of AVTs entries against different diseases under multilocation testing during 2019-20

S. No.	Entry	LB (dd)		KB (%)		PM (0-9)		FS (%)		FHB (0-5)	FR (%)	LS (%)		HB (%)	
		AV	HS	AV	HS	AV	HS	AV	HS	HS	HS	AV	HS	AV	HS
I. North Hill Zone (NHZ)															
1	HS 507 (C)	35	78	2.9	8.3	3	5	7.1	8.7	5	20.0	24.7	46.7	11.1	18.4
2	HS 562 (C)	45	89	4.2	11.6	3	5	4.1	9.3	4	5.0	34.4	58.7	16.2	36
3	HPW 349 (C)	35	68	9.2	31.3	3	7	4.7	8.3	5	29.4	22.1	45.8	21.3	57.3
4	HS 668	46	79	5.8	15.3	4	6	3.7	11.1	4	5.6			26.1	50
5	VL 907 (C)	45	79	5	8.6	4	6	4.2	12.5	4	20.0	21.3	26.9	6.3	12.5
6	VL 2036	46	89	4.7	11.8	4	6	6.6	13.3	4	16.7			20.9	48.9
7	HS 681	34	78	4.8	10	3	4	4.2	12.5	5	15.0			15.8	37.5
8	VL 3022	35	78	4.4	8.2	2	6	5.5	16.6	5	16.7			13	28.6
9	HS 680	35	89	6.1	15	3	5	8.7	11.1	4	5.9			10.1	26.6
10	VL 3023	56	89	8.3	23.8	3	6	4.2	8.6	5	11.8			21.1	41.1
11	HPW 474	57	99	3.5	9.5	2	4	2.8	8.3	5	35.0			19.9	31.5
12	UP 3069	46	79	3.6	11.1	3	5	5.7	8.6	4	11.1			11.9	25
13	HPW 473	46	79	4.8	9.1	2	5	10.6	16.6	5	0.0			8.5	19.7
14	VL 892 (C)	46	99	7.9	15.6	5	7	10	14.3	5	5.6	20	34.6	48.7	100
15	VL 3024	45	89	5.1	13.6	4	6	8	13.3	5	0.0			5.6	15
16	HS 490 (C)	46	89	4	14.3	2	5	10.5	14.2	5	10.5	18.9	36.8	10.4	26.5
17	HS 679	46	89	4.4	14.3	4	7	4.4	13.3	5	31.3			10.2	17
II. North Western Plain Zone (NWPZ)															
18	DBW88 (C)	46	99	4.7	12.4	4	7	3.5	10.5	5	42.1	45.5	73.3		
19	DBW187(I) (C)	46	99	4.9	13.3	4	6	5.8	13.6	4	37.5	31	46.7		
20	HD2967 (C)	35	78	3.7	10	4	6	8	8.3	5	0.0	32.8	86.7		
20A	**Infector**	**78**	**99**	**15.3**	**30.7**	**7**	**9**	**25.8**	**26.6**	**5**					
21	WH1105 (C)	57	89	5.3	9	4	7	5.5	16.6	5	26.7	40.5	60.3		
22	DBW222(I) (C)	45	89	6.6	13.6	3	6	6.6	13.3	4	78.6	6.5	15		
23	HD3086 (C)	46	89	3.2	8.3	4	5	5.6	14.2	5	20.0	3.6	12.5		
24	PBW840	46	99	5.3	15	4	7	6	15	5	29.4				
25	PBW803	46	89	4.2	13.6	5	7	6.6	14.6	5	84.2				
26	PBW550 (C)	46	99	7.9	26.7	6	9	10.1	14.5	4	20.0	35.7	59		
27	HD3334	46	99	4.4	11.1	3	5	9	16.6	5	35.0				
28	HD3059 (C)	46	89	3.3	8.3	4	6	6.4	11.1	5	5.0	27.7	81.1		

S. No.	Entry	LB (dd)		KB (%)		PM (0-9)		FS (%)		FHB (0-5)	FR (%)	LS (%)		HB (%)	
		AV	HS	AV	HS	AV	HS	AV	HS	HS	HS	AV	HS	AV	HS
29	HD3332	46	99	5	12.3	4	5	9.1	14.6	4	31.3				
30	DBW173 (C)	56	89	2.2	7.5	4	7	4.2	12.5	4	44.4	25.5	62.5		
31	WH1021 (C)	57	99	3.2	12.5	4	5	2.8	8.3	4	36.8	28.1	77.7		
32	PBW811	46	89	3.3	10.6	3	7	4.4	9.5	4	15.0				
33	DBW291	46	89	4.5	10	3	6	4.8	8.3	4	29.4				
34	WH1264	46	89	6.5	14.3	3	5	5.5	12.5	5	66.7				
35	PBW812	46	89	4	16.6	3	7	8.4	13.6	5	66.7				
36	JKW261	35	89	4.2	12.6	4	7	7.1	11.1	5	0.0				
37	DBW290	45	89	4.6	8.6	4	7	11.5	16.6	5	44.4				
38	PBW771(I) (C)	46	89	4.8	8.3	6	9	10.5	16.7	4	23.5	43.8	83.3		
39	PBW813	45	89	5	8	5	7	2.9	8.6	4	20.0				
40	HD3331	46	89	4.3	10.8	3	7	4.6	9.5	4	6.7				
40A	**Infector**	**78**	**99**	**12.1**	**22.2**	**7**	**9**	**26.4**	**34.5**	**5**					
41	HD3298*	46	89	4	7.5	2	4	8	13.2	5	80.0	10.9	16.1		
42	WH1124 (C)	57	89	2.5	9.1	3	5	4.7	8.3	5	60.0	21.3	85		
43	UP3033	46	89	5	12.5	3	4	5.7	8.6	3	47.4				
44	HUW838	46	89	4.6	14.3	3	5	2.5	7.5	5	79.0				
45	HD3043 (C)	45	89	4	13.3	3	6	2.7	6.6	5	10.0	38	87.1		
46	PBW644 (C)	46	89	6	12.5	3	6	11.3	15.3	4	30.0	21.7	43.8		
47	DBW296	46	89	6.2	18.3	2	7	7	11.1	5	66.7				
48	HI1628(I) (C)	46	89	4.7	16.7	2	4	5.7	13.3	5	0.0	52	71.2		
49	WH1080 (C)	46	99	4.7	15	2	4	8.1	14.2	3	5.0	47.8	64.5		
50	JAUW672	46	89	4.2	13.7	3	6	5.3	12.3	5	0.0				
51	WH1142 (C)	46	89	5	15	3	5	6.3	13.5	5	0.0	46.6	99.2		
52	NIAW3170(I) (C)	56	99	5.4	18.7	2	4	6.1	16.6	5	5.0	37.7	56.7		
III. North Eastern Plain Zone (NEPZ)															
53	PBW804	46	89	5.8	16.7	2	3	4.2	12.5	5	5.0				
54	DBW187 (C)	46	99	3.4	14.3	2	3	5.6	11.3	5	0.0	31	46.7		
55	K1006 (C)	46	79	3.3	12.5	3	4	5	15	5	5.6				
56	DBW39 (C)	45	89	3.6	8.6	3	6	4.8	12.5	5	0.0	41.9	95		
57	HD3249(I) (C)	46	99	4.2	11.3	3	7	7.8	14.6	5	5.0	20.5	35		
58	HD2733 (C)	46	89	3.8	14.4	4	7	5.4	16.3	4	0.0	16.3	37.5		

S. No.	Entry	LB (dd)		KB (%)		PM (0-9)		FS (%)		FHB (0-5)	FR (%)	LS (%)		HB (%)	
		AV	HS	AV	HS	AV	HS	AV	HS	HS	HS	AV	HS	AV	HS
59	HD3171 (C)	56	99	4.8	12.6	4	9	9.4	13.2	4	0.0	17.1	34.7		
60	HD2888 (C)	45	89	11.6	40	3	5	13.1	17	4	27.8	16.1	45.1		
60A	**Infector**	**78**	**99**	**11.9**	**25**	**6**	**9**	**28.8**	**37.3**	**5**					
61	HD3293*	35	89	3.9	11.6	4	9	7.4	16.6	4	25.0	33.8	65		
62	K1317 (C)	45	89	4.8	13.4	3	7	4.8	12.8	5	33.3	25.8	53.2		
63	HI1612 (C)	35	78	5.3	9.3	3	5	7	14.6	4	42.1	37.4	81.1		
64	DBW252(I) (C)	45	89	3.5	12.5	2	4	4.5	11.8	4	17.7	23.4	49.7		
IV. Central Zone (CZ)															
65	TAW155	35	89	3.8	14.5	3	9	4.6	8.3	4	0.0				
66	HI1636	46	99	4.5	10	5	9	4.6	10.5	5	0.0				
67	MP1361	46	89	4.8	9.5	4	7	5.9	14.5	4	10.0				
68	MACS6747	46	89	5.3	12.8	5	9	7.8	13.3	5	5.0				
69	HD3377	46	89	2.1	7.5	5	8	2.9	8.6	5	0.0				
70	HI1637	46	99	2.9	6.6	5	9	4.7	8.3	5	21.1				
71	RAJ4541	46	89	4.5	12.5	3	7	5.6	8.3	4	0.0				
72	GW513	56	89	5.6	14.3	5	9	3.7	11.1	5	10.0				
73	GW322 (C)	45	89	5	15	4	9	4.6	7.5	4	0.0	43.9	66.5		
74	HI1544 (C)	57	89	11.6	42.9	4	9	12.2	23.1	4	18.8	17.9	45		
75	HI1634*	46	89	4.4	12.5	3	6	4.6	6.8	5	5.3	22.3	42.2		
76	HD2932	46	89	3.6	10	4	9	2.5	7.5	5	47.4				
77	MP3336	56	89	4.1	13.3	5	9	2.1	6.3	5	17.7	18.3	46.6		
78	HD2864	56	89	4	8.6	4	6	2.5	7.5	5	27.8	12.6	37.4		
79	CG1029*	56	99	4.4	12.5	5	9	3.7	8.3	5	84.2	28.5	44.6		
80	MPO1357(d)	45	99	1.5	4.6	3	5	2	6	4	37.5				
80A	**Infector**	**78**	**99**	**12.7**	**25**	**6**	**9**	**30.3**	**38.1**	**5**					
81	HI8627(d)	46	99	2.9	10	2	4	0	0	5	87.5	7.0	26.6		
82	UAS466(d)(I)	46	89	1.4	5	2	4	0	0	4	42.9	3.9	12.5		
83	UAS472(d)	46	99	2.1	5.1	4	6	0	0	5	41.2				
84	DBW110	46	68	2.4	5	3	5	1.9	5.6	5	15.0	16.6	27.3		
85	MP3288	46	89	3.7	6.3	4	7	2.7	8.1	4	20.0	30.5	48		
86	HI 8823(d)	46	89	2.1	8.3	4	7	0	0	4	0.0				
87	DDW47(d)(I)	36	79	2.7	5.2	2	6	0	0	5	5.3	3.9	12.5		

S. No.	Entry	LB (dd)		KB (%)		PM (0-9)		FS (%)		FHB (0-5)	FR (%)	LS (%)		HB (%)	
		AV	HS	AV	HS	AV	HS	AV	HS	HS	HS	AV	HS	AV	HS
V. Peninsular Zone (PZ)															
88	WHD964(d)	46	99	1.2	5	3	5	0	0	3	42.1				
89	DDW48(d) *	45	99	1.5	6.7	3	5	0	0	3	57.9	4.5	12.5		
90	MACS6222 (C)	57	89	4.5	8.7	5	9	2.2	6.7	4	25.0	31.2	53.3		
91	MACS3949(d) (C)	56	99	1.4	5	4	9	0	0	4	16.7	10.4	16.6		
92	HI8818(d)	46	99	2.2	5	4	6	0	0	4	36.8				
93	UAS428(d) (C)	35	99	1.8	5.5	4	7	0	0	5	35.7	3.2	11.1		
94	DDW49(d) *	45	99	4.2	8.4	5	7	0	0	5	30.0	27.3	52.5		
95	GW322 (C)	57	89	7	17	4	7	2.8	8.3	5	0.0	29.4	46.4		
96	GW519	57	99	4.2	8.6	4	9	7.1	16.3	5	10.0				
97	HI1646	46	89	4.8	9.1	4	9	5.1	12.7	5	15.8				
98	HD3090 (C)	46	99	4.5	12.3	4	6	4.9	14.7	5	10.0	44.7	73.3		
99	RAJ4083 (C)	57	89	5.1	11.6	4	9	5.5	13.2	4	5.0	22.4	35.4		
100	UAS3008	56	89	3.4	12.3	4	9	6.4	11.8	4	0.0				
100A	**Infector**	**78**	**99**	**12.6**	**21.3**	**6**	**9**	**23.9**	**27.6**	**5**					
101	MACS6749	57	89	3.9	13.7	3	4	2.8	8.3	5	5.0				
102	HD2932 (C)	57	89	3.5	14.2	4	9	4.2	12.5	5	0.0	30.9	42.2		
103	HI1641	57	99	7.2	32	4	9	6.9	16.6	5	11.1				
104	HI1642	56	89	3.5	12.4	5	9	5.1	12.5	5	31.6				
105	HI1633*	56	89	3.2	11.2	5	9	2.9	8.7	5	0.0	24.8	40.9		
106	MACS6752	56	89	5.1	16.7	5	9	5.2	7.5	5	10.0				
107	NIDW 1149(d)*	56	89	1.9	6.5	5	9	0	0	4	10.0	3.3	13.3		
108	UAS446(d) (C)	46	89	2.8	9.1	3	5	0	0	4	40.0	1.9	7.5		
109	HI 1605 (C)	46	89	2.8	8.6	4	7	2.2	6.6	5	15.8	17.7	26		
110	MACS 4087(d)	46	89	3.2	8.3	4	7	0	0	4	5.3				
111	MP 1358	46	89	4.7	10.1	3	5	1.7	5	5	42.1				
112	AKDW 2997-16(d)(C)	56	99	1.8	5.5	3	6	0	0	3	16.7	3.1	12.5		
113	HI8805(d)(I)(C)	46	99	1.6	4.5	3	9	0	0	4	25.0	2.8	11.1		
114	UAS 472(d)	46	89	1.7	3.8	5	8	0	0	5	25.0				
115	MPO 1357(d)	46	89	1.4	5	5	8	0	0	5	10.0				
116	NIAW3170(I) (C)	46	89	1.8	8.3	4	5	2.2	6.6	5	42.1	40.8	72		
VI. Special trial (Dicoccum)															

S. No.	Entry	LB (dd)		KB (%)		PM (0-9)		FS (%)		FHB (0-5)	FR (%)	LS (%)		HB (%)	
		AV	HS	AV	HS	AV	HS	AV	HS	HS	HS	AV	HS	AV	HS
117	MACS5055	45	68	1.7	6.6	2	6	0	0	4	0.0				
118	MACS6222 (aest.)(C)	46	89	3.5	10	3	6	2.8	8.3	4	50.0	27.8	53.8		
119	DDK1029 (C)	46	89	3	11.5	3	9	0	0	4	10.0	25.6	76.7		
120	MACS5054	46	89	1.4	6.3	3	7	0	0	4	58.8				
120A	**Infector**	**78**	**99**	**13.3**	**28.6**	**7**	**9**	**29.6**	**35.8**	**5**					
121	DDK1058	57	89	1.2	5	3	6	0	0	4	0.0				
122	HW1098 (C)	46	89	1.4	5	2	5	0	0	4	33.3	18.8	75		
123	DDK1059	46	89	1.6	5	3	6	0	0	4	10.5				
VII. Special trial (SPL-HYPT)															
124	DBW327	46	89	4.4	12.5	3	6	4.7	9.1	4	27.8				
125	HD3086 (C)	45	89	4.5	14.3	4	6	4.7	11.1	4	10.5	3.6	12.5		
126	DBW332	45	89	4.7	13.3	4	6	3.3	10	5	36.8				
127	DBW303*	46	89	2.6	8.7	3	7	4.2	12.5	5	26.3	23.8	45.5		
128	HD2967 (C)	34	78	4	14.3	3	6	1.5	4.6	4	10.5	37.5	54.6		
129	DBW187*	45	89	5.5	12.5	2	6	3.1	5.6	4	45.0	13.0	21.3		
130	DBW329	45	89	2.3	7.6	3	6	4.1	7.5	5	20.0				
131	WH1252	46	89	4.5	11.7	4	7	2.8	8.3	5	14.3				
132	HD3378	45	89	3.7	10	3	6	3	9.1	4	35.3				
133	WH1270*	46	89	4.6	13.3	3	6	4.2	8.6	5	15.0				
134	DBW333	45	89	4.4	14.3	3	6	4.9	8.3	5	16.7				
135	DBW330	35	89	4.4	12.5	3	4	8.2	11.1	4	10.0				
136	DBW328	35	89	3.5	9.1	3	5	4.2	12.5	5	5.0				
137	DBW331	35	89	4.4	12.8	5	7	4.4	13.3	5	5.0				

Abbreviations: LB = Leaf blight, KB = Karnal bunt, PM = Powdery mildew, FS = Flag smut, FHB = Fusarium head blight, FR = Foot rot, LS = loose smut, HB = Hill bunt

Table 1.4: Status of disease resistance in AVT (Final year entries) and check varieties during 2017-18, 2018-19 and 2019-20

S. No	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Strip rust		LB (dd)		PM (0-9)		KB (%)		LS (%)		FS (%)		FR (%)	FHB (0-5)	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS	Avg.	HS	Avg.	HS	Avg.	HS	Avg.	HS	HS	Avg.	HS
North Western Plain Zone (NWPZ)																						
AVT-IR-LS-TAS																						
1	HD3298*																					
	2017-18	16.3	40S	3.0	20MS	1.0	5S	6.4	20S													
	2018-19	18.3	30S	10.8	60S*	6.2	30S	9.8	60S	46	89	3	5	3.7	6.6	20.5	29.4	1.2	3.5	45	3	4
	2019-20	19.5	60S	5.6	20S	13.3	20S	17.3	60S	46	89	2	4	4	7.5	10.9	16.1	8	13.2	80		5
	MEAN	18.0	60S	6.5	60S*	6.8	30S	11.2	60S	46	89	2	5	3.8	7.5	15.7	29.4	4.6	13.2	80	3	5
2	HD3059 (C)																					
	2017-18	12.1	20S	3.9	20MS	3.7	10S	40.4	80S	46	89	4	7	5.4	7.4	28	35.8	8.3	22.2	20		
	2018-19	11.0	30S	1.2	5MS	7.3	40S	35.8	80S	46	78	3	9	4.2	8.3	37.7	59.4	1.8	6.6	NG	2	4
	2019-20	6.4	20MS	4.0	10S	3.3	10S	15.3	60S	46	89	4	6	3.3	8.3	27.7	81.1	6.4	11.1	5		5
	MEAN	9.8	20S	3.0	20MS	4.8	40S	30.5	80S	46	89	4	9	4.3	8.3	31.1	81.1	5.5	22.2	20	2	5
3	DBW173 (C)																					
	2017-18	1.3	5S	1.0	5MS	2.6	10S	23.3	80S	56	78	3	6	3.2	4.6	42.2	71.7	7.3	14.3	26.3	-	-
	2018-19	2.6	10MS	3.1	20S	3.6	10S	19.3	60S	46	57	3	9	4.3	6.7	42.3	68.7	1.8	5.7	30	3	4
	2019-20	1.1	5MS	5.5	40MS	4.8	20S	11.5	40S	56	89	4	7	2.2	7.5	25.5	62.5	4.2	12.5	44.4		4
	MEAN	1.7	10MS	3.2	40MS	3.7	20S	18.0	80S	56	89	3	9	3.2	7.5	36.7	71.7	4.4	14.3	44.4	3	4
4	WH1021 (C)																					
	2017-18	1.2	10MR	9.0	40S	3.8	10S	51.0	80S	46	69	5	7	5.9	12.5	22.9	60	10.8	37.5	18.8	-	-
	2018-19	3.8	20MS	6.7	40S*	15.9	60S	46.2	80S	57	89	3	7	6.2	11.7	37	74.4	2.9	6.3	30	3	5
	2019-20	4.2	20MS	19.5	60S	9.9	40S	41.8	80S	57	99	4	5	3.2	12.5	28.1	77.7	2.8	8.3	36.8		4
	MEAN	3.1	20MS	11.7	60S	9.9	60S	46.3	80S	57	99	4	7	5.1	12.5	29.3	77.7	5.5	37.5	36.8	3	5
5	PBW771(I)(C)																					
	2017-18	5.9	10S	4.1	20S	0.2	5R	7.7	40S	34	68	7	9	5.9	14.3	-	-	23.5	62.5	15	-	5
	2018-19	7.5	30S	0.4	10R	0.9	5S	2.4	10S	45	89	4	9	5.9	9	23.6	34.1	4.9	9.1	0	3	4
	2019-20	6.6	20MS	2.2	5S	3.4	10S	11.3	40S	46	89	6	9	4.8	8.3	43.8	83.3	10.5	16.7	23.5		4
	MEAN	6.7	30S	2.2	20S	1.5	10S	7.1	40S	45	89	6	9	5.5	14.3	33.7	83.3	13.0	62.5	23.5	3	5
6	WH1124 (C)																					
	2017-18	26.7	40S	8.5	40S	14.0	40S	1.9	10S	47	79	3	5	5.5	12.8	8.2	21.2	7.6	27.3	15.8		
	2018-19	38.8	60S	9.6	60S*	17.6	40S	6.0	20S	46	99	3	7	5	9.2	4.4	13.3	2.3	7.3	NG	3	4
	2019-20	39.0	80S	19.0	80S	17.0	40S	20.9	60S	57	89	3	5	2.5	9.1	21.3	85	4.7	8.3	60		5

	MEAN	34.8	80S	12.4	80S	16.2	40S	9.6	60S	47	99	3	7	4.3	12.8	11.3	85	4.9	27.3	60	3	5
North Eastern Plain Zone (NEPZ)																						
AVT-RI-TS-TAS																						
7	HD3293*																					
	2017-18	14.3	30S	5.6	40S*	9.1	50S*	10.4	20s													
	2018-19	24.7	40S	2.8	10MS	18.4	70S	3.1	10S	35	68	2	5	1.9	5.1	-	-	4.9	8.1	5	2	4
	2019-20	25.4	60S	19.8	60S	21.4	40S	7.0	20MS	35	89	4	9	3.9	11.6	33.8	65	7.4	16.6	25		4
	MEAN	21.5	60S	9.4	60S	16.3	70S	6.8	20S	35	89	3	9	2.9	11.6	33.8	65	6.2	16.6	25	2	4
8	HD3171 (C)																					
	2017-18	22.0	40S	5.5	20MS	5.7	20S	24.0	60S	23	45	3	5	10.1	33.3	31.7	55	6.7	21.4	15		4
	2018-19	14.1	20S	10.9	60S*	31.5	80S	19.9	60S	35	68	3	7	7.7	16.7	10.4	23.7	3.5	6.4	5.5	3	4
	2019-20	20.8	40S	31.3	80S	40.0	70S	18.6	60S	56	99	4	9	4.8	12.6	17.1	34.7	9.4	13.2	0		4
	MEAN	19.0	40S	15.9	80S	25.7	80S	20.8	60S	35	99	3	9	7.5	33.3	19.7	55	6.5	21.4	15	3	4
9	HD2888 (C)																					
	2017-18	1.7	10MS	0.5	20R	1.4	10S	27.1	60S	24	36	4	7	5.1	7.7	37.3	61.7	19.4	72.7	5.3		5
	2018-19	0.8	5MS	0.7	5S	6.4	20S	26.5	60S	46	57	5	7	11.3	17.8	27.9	46.9	3.5	7.3	12.5	4	5
	2019-20	2.5	20MS	1.3	10MS	16.0	60S	27.6	80S	45	89	3	5	11.6	40	16.1	45.1	13.1	17	27.8		4
	MEAN	1.7	20MS	0.8	10MS	7.9	60S	27.1	80S	35	89	4	7	9.3	40	27.1	61.7	12.0	72.7	27.8	4	5
10	K1317 (C)																					
	2017-18	6.2	40MR	5.0	30S	3.2	10S	14.0	40S	24	56	3	4	8.1	10.4	49	62.5	1	4.2	37.5		3
	2018-19	9.4	30MS	2.3	10MS	15.1	60S	18.7	40S	46	89	3	7	4.3	6.4	32.3	66.4	1.3	3.5	0	4	4
	2019-20	12.3	40S	18.0	40S	6.0	20S	11.5	40S	45	89	3	7	4.8	13.4	25.8	53.2	4.8	12.8	33.3		5
	MEAN	9.3	40S	8.4	40S	8.1	60S	14.7	40S	35	89	3	7	5.7		35.7	66.4	2.4	12.8	37.5	4	5
11	HI1612 (C)																					
	2017-18	44.0	80S	3.3	20MS	3.9	20MS	6.1	10S	13	35	4	7	8.8	22.7	38.3	55	36.6	87.5	31.6		4
	2018-19	24.3	40S	1.8	10MS	7.8	30S	5.4	40MS*	35	69	2	5	2.1	4.5	23	62	6.1	9.5	0	2	4
	2019-20	41.0	80S	4.8	20S	3.0	10S	20.8	60S	35	78	3	5	5.3	9.3	37.4	81.1	7	14.6	42.1		4
	MEAN	36.4	80S	3.3	20S	4.9	30S	10.8	60S	24	78	3	7	5.4	22.7	32.9	81.1	16.6	87.5	42.1	2	4
12	DBW252(I) (C)																					
	2017-18	10.4	20S	3.3	20S	1.5	10S	19.6	40S	34	57	3	5	6	9.1	-	-	24.9	85.7	0		4
	2018-19	12.0	20S	0.5	5MR	6.9	30S	21.0	60S	45	57	3	7	4.1	8.5	26	40	7.4	11.1	62.5	3	4
	2019-20	7.4	20S	7.3	40S	8.1	20S	7.5	20S	45	89	2	4	3.5	12.5	23.4	49.7	4.5	11.8	17.7		4
	MEAN	9.9	20S	3.7	40S	5.5	30S	16.0	60S	45	89	3	7	4.5	12.5	24.7	49.7	12.3	85.7	62.5	3	4
Central Zone (CZ)																						
AVT-IR-LS-TAD																						
13	HI1634*																					
	2017-18	1.5	10MR	0.4	10R	6.5	30S	47.6	70S													

	2018-19	1.0	5MS	1.4	10S	3.1	10S	46.6	100S	46	89	3	5	3.8	6.1	-	-	2.7	7.5	55	5	5
	2019-20	0.3	5MR	3.1	20S	5.6	20S	49.5	80S	46	89	3	6	4.4	12.5	22.3	42.2	4.6	6.8	5.3		5
	MEAN	0.9	5MS	1.6	20S	5.1	30S	47.9	100	46	89	3	6	4.1	12.5	22.3	42.2	3.7	7.5	55	5	5
14	CG1029*																					
	2017-18	3.9	10S	1.3	10MS	4.3	20S	70.0	90S													
	2018-19	3.0	10MS	0.7	5S	2.5	10S	69.1	100S	46	89	5	9	7.4	14.1	-	-	9.9	26.1	90	3	5
	2019-20	4.2	10MS	2.7	20MS	5.0	20S	62.7	80S	56	99	5	9	4.4	12.5	28.5	44.6	3.7	8.3	84.2		5
	MEAN	3.7	10S	1.6	20MS	3.9	20S	67.3	100S	46	99	5	9	5.9	14.1	28.5	44.6	6.8	26.1	90	3	5
15	HD2932 (C)																					
	2017-18	6.3	30MR	15.1	80S*	21.0	70S	58.0	90S													
	2018-19	8.4	20MS	19.4	40S	34.6	90S	55.0	80S	56	89	3	5	4.5	13.5	-	-	2.1	4.8	45	3	4
	2019-20	11.3	20S	38.8	80S	35.0	70S	51.4	80S	46	89	4	9	3.6	10	-	-	2.5	7.5	47.4		5
	MEAN	8.7	20S	24.4	80S	30.2	90S	54.8	90S	46	89	3	9	4.1	13.5	-	-	2.3	7.5	47.4	3	5
16	MP3336 (C)																					
	2017-18																					
	2018-19	15.3	40S	8.1	40S*	19.3	40S	53.0	100S	57	99	5	7	4.2	10.1	-	-	2	6.6	65	3	5
	2019-20	9.4	30MS	26.5	80S	28.8	50S	51.8	80S	56	89	5	9	4.1	13.3	18.3	46.6	2.1	6.3	17.7		5
	MEAN	12.4	40S	17.3	80S	24.1	50S	52.4	100S	56	99	5	9	4.2	13.3	18.3	46.6	2.1	6.6	65	3	5
17	HD2864 (C)																					
	2017-18	0.9	5MR	1.3	5MS	4.9	30S	59.0	80S													
	2018-19	2.8	10S	6.5	40S*	6.0	20S	61.8	100S	57	79	4	7	7.3	12.2	-	-	2.1	7.1	65	3	5
	2019-20	2.5	10S	7.6	60S*	5.6	20MS	57.7	80S	56	89	4	6	4	8.6	12.6	37.4	2.5	7.5	27.8		5
	MEAN	2.1	10S	5.1	60S	5.5	30S	59.5	100S	56	89	4	7	5.7	12.2	12.6	37.4	2.3	7.5	65	3	5
Peninsular Zone (PZ)																						
AVT-IR-TS-TAS																						
18	DDW48(d) *																					
	2017-18	12.3	30S	8.6	40S	2.9	20S	3.3	10S													
	2018-19	6.7	20S	2.6	20MS	2.4	15S	15.0	60S	35	56	3	7	1.9	4.3	-	-	2.2	6.1	0	3	4
	2019-20	18.1	100S*	5.6	20MS	6.6	40S	8.7	40S	45	99	3	5	1.5	6.7	4.5	12.5	0	0	57.9		3
	MEAN	12.4	100S	5.6	40S	4.0	40S	9.0	60S	45	99	3	7	1.7	6.7	4.5	12.5	1.1	6.1	57.9	3	4
19	DDW49(d) *																					
	2017-18	17.5	20S	9.8	40S	2.0	10MS	8.0	20S													
	2018-19	13.7	40S	13.1	40S*	12.4	40S	11.7	30S	56	89	3	5	2.3	4.8	-	-	0.7	2.7	55	3	4
	2019-20	40.8	100S	8.4	20S	8.9	30S	5.8	20S	45	99	5	7	4.2	8.4	27.3	52.5	0	0	30		5
	MEAN	24.0	100S	10.4	40S	7.8	40S	8.5	30S	56	99	4	7	3.3	8.4	27.3	52.5	0.4	2.7	55	3	5
20	MACS6222 (C)																					
	2017-18	2.1	20MR	3.5	20S	2.3	20MS	16.6	30S	35	67	4	7	6.7	13.7	30	43.9	7.9	27.3	10.5		5

	2018-19	3.0	10MS	0.7	5S	1.3	10S	27.4	80S	46	78	3	5	3.1	4.5	20.2	49.3	1.9	4.8	5	2	4
	2019-20	5.0	10S	7.2	40S	2.0	10S	28.3	80S	57	89	5	9	4.5	8.7	31.2	53.3	2.2	6.7	25		4
	MEAN	3.4	10S	3.8	40S	1.9	20MS	24.1	80S	45	89	4	9	4.8	13.7	27.1	53.3	4.0	27.3	25	2	5
21	MACS3949(d) (C)																					
	2017-18	7.2	20MS	4.0	20MS	0.0	TR	6.5	20MS	35	68	3	8	5.7	11.8	-	-	2.8	8.1	26.3		3
	2018-19	7.3	30S	5.2	20S	2.3	10S	3.7	20MS	46	99	4	7	1.6	2.9	5.1	6.1	2.4	5.3	35	3	4
	2019-20	9.8	40S	6.1	20MS	1.8	10MS	2.5	20S	56	99	4	9	1.4	5	10.4	16.6	0	0	16.7		4
	MEAN	8.1	40S	5.1	20S	1.4	10S	4.2	20S	46	99	4	9	2.9	11.8	7.8	16.6	1.7	8.1	35	3	4
22	UAS428(d) (C)																					
	2017-18	8.1	20MS	10.3	60S	1.1	10MS	8.0	20S	24	68	4	8	3.2	6.8	-	-	4.9	19.6	23.5		3
	2018-19	4.8	30MS	2.3	20MR	1.9	10MS	3.6	10S	46	78	3	6	4.2	10	15	45	2.4	7.1	40	3	4
	2019-20	15.0	80S	8.8	40S	2.1	10S	3.5	20MS	35	99	4	7	1.8	5.5	3.2	11.1	0	0	35.7		5
	MEAN	9.3	80S	7.1	60S	1.7	10S	5.0	20S	35	99	4	8	3.1	10	9.1	45	2.4	19.6	35.7	3	5
Peninsular Zone (PZ)																						
AVT-IR-LS-TAS																						
23	HI1633*																					
	2017-18	1.9	5MS	0.8	5MS	11.4	50S	46.0	60S													
	2018-19	3.4	20MS	1.5	10S	3.9	20S	46.6	100S	46	79	3	7	6.2	13.3	-	-	1.3	3.5	25	3	5
	2019-20	2.0	10S	10.0	80S*	7.0	20S	48.6	80S	56	89	5	9	3.2	11.2	24.8	40.9	2.9	8.7	0		5
	MEAN	2.4	20MS	4.1	80S	7.4	50S	47.1	100S	46	89	4	9	4.7	13.3	24.8	40.9	2.1	8.7	25	3	5
24	HD3090 (C)																					
	2017-18																					
	2018-19	5.7	40MR	0.1	TR	3.3	10S	48.4	100S	57	89	3	9	9.2	16.1	-	-	11	14.3	5	3	5
	2019-20	3.8	20MR	3.1	30MS	5.8	15S	47.7	80S	46	99	4	6	4.5	12.3	44.7	73.3	4.9	14.7	10		5
	MEAN	4.8	40MR	1.6	30MS	4.6	15S	48.1	100S	46	99	3	9	6.9	16.1	44.7	73.3	8.0	14.7	10	3	5
25	RAJ4083 (C)																					
	2017-18																					
	2018-19	6.0	20MS	9.3	40S	11.5	40S	16.3	40S	57	99	3	5	6.6	12.2	-	-	1.9	7.6	25	2	5
	2019-20	4.4	20S	16.6	80S	10.8	40S	35.5	80S	57	89	4	9	5.1	11.6	22.4	35.4	5.5	13.2	5		4
	MEAN	5.2	20S	13.0	40S	11.2	40S	25.9	80S	57	99	3	9	5.9	12.2	22.4	35.4	3.7	13.2	25	2	5
26	HD2932 (C)																					
	2017-18	6.3	30MR	15.1	80S	21.0	70S	58.0	90S													
	2018-19	10.3	20S	16.7	60S	31.6	80S	51.6	100S	57	99	3	5	11	17.4	-	-	9	13.6	22.2	3	5
	2019-20	15.8	40S	38.5	80S	32.8	60S	46.5	80S	57	89	4	9	3.5	14.2	30.9	42.2	4.2	12.5	0		5
	MEAN	10.8	40S	23.4	80S	28.5	80S	52.0	100S	57	99	3	9	7.3	17.4	30.9	42.2	6.6	13.6	22.2	3	5
Peninsular Zone (PZ)																						

AVT-RI-TS-TAD																						
27	NIDW1149 (d)*																					
	2017-18	3.5	10MS	2.8	20S	5.7	40S*	4.1	15S													
	2018-19	6.0	40MR	0.8	5MS	5.5	30MS	3.0	10S	56	89	3	7	2.4	4.1	-	-	1	4.1	66.6	4	4
	2019-20	2.9	10MS	2.3	20MS	2.6	10S	4.6	10S	56	89	5	9	1.9	6.5	3.3	13.3	0	0	10		4
	MEAN	4.1	40MR	2.0	20S	4.6	40S	3.9	15S	56	89	4	9	2.2	6.5	3.3	13.3	0.5	4.1	66.6	4	4
28	UAS446(d) (C)																					
	2017-18	2.3	5MS	1.2	5S	1.6	10S	17.3	40S	35	68	4	6	3.1	6.1	-	-	1.9	5.4	15		4
	2018-19	10.7	40S*	1.6	10S	6.0	40S*	13.4	60S	46	78	4	7	5.4	9.3	4.7	18.6	2.1	5.6	37.5	4	5
	2019-20	16.8	100S	5.1	20S	2.8	10S	2.8	10S	46	89	3	5	2.8	9.1	1.9	7.5	0	0	40		4
	MEAN	9.9	100S	2.6	20S	3.5	40S	11.2	60S	46	89	4	7	3.77	9.3	3.3	18.6	1.33	5.6	40	4	5
29	HI 1605 (C)																					
	2017-18	7.3	20MS	12.2	20MS	3.6	20S	27.0	40S	35	78	4	7	5.8	10	-	-	1.4	5.6	45		3
	2018-19	7.6	20S	13.2	40S	16.5	40S	22.4	40S	56	89	3	7	5.2	8.3	39	68.3	2.5	8.3	44.4	3	5
	2019-20	5.3	20S	19.0	80S	5.0	20S	15.2	40MS	46	89	4	7	2.8	8.6	17.7	26	2.2	6.6	15.8		5
	MEAN	6.7	20S	14.8	80S	8.4	40S	21.5	40S	46	89	4	7	4.6	10	28.4	68.3	2.03	8.3	44.4	3	5
30	AKDW 2997-16(d) (C)																					
	2017-18	35.0	40S	7.3	20S	7.6	40S	7.9	20S	46	78	6	9	1.8	4.4	12.8	51	7.5	25.9	21.1		5
	2018-19	14.3	40S	2.3	10MS	4.1	10S	8.8	30S	57	99	5	9	2.5	5	3.7	6.7	0.4	1.5	50	3	5
	2019-20	28.5	80S	10.6	60S	5.9	20S	12.1	60S	56	99	3	6	1.8	5.5	3.1	12.5	0	0	16.7		3
	MEAN	25.9	80S	6.7	60S	5.9	40S	9.6	60S	56	99	5	9	2.03	5.5	6.53	51	2.63	25.9	50	3	5
31	HI8805(d)(I)(C)																					
	2017-18	2.8	10S	2.0	10MR	1.0	5S	4.2	20MS	35	67	4	7	4	6.1	-	-	0	0	33.3		4
	2018-19	1.7	5S	1.9	10MS	8.1	40S	4.2	20S	46	89	3	7	5.7	11.7	1.6	6.3	0.1	0.5	0	2	4
	2019-20	5.5	20S	9.8	60S	3.6	20S	4.6	20S	46	99	3	9	1.6	4.5	2.8	11.1	0	0	25		4
	MEAN	3.3	20S	4.6	60S	4.2	40S	4.3	20S	46	99	3	9	3.77	11.7	2.2	11.1	0.03	0.5	33.3	2	4
32	NIAW3170(I)(C)																					
	2017-18	4.7	10S	3.8	10MS	3.4	10S	14.5	40S	35	68	3	6	3.8	8.5	-	-	1.4	3.7	11.8		4
	2018-19	4.3	10MS	2.5	10S	3.6	15S	14.9	40S	56	89	2	7	5.8	8.5	-	-	2.2	8.7	0	3	4
	2019-20	13.0	60S	0.9	15MR	4.3	10S	26.0	60S	46	89	4	5	1.8	8.3	40.8	72	2.2	6.6	42.1		5
	MEAN	7.3	60S	2.4	10S	3.8	15S	18.5	60S	46	89	3	7	3.8	8.5	40.8	72	1.93	8.7	42.1	3	5
Special Trial - HYPT																						
33	DBW187*																					
	2017-18	8.0	20S	1.6	5MS	4.3	20S	8.9	20S	46	89	3	5	4.9	6.7	34.9	45	8.3	20	35		
	2018-19	10.2	30S	0.7	5S	5.4	15S	6.5	20MS	46	78	2	5	2.5	6.6	29.2	53.1	1.5	5.9	7.1	3	4
	2019-20	10.8	40S	3.9	15MS	1.5	10S	12.9	60S*	45	89	2	6	5.5	12.5	13	21.3	3.1	5.6	45		4

	MEAN	9.7	40S	2.1	15MS	3.7	20S	9.4	60S	46	89	2	6	4.3	12.5	25.7	53.1	4.3	20	45	3	4
343	DBW303*																					
	2017-18																					
	2018-19	5.2	20MS	2.8	10MS	2.4	10S	9.5	20S	46	78	2	4	5.8	11.1	-	-	1.2	4.3	5	3	4
	2019-20	7.0	20MS	1.6	10MS	0.6	10MR	6.7	20S	46	89	3	7	2.6	8.7	23.8	45.5	4.2	12.5	26.3		5
	MEAN	6.1	20MS	2.2	10MS	1.5	10S	8.1	20S	46	89	3	7	4.2	11.1	23.8	45.5	2.7	12.5	26.3	3	5
35	WH1270*																					
	2017-18																					
	2018-19	1.0	5S	3.4	20S	4.4	20S	4.5	30S	46	89	2	5	7.7	11.8	-	-	2.5	5.2	50	3	4
	2019-20	12.5	40S	10.4	60S	3.5	10S	13.8	40S	46	89	3	6	4.6	13.3	-	-	4.2	8.6	15		5
	MEAN	6.8	40S	6.9	60S	4.0	20S	9.2	40S	46	89	3	6	6.15	13.3	-	-	3.35	8.6	50	3	5
36	HD3086 (C)																					
	2017-18	37.3	60S	6.1	40S*	10.9	20S	2.9	10S	46	79	3	5	6.3	15.2	7.8	31.1	11.6	36.4	10	-	-
	2018-19	26.7	40S	10.8	60S*	28.1	40S	10.0	40MS	46	78	2	5	5.7	9.9	7.6	17.8	2.2	7.8	NG	3	5
	2019-20	43.0	80S	17.4	80S	30.0	60S	21.4	60S	45	89	4	6	4.5	14.3	3.6	12.5	4.7	11.1	10.5		4
	MEAN	35.7	80S	11.4	80S	23.0	60S	11.4	60S	46	89	3	6	5.5	15.2	6.33	31.1	6.17	36.4	10.5	3	5
37	HD2967 (C)																					
	2017-18	3.8	10MS	0.3	10R	3.7	20MS	39.9	80S	35	67	3	6	6.8	16.1	31.4	61.9	14.1	42.9	20		
	2018-19	8.7	30S	1.5	10MS	6.5	30S	37.5	80S	35	57	3	7	6.6	11.1	26.6	51.2	2.5	7.1	70	3	4
	2019-20	6.8	20S	1.6	10S	14.0	40S	31.4	60S	34	78	3	6	4	14.3	37.5	54.6	1.5	4.6	10.5		4
	MEAN	6.4	30S	1.1	10S	8.1	40S	36.3	80S	35	78	3	7	5.8	16.1	31.8	61.9	6.03	42.9	70	3	4

Abbreviations: LB = Leaf blight, KB = Karnal bunt, PM = Powdery mildew, FS = Flag smut, FHB = Fusarium head blight, FR = Foot rot, LS = loose smut

Table 1.5: Adult plant respons of NIVT entries against rusts under disease epiphytotic conditions at hot spot locations in field during 2019-20

AVT No.	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
NIVT-1A									
1	Raj4548	12.0	40S	6.1	40S	2.7	10S	6.7	40S
2	UP3052	3.3	10MS	5.3	30S	12.6	40S	23.5	60S
3	HD3348	27.5	60S	14.0	60S	13.2	40S	10.4	40S
4	DBW334	11.8	20S	18.6	80S	18.2	60S	21.3	60S
5	UP3053	34.3	80S	15.8	80S	4.3	10S	16.8	40S
6	HUW 839	24.3	60S	3.3	10S	0.6	5S	7.0	20MS
7	K1901	7.8	20S	8.8	60S*	1.3	10S	17.0	60S
8	HD3352	13.3	40S	23.0	60S	9.4	40S	17.5	40S
9	KRL1810	21.0	60S	6.1	20S	2.3	5S	16.1	40S
10	DBW309	9.5	20S	14.9	60S	6.7	10S	18.6	60S
11	PBW828	7.6	20S	4.7	20MS	5.4	20S	12.4	40S
12	K1006 (C)	14.0	40S	11.9	60S	7.8	20MS	25.3	80S
13	HD3349	12.6	40S	8.5	60S*	5.0	20S	8.3	40S
14	PBW841	11.2	40S	1.3	15MR	0.1	TS	4.3	30S
15	HD2967 (C)	4.2	10MS	3.3	20S	3.3	20S	23.3	40S
16	PBW829	6.3	20MS	9.6	40S	2.6	10S	1.5	10S
17	DBW308	2.6	20MS	2.1	20MS	2.6	20S	10.2	80S
18	AAI-W29	31.5	60S	47.5	100S	23.9	40S	49.2	80S
19	HD3353	7.3	40MS	15.1	80S	2.1	10S	20.5	60S
20	DBW306	41.8	100S	8.8	40S	7.8	40S	3.6	15MS
20A	**Infector**	**77.5**	**100S**	**77.5**	**100S**	**70.0**	**100S**	**72.7**	**100S**
21	WH1284	17.1	40S	16.1	60S	7.4	20S	18.5	60S
22	UP3051	42.4	80S	12.4	60S	6.0	20S	20.8	60S
23	WH1272	7.9	40S	3.8	20S	3.0	10S	19.2	60S
24	HD3350	24.0	60S	19.5	80S	7.4	20S	16.0	60S
25	HD3086 (C)	32.0	40S	20.5	80S	13.8	30S	16.1	40S
26	Raj4547	3.3	10S	3.6	20S	3.9	20S	27.5	60S
27	UP3054	1.9	10S	2.3	10S	5.2	40S	4.7	20S
28	NW7079	13.0	20S	24.0	80S	17.6	40S	22.4	60S
29	PBW827	8.4	20S	4.9	20MS	1.3	10S	1.4	5S
30	HD3351	16.9	40S	21.6	80S	3.6	10S	30.5	60S
31	DBW187 (C)	1.6	20MR	3.0	20MS	1.4	10S	2.9	10S
32	PBW826	4.0	10S	8.6	40S	6.3	20MS	8.2	30S
33	Raj4546	8.3	40MS	7.6	40S	4.4	20MS	14.4	40S
34	WH1273	17.8	40S	2.3	20MS	3.3	20S	10.1	40S
35	DBW307	13.5	40S	21.8	60S	18.3	40S	23.4	60S
36	WH1271	10.3	20S	2.1	10MS	12.5	40S	4.3	20S
NIVT-1B									
37	WH1274	1.6	10S	9.4	60S	2.5	10S	3.2	10S
38	JKW275	4.9	10MS	8.4	60S*	3.0	10S	4.9	15S
39	K1905	18.5	40S	12.9	80S	17.0	40S	18.1	40S
40	UP3055	34.9	100S	4.3	20S	5.5	20S	9.5	40S
40A	**Infector**	**82.5**	**100S**	**85.0**	**100S**	**70.0**	**80S**	**70.9**	**90S**
41	NW7093	19.0	40S	1.6	15MS	4.8	20S	5.0	20S
42	Raj4549	5.6	20MS	8.1	40S	5.5	30S	25.0	60S
43	K1903	27.1	60S	10.0	60S	1.5	10S	3.8	20S

AVT No.	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
44	PBW830	11.1	40S	12.2	60S	2.3	10S	3.2	10S
45	PBW831	46.8	100S	19.2	100S	1.9	15S	4.9	20MS
46	NW7094	7.6	20S	6.3	40S	5.8	40S	4.8	20S
47	UP3057	6.5	20S	3.1	20MS	3.3	10S	12.7	20S
48	WH1283	2.0	10S	10.7	60S	3.8	20S	4.5	10S
49	Raj4550	8.6	40S	15.6	80S	18.1	40S	24.6	60S
50	DBW313	13.6	40S	5.7	40MS	3.3	15S	5.0	20S
51	BRW3877	31.0	100S	8.4	30S	2.1	10S	14.7	40S
52	DBW312	8.8	40MS	13.8	60S	5.9	15S	18.5	40S
53	UP3056	24.8	60S	16.1	80S	10.7	40S	11.0	40S
54	NW7088	23.5	80S	12.3	60S	4.5	30S	7.9	20S
55	HD3355	14.8	60S	9.2	50S	2.6	20S	15.2	40S
56	HUW841	7.2	20S	11.2	40S	4.4	15S	25.9	60S
57	K1904	11.4	40MS	5.1	40S	4.5	20S	21.7	60S
58	HD3356	3.2	20MS	4.1	20S	5.8	20S	18.1	60S
59	AAI-W22	10.6	20MS	25.0	80S	19.3	60S	41.4	60S
60	HD3357	31.8	60S	19.4	80S	20.2	40S	27.2	60S
60A	**Infector**	**85.0**	**100S**	**85.0**	**100S**	**68.8**	**80S**	**73.6**	**90S**
61	HUW840	0.1	TR	12.0	60S	20.0	60S	13.2	40S
62	HD2967 (C)	7.2	20S	6.8	30S	4.5	20S	24.5	40S
63	KRL1803	31.0	80S	8.7	40MS	2.6	20S	8.6	20S
64	KRL1808	26.8	60S	9.3	40S	5.6	20S	15.9	40S
65	JKW277	9.7	40S	17.8	80S	10.0	20S	18.8	60S
66	HD3086 (C)	41.8	80S	10.9	40S	13.3	40S	20.8	60S
67	DBW187 (C)	15.6	40S	12.0	80S*	3.3	20S	3.6	20MS
68	BRW3869	5.4	20S	4.3	20S	2.6	10S	16.1	40S
69	HD3354	27.3	60S	10.8	60S	1.3	5S	13.9	60S
70	DBW311	27.6	80S	14.2	40S	9.4	20S	12.6	40S
71	K1006 (C)	9.0	40MS	3.8	10MS	12.5	30S	25.7	60S
72	DBW310	5.7	20S	13.1	60S	13.1	20S	28.4	60S
NIVT-2									
73	GW521	4.6	20S	12.5	80S	4.4	20S	55.5	60S
74	MP3535	13.5	40S	6.4	20S	2.5	20S	41.4	60S
75	MACS6478 (C)	34.3	60S	7.2	20S	3.5	10S	39.6	60S
76	RVW4301	3.1	40MR	3.6	20S	2.6	10S	3.5	10S
77	UAS3012	2.8	20MS	5.6	40S	1.4	10S	11.0	40S
78	NWS2176	2.4	20MR	2.4	20MS	4.1	20S	19.9	40S
79	RVW4304	2.0	20MR	3.3	20MS	6.6	20S	31.0	60S
80	HI1544 (C)	2.7	10S	4.1	40MS	3.9	30S	50.0	80S
80A	**Infector**	**77.5**	**100S**	**82.5**	**100S**	**75.0**	**100S**	**76.4**	**100S**
81	DBW314	3.5	20MS	1.8	10MS	2.9	10S	12.9	40S
82	HI1650	1.9	10MS	1.1	20MR	4.4	20MS	31.3	80S
83	HD3376	4.0	20MS	1.8	10MS	0.8	5S	22.2	60S
84	GW322 (C)	12.8	20S	11.1	40S	20.0	40S	38.2	80S
85	HI1648	5.0	20MR	2.7	20MS	7.8	30S	35.5	60S
86	WH1275	31.0	60S	14.0	80S	12.6	20S	21.6	60S
87	MACS3735	3.9	10S	23.3	60S	12.6	30S	37.3	80S
88	UAS3011	17.1	40S	11.6	60S	8.1	30S	31.8	60S
89	GW522	9.6	60S*	10.1	80S*	4.4	20S	44.5	60S

AVT No.	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
90	NIAW3889	5.5	20MS	10.1	60S	4.9	20S	27.5	60S
91	HI1649	22.3	40S	23.3	60S	10.5	40S	45.0	80S
92	NIAW3882	3.5	20MR	4.3	20MS	3.1	10S	24.5	80S
93	AKAW5099	17.1	50S	11.0	80S*	4.4	30S	51.4	80S
94	HD3359	11.5	40MS	6.6	40S	6.8	20S	22.7	60S
95	MP1369	8.3	40S	22.8	80S	15.6	40S	55.5	80S
96	UP3058	1.7	10MS	6.5	40S	5.1	20S	9.4	40S
97	HI1647	17.3	60S	14.4	80S	6.3	20S	19.5	60S
98	MACS6764	6.8	40S	11.5	40S	14.4	60S	34.0	60S
99	PBW832	18.8	40S	3.4	20MS	3.1	20S	2.4	10S
100	GW523	12.8	40MS	13.0	60S	16.9	60S	41.4	80S
100A	**Infector**	**85.0**	**100S**	**82.5**	**100S**	**71.3**	**100S**	**70.9**	**100S**
101	MP1370	3.1	20MR	3.3	20MS	7.3	20S	58.2	80S
102	CG1034	2.7	20MR	2.3	10MS	9.3	20S	48.6	80S
103	MACS6768	11.3	40S	5.7	40S	3.0	10S	68.2	100S
104	Raj4551	8.4	30S	7.1	40S	5.2	20S	11.2	40S
105	DBW315	10.8	40S	3.3	10S	3.3	10S	23.8	40S
106	MP3526	7.9	30S	14.1	60S	5.8	20S	26.9	60S
107	MP1371	3.8	10MS	5.1	40S	5.0	20S	44.5	80S
108	MACS6222 (C)	5.6	30MS	10.1	80S*	1.4	10S	26.7	60S
NIVT-3A									
109	K1907	18.1	40MS	12.9	60S	3.8	20S	11.7	20S
110	HD3361	19.8	40MS	13.5	60S	14.4	40S	8.0	20S
111	DBW335	2.4	10MS	12.7	40S	8.4	20S	9.1	20S
112	HD3362	12.3	20S	3.6	20MS	6.8	20S	9.0	20S
113	WH1278	5.7	40MR	4.3	10S	2.6	20S	3.4	10S
114	DBW173 (C)	0.7	10MR	2.9	20MS	1.5	10S	5.7	10S
115	UP3065	0.8	5MS	3.0	20S	2.7	10S	6.5	20S
116	NW7092	16.1	40S	17.7	60S	6.4	20S	14.1	40S
117	HD3363	16.0	40S	10.1	40S	9.0	20S	7.4	20S
118	PBW836	1.0	10MR	4.5	40MS	3.4	15S	11.4	40S
119	DBW317	8.4	20S	21.9	60S	10.2	40S	7.3	20S
120	K1908	25.5	80S	6.0	20S	21.4	60S	11.0	20S
120A	**Infector**	**77.5**	**100S**	**77.5**	**100S**	**73.8**	**100S**	**71.8**	**100S**
121	HD3364	5.6	40MS	2.1	10MS	4.3	20S	3.1	10S
122	PBW834	9.8	40MS	13.8	80S	3.5	20S	5.2	30S
123	HUW842	18.1	40S	3.6	10S	2.1	5S	10.6	20S
124	UP3059	18.5	40S	2.8	20MS	1.5	10S	4.6	10S
125	Raj4552	3.3	10S	12.3	80S	1.4	10S	10.0	20S
126	HD3360	35.8	60S	19.1	80S	13.9	40S	17.9	60S
127	UP3061	7.9	20S	12.9	60S	7.0	20S	7.7	20S
128	HD3365	20.1	40S	13.1	60S	11.3	20S	22.7	60S
129	WH1276	22.1	40S	5.7	40MS	5.3	20MS	6.8	20S
130	Raj4554	4.7	20MS	2.3	10S	2.3	10S	16.4	60S
131	UP3060	6.8	20S	7.8	50S*	3.0	15S	11.9	30S
132	HI1563 (C)	1.5	10MS	2.1	20MS	1.3	5S	46.4	80S
133	PBW833	33.0	80S	1.3	5S	1.4	10S	15.4	60S
134	DBW316	2.0	10MS	1.1	5MS	1.5	10S	3.4	10S
135	HD3059 (C)	8.8	20S	5.2	40MS	4.3	20S	19.8	60S

AVT No.	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
136	DBW107 (C)	2.6	10MS	4.8	20S	2.4	5S	14.7	40S
137	NW8000	9.9	40S	14.3	60S	8.9	20S	21.2	60S
138	PBW835	13.1	40S	8.3	60S*	1.3	10S	1.7	10S
139	Raj4553	12.0	20S	13.9	80S	5.2	20S	17.9	60S
140	JKW278	4.9	20MS	14.8	80S	13.3	30S	17.0	60S
140A	**Infector**	**80.0**	**100S**	**80.0**	**100S**	**68.8**	**80S**	**71.8**	**100S**
141	WH1277	8.5	20MS	2.7	20MS	1.8	10S	6.8	20S
142	DBW318	2.1	20MS	10.0	60S	1.9	10S	4.5	10S
143	DBW319	3.1	20MS	6.3	40S	5.5	20S	29.1	60S
144	JKW270	3.8	10MS	2.1	20MS	2.0	10S	13.7	30S
NIVT-3B									
145	LOK77	3.6	20MS	8.1	60S*	5.0	20S	17.3	40S
146	HD3366	18.0	40S	9.4	60S*	2.7	10S	25.4	60S
147	MP3527	17.5	40S	19.2	80S	11.4	30S	28.6	60S
148	NIAW3895	14.0	40S	10.6	60S	2.4	10S	29.5	60S
149	MP1372	11.2	40S	17.1	60S	5.2	20S	55.5	80S
150	CG1035	26.0	80S	15.6	80S	11.9	40S	24.8	60S
151	HD3367	9.6	40S	3.1	10S	3.1	10S	23.4	60S
152	WH1279	3.4	20S	2.6	10MS	2.3	10S	11.9	40S
153	HI1651	1.8	10MR	2.7	20MS	4.5	20S	31.8	60S
154	HI1652	7.5	40S	5.5	40S	2.6	20S	35.5	60S
155	RVW4309	26.9	60S	22.4	80S	6.1	20S	33.2	60S
156	NWS2180	15.0	40S	9.3	40MS	3.3	10S	17.7	40S
157	MACS6774	9.8	20MS	12.6	60S	2.7	20S	28.0	60S
158	HD2932 (C)	18.6	60S	23.5	80S	26.3	40S	44.5	60S
159	UAS3013	35.8	60S	4.6	20MS	8.8	20S	19.8	60S
160	AKAW5080	5.8	40MR	12.3	80S*	9.9	30S	50.0	80S
160A	**Infector**	**75.0**	**100S**	**75.0**	**100S**	**72.5**	**100S**	**70.0**	**100S**
161	DBW320	11.0	20S	10.1	60S	10.0	30S	7.3	30S
162	CG1037	23.1	60S	10.2	40S	10.7	40S	26.6	60S
163	GW527	5.8	30MS	9.7	60S	10.2	40S	52.7	80S
164	MACS6769	0.3	5R	4.5	20S	7.3	30S	53.6	80S
165	HD2864 (C)	0.2	5R	2.1	20MS	6.0	20S	54.5	80S
166	GW525	1.2	10MR	0.9	15MR	6.2	20S	52.7	80S
167	NIAW3898	2.5	10S	2.5	20MS	5.4	30S	29.4	80S
168	MP3529	13.3	40S	13.0	80S	1.4	10S	5.7	20S
169	PBW837	17.2	60S	2.3	20MS	1.3	10S	1.8	10S
NIVT-4									
170	PWU5	23.0	80S	28.5	80S	16.0	40S	41.4	80S
171	HI8713 (C)	9.1	60S*	2.9	10MS	12.2	60S	10.8	60S
172	HI8826	6.8	40S	1.2	20MR	10.8	60S	9.8	40S
173	MACS4106	7.0	40S	6.2	40S	1.9	10S	5.6	20S
174	UAS473	3.3	10S	2.6	20MS	1.3	10S	3.7	20MS
175	HI8828	6.1	40S	1.1	20MR	1.3	10S	8.6	30S
176	MPO1375	5.7	20S	1.5	15MR	3.3	20S	7.9	20S
177	MACS4100	16.5	60S	5.9	40S	0.8	5S	12.8	40S
178	WHD965	11.0	40S	1.5	20MR	2.0	10S	6.2	20S
179	NIDW1348	4.1	10S	3.3	20MS	1.3	5S	1.6	10MS
180	DDW53	13.8	60S	3.1	15MS	2.4	10S	4.5	20MS

AVT No.	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
180A	**Infector**	**82.5**	**100S**	**77.5**	**100S**	**72.5**	**100S**	**71.8**	**100S**
181	HI8829	8.1	40S	5.1	40S	3.0	10S	5.5	20MS
182	PDW360	20.6	80S	3.8	20S	4.4	20S	1.4	5S
183	HI8825	5.3	20S	7.4	40S	1.4	5S	2.2	10MS
184	HI8827	1.8	20MR	6.2	20MS	1.4	5S	4.0	10S
185	HI8737 (C)	8.0	20S	4.6	20MS	0.7	5S	4.4	20MS
186	DDW54	26.3	80S	7.6	40S	3.5	10S	3.2	10MS
187	MACS3949 (C)	6.6	40S	3.1	20MS	3.6	10S	1.9	10MS
188	UAS474	11.8	80S*	2.7	20MS	1.9	10S	1.8	10S
189	PBND4812	4.2	20S	6.1	40S	2.3	10MS	6.3	40S
190	GW1355	1.9	5S	3.6	20MS	1.8	5S	9.6	40S
191	GW1354	1.9	5S	2.3	20MR	1.2	5MS	17.1	40S
192	NIDW1345	11.3	80S*	1.8	20MR	1.3	20MR	2.1	10S
193	MPO1374	8.2	20S	5.6	40S	0.4	5MR	3.0	20MS
194	MPO1373	25.8	80S	7.1	20S	0.5	10MR	7.0	20S
NIVT-5A									
195	WH1280	17.3	40MS	12.2	60S	16.9	40S	16.7	40S
196	HD3368	15.9	40S	12.7	60S	3.4	20S	8.7	20S
197	HD3369	13.7	60S	2.5	10MS	3.8	20S	8.1	20S
198	DBW321	45.0	80S	11.2	60S	8.9	30S	7.5	20S
199	BRW3863	6.1	30MS	19.8	60S	15.1	40S	13.1	40S
200	WH1281	17.5	40S	2.2	10MS	13.1	40S	18.1	40S
200A	**Infector**	**82.5**	**100S**	**87.5**	**100S**	**75.0**	**100S**	**72.7**	**100S**
201	DBW324	19.5	60S	3.4	10S	14.3	40S	28.2	60S
202	HD3171 (C)	30.0	60S	32.0	80S	23.8	40S	19.1	60S
203	UP3063	1.4	5S	11.0	40S	7.4	20S	8.8	40S
204	JAUW683	5.8	40S	13.6	60S	7.0	20S	13.5	60S
205	K1910	15.4	60S	13.0	40MS	3.2	10S	12.6	40S
206	PBW644 (C)	17.1	40S	16.6	60S	7.9	40S	24.2	60S
207	HI1654	1.2	5S	2.0	10MS	1.4	10S	3.7	10MS
208	K1317 (C)	7.9	20S	8.4	40MS	3.4	20S	13.4	60S
209	NW7096	2.5	5S	7.0	40S	3.3	20S	10.4	40S
210	DBW323	13.4	40S	3.1	10MS	4.0	30S	12.8	40S
211	HI1653	7.9	40MS	7.1	40S	4.0	30S	11.2	40S
212	PBW848	18.0	40S	5.1	20MS	4.1	30S	6.5	20S
213	PBW839	8.6	20S	1.7	5MS	5.2	30S	11.2	40S
214	HUW843	17.5	40MS	23.1	60S	4.4	20S	14.7	60S
215	PBW838	22.5	80S	15.5	80S	7.6	20S	12.0	20S
216	DBW322	53.5	80S	27.5	80S	9.5	40MS	18.3	60S
217	WH1142 (C)	6.1	20S	18.0	60S	10.8	40S	19.0	40S
218	BCW5	6.1	20S	0.8	15MR	5.5	20S	21.7	40S
219	UP3062	3.0	10S	22.0	80S	8.0	20S	10.0	20S
NIVT-5B									
220	DBW326	5.3	20MS	16.3	60S	1.9	10S	9.9	40S
220A	**Infector**	**80.0**	**100S**	**80.0**	**100S**	**68.8**	**80S**	**71.8**	**100S**
221	GW528	1.2	5S	1.5	20MR	4.5	20S	39.4	80S
222	MP1367	4.8	10S	8.1	60S*	7.0	20S	52.3	80S
223	UAS446(d) (C)	4.8	20S	1.4	15MR	2.0	15S	5.8	20S
224	UAS475(d)	4.2	20S	1.1	10MR	3.1	15S	3.6	20S

AVT No.	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
225	DDW55(d)	12.8	40S	4.8	20MS	2.6	20S	16.5	60S
226	MACS6753	4.9	20S	4.1	40MS	1.4	10S	47.3	80S
227	HD3372	8.2	20MS	10.1	40S	3.9	20S	13.9	40S
228	HI1605 (C)	9.9	40S	20.5	80S	8.7	20S	19.5	60S
229	DBW110 (C)	7.8	20S	4.1	10MS	6.8	20S	38.6	80S
230	HI8830(d)	7.0	40S	3.1	10MS	4.5	30S	13.9	40S
231	HI1655	1.1	5S	8.5	60S*	1.4	10S	26.5	60S
232	HD3371	8.1	20S	5.8	20MS	2.6	10S	20.0	40S
233	GW1356(d)	20.5	40S	35.5	80S	5.0	10S	68.2	100S
234	NIAW3855	9.8	30MS	9.6	40S	5.0	20S	13.2	40S
235	HI8627(d) (C)	4.5	20S	1.3	20MR	1.4	10S	4.8	20S
236	HI8831(d)	10.6	40S	2.7	10MS	3.9	20S	7.8	30S
237	MP3523	16.5	40S	13.1	40S	10.0	20S	30.0	60S
238	NIAW3851	17.9	40S	11.3	60S	3.8	20S	13.5	40S
239	CG1036	3.3	10S	10.1	80S*	4.5	20S	55.5	80S
240	UAS3014	7.5	20MS	7.8	40MS	10.1	20S	22.6	60S
240A	**Infector**	**80.0**	**100S**	**80.0**	**100S**	**73.8**	**100S**	**73.6**	**100S**
241	MP1368	9.5	40MS	13.1	40S	5.6	20S	54.5	80S
242	MACS6755	6.0	20MS	2.6	20MS	3.3	10S	56.4	80S
243	AKAW5088	27.0	80S	1.8	10MS	2.6	20S	8.7	40S
244	DBW325	12.4	40S	15.7	40S	11.3	20S	45.0	80S
IVT (Hill Zone)									
245	HS 507 (C)	0.9	5S	2.5	20MS	5.7	30S	12.5	30S
246	SKW 356	2.7	20S	7.1	40S	4.6	20S	13.8	60S
247	VL 2042	12.8	40S	8.7	60S*	5.6	20S	24.5	60S
248	HPW 471	25.3	60S	18.8	80S	3.7	20S	21.7	40S
249	HS 675	12.9	60S	2.3	20MS	2.7	20S	4.6	20MS
250	HPW 472	6.7	40S	11.6	40S	6.4	30S	13.3	60S
251	VL 2039	17.6	40S	8.5	40S	4.0	30S	29.4	80S
252	HS 677	5.8	40S	0.3	5MR	3.1	20S	8.9	40S
253	HS 676	0.5	10MR	2.6	20MS	5.1	20S	10.2	40S
254	UP 3064	0.9	5S	0.9	15MR	4.4	20S	20.4	60S
255	HS 678	2.4	10MS	3.1	20MR	6.2	20S	12.7	60S
256	HS 562 (C)	24.5	60S	11.1	40S	2.9	10S	19.3	60S
257	HPW 470	27.0	60S	10.5	40S	8.3	20S	13.6	40S
258	HPW 469	23.3	60S	10.8	40MS	4.4	20S	20.5	60S
259	VL 2041	11.5	60S	2.6	10MS	2.5	20S	14.5	40S
260	VL 2040	12.0	40S	3.0	20MS	11.9	40S	21.9	60S
260A	**Infector**	**75.0**	**100S**	**77.5**	**100S**	**75.0**	**100S**	**71.8**	**100S**

Abbreviations: ACI = Average Coefficient of Infection, HS = Highest Score, Avg. = Mean, *Indicates high rust score (more than 40S) at one location only.

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PROGRAMME 2. RUSTS: BROWN, YELLOW AND BLACK

2.1 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, 2.2, 2.3)
Yellow rust – Ludhiana and New Delhi (Table 2.4)
Brown rust - New Delhi and Ludhiana (Table 2.4)
Black rust (under controlled conditions): Indore and Mahabaleshwar (Table 2.5)
Data not received from Pune and not considered of Powarkheda (used mixture of races).

Race specific Adult Plant Resistance (APR) in AVT entries (2019-20) at IIWBR, RS, Shimla

The AVT lines of wheat for 2019-20 were screened against the most predominant and virulent pathotypes of *Puccinia triticina* and *P. striiformis*. These evaluations were conducted under polyhouses equipped with temperature and light adjustments. Proper checks including differentials, resistance genes and seedlings of AVT lines were evaluated under same set of conditions. The lines which showed susceptibility at seedling and resistance at adult plant stage were categorized as Adult plant resistant lines. Detailed information of APR for two wheat rusts is presented in Table 1 and 2.

None of the lines showed appreciable APR to both leaf and stripe rusts. DBW187 possessed APR to all the three pts. of stripe rust and pt. 77-5 of leaf rust. Likewise HD3086 conferred APR to stripe rust and pt.104-2 of leaf rust whereas HD3332 to stripe rust and pts.77-5 and 77-9 of leaf rust.

Leaf rust

Fifty seven lines of AVT (2019-20) conferred APR to one or more pathotypes of leaf rust. Nine lines (HD3378, HI1605, JAUW672, K1006, K1317, PBW811, UP3069, WH1080 and WH1252) showed adult plant resistance to three pts. Eighteen lines possessed APR to 2 pathotypes whereas 30 other lines supported APR to one or other pathotype (Table 1).

Table 2.1: Adult plant resistance to the predominant and virulent pathotypes of *Puccinia triticina* in wheat lines of AVT during 2019-20

Pathotypes	No. of lines	Lines
77-5, 77-9 and 104-2	9	HD3378, HI1605, JAUW672, K1006, K1317, PBW811, UP3069, WH1080, WH1252
77-5,77-9	9	DBW88, DBW327, HD3059, HD3332, HD3349, HD3377, HPW349, NIAW3170, VL892, WH1270
77-9,104-2	3	HD2733, HS490, HS562, MP3336
77-5,104-2	6	DBW296, HS668, HS679, HS681, PBW644, PBW804
77-5	13	DBW110, DBW252, DBW291, GW322, HD2932, HD3334, HI1612, HI1628, RAJ4083, TAW155, WH1021, WH1105, WH1124
77-9	5	DBW173, DBW187, DBW222, HS680, VL907
104-2	12	DBW290, HD3043, HD3086, HD3331, HD3298, HI8823, HPW474, MPO1357, UAS472, VL2036, WH1142, WHD964

Stripe rust
Fifty eight lines exhibited APR to different pts. of stripe rust. Among these 12 lines viz. AKDW 2997-16(d) (C), DBW187(I) (C), DBW333, DDW47(d)(I), HD3086 (C), HD3249(I) (C), HD3332, HI8805(d)(I) (C), HI8818(d), MACS3949(d) (C), UAS428(d) (C), UAS446(d) (C) could confer APR

to all three major pathotypes of *P. striiformis* in India. Fourteen lines conferred APR to two of the three pts. Thirty two other lines possessed APR to 110S119 (Table 2).

Table 2.2: Adult plant resistance to the predominant and virulent pathotypes *Puccinia striiformis tritici* in wheat lines of AVT during 2019-20

Pathotypes	No. of lines	Lines
238S119, 110S119 and 46S119	12	AKDW 2997-16(d) (C), DBW187(I) (C), DBW333, DDW47(d)(I), HD3086 (C), HD3249(I) (C), HD3332, HI8805(d)(I) (C), HI8818(d), MACS3949(d) (C), UAS428(d) (C), UAS446(d) (C)
238S119 and 110S119	11	DBW291, DBW296, DBW332, HI1612 (C), HPW 349 (C), HPW 474, HS 562 (C), JAUW672, PBW811, WH1124 (C), WH1270
110S119 and 46S119	3	DBW328, HI 8823(d), MPO1357(d)
110S119	32	DBW173 (C), DBW252(I) (C), DBW303*, DBW327, DBW331, DDW48(d)Q*, HD3298 *, HI8627(d), HS 679, K1317, MACS5055, MACS6222 (C), MP1358, MP1361, MP3288, PBW644 (C), PBW803, PBW804, PBW812, PBW840 (M), TAW155, UAS466(d)(I), UAS472(d), UP 3069, UP3033, VL 2036, VL 3024, VL 907 (C), WH1080 (C), WH1142 (C), WH1252, WHD964(d)

Table 2.3: Seedling specific APR to stripe rust and leaf rust pathotypes to AVTs of wheat during 2019-20 at ICAR-IIWBR, RS, Shimla

S. No.	Variety/Line	Stripe rust pathotypes			Leaf rust pathotypes		
		110S119	238S119	46S119	77-5	77-9	104-2
I. Northern Hill Zone (NHZ)							
1	HS 507 (C)	20MR	40MS	5R	0	10R	0
2	HS 562 (C)	TR	5MR	5MS	40MS	20MR	0
3	HPW 349 (C)	10R	5MR	5MS	20MR	20MR	20MS
4	HS 668	10MS	10MS	20MS	10R	40MS	0
5	VL 907 (C)	10MR	20MS	10MS	0	TR	TMS
6	VL 2036	10MR	5S	10S	0	0	TR
7	HS 681	5R	10MR	5MS	0	10MR	0
8	VL 3022	5S	10S	5S	0	10R	0
9	HS 680	5MR	20S	TS	0	0	0
10	VL 3023	40MS	20S	20MS	40S	20MS	0
11	HPW 474	5MR	TMR	5MR	0	0	0
12	UP 3069	5MR	10MR	5MR	0	5R	0
13	HPW 473	5MR	20MR	5MR	60MS	20MS	-
14	VL 892 (C)	60S	20S	20S	10MR	TR	0
15	VL 3024	0R	0	0	0	TR	0
16	HS 490 (C)	20MS	40MS	10MS	0	0	0
17	HS 679	5MR	5MR	TMR	0	TR	0
II. North Western Plain Zone (NWPZ)							
18	DBW88 (C)	30MS	10MS	30MS	0	20MR	0
19	DBW187(I) (C)	10MR	10MR	5MS	0	10MR	0
20	HD2967 (C)	60S	60S	20S	0	40S	0
21	WH1105 (C)	5MS	20MS	10MS	0	0	0
22	DBW222(I) (C)	30MS	40MS	20S	0	TR	0
23	HD3086 (C)	5MR	TS	10S	60S	40S	0
24	PBW840M	5MR	10MS	10MS	0	0	0
25	PBW803	TMR	5MS	5MS	0	0	0

26	PBW550 (C)	5MS	20S	20S	0	0	0
27	HD3334	5MS	10MS	10MS	0	20R	0
28	HD3059 (C)	30MS	20MS	20S	0	10MR	-
29	HD3332	5MR	10R	5MR	0	10R	-
30	DBW173 (C)	5MR	5MS	5MS	0	10R	0
31	WH1021 (C)	80S	60S	60S	10MR	20MR	0
32	PBW811	5R	5MR	5MR	0	10R	0
33	DBW291	5MR	TMR	5MS	0	20MS	0
34	WH1264	5MR	TMS	20MS	0	0	-
35	PBW812	5MR	10MS	5MR	0	0	0
36	JKW261	10MS	20MS	10MS	0	0	0
37	DBW290	5MS	10MS	10S	0	0	0
38	PBW771(I) (C)	5MS	10S	5MS	0	0	0
39	PBW813	0	0	0	0	10MS	0
40	HD3331#WB	5MR	10MS	5S	20MS	20MS	0
41	HD3298*	5MR	5MS	5MS	0	0	5MR
42	WH1124 (C)	5MR	10MR	5MS	10MS	40MS	TR
43	UP3033	5MR	20MS	0	20MS	0	0
44	HUW838#WB	30MS	10MS	10MS	0	0	0
45	HD3043 (C)	20MS	20S	10S	40S	40MSS	0
46	PBW644 (C)	5MR	10S	10S	0	40S	0
47	DBW296	5MR	5MR	10MS	5R	TR	TR
48	HI1628(I) (C)	40S	TR	5MR	5MR	10S	0
49	WH1080 (C)	10MR	10MR	5S	0	0	0
50	JAUW672	TR	TR	5MR	10MR	10R	0
51	WH1142 (C)	10MR	5MS	5S	60MS	0	5MS
52	NIAW3170(I) (C)	40MS	20MS	20S	0	0	0
III. North Eastern Plain Zone (NEPZ)							
53	PBW804	5MR	10MS	10S	10R	TR	0
54	DBW187(I) (C)	10MR	10MR	5MS	0	10MR	0
55	K1006 (C)	40MS	60S	20S	5R	10R	0
56	DBW39 (C)	20MS	60S	20S	0	0	0
57	HD3249(I) (C)	5MR	20MR	5MR	0	10R	0
58	HD2733 (C)	40S	60S	40S	0	20MR	0
59	HD3171 (C)	20MS	40S	10S	0	40MS	0
60	HD2888 (C)	60MS	40MS	20MS	0	0	0
61	HD3293*	20MR	20MS	5MS	0	40MS	TR
62	K1317 (C)	0	TS	5S	0	20MR	0
63	HI1612 (C)	5MR	20MR	5S	0	0	TR
64	DBW252(I) (C)	5MR	40MS	5S	0	0	0
IV. Central Zone							
65	TAW155	5R	10MR	TS	0	TR	0
66	HI1636	80S	50S	10S	0	TR	-
67	MP1361	5MR	5MR	-	40MS	0	0
68	MACS6747	20MS	60S	-	0	0	0
69	HD3377[B]	30MS	20S	10S	0	0	0
70	HI1637	60S	40MS	10S	-	0	0
71	RAJ4541[B]	10MR	20MR	5MS	-	0	0
72	GW513	80S	80S	60S	0	0	0
73	GW322	40MS	40S	20MS	10MR	40S	0
74	HI1544	80S	60S	40S	0	0	0
75	HI1634[Q*]	60MS	60MS	40S	0	0	0

76	HD2932	80S	80S	60S	20MS	60S	20MS
77	MP3336	80S	80S	30S	60S	0	0
78	HD2864	60S	60S	40S	0	0	0
79	CG1029*	60S	60S	40S	0	0	0
80	MPO1357(d)	5MR	20MR	5MR	0	0	0
81	HI8627(d)	5MR	20MS	5S	0	0	-
82	UAS466(d)(I)	TMR	5S	10MR	TS	0	0
83	UAS472(d)	10MR	40MS	20S	0	0	0
84	DBW110	20S	60S	40S	0	40MS	0
85	MP3288	10MR	40S	20S	0	0	0
86	HI 8823(d)	TR	20MS	20MR	0	0	0
87	DDW47(d)(I)	10MR	10MR	20MR	0	0	0
IV. Peninsular Zone (PZ)							
88	WHD964(d)	5MR	10MR	10MS	0	0	0
89	DDW48(d)Q*	5MR	10MR	10MS	0	0	-
90	MACS6222 (C)	30MR	20MS	20S	0	TR	0
91	MACS3949(d) (C)	TR	5MR	5MR	0	0	-
92	HI8818(d)	5MR	20MR	5MR	0	0	-
93	UAS428(d) (C)	TR	TMR	5MR	-	0	-
94	DDW49(d)Q*	10MS	40MS	10S	0	10MS	-
95	GW322 (C)	40MS	40S	20MS	10MR	40S	0
96	GW519	60S	60S	40S	0	0	0
97	HI1646	40MS	60MS	10S	-	10MS	0
98	HD3090 (C)	60S	60MS	40S	0	TR	0
99	RAJ4083 (C)	60MS	40MR	20S	0	20MS	-
100	UAS3008	30MS	60S	20S	0	0	0
101	MACS6749	60S	80S	60S	0	0	0
102	HD2932 (C)	80S	80S	60S	20MS	60S	20MS
103	HI1641	60S	60S	40S	0	0	0
104	HI1642	80S	80S	40S	0	0	0
105	HI1633*	60S	60MS	20S	0	0	0
106	MACS6752	80S	60S	40S	0	0	0
107	NIDW 1149(d)*	5MR	TR	0	0	0	-
108	UAS446(d) (C)	TR	TR	TMR	0	0	0
109	HI 1605 (C)	30MS	20S	10S	0	5R	0
110	MACS 4087(d)	5MS	20MS	20MS	0	0	-
111	MP 1358	TR	10MS	TR	0	10MR	0
112	AKDW 2997-16(d) (C)	0	TR	TMR	0	0	10R
113	HI8805(d)(I) (C)	TR	5MR	TMR	-	0	0
114	UAS 472(d)	10MR	40MS	20S	0	0	0
115	MPO 1357(d)^{Q}	5MR	20MR	5MR	0	0	0
116	NIAW3170(I) (C)	40MS	20MS	20S	0	0	0
V. Special Trial (Dicoccum)							
117	MACS5055	20MR	40MR	10MS	20R	TR	TR
118	MACS6222 (aest.) (C)	30MR	20MS	20S	0	TR	0
119	DDK1029 (C)	40MR	60MS	40MS	0	5R	10R
120	MACS5054	40MR	60MS	40MS	5R	0	-
121	DDK1058	40MS	80MS	40MS	0	0	0
122	HW1098 (C)	40MS	60MS	5MS	0	0	0
123	DDK1059	40MS	60MS	40MS	0	5R	10R
VI. Special Trial (SPL-HYPT)							
124	DBW327	TR	10MS	0	0	10R	0

125	HD3086 (C)	5MR	TS	10S	60S	40S	0
126	DBW332	TR	5MR	0	0	0	0
127	DBW303*	10MR	40MR	5MR	TR	0	0
128	HD2967 (C)	60S	40S	10S	0	10R	0
129	DBW187(I) (C)	10MR	10MR	5MS	0	10MR	0
130	DBW329	40MS	20MR	5S	0	5MR	0
131	WH1252	10MR	10MS	5S	0	TR	0
132	HD3378	10MR	10MS	TMR	0	20MS	0
133	WH1270*	5MR	5MR	TMS	0	20MS	0
134	DBW333	5MR	10MR	TMR	5S	0	0
135	DBW330	5MR	20MS	5MS	0	20MS	0
136	DBW328	10MR	10MR	5MR	0	0	0
137	DBW331	5MR	20S	5S	0	0	0

Table 2.4: Race Specific APR in AVT entries (NHZ, NWPZ and NEPZ) against selective pathotypes of yellow and leaf rust at Ludhiana and Delhi centres during 2019-20.

S. No.	Entries	Yellow rust pathotypes				Leaf rust pathotypes		
		110S119		46S119		77-5		77-9
		Ludhiana	Delhi	Ludhiana	Delhi	Ludhiana	Delhi	Ludhiana
I. Northern Hill Zone								
1	HS 507 (C)	40S	TR	60S	TR	10S	0	20S
2	HS 562 (C)	10MS	5MS	5MS	5MR	10S	TR	0
3	HPW 349 (C)	10MS	5MS	10S	10MR	0	5S	0
4	HS 668	60S	TR	60S	0	0	5S	0
5	VL 907 (C)	40S	5MR	40S	10MR	0	TR	0
6	VL 2036	20S	5MR	10S	10S	0	5MR	0
7	HS 681	20S	TR	20S	0	5S	0	20S
8	VL 3022	40S	TR	40S	5MR	0	0	0
9	HS 680	40S	10MS	40S	10MR	0	0	0
10	VL 3023	40S	10MS	40S	10MS	0	0	0
11	HPW 474	10MS	5MS	5S	10MS	0	TR	0
12	UP 3069	10S	5S	5MS	5MS	10S	0	0
13	HPW 473	20MS	0	20S	0	0	5S	0
14	VL 892 (C)	0	20S	0	20S	0	0	40S
15	VL 3024	40S	0	60S	0	10S	0	0
16	HS 490 (C)	20S	5MR	5S	40MS	0	5MR	40S
17	HS 679	10MS	5MR	10S	10MS	0	0	40S
II. North Western Plain Zone (NWPZ)								
18	DBW88 (C)	60S	TR	40S	40S	0	0	0
19	DBW187(I) (C)	10S	TR	10S	5MR	0	0	0
20	HD2967 (C)	60S	60S	40S	60S	0	0	0
20A	Infector	-	100S	-	90S	-	80S	-
21	WH1105 (C)	60S	TR	20S	5MR	0	5MS	0
22	DBW222(I) (C)	60S	5MR	40S	10MR	0	0	0
23	HD3086 (C)	20S	5R	10S	5MR	0	0	20S
24	PBW840M	40S	5MR	40S	5MR	0	5MS	0
25	PBW803	20S	5MR	20S	5MR	0	0	5S
26	PBW550 (C)	60S	10MS	60S	10S	0	0	0

27	HD3334	20S	5MR	10S	5R	0	0	0
28	HD3059 (C)	40MS	5MR	40S	5MR	0	0	0
29	HD3332	10S	5R	10S	10S	0	5MR	0
30	DBW173 (C)	20S	5R	10S	5R	0	0	20S
31	WH1021 (C)	60S	60S	60S	60S	0	0	0
32	PBW811	5MR	TR	10S	TR	0	0	0
33	DBW291	10MS	0	20MS	0	20S	0	20S
34	WH1264	5S	5MS	10S	5MR	0	TR	20S
35	PBW812	20MS	5R	40S	TR	0	10S	10S
36	JKW261	40S	5MR	40S	5MR	0	TR	0
37	DBW290	40S	0	40S	5S	0	0	0
38	PBW771(I) (C)	10S	TR	5S	0	0	5MR	0
39	PBW813	0	0	0	0	0	0	0
40	HD3331	10MS	TR	5MS	5MR	10S	TR	20S
40A	Infector	-	90S	-	90S	-	80S	-
41	HD3298*	10S	TR	40S	TR	0	0	0
42	WH1124 (C)	10S	5MR	40S	5MR	20S	0	0
43	UP3033	40S	5S	40S	TMR	0	0	0
44	HUW838	20S	5MR	20S	TR	0	5S	0
45	HD3043 (C)	60S	5MR	40S	TMR	0	5S	40S
46	PBW644 (C)	40S	TR	40S	TMS	40S	0	40S
47	DBW296	5S	0	10S	0	0	5MR	0
48	HI1628(I) (C)	5S	10S	10S	10MS	0	0	0
49	WH1080 (C)	5S	5MR	40S	5MR	0	0	40S
50	JAUW672	5S	0	5S	TR	0	5MR	20S
51	WH1142 (C)	10MS	5MR	10S	5MR	0	5MS	40S
52	NIAW3170(I) (C)	40S	10MR	40S	40S	0	5MS	0
III. North Eastern Plain Zone (NEPZ)								
53	PBW804	5S	TR	10S	5MR	0	0	0
54	DBW187 (C)	10S	TR	10S	10MS	0	0	0
55	K1006 (C)	60S	40S	60S	40S	10S	TR	10S
56	DBW39 (C)	60S	10S	60S	60S	0	0	0
57	HD3249(I) (C)	10S	5R	20S	10MS	0	0	0
58	HD2733 (C)	80S	40S	60S	80S	0	10S	0
59	HD3171 (C)	60S	10MR	40S	10MR	20S	10MS	20S
60	HD2888 (C)	60S	40S	60S	20S	0	0	0
60A	Infector	-	90S	-	90S	-	80S	-
61	HD3293*	20S	5MR	60S	0	20S	80S	0
62	K1317 (C)	40S	0	10S	0	0	5S	0
63	HI1612 (C)	10S	5MR	20S	5MR	0	0	0
64	DBW252(I) (C)	40S	5MR	40S	0	0	TR	0

Table 2.5: Race Specific APR in AVT entries (CZ and PZ) against selective pathotypes of stem rust at Indore and Mahabaleshwar centers during 2019-20.

S. No.	Entries	Stem rust pathotypes			
		40A		117-6	
		Indore	Mahabaleshwar	Indore	Mahabaleshwar
IV. Central Zone					
1	TAW155	20MS	10S	10MS	10S
2	HI1636	10MR	10MR	5R	TR
3	MP1361	20MR	TMS	20MR	20S

4	MACS6747	20MR	TR	20MR	TR
5	HD3377	0	TR	0	TR
6	HI1637	5R	TR	5R	TR
7	RAJ4541	10MR	TMR	10MS	TR
8	GW513	10R	TMR	5R	TR
9	GW322	10MS	10MS	10MS	TR
10	HI1544	10R	TR	10R	TMR
11	HI1634*	10MR	TR	10MR	TR
12	HD2932	20MR	30S	10MS	20S
13	MP3336	10MR	TR	10MS	TS
14	HD2864	10R	TR	10MR	TMR
15	CG1029*	20MR	10MR	10MR	10R
16	MPO1357(d)	5MR	TMR	5MR	TR
17	HI8627(d)	5MS	TR	10S	TR
18	UAS466(d)(I)	10S	TMR	5S	20MS
19	UAS472(d)	10MR	10MS	5MR	5MR
20	DBW110	20MR	TMR	10MS	TR
21	MP3288	20MR	TMR	20R	10MR
22	HI 8823(d)	5R	10MS	5MS	TR
23	DDW47(d)(I)	10MR	TR	20S	10MS
V. Peninsular Zone (PZ)					
24	WHD964(d)	40S	TS	20MS	30S
25	DDW48(d) *	20S	TMR	20S	TR
26	MACS6222 (C)	20MR	TR	5MR	TMR
27	MACS3949(d) (C)	10MS	TMS	20S	TR
28	HI8818(d)	5MR	TMR	TMR	TR
29	UAS428(d) (C)	10MR	TR	5MR	TMS
30	DDW49(d) *	40S	TS	40S	TS
31	GW322 (C)	10S	10S	20MS	10S
32	GW519	20MR	TMR	5MR	TR
33	HI1646	20S	TS	20S	10S
34	HD3090 (C)	20R	TR	20MR	TR
35	RAJ4083 (C)	10MR	TS	20R	TR
36	UAS3008	10S	TMS	20S	TS
37	MACS6749	5R	TR	20MR	TR
38	HD2932 (C)	10S	10MS	20MR	TS
39	HI1641	5R	TR	10R	TR
40	HI1642	10R	10MR	10R	TR
41	HI1633*	10MR	TR	5R	TR
42	MACS6752	10MR	TMR	10R	TMR
43	NIDW 1149(d)*	5MS	TRE	20MS	10MR
44	UAS446(d) (C)	10MS	TMR	40MS	TMR
45	HI 1605 (C)	20S	10S	5MR	10MS
46	MACS 4087(d)	10MS	TMS	40S	TS
47	MP 1358	5MR	TMR	0	TR
48	AKDW 2997-16(d) (C)	20S	TR	20S	TMS
49	HI8805(d)(I) (C)	5MR	TR	10S	TR
50	UAS 472(d)	5MR	TMR	TS	TR
51	MPO 1357(d)	10MR	TMR	5S	TR
52	NIAW3170(I) (C)	20MR	10MR	10MS	TR

2.2 Identification of Slow Ruster Lines in AVT Material 2019-20

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.

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

AUDPC	Entries
0	PBW813
0.1 – 10	UAS428(d) (C), AKDW 2997-16(d) (C) and TAW155
10.1 – 100	UAS446(d) (C), HS 507 (C), VL 3024, MPO1357(d), DBW291, DBW296, HI1612 (C), HI8805(d)(I) (C), DDW48(d)*, HI8818(d), PBW803, NIDW 1149(d)*, UP 3069, HI8627(d) , DDW47(d)(I), DDW49(d)*, MPO 1357(d), WH1080 (C), DBW332, HD3086 (C), HS 679, WH1124 (C), WH1142 (C), MP 1358, HD3378, DBW331, HS 681, PBW771(I) (C), MACS3949(d) (C), HD3332, PBW812, DBW328, HW1098 (C), DBW333, WHD964(d), DDK1058, WH1252, PBW804, WH1270*, JAUW672, DBW187 (C), HS 562 (C), DBW330, MP1361, UAS466(d)(I), MACS5054 and MACS5055
100.1 - 200	DBW252(I) (C), DDK1059, HPW 349 (C), DBW187(I) (C), DBW290, DBW327, HS 680, MACS 4087(d), DBW187*, DBW303*, HD3298*, PBW840M, PBW811, UAS 472(d), HI1628(I) (C), K1317 (C), RAJ4541, HD3249(I) (C), HS 668, JKW261, VL 2036, HD3334 and HD3293*

B. Ludhiana

AUDPC	Entries
0	PBW813
0.1 – 10	Nil
10.1 – 100	HI8805(d)(I) (C) and VL 3024
100.1 - 200	MACS3949(d) (C), DBW252(I) (C), WH1252, DDW47(d)(I), HI8818(d), PBW804, NIDW 1149(d)*, UAS446(d) (C) and MPO1357(d)

Leaf Rust

A. Mahabaleshwar

AUDPC	Entries
0	Nil
0.1 – 10	HI1633*, AKDW 2997-16(d) (C), UAS 472(d), NIAW3170(I) (C), MACS6222 (aest.) (C), HW1098 (C), VL 2036, VL 3022, DBW88 (C), DBW222(I) (C), WH1264, NIAW3170(I) (C), DBW187 (C), HI1612 (C), DBW252(I) (C), DDW48(d)*, MACS6222 (C), MACS3949(d) (C), HI8818(d), GW519 and UAS446(d) (C)
10.1 – 100	HPW 349 (C), HS 681, HS 680, HPW 474, PBW550 (C), DBW173 (C), PBW811, DBW290, PBW771(I) (C), PBW813, HD3298*, UP3033, DBW296, PBW804, HD3249(I) (C), HD2888 (C), HD3090 (C), MACS6749, HI1642, MACS6752, NIDW 1149(d)*, HI 1605 (C), MP 1358, HI8805(d)(I) (C), MPO 1357(d), MACS5055, DDK1029 (C), DDK1058, DDK1059, DBW332, DBW303*, HD2967 (C), DBW187*, WH1252, WH1270* , DBW333, DBW328, TAW155, HI1636, MP1361, MACS6747, HI1637, RAJ4541, GW513, GW322, HI1544, HI1634*, HD2864, CG1029*, MPO1357(d), HI8627(d), UAS466(d)(I), UAS472(d), HI 8823(d), DDW47(d)(I), DBW39 (C), HI1641, HS 562 (C), HS 668, VL 907 (C), HS 490 (C), PBW840, HD3059 (C), PBW812, HI1628(I) (C), JAUW672, WHD964(d), UAS428(d) (C), MACS 4087(d), HD3377, HS 679, HS 507 (C), PBW803, HD3334, DBW327, HUW838, DDW49(d)*, HD2967 (C), JKW261, UP 3069, MACS5054, PBW644(C), VL 3024, HD2733 (C), DBW110, HD3331 and WH1080 (C)
100.1 - 200	DBW187(I) (C), DBW329, MP3288, UAS3008, DBW331, HD3332, DBW330, HD3378, K1317 (C), GW322(C), WH1105 (C), HD3086 (C) and VL 892 (C)

Stem Rust

A. Indore

AUDPC	Entries
0	UAS 472(d), DDK1029 (C), MACS5054, HD3377 and HI 8823(d)
0.1 – 10	VL 3023, DBW173 (C), MACS5055, DDK1059 and HI1636
10.1 – 100	VL 907 (C), UP3033, HI1633*, MPO 1357(d), HI8627(d) , UAS472(d), HS 681, HD2888 (C), HI8818(d), RAJ4083 (C), NIDW 1149(d)*, DDK1058, HW1098 (C), WH1252, HI1637, GW513, HI1634*, HD2864 , DDW47(d)(I), VL 3024, HS 679, PBW550 (C), HD3334, HUW838, DBW39 (C), HD2733 (C), GW519, MACS6749, UAS446(d) (C), HI 1605 (C), MP 1358, HI8805(d)(I) (C), RAJ4541, HI1544, HS 507 (C), MP3288 and DBW296
100.1 - 200	HD2967 (C), WH1021 (C), HD3043 (C), WH1142 (C), DBW187 (C), HD3249(I) (C), K1317 (C), WHD964(d), MACS6222 (C), MACS3949(d) (C), UAS428(d) (C), DDW49(d)*, HD3090 (C), HI1642, MACS6752 , MACS6222 (aest.) (C), HD2967 (C), CG1029*, MPO1357(d), HS 668, VL 892 (C), UAS466(d)(I), PBW840, NIAW3170(I) (C), NIAW3170(I) (C) and MACS6747

B. Mahabaleshwar

AUDPC	Entries
0	Nil
0.1 – 10	HPW 349 (C), VL 907 (C), VL 2036, VL 3022, HD2967 (C), PBW840, PBW803, PBW550 (C), HD3334, HD3059 (C), DBW173 (C), WH1021 (C), PBW771(I) (C), DBW39 (C), HD2733 (C), HD2888 (C), DBW252(I) (C), MACS3949(d) (C), MP 1358, UAS 472(d), MPO 1357(d), MACS5055, DDK1058, HI1636, MP1361, HI1634*, CG1029*, HI8627(d), UAS472(d), HI 8823(d) and DDW47(d)(I)
10.1 – 100	HS 562 (C), HS 668, HS 680, HPW 474, HS 679, HUW838, RAJ4083 (C), HI1641, HI 1605 (C), HW1098 (C), HI1637, HS 681, PBW804, MACS5054, HD3378, VL 3024, HS 490 (C), DBW88 (C), WH1105 (C), DBW222(I) (C), DBW290, HD3331, HD3298*, UP3033, DBW296, HI1628(I) (C), JAUW672, WH1142 (C), HD3249(I) (C), MACS6222(C), HI8818(d), UAS428(d) (C), HD3090 (C), UAS3008, MACS6749, HI1642, HI1633*, MACS6752, HI8805(d)(I) (C), NIAW3170(I)(C), MACS6222(aest.)(C), DDK1029(C), DDK1059, DBW327, DBW303*, HD2967 (C), DBW187*, DBW329, WH1270*, DBW328, TAW155, RAJ4541, HI1544, HD2864, MPO1357(d), UAS466(d)(I), DBW110, MP3288, VL 3023, K1006 (C), K1317 (C), PBW811, HS 507 (C), DBW187(I) (C), NIAW3170(I) (C), DBW187 (C), WH1080 (C), GW519, NIDW 1149(d)*, UAS446(d)(C), WH1252, GW513, VL 892 (C), UP 3069, HD3086 (C), PBW812, GW322 (C), HI1646, DBW331, DDW48(d)* and WH1264
100.1 - 200	DBW291, WH1124 (C), MACS6747, DBW330, PBW813, PBW644 (C), HD3043 (C), WHD964(d), MACS 4087(d), HD3086 (C), DBW332, GW322 and DDW49(d)*

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2.3 Seedling Resistance Test against Pathotypes of Wheat Rusts

A. Flowerdale, Shimla

a. Rust resistance

To know the rust resistance of wheat lines of AVTs at seedling stage, 59 pathotypes of three species of Puccinia on wheat were used for screening. Sixteen pathotypes of stripe rust, 21 of stem and 22 of leaf rust which are most virulent and predominant, were used for evaluation**.** Detailed information on the genetics of rust resistance of the advanced wheat lines is given below:

Rust resistance in AVT lines

None of the lines of AVT was resistant to all the rusts. PBW813 was resistant to stem and stripe rusts. Whereas HI1641, HI1642 and MACS 6752 were resistant to leaf and stem rusts. Twenty other lines were resistant to leaf and 3 to stem rust only. In addition 25 lines having Sr31/Lr26/Yr9 were resistant to stem rust whereas some to leaf rust also (Table 2.6). The wheat lines showing resistance to one or other rusts are given below:

Table 2.6: Rust resistance in advanced wheat material (AVT: 2019-20)

Rusts	No. of lines	Wheat lines
Stem and stripe rusts	1	PBW813
Leaf and stem rusts	3	HI1641, HI1642, MACS6752
Leaf rust only	20	CG1029*, GW513, GW519, HD3090 (C), HD2864, HI1544, HI1633, HI1634Q, HI1636, HI1637, MACS 4087 (D), MACS 6747, MACS 6749, MACS3949 (D) (C), MACS6222 (C), PBW550 (C), PBW771 (C), PBW840, RAJ 4541B, UAS446 (D) (C)
Stem rust only	3	DBW303*, DBW110, DWB332

b. Rust resistance genes in AVT lines (Gene postulation)

Wheat rust resistance genes (*Lr, Sr, Yr*) were characterized using gene matching technique. Rust resistance genes were characterized only in the lines where differential host-pathogen interaction was present. In addition, linked characters, morphological markers, characteristic infection types and pedigree also formed the basis for postulating rust resistance genes in absence of host-pathogen differential reactions.

***Yr*-genes**

Among the 137 lines of AVT, *Yr* genes were characterized in 95 lines. *Yr* genes were postulated in lines where differential interactions were observed and in other cases tight linkage of *Yr* genes to resistance genes to other rusts also facilitated to infer the presence of a resistance gene. Four *Yr* genes viz. *Yr2, Yr9, YrA* and *Yr18* contributed for yellow rust resistance in India. Among the postulated *Yr* genes *Yr2* was most common and was characterized in more than half of the lines. *Yr9* on the other hand occurred in 25, *YrA* in 16 and *Yr18* in one line only (Table 2.7).

Table 2.7: *Yr-genes* in AVT entries during 2019-20

Yr gene	No. of lines	Detail of lines
Yr2+	61	CG1029, DBW88 (C), DBW110, DBW187 (I) (C), DBW252 (I) (C), DBW290, DBW291, DBW296, DBW303, DBW327, DBW328, DBW329, DBW330, DBW333, DDW48 (D), GW513, GW519, HD2864, HD2967 (C), HD3059 (C), HD3086 (C), HD3171 (C), HD3249 (I) (C), HD3293 , HD3298 , HD3331 , HD3332, HD3377, HI1605 (C), HI1612 (C), HI1628 (I) (C), HI1646, HI8627 (D), HI8818 (D), HPW349 (C), HPW474, HUW838, HW1098 (C), MACS3949 (D) (C), MACS6222 (C), MP1361, MP3288, MPO1357 (D), NIDW1149 (D), PBW644 (C), PBW803, PBW811, PBW812, RAJ4083 (C), RAJ4541,

		TAW155, UAS3008, UAS472 (D), VL2036, VL892 (C), WH1080 (C), WH1105 (C), WH1124 (C), WH1252, WH1264, WH1270
Yr9+	17	DBW39 (C), DBW173 (C), DBW222 (I) (C), HD3090 (C), HI1633, HI1634, HS507 (C), HS668, HS679, HS680, HS681, PBW550 (C), UP3033, VL907 (C), VL3024, WH1021 (C), WH1142 (C)
Yr9+18+	01	HD2733 (C)
Yr9+A+	07	HD3043 (C), HD3334, K1317 (C), PBW771 (I) (C), PBW840 (M), VL3022, VL3023
YrA+	08	DBW332, HI1642, HPW473, HS490 (C), HS562 (C), JAUW672, MP1358, UP2369
Total	**94**	

***Lr*-genes**

Ten *Lr* genes viz. *Lr1*, *Lr2a*, *Lr3*, *Lr10*, *Lr13*, *Lr18*, *Lr23*, *Lr24*, *Lr26* and *Lr34* were characterized in 112 lines. *Lr10* was the most commonly occurring leaf rust resistance and was characterized in highest number of lines (37) followed by *Lr13* (30 lines), *Lr1* (29 lines) and *Lr26* (25 lines). *Lr24* was also postulated in 12 lines. Among these Lr13 becomes effective at higher temperature. While *Lr2a*/*Sr30* and *Lr3* were inferred in 6 lines each, *Lr18* was postulated in 2, *Lr34* in 1 line only. *Lr2a*/*Sr30* are closely linked and we have differentiating pathotypes for both the resistance genes. Most of the genes occurred in combination and many of the lines have leaf rust resistance derived from 3 or more *Lr* genes (Table 2.8).

Table 2.8: *Lr-genes* in AVT entries during 2019-20

Lr gene	**No. of lines**	**Lines/Varieties**
Lr13+	12	DBW222, DBW303, DDK1029, HD2932, HI1605, HI8627, MP3336, PBW804, PBW811, RAJ4083, UAS466, WH1105, WH1252
Lr13+1+	6	DBW329, DBW332, GW322, K1006, PBW644, UAS3008,
Lr13+3+	3	HD3059, HPW473, WH1080
Lr13+10+	10	DBW252, DBW290 DBW330, HD3332 HD3249, HD3293, HI1628, HPW349, VL892, WH1264
Lr13+10+1+	5	DBW291, DBW333, HI1646, MP1361, NIAW3170
Lr13+10+1+2a	1	TAW155
Lr13+10+3+	4	DBW88, HD3086, HUW838, WH1124
Lr13+10+3+2a	1	HPW474
Lr18+	2	DDW49, HW1098
Lr23+	10	AKDW2997-16, HD2967, HI1612, HI8805, HS562, MACS5055, MPO1357, NIDW1149, UAS428, WH1270,
Lr23+1+	3	DBW327, HD3377, HD3378
Lr23+2a+	1	HD3298
Lr23+3+2a+	2	PBW803, PBW812
Lr23+10+	3	DBW110, HI8818, MP1358
Lr23+10+1+	3	DBW187, DBW331, DBW328
Lr23+10+2a+	1	VL2036
Lr23+10+3+	1	HS490
Lr23+13+	4	JKW261, JAUW672, MPO1357, WHD964
Lr23+13+3+	1	HD3331
Lr23+13+10+	2	HD3171, DBW296
Lr24+	12	CG1029, GW513, GW519, HD2864, HI1636, HI1637, HI1544, MACS6222, MACS6747, MACS6749, MP3288, RAJ4541
Lr26+	6	HD3090, HI1633, HI1634, PBW550, PBW840, VL907
Lr26+1+	3	HS507, K1317, WH1021
Lr26+10+3+	2	DBW173,UP3033

Lr26+23+	3	DBW222, HD3043, VL3023
Lr26+23+1+	5	HD3334, HS679,HS681,PBW771, VL3022
Lr26+23+1+3	1	HS668
Lr26+23+10+	1	DBW39
Lr26+23+10+1+	2	HS680, VL3024
Lr26+23+10+3+	1	WH1142
Lr26+34+	1	HD2733
Total	**112**	

***Sr*-genes**

Thirteen stem rust resistance genes (*Sr*2, *Sr5, Sr7b, Sr8a, Sr8b, Sr9b, Sr9e, Sr11, Sr13, Sr24, Sr28, Sr30* and *Sr31*) were characterized in 120 AVT lines (Table 3). *Sr* genes *Sr2* and *Sr11* were postulated in 43 AVT entries. *Sr31*, linked with *Lr26* and *Yr9* and conferring resistance to all the known Pgt pathotypes in Indian subcontinent, was postulated in 25 AVT entries. *Sr*-genes *Sr24, Sr28, Sr5, Sr13* and *Sr7b* were characterized in 12, 4, 18, 12 and 31 entries, respectively. *Sr30, Sr9b, Sr8a* were inferred in seven entries each. Most of the *Sr* genes occurred in the combination of other genes. Entry DBW252 possessed a combination of maximum four genes i.e. *Sr5+8a+11+2+* (Table 2.9).

Table 2.9: *Sr genes* in AVT entries during 2019-20

Postulated genes	Number of lines	Detail of lines
Sr31+5+2+	01	WH1021 (C)
Sr31+5+	07	HD3334, HS507 (C), HS679, HS681, PBW840M, UP3033, VL3024
Sr31+2+	08	DBW39 (C), HD2733 (C), HD3043 (C), HD3090 (C), K1317 (C), PBW550 (C), VL907 (C), WH1142 (C)
Sr31+	09	DBW173 (C), DBW222(I) (C), HI1633*, HI1634^{Q*}, HS668, HS680, PBW771(I)(C), VL3022, VL3023
Sr24+2+	02	HI1544, MP3288
Sr24+	10	CG1029*, GW513, GW519, HD2864, HI1636, HI1637, MACS6222 (C), MACS6747, MACS6749, RAJ4541^{B}
Sr30+5+	04	HPW474, PBW803, TAW155, VL2036
Sr30+11+	02	PBW812, VL892 (C)
Sr30+	01	HD3298*
Sr28+9b+	01	HS490 (C)
Sr28+11+	02	DBW330, DBW333
Sr28+	01	MP1361
Sr8a+9b+2+	01	HS562 (C)
Sr8a+11+2+	01	HD2967 (C)
Sr8a+11+	01	PBW813
Sr8b+9b+11+	01	K1006 (C)
Sr8a+2+	01	NIAW3170(I) (C)
Sr5+8a+11+2+	01	DBW252(I) (C)
Sr5+8a+11+	02	HI1646, HUW838#WB
Sr5+11+7b	01	DBW291
Sr5+11+	03	DBW187(I) (C), DBW328, UAS3008
Sr9e+7b+	01	WH1252
Sr9e+2+	02	HI8627(d), WH1080 (C)
Sr9e+	01	DBW331
Sr9b+11+	01	PBW811
Sr13+5+	01	DBW327
Sr13+9b+	02	DBW290, JAUW672

Sr13+11+2+	01	HI8805(d)(I) (C)
Sr13+7b+	06	DBW296, HD3331#WB, HD3332, JKW261, MACS5055, PBW804
Sr13+	02	HD3293*, WH1270*
Sr11+9b+	01	DBW329
Sr11+7b+2+	02	DDW47(d)(I), HD3171 (C)
Sr11+7b+	06	DDK1058, HD3378, HI8818(d), MACS4087(d), MACS5054, MPO1357(d)^{Q}
Sr11+2+	13	DBW88 (C), DDK1029 (C), GW322 (C), HD3059 (C), HD3249(I) (C), W1098(C), MP3336, NIDW1149(d)*, PBW644 (C), UAS446(d) (C), UAS466(d)(I), UAS472(d), WH1105 (C)
Sr11+	05	HD2932 (C), HI1605 (C), HI8823(d), MP1358, RAJ4083 (C)
Sr7b+2+	08	AKDW2997-16(d) (C), DDW48(d)Q*, DDW49(d)Q*, HD3086 (C), HI1612 (C), HPW349 (C), MACS3949(d) (C), WH1124 (C)
Sr7b+	07	DDK1059, HD3377^{B}, HPW473, UAS428(d) (C), UP3069, WH1264, WHD964(d)
Sr2+	01	HI1628(I) (C)
Total	**120**	

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AVT entries of CZ & PZ and NIVT (NIVT-4 and NIVT-5B) were tested against selective pathotypes of stem and leaf rusts under glass house condition. These were tested at seedling stage against 12 pathotypes of stem rust and 9 pathotypes of leaf rust. The entries found resistant in seedling resistance test are depicted in Table 2.10 as detailed below.

Pathotypes used:
Stem Rust: 11, 24A, 40, 40- A, 42, 42B, 117- 2, 117- 4, 117- 5, 117- 6, 122 and 295.
Leaf Rust: 12-4, 12-5, 77-1, 77-4, 77-5, 77-9, 104A, 104-1 and 108.

Table 2.10. Resistant entries from AVT and NIVT trial against selective pathotypes at seedling stage under glass house condition.

	Stem rust	Leaf rust
AVT	HI1636, HI1637, RAJ4541, HI1544, HI1634*, CG1029*, MPO1357(d), HI8627(d), DBW110, MP3288, MACS6222 (C), HI8818(d), HD3090 (C), MACS6749, HI1641, HI1642, HI1633*, MACS6752, HI8805(d)(I) (C) and MPO 1357(d)	HI1636, MP1361, MACS6747, HI1637, RAJ4541, GW513, HI1544, HI1634*, HD2864, CG1029*, MPO1357(d), MP3288, DDW47(d)(I), WHD964(d), DDW48(d) *, MACS6222 (C), MACS3949(d)(C), HI8818(d), UAS428(d) (C), GW519, HD3090 (C), MACS6749, HI1641, HI1642, HI1633*, MACS6752, NIDW 1149(d)*, UAS446(d) (C), MACS 4087(d), AKDW 2997-16(d) (C), HI8805(d)(I) (C), UAS 472(d) and MPO 1357(d)
NIVT	HI8826, HI8828, MPO1375, HI8829, HI8825, GW1354, GW528, MP1367, MACS6753, HI8830(d), HI1655, HI8627(d) (C), CG1036, UAS3014, MP1368 and MACS6755	UAS473, HI8828, MACS4100, WHD965, HI8829, PDW360, HI8827, MACS3949 (C), UAS474, GW1354, MPO1374, GW528, MP1367, DDW55(d), MACS6753, HI8830(d), HI1655 and CG1036

PROGRAMME 3. LEAF BLIGHT

3.1. LEAF BLIGHT SCREENING NURSERY (LBSN), 2019-20

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 14 centres listed below:

Zones	Test locations
NWPZ	Karnal, Pantnagar, Ludhiana, Hisar (4)
NEPZ	Faizabad, Varanasi, Pusa (IARI), Coochbehar, Shillongani, Kalyani, Ranchi, Nauni, (8)
PZ	Dharwad, Wellington (2)

The nursery was planted at 14 centers cited as above, the data from Nauni and Wellington was not considered due to poor/ erratic disease development.

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. The data of AVT entries is also presented in Table 1.3 of chapter 1. Center wise data of leaf blight score of different entries at hard dough growth stage is given in Table 3.1.

Source of resistance

The entries from AVTs which showed the moderate level of resistance within average score below 35 are HS 681, HD2967(C), HS 680 and DBW331but the highest score exceeded 57 due to high disease at one location. Besides these, the entries showed moderate level of resistance with average score below 35 are VL3022, HI1612(C), JKW261, HD3293*, TAW155, DBW330, DBW328 and UAS428(d) (C) but the highest score exceeded 57 due to high disease at two locations.

Table 3.1 Center wise data of leaf blight score of different entries at hard dough growth stage 2019-20

S. No.	Entry	Leaf Blight Score (0-9, dd) IIIrd (Hard dough) stage												
		Ludhiana	Karnal	Hisar	Pantnagar	Varanasi	Faizabad	Pusa	Coochbehar	Shillongani	Ranchi	Kalyani	Avg.	HS
I. Northern Hill Zone (NHZ)														
1	HS 507 (C)	78	12	45	67	68	46	34	03	14	03	35	35	78
2	HS 562 (C)	78	12	57	35	89	57	34	00	13	36	36	45	89
3	HPW 349 (C)	58	24	56	24	68	46	23	01	13	36	36	35	68
4	HS 668	79	57	67	35	78	57	34	13	25	24	46	46	79
5	VL 907 (C)	79	46	46	45	68	45	23	01	25	14	56	45	79
6	VL 2036	89	68	45	46	89	57	23	02	25	36	57	46	89
7	HS 681	78	35	34	34	35	35	34	00	14	14	46	34	78
8	VL 3022	78	25	23	35	47	46	23	13	14	36	58	35	78
9	HS 680	89	35	35	37	48	46	23	23	24	13	57	35	89
10	VL 3023	89	46	67	79	89	46	35	24	25	46	45	56	89
11	HPW 474	89	57	56	47	99	68	35	23	25	57	46	57	99
12	UP 3069	78	36	45	57	79	56	34	23	25	26	46	46	79
13	HPW 473	78	36	36	79	79	56	34	23	25	14	68	46	79
14	VL 892 (C)	89	36	37	79	99	46	23	35	25	13	57	46	99
15	VL 3024	89	47	23	45	68	45	34	35	36	13	45	45	89
16	HS 490 (C)	89	35	46	37	68	56	23	23	25	35	45	46	89
17	HS 679	89	58	24	25	89	56	35	02	24	34	35	46	89
II. North Western Plain Zone (NWPZ)														
18	DBW88 (C)	78	58	25	45	99	46	23	13	24	36	36	46	99
19	DBW187(I) (C)	89	35	35	48	99	57	23	35	25	57	36	46	99
20	HD2967 (C)	78	36	46	39	24	24	34	11	13	02	56	35	78
20A	Infector	89	58	89	89	99	78	47	57	79	69	78	78	99
21	WH1105 (C)	89	46	35	57	79	46	34	58	24	26	79	57	89
22	DBW222(I) (C)	89	35	36	34	68	45	23	23	23	15	79	45	89
23	HD3086 (C)	89	35	78	68	89	57	23	13	25	36	46	46	89
24	PBW840M	99	24	56	69	89	56	23	35	25	37	45	46	99
25	PBW803	89	35	78	68	79	57	23	13	25	46	45	46	89
26	PBW550 (C)	99	46	45	36	99	46	23	13	25	24	35	46	99
27	HD3334	89	12	35	45	99	67	45	35	24	15	46	46	99
28	HD3059 (C)	89	25	36	57	68	45	34	13	24	47	56	46	89
29	HD3332	89	35	45	78	99	56	23	23	24	13	57	46	99
30	DBW173 (C)	78	46	56	89	89	36	23	23	25	57	57	56	89
31	WH1021 (C)	89	57	67	68	99	78	34	35	26	36	57	57	99
32	PBW811	89	57	46	57	78	56	23	11	25	24	45	46	89
33	DBW291	79	35	57	89	89	46	23	05	24	58	45	46	89
34	WH1264	89	58	35	35	89	56	34	35	25	24	56	46	89
35	PBW812	89	37	46	78	89	47	34	35	25	26	25	46	89

36	JKW261	89	35	34	38	78	56	23	03	13	24	24	35	89
37	DBW290	89	24	46	46	79	56	12	01	13	12	68	45	89
38	PBW771(I) (C)	89	46	47	36	79	57	34	25	13	13	57	46	89
39	PBW813	89	35	57	45	68	56	34	35	13	02	46	45	89
40	HD3331	89	35	45	37	57	57	35	25	13	12	56	46	89
40A	Infector	99	68	89	89	99	78	46	57	79	68	79	78	99
41	HD3298*	89	46	23	45	68	46	35	35	25	25	46	46	89
42	WH1124 (C)	89	35	46	78	89	47	35	36	25	36	58	57	89
43	UP3033	79	12	45	36	89	68	34	35	13	46	46	46	89
44	HUW838	89	35	34	45	89	56	23	15	14	25	68	46	89
45	HD3043 (C)	89	24	45	34	89	36	35	35	13	15	35	45	89
46	PBW644 (C)	89	46	56	47	79	47	35	03	26	35	46	46	89
47	DBW296	89	28	67	35	89	57	23	13	25	46	58	46	89
48	HI1628(I) (C)	89	35	46	27	68	56	23	13	24	24	57	46	89
49	WH1080 (C)	99	46	47	58	89	57	23	35	24	25	56	46	99
50	JAUW672	89	56	57	68	46	45	34	35	24	23	46	46	89
51	WH1142 (C)	89	24	58	67	89	46	34	56	24	14	35	46	89
52	NIAW3170(I) (C)	89	46	67	58	99	56	34	56	26	14	56	56	99
III. North Eastern Plain Zone (NEPZ)														
53	PBW804	79	24	35	36	89	79	34	35	35	13	57	46	89
54	DBW187 (C)	89	24	36	56	99	57	35	57	35	14	58	46	99
55	K1006 (C)	78	46	34	57	79	56	35	56	34	13	45	46	79
56	DBW39 (C)	89	35	45	35	46	46	23	15	12	36	67	45	89
57	HD3249(I) (C)	89	12	47	34	99	46	23	58	13	24	46	46	99
58	HD2733 (C)	89	35	67	78	46	35	23	35	35	24	45	46	89
59	HD3171 (C)	89	56	35	68	99	45	34	67	35	35	57	56	99
60	HD2888 (C)	89	56	45	45	89	57	23	25	24	13	24	45	89
60A	Infector	99	68	89	89	99	78	47	68	79	68	68	78	99
61	HD3293*	89	24	34	67	57	36	35	13	25	13	25	35	89
62	K1317 (C)	89	24	45	37	89	46	34	01	25	13	57	45	89
63	HI1612 (C)	78	35	46	36	46	57	23	01	24	13	58	35	78
64	DBW252(I) (C)	89	35	56	25	89	47	23	02	25	12	57	45	89
IV. Central Zone (CZ)														
65	TAW155	89	46	34	78	46	36	23	00	13	13	45	35	89
66	HI1636	89	35	35	67	99	46	34	00	35	46	45	46	99
67	MP1361	79	68	37	78	89	56	34	00	35	03	57	46	89
68	MACS6747	89	35	46	58	89	57	34	00	24	46	56	46	89
69	HD3377	89	24	56	67	68	46	23	13	24	26	57	46	89
70	HI1637	89	35	57	45	99	56	34	13	24	24	58	46	99
71	RAJ4541	89	46	56	48	79	46	34	13	35	24	79	46	89
72	GW513	89	46	67	78	89	67	45	13	25	36	25	56	89
73	GW322	89	46	45	68	68	56	34	00	24	35	25	45	89
74	HI1544	89	57	67	78	68	78	45	13	36	37	56	57	89
75	HI1634*	89	57	78	58	68	56	23	14	36	25	57	46	89
76	HD2932	89	68	56	67	68	35	45	12	24	36	25	46	89
77	MP3336	89	35	45	89	68	58	45	14	35	46	67	56	89

78	HD2864	89	46	78	89	89	47	35	00	24	57	45	56	89
79	CG1029*	99	57	67	78	89	46	23	00	35	35	56	56	99
80	MPO1357(d)	79	00	35	35	99	57	45	25	35	03	45	45	99
80A	Infector	99	68	89	68	99	78	46	79	79	69	47	78	99
81	HI8627(d)	89	12	23	68	99	57	35	35	35	24	46	46	99
82	UAS466(d)(I)	68	24	34	46	89	57	35	35	35	35	57	46	89
83	UAS472(d)	89	35	23	35	99	56	45	35	36	13	45	46	99
84	DBW110	47	46	23	57	68	45	23	46	24	46	57	46	68
85	MP3288	89	35	34	78	78	68	35	26	24	36	57	46	89
86	HI 8823(d)	89	35	35	89	35	78	35	00	35	35	35	46	89
87	DDW47(d)(I)	79	12	37	46	46	58	35	26	35	25	36	36	79
V. Peninsular Zone (PZ)														
88	WHD964(d)	89	46	45	45	99	57	23	11	35	13	58	46	99
89	DDW48(d) *	48	46	34	36	99	56	35	11	24	24	46	45	99
90	MACS6222 (C)	89	57	45	35	89	57	45	58	36	36	58	57	89
91	MACS3949(d) (C)	89	57	56	24	99	58	45	67	35	14	24	56	99
92	HI8818(d)	79	24	45	26	99	68	45	68	25	25	23	46	99
93	UAS428(d) (C)	69	35	35	12	99	46	34	23	25	35	26	35	99
94	DDW49(d) *	79	12	45	23	99	68	34	24	35	25	46	45	99
95	GW322 (C)	89	35	67	89	78	57	23	37	35	36	67	57	89
96	GW519	99	46	68	36	89	68	34	48	35	35	57	57	99
97	HI1646	89	36	45	34	89	45	23	58	35	46	25	46	89
98	HD3090 (C)	89	36	46	56	99	58	23	47	25	36	36	46	99
99	RAJ4083 (C)	89	46	35	57	89	68	23	67	35	58	46	57	89
100	UAS3008	89	35	46	57	89	68	34	67	35	36	45	56	89
100A	Infector	99	68	89	89	99	78	47	67	79	68	89	78	99
101	MACS6749	89	57	67	56	79	56	34	68	35	46	67	57	89
102	HD2932 (C)	89	58	68	47	78	46	34	59	36	25	68	57	89
103	HI1641	89	68	79	37	99	78	35	67	36	36	56	57	99
104	HI1642	89	46	78	57	89	68	34	25	35	35	25	56	89
105	HI1633*	89	35	79	45	78	56	34	68	36	24	57	56	89
106	MACS6752	89	12	87	36	78	57	35	58	35	46	56	56	89
107	NIDW 1149(d)*	89	24	67	45	79	68	45	68	24	23	68	56	89
108	UAS446(d) (C)	89	35	45	57	68	46	45	67	35	23	25	46	89
109	HI 1605 (C)	89	46	36	34	68	46	35	58	35	26	25	46	89
110	MACS 4087(d)	89	46	35	35	89	78	35	35	24	26	24	46	89
111	MP 1358	89	57	37	26	68	47	34	38	36	13	36	46	89
112	AKDW 2997-16(d) (C)	89	12	48	67	99	78	35	36	25	46	35	56	99
113	HI8805(d)(I) (C)	99	35	45	68	68	46	35	48	36	24	25	46	99
114	UAS 472(d)	89	35	36	35	68	56	35	56	35	13	67	46	89
115	MPO 1357(d)	89	46	37	58	68	56	34	34	24	13	57	46	89
116	NIAW3170(I) (C)	89	57	35	68	89	46	23	34	35	13	25	46	89
VI. Special Trial (Dicocum)														
117	MACS5055	68	68	67	14	35	34	34	00	25	46	56	45	68
118	MACS6222 (aest.) (C)	89	68	56	34	89	35	45	00	25	36	67	46	89

119	DDK1029 (C)	89	68	57	25	46	35	45	35	35	26	46	46	89
120	MACS5054	89	68	78	35	46	36	35	35	25	36	67	46	89
120A	Infector	99	68	79	89	99	78	46	67	79	69	79	78	99
121	DDK1058	89	68	78	47	68	45	45	35	25	47	57	57	89
122	HW1098 (C)	89	68	78	35	35	46	35	35	24	24	58	46	89
123	DDK1059	89	24	67	57	36	58	35	35	35	36	46	46	89
VII. Special Trial (SPL-HYPT)														
124	DBW327	89	12	34	35	89	57	35	18	24	24	78	46	89
125	HD3086 (C)	89	00	67	34	89	57	35	00	25	36	46	45	89
126	DBW332	89	12	45	24	68	56	23	24	25	24	58	45	89
127	DBW303*	89	35	67	57	68	56	23	34	35	13	46	46	89
128	HD2967 (C)	78	13	78	35	24	24	12	00	14	12	58	34	78
129	DBW187*	89	35	56	34	79	46	23	00	24	24	57	45	89
130	DBW329	89	46	45	25	89	46	23	00	25	13	46	45	89
131	WH1252	89	24	78	36	79	56	34	00	35	36	56	46	89
132	HD3378	89	35	67	57	68	57	34	00	24	24	35	45	89
133	WH1270*	89	46	35	25	89	57	23	00	35	47	46	46	89
134	DBW333	89	24	23	45	89	67	23	00	35	24	45	45	89
135	DBW330	89	00	34	25	68	56	34	00	24	25	25	35	89
136	DBW328	89	00	23	57	68	45	23	00	35	36	45	35	89
137	DBW331	89	35	23	35	46	35	23	00	24	15	45	35	89
VIII. Resistant Sources from Previous Years														
138	HI1652	79	46	46	35	78	67	34	26	24	37	46	46	79
139	HD 3345	89	12	56	67	78	46	35	14	24	26	45	46	89
140	DDW 48(d)	99	12	57	57	99	57	35	12	24	25	57	46	99
140A	Infector	99	68	79	89	99	78	47	57	79	68	68	78	99
141	DDW 47(d)	89	12	56	78	36	35	45	24	14	36	67	46	89

COOPERATORS:

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PROGRAMME 4. KARNAL BUNT

4.1 KARNAL BUNT SCREENING NURSERY (KBSN) 2019-2020

Wheat entries along with checks were evaluated for resistance to Karnal bunt at multilocations (Ludhiana, New Delhi, Hisar, Pantnagar, Jammu and Dhaulakuan) during 2019-20 crop season under artificially inoculated conditions.

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 also given in Table 1.3. The resistant entries identified are listed below:

AVTs 2019-20
Free from infection: Nil

Resistant (average incidence upto 5%):
HS 507(C), HS 562 (C), VL 907(C), VL 2036, HS 681, VL 3022, HPW 474, UP 3069, HPW 473, HS 490 (C), HS 679, DBW 88(C), DBW 187(I)(C), HD 2967(C), HD 3086(C), PBW 803, HD 3334, HD 3059 (C), HD 3332, DBW 173(C), WH 1021(C), PBW 811, DBW 291, PBW 812, JKW 261, DBW 290, PBW 771(I)(C), PBW 813, HD 3331, HD 3298*, WH 1124 (C), UP 3033, HUW 838, HD 3043 (C), HI 1628(I) (C), WH 1080(C), JAUW 672, WH 1142 (C), DBW 187 (C), K 1006 (C), DBW39 (C), HD 3249(I)(C), HD 2733(C), HD 3171(C), HD 3293*, K 1317(C), DBW 252(I)(C), TAW 155, HI 1636, MP 1361, HD 3377, HI 1637, RAJ 4541, GW 322, HI 1634*, HD 2932, MP 3336, HD 2864, CG 1029*, MPO 1357(d), HI 8627(d), UAS 466(d)(I), UAS 472(d), DBW 110, MP 3288, HI 8823(d), DDW 47(d)(I), WHD 964(d), DDW 48(d)*, MACS 6222 (C), MACS 3949(d)(C), HI 8818(d), UAS 428(d)(C), DDW 49(d)*, GW 519, HI 1646, HD 3090 (C), UAS 3008, MACS 6749, HD 2932 (C), HI 1642, HI 1633*, NIDW 1149(d)*, UAS 446(d)(C), HI 1605 (C), MACS 4087(d), MP 1358, AKDW 2997-16(d)(C), HI 8805(d)(I)(C), UAS 472(d), MPO 1357(d), NIAW 3170(I)(C), MACS 5055, MACS 6222 (aest.)(C), DDK 1029 (C), MACS 5054, DDK 1058, HW 1098(C), DDK 1059, DBW 327, HD 3086 (C), DBW 332, DBW 303*, HD 2967 (C), DBW 329, WH 1252, HD 3378, WH 1270*, DBW 333, DBW 330, DBW 328, DBW 331, VL 3019, VL 3021, PBW 821, PBW 781, HD 3277, WH 1239, DBW 252, DBW 273, NIDW 1158 (d), HI 8811 (d), GW 1348 (d), PBW 822, UAS 3002, HI 1634, HI 8807 (d), PBW 823, MACS 5052 and HD 3298.

Table 4.1: Karnal bunt incidence in KBSN entries evaluated under artificially inoculated conditions at multilocations during 2019-20

S. No.	Entry	Karnal bunt incidence (%)							
		Ludhiana	Delhi	Hisar	Pantnagar	Jammu	Dhaulakuan	Avg.	HS
I. Northern Hill Zone									
1	HS 507 (C)	0	1.0	8.3	0	7.5	0.8	2.9	8.3
2	HS 562 (C)	5.8	3.3	11.6	0.8	3.8	0	4.2	11.6
3	HPW 349 (C)	31.3	5.0	12.5	2	4.1	0.3	9.2	31.3
4	HS 668	15.3	2.9	9.6	0	4.6	2.2	5.8	15.3

5	VL 907 (C)	8.3	4.5	8.6	0	8.3	0.5	5.0	8.6
6	VL 2036	2.6	11.8	6.7	0.6	6.2	0.3	4.7	11.8
7	HS 681	2.9	7.5	10	0	8.3	0	4.8	10.0
8	VL 3022	8.2	4.2	8.2	1.9	3.4	0.6	4.4	8.2
9	HS 680	15	3.5	9.1	0	8.3	0.4	6.1	15.0
10	VL 3023	23.8	7.6	12.5	0	6.1	0	8.3	23.8
11	HPW 474	0	2.7	8.2	0	9.5	0.4	3.5	9.5
12	UP 3069	0	4.5	11.1	0.5	4.4	0.9	3.6	11.1
13	HPW 473	5.3	9.0	9.1	0	4.3	0.8	4.8	9.1
14	VL 892 (C)	15.6	6.7	15	0.4	7.1	2.4	7.9	15.6
15	VL 3024	0	2.9	13.6	4.4	9.1	0.4	5.1	13.6
16	HS 490 (C)	0	5.0	14.3	0	4.3	0.4	4.0	14.3
17	HS 679	2.3	3.4	14.3	0	6.2	0.4	4.4	14.3
II. North Western Plain Zone									
18	DBW88 (C)	12.4	5.3	8.6	0.4	1.5	0	4.7	12.4
19	DBW187(I) (C)	5.2	2.0	13.3	1.1	7.2	0.8	4.9	13.3
20	HD2967 (C)	0	3.3	10	1.5	7.2	0.2	3.7	10.0
20A	Infector	30.7	10.5	26.6	3.9	16.3	3.9	15.3	30.7
21	WH1105 (C)	9	5.6	6.6	1	8.5	1.3	5.3	9.0
22	DBW222(I) (C)	12	13.6	9.1	0.5	4.2	0.2	6.6	13.6
23	HD3086 (C)	4.5	5.6	8.3	0.3	0	0.3	3.2	8.3
24	PBW840M	8	2.5	15	1.3	2.2	2.6	5.3	15.0
25	PBW803	0	4.4	13.6	0	7.1	0	4.2	13.6
26	PBW550 (C)	26.7	1.0	12.5	2.7	1.5	3.1	7.9	26.7
27	HD3334	4.9	5.0	11.1	1	4.2	0	4.4	11.1
28	HD3059 (C)	5	3.3	8.3	0.7	1.9	0.6	3.3	8.3
29	HD3332	1	12.3	6.7	2.3	7.2	0.6	5.0	12.3
30	DBW173 (C)	1.1	2.9	7.5	1.7	0	0	2.2	7.5
31	WH1021 (C)	0	2.8	12.5	0.4	3.2	0.5	3.2	12.5
32	PBW811	0	10.6	8.3	0.4	0	0.7	3.3	10.6
33	DBW291	0	10.0	10	0	7.1	0	4.5	10.0
34	WH1264	6.4	9.5	14.3	0.4	6.5	1.9	6.5	14.3
35	PBW812	0	5.0	16.6	0	0.5	1.8	4.0	16.6
36	JKW261	1.3	9.3	12.6	1.9	0	0.3	4.2	12.6
37	DBW290	3.9	7.0	8.6	3.7	4.1	0	4.6	8.6
38	PBW771(I) (C)	7.1	8.3	6.7	1	5.5	0.3	4.8	8.3
39	PBW813	7	8.0	7.5	1.1	6.1	0	5.0	8.0
40	HD3331	5.5	10.8	5	0.4	0	3.8	4.3	10.8
40A	Infector	16.3	12.5	22.2	4.2	13.4	3.7	12.1	22.2
41	HD3298*	4.8	1.0	7.5	4.2	6.6	0	4.0	7.5
42	WH1124 (C)	2.9	2.5	9.1	0	0	0.6	2.5	9.1
43	UP3033	4.8	7.3	12.5	1.2	4.4	0	5.0	12.5
44	HUW838	6.3	4.3	14.3	0.3	1.5	0.7	4.6	14.3
45	HD3043 (C)	0	5.7	13.3	1	4.2	0	4.0	13.3
46	PBW644 (C)	4.5	8.3	12.5	2	8.6	0	6.0	12.5
47	DBW296	5.8	8.5	18.3	0	4.3	0	6.2	18.3

48	HI1628(I) (C)	3.8	2.9	16.7	0.5	3.3	0.8	4.7	16.7
49	WH1080 (C)	6.3	1.0	15	0	6.1	0	4.7	15.0
50	JAUW672	0	9.0	13.7	0	2	0.7	4.2	13.7
51	WH1142 (C)	4.8	7.0	15	3	0	0.4	5.0	15.0
52	NIAW3170(I) (C)	0	5.5	18.7	0.8	5.3	2.1	5.4	18.7
III. North Eastern Plain Zone									
53	PBW804	2.9	8.5	16.7	1.3	5	0.4	5.8	16.7
54	DBW187 (C)	2.6	2.6	14.3	0.8	0	0.3	3.4	14.3
55	K1006 (C)	0	5.5	12.5	1.5	0	0.3	3.3	12.5
56	DBW39 (C)	5.7	4.4	8.6	0.5	2.1	0.2	3.6	8.6
57	HD3249(I) (C)	2.4	1.0	11.3	1	8.8	0.4	4.2	11.3
58	HD2733 (C)	0	6.6	14.4	0.7	0.3	0.6	3.8	14.4
59	HD3171 (C)	3.2	4.4	12.6	0	8.3	0	4.8	12.6
60	HD2888 (C)	40	5.6	12.5	4.3	4.4	2.7	11.6	40.0
60A	Infector	11.3	13.4	25	3.1	14.2	4.1	11.9	25.0
61	HD3293*	4.1	2.5	11.6	0.5	4.4	0.5	3.9	11.6
62	K1317 (C)	2.7	2.2	13.4	2.3	8.1	0	4.8	13.4
63	HI1612 (C)	4.7	5.5	9.1	2.4	9.3	0.5	5.3	9.3
64	DBW252(I) (C)	2	4.3	12.5	1.5	0	0.4	3.5	12.5
IV. Central Zone									
65	TAW155	0	5.5	14.5	1	0	1.6	3.8	14.5
66	HI1636	6.3	0.0	10	0.4	9.1	1.3	4.5	10.0
67	MP1361	4.8	4.0	9.5	3	3.3	3.9	4.8	9.5
68	MACS6747	12.8	1.8	8.6	1.3	6.5	0.9	5.3	12.8
69	HD3377	2	0.0	7.5	0	2.3	1	2.1	7.5
70	HI1637	2.5	3.2	6.6	0	4.1	1.2	2.9	6.6
71	RAJ4541	7.4	**1.0**	12.5	2.2	3.3	0.4	4.5	12.5
72	GW513	4.8	0.0	14.3	1.6	6.1	7	5.6	14.3
73	GW322	0	5.0	15	1.6	7.2	1.3	5.0	15.0
74	HI1544	42.9	4.3	13.3	0	8.3	0.9	11.6	42.9
75	HI1634*	4	3.3	12.5	1.4	4.6	0.7	4.4	12.5
76	HD2932	3.5	0.0	10	0.2	6.6	1.1	3.6	10.0
77	MP3336	0	0.0	13.3	3.5	6.6	1.1	4.1	13.3
78	HD2864	7	0.0	8.6	2.6	3.6	2.1	4.0	8.6
79	CG1029*	5.9	0.0	12.5	0	8.2	0	4.4	12.5
80	MPO1357(d)	0	0.0	4.6	3.7	0	0.6	1.5	4.6
80A	Infector	17.9	9.7	25	4	16.1	3.7	12.7	25.0
81	HI8627(d)	0	6.0	10	0	1.1	0.5	2.9	10.0
82	UAS466(d)(I)	0	0.0	5	0	2.4	0.8	1.4	5.0
83	UAS472(d)	2	0.0	5	5.1	0	0.7	2.1	5.1
84	DBW110	0	4.0	5	0.9	3.6	1	2.4	5.0
85	MP3288	6.3	4.7	6	4.2	0	0.9	3.7	6.3
86	HI 8823(d)	0	2.5	8.3	0	0.3	1.3	2.1	8.3
87	DDW47(d)(I)	0	3.9	5	5.2	1.1	0.9	2.7	5.2
V. Peninsular Zone									
88	WHD964(d)	0	2.0	5	0	0	0	1.2	5.0

89	DDW48(d) *	0	0.0	6.7	0.2	2.3	0	1.5	6.7
90	MACS6222 (C)	6.3	0.0	8.7	5	6.6	0.3	4.5	8.7
91	MACS3949(d) (C)	0	0.0	5	0	3.3	0	1.4	5.0
92	HI8818(d)	0	3.9	5	0	4.1	0.3	2.2	5.0
93	UAS428(d) (C)	0	5.5	5	0	0	0	1.8	5.5
94	DDW49(d) *	0	6.6	5	8.4	4.4	0.8	4.2	8.4
95	GW322 (C)	17	9.1	12.5	0.8	1.5	1.1	7.0	17.0
96	GW519	5.6	6.2	8.6	2.7	2.1	0.2	4.2	8.6
97	HI1646	9.1	2.0	9.1	1	5.5	1.9	4.8	9.1
98	HD3090 (C)	12.3	1.5	10	3.3	0	0	4.5	12.3
99	RAJ4083 (C)	5.7	6.7	11.6	1.9	4.1	0.3	5.1	11.6
100	UAS3008	0	5.6	12.3	0	2.1	0.5	3.4	12.3
100A	Infector	18.5	12.5	21.3	3	16.1	4	12.6	21.3
101	MACS6749	5.7	3.3	13.7	0	0	0.5	3.9	13.7
102	HD2932 (C)	0	1.0	14.2	1.6	3.5	0.6	3.5	14.2
103	HI1641	32	5.8	5	0	0	0.5	7.2	32.0
104	HI1642	0	0.0	12.4	2.3	6.1	0	3.5	12.4
105	HI1633*	3.8	4.0	11.2	0	0	0	3.2	11.2
106	MACS6752	16.7	0.0	8.3	1.2	4.3	0	5.1	16.7
107	NIDW 1149(d)*	0	0.0	5	0	6.5	0	1.9	6.5
108	UAS446(d) (C)	0	0.0	4.6	0	9.1	2.8	2.8	9.1
109	HI 1605 (C)	0	0.9	8.6	0.4	6.1	0.5	2.8	8.6
110	MACS 4087(d)	8.3	0.0	6.5	2.1	2.1	0	3.2	8.3
111	MP 1358	3.1	7.1	6.7	0	10.1	1.2	4.7	10.1
112	AKDW 2997-16(d) (C)	0	5.5	4.6	0.7	0	0	1.8	5.5
113	HI8805(d)(I) (C)	1.3	2.4	4.5	0.3	1.1	0	1.6	4.5
114	UAS 472(d)	3.8	0.0	3.5	0	2.3	0.6	1.7	3.8
115	MPO 1357(d)	2	0.0	5	0	0.5	0.6	1.4	5.0
116	NIAW3170(I) (C)	0	2.0	8.3	0.6	0	0	1.8	8.3
VI. Special Trial (Dicocum)									
117	MACS5055	0	0.0	6.6	0	2.6	0.7	1.7	6.6
118	MACS6222 (aest.) (C)	0	2.5	10	2	6.6	0	3.5	10.0
119	DDK1029 (C)	0	11.5	6.6	0	0	0	3.0	11.5
120	MACS5054	0	0.0	6.3	0	2.3	0	1.4	6.3
120A	Infector	21.4	10.2	28.6	3.5	13.1	3.1	13.3	28.6
121	DDK1058	0	0.0	5	0	2.3	0	1.2	5.0
122	HW1098 (C)	0	0.0	5	0	3.3	0	1.4	5.0
123	DDK1059	0	0.0	5	4	0	0.6	1.6	5.0
VII. Special Trial (HYPT)									
124	DBW327	1.9	1.0	12.5	0.9	9.1	1.1	4.4	12.5
125	HD3086 (C)	4.5	2.2	14.3	0	4.7	1	4.5	14.3
126	DBW332	5.2	0.0	13.3	1	8.2	0.6	4.7	13.3
127	DBW303*	0	0.0	8.7	0.2	6.2	0.5	2.6	8.7
128	HD2967 (C)	0	0.0	14.3	1.5	7.2	1.1	4.0	14.3
129	DBW187*	5	2.9	12.5	1.5	10.3	0.8	5.5	12.5
130	DBW329	0	0.0	7.6	3.2	2.1	0.8	2.3	7.6

131	WH1252	6	0.0	11.7	0.7	8.24	0.6	4.5	11.7
132	HD3378	6.3	0.0	10	0.7	3.6	1.3	3.7	10.0
133	WH1270*	3.8	5.6	13.3	0.2	4	0.6	4.6	13.3
134	DBW333	7.4	0.0	14.3	0.8	3.3	0.6	4.4	14.3
135	DBW330	6.4	0.0	12.5	0.5	6.3	0.7	4.4	12.5
136	DBW328	2.9	0.0	9.1	2	6.5	0.5	3.5	9.1
137	DBW331	4.8	2.5	12.8	1.7	4.1	0.6	4.4	12.8
VIII. Resistant Sources from Previous Year									
138	HS 673	21.9	6.1	5	0.6	0	3.1	6.1	21.9
139	UP 3041	35	4.4	6.6	4.2	5.5	0.7	9.4	35.0
140	VL 3019	10.7	5.0	8.3	0	0	0.6	4.1	10.7
140A	Infector	21	13.2	20	2.9	15.1	3.8	12.7	21.0
141	VL 3021	9.3	5.3	6.6	0.8	1.1	1.2	4.1	9.3
142	PBW 820	21.9	6.3	8.3	1.5	0	1.3	6.5	21.9
143	PBW 821	2	0.0	8.3	2.3	1.3	1	2.5	8.3
144	NIAW 3170	70	3.4	10	3.3	6.6	1.4	15.8	70.0
145	PBW 781	14.1	0.0	5	0	0	0.8	3.3	14.1
146	HD 3277	6	0.0	8.6	1.3	2.4	0.5	3.1	8.6
147	DBW 187	45	6.7	7.5	1.7	0	1.1	10.3	45.0
148	WH 1239	16.7	2.5	8.3	1.3	0	0.8	4.9	16.7
149	HD 3293	23.5	8.0	6.7	1.6	6.3	1.4	7.9	23.5
150	DBW 252	9.1	2.2	8.3	1.3	0	1.3	3.7	9.1
151	DBW 273	4.6	4.5	6.7	0	4.5	0.6	3.5	6.7
152	NIDW 1158 (d)	0	0.0	5	2.6	2.1	0.6	1.7	5.0
153	HI 8811 (d)	0	2.5	5	2	0	1.6	1.9	5.0
154	GW 1348 (d)	0	3.3	5	4.8	0.5	0.6	2.4	5.0
155	PBW 822	3.4	4.5	5	1.2	3.3	1	3.1	5.0
156	MP 3336	16.7	0.0	6.7	0.6	6.3	1	5.2	16.7
157	UAS 3002	0	0.0	7.7	0	0.5	0.5	1.5	7.7
158	HI 1634	2.9	0.0	8.3	3.7	6	1	3.7	8.3
159	HI 8807 (d)	0	0.0	6.7	2.5	2.4	1.3	2.2	6.7
160	PBW 823	0	0.0	12.5	0.2	8.1	1.9	3.8	12.5
160A	HD 2967 (C)	41.2	12.0	19.2	3.4	14.3	3.8	15.7	41.2
161	DDW 49 (d)	0	24.0	5	0	1.3	1.2	5.3	24.0
162	MACS 5052	0	0.0	5	0	0	0	0.8	5.0
163	DBW 304	16.7	4.7	16.6	0.4	4.5	0.9	7.3	16.7
164	HD 3298	5.7	0.0	12.5	0.3	6.1	0.9	4.3	12.5

COOPERATORS:

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PROGRAMME 5. LOOSE SMUT

5.1 Evaluation of AVT material (2018-19) 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 preferred 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 AVTs (2018-19), were inoculated with local isolates of loose smut pathogen using 'Go go' method at hot spot locations like Ludhiana, Almora, Durgapura and Hisar. The inoculated seeds were sown again during 2019-20 crop season at these locations of NWPZ and NHZ for expression of disease. 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 are presented in Table 5.1. The promising entries in AVTs are:

AVTs year, 2018-19

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

HPW 467, HD 3086(C), HI 8713(d)(C), HI 8811(d), HI 8812(d), GW 1348(d), DDW 49(d), DDW 48(d), UAS 466(d)*, DDW 47(d)*^{Q}, UAS 428 (d)(C), WHD 963(d), HI 8805(d)*, AKDW 2997, 16(d)(C), UAS 446(d)(C), NIDW 1149(d) and DDK 1057.

Table 5.1. Loose smut infection (%) in the entries of AVTs of year 2018-19 expressed during 2019-20 crop season

S. No.	Entry	Loose smut incidence (%)					
		Ludhiana	Almora	Durgapura	Hisar	Avg.	HS
I. Northern Hill Zone							
1	HPW349 (C)	0	45.8	6.8	35.6	22.1	45.8
2	VL907 (C)	23.4	26.9	9.7	25.2	21.3	26.9
3	HS507 (C)	28.9	20	3.3	46.7	24.7	46.7
4	HS652	37.5	38.4	10.3	16.3	25.6	38.4
5	HS562 (C)	44.4	58.7	2.3	32.3	34.4	58.7
6	VL892 (C)	12.5	34.6	6.2	26.7	20.0	34.6
7	HS490 (C)	16	36.8	10.5	12.3	18.9	36.8
8	HPW468	0	0	1.2	41.6	10.7	41.6
9	HS673	18.8	61.3	14.5	13.3	27.0	61.3
10	VL3020	8.3	41.8	10.8	27.7	22.2	41.8
11	UP3041	28.6	53.2	9.2	33.3	31.1	53.2
12	HPW467	0	1.5	0.0	18.2	4.9	18.2
13	HS674	19.6	34.9	21.3	14.3	22.5	34.9
14	VL3019	8.3	49.2	15.9	42.6	29.0	49.2
15	VL3021	18.2	17.9	22.0	22.3	20.1	22.3
II. North Western Plain Zone							
16	WH1105 (C)	28.6	60.3	26.3	46.7	40.5	60.3
17	HD3226(I) (C)	18.2	42.5	22.0	43.3	31.5	43.3
18	HD3086 (C)	0	1.7	0.0	12.5	3.6	12.5
19	PBW820^{M}	20.3	70	21.6	23.3	33.8	70
20	DBW 221*	14.1	34.8	41	41.6	32.9	41.6
20A	Infector/Sonalika (C)	17.6	47.4	44.7	90	49.9	90
21	DBW 222*	0	11.1	0.0	15	6.5	15
22	PBW550 (C)	24.6	59	22.0	37.3	35.7	59
23	PBW821^{M}	40.8	30.9	14.6	65	37.8	65
24	HD2967 (C)	9.3	33.6	1.6	86.7	32.8	86.7

25	NW 7049	25	20.2	16.2	76.3	34.4	76.3
26	DPW621-50 (C)	25.7	58.7	5.1	56.3	36.5	58.7
27	DBW88 (C)	31.2	46	31.3	73.3	45.5	73.3
28	PBW752(I) (C)	19	33.3	23.8	12.5	22.2	33.3
29	DBW173 (C)	3.3	30.6	5.5	62.5	25.5	62.5
30	WH1021 (C)	13.2	0	21.6	77.7	28.1	77.7
31	HD3059 (C)	17.2	0	12.4	81.1	27.7	81.1
32	WH1124 (C)	0	0	0.0	85	21.3	85
33	PBW 771*	0	66.1	25.7	83.3	43.8	83.3
34	HI1620(I) (C)	12.3	49.3	21.1	83.3	41.5	83.3
35	PBW 796	0	64.7	28.9	76.7	42.6	76.7
36	HI 1628*	43.3	60.7	32.6	71.2	52.0	71.2
37	WH1142 (C)	36	99.2	38.8	12.5	46.6	99.2
38	HD3043 (C)	2.7	53	9.3	87.1	38.0	87.1
39	PBW644 (C)	16.1	43.8	14.2	12.5	21.7	43.8
40	HD3237(I) (C)	18.5	62.5	17.1	75	43.3	75
40A	Infector/Sonalika (C)	19.3	69.3	60.1	83.3	58.0	83.3
41	BRW 3806*[#]	39.7	31.7	23.1	36.7	32.8	39.7
42	NIAW 3170*	23.8	43	27.2	56.7	37.7	56.7
43	WH1080 (C)	44.7	64.5	19.4	62.5	47.8	64.5
III. North Eastern Plain Zone							
44	HD3249*[#Q]	17	18.6	11.3	35	20.5	35
45	HD2733 (C)	5.9	21.8	0.0	37.5	16.3	37.5
46	PBW 781	11.7	74.8	12.2	12.5	27.8	74.8
47	DBW 257	20.8	24.1	2.1	83.3	32.6	83.3
48	DBW39 (C)	18.5	47.9	6.0	95	41.9	95
49	HD 3277	27.7	48.1	19.8	73.3	42.2	73.3
50	RAJ 4529	30.9	25.9	10.0	65	33.0	65
51	DBW187(I) (C)	20.6	46.3	10.3	46.7	31.0	46.7
52	WH 1239	41.4	65.5	13.4	83.3	50.9	83.3
53	K0307 (C)	40.7	21.8	16.1	55	33.4	55
54	HD2967 (C)	0	22.1	6.8	46.7	18.9	46.7
55	K1317 (C)	0	53.2	14.8	35	25.8	53.2
56	HI1612 (C)	14.8	37	16.8	81.1	37.4	81.1
57	HD 3293	1.5	45.4	23.1	65	33.8	65
58	HD3171 (C)	34.7	10.1	10.9	12.5	17.1	34.7
59	HD2888 (C)	0	45.1	5.9	13.3	16.1	45.1
60	DBW 252*[#]	18.5	49.7	12.9	12.5	23.4	49.7
60A	Infector/Sonalika (C)	26.9	37.7	49.1	76.7	47.6	76.7
61	K8027 (C)	24.3	29.3	12.0	13.3	19.7	29.3
62	DBW 273	38.8	46.2	15.0	12.5	28.1	46.2
IV. Central Zone							
63	HI8713(d) (C)	0	0	0.0	12.5	3.1	12.5
64	NIDW 1158 (d)	30.9	6.8	0.0	11.1	12.2	30.9
65	HI 8811 (d)	0	0	0.0	18.7	4.7	18.7
66	HD3343[M]	4	11.2	28.3	12.5	14.0	28.3
67	GW322 (C)	60	66.5	36.4	12.5	43.9	66.5
68	HI1544 (C)	45	13.4	2.2	11.1	17.9	45
69	HI8737(d) (C)	0	2.2	7.5	11.7	5.4	11.7
70	HI 8812 (d)	0	0	0.0	9.5	2.4	9.5
71	GW 1348 (d)	0	1.8	0.0	8.3	2.5	8.3
72	DDW 49 (d)	0	NG	1.2	7.6	2.9	7.6

73	PBW 822[B]	20	72.2	33.6	16.6	35.6	72.2
74	HD 3345[B]	22.8	31.4	49.7	25	32.2	49.7
75	DDW 48 (d)	0	5.6	0.0	12.5	4.5	12.5
76	HI8627(d) (C)	0	0	1.3	26.6	7.0	26.6
77	DBW110 (C)	7	19.8	12.4	27.3	16.6	27.3
78	UAS 466(d)*	0	2.9	0.0	12.5	3.9	12.5
79	MP3288 (C)	11.1	48	16.1	46.7	30.5	48
80	DBW 277	17.1	71.9	11.3	31.3	32.9	71.9
80A	Infector/Sonalika (C)	24.2	24.5	55.1	86.7	47.6	86.7
81	DDW 47(d)*[Q]	2.9	0	0.0	12.5	3.9	12.5
82	HD2932 (C)	13.7	65.4	17.4	11.1	26.9	65.4
83	HD2864 (C)	2.2	37.4	2.3	8.3	12.6	37.4
84	MP3336 (C)	5	NG	3.3	46.6	18.3	46.6
85	MP4010 (C)	0	20.9	24.2	31.3	19.1	31.3
86	CG1029	40	44.6	16.8	12.5	28.5	44.6
87	UAS3002	31.4	57.1	19.8	13.3	30.4	57.1
88	HI1633	42.5	81.1	10.6	16.7	37.7	81.1
89	HI1634	9.5	42.2	10.8	26.7	22.3	42.2
90	HI8808 (d)	0	44.5	0.0	31.3	19.0	44.5
91	HI8807 (d)	0	12.5	0	12.5	6.3	12.5
V. Peninsular Zone							
92	PBW 823[B]	20	0	31.8	8.7	15.1	31.8
93	UAS428 (d) (C)	0	0	1.5	11.1	3.2	11.1
94	DDW 49 (d)	20	52.5	8.1	28.6	27.3	52.5
95	UAS 3001	26.7	27.3	14.6	12.5	20.3	27.3
96	MACS3949 (d) (C)	4.9	11.5	8.4	16.6	10.4	16.6
97	MACS6222 (C)	18.4	42.2	11.0	53.3	31.2	53.3
98	GW 322 (C)	46.4	36.1	22.5	12.5	29.4	46.4
99	DDW 48 (d)	5	0	1.4	22.2	7.2	22.2
100	MACS6478 (C)	27.5	16.5	2.8	46.7	23.4	46.7
100A	Infector/Sonalika (C)	20	61.6	48.1	86.7	54.1	86.7
101	HD3343[M]	0	35.7	30.3	8.3	18.6	35.7
102	WHD 963 (d)	0	0	0.0	12.5	3.1	12.5
103	HI8807(d)	0	6.1	0.8	16.6	5.9	16.6
104	HI1633	15.5	40.9	24.3	18.6	24.8	40.9
105	UAS 3002	11.7	64.6	1.1	11.1	22.1	64.6
106	Raj4083 (C)	35.4	24.7	16.9	12.5	22.4	35.4
107	HD2932 (C)	42.2	34.8	30	16.6	30.9	42.2
108	GW509	8.3	69.9	15.0	21.1	28.6	69.9
109	HD3090 (C)	73.3	61.2	19.4	25	44.7	73.3
110	NIAW 3170*	43.2	72	11.5	36.6	40.8	72
111	GW 1346(d)*	0	0	0.0	35	8.8	35
112	MACS 4058(d)*	13.8	0.5	0.0	33.3	11.9	33.3
113	DBW93 (C)	0	42.2	9.6	76.7	32.1	76.7
114	HI 8805(d)*	0	0	0.0	11.1	2.8	11.1
115	AKDW2997-16(d) (C)	0	0	0.0	12.5	3.1	12.5
116	MACS 6695*	0	27.3	13.1	8.3	12.2	27.3
117	UAS446(d) (C)	0	0	0.0	7.5	1.9	7.5
118	HI1605 (C)	21.3	26	15.0	8.3	17.7	26
119	MACS 6696*	27.6	26	27.3	26.7	26.9	27.6
120	NIDW 1149(d)	0	0	0.0	13.3	3.3	13.3
120A	Infector/Sonalika (C)	36.3	47.3	51.3	86.7	55.4	86.7

121	HI 8802(d)*	0	0	NG	80	26.7	80
VI. Special Trial (Dicocum)							
122	DDK1029 (C)	0	NG	0.0	76.7	25.6	76.7
123	MACS5052	0	0	0.0	83.3	20.8	83.3
124	MACS6222 (aest.) (C)	17.5	53.8	14.7	25	27.8	53.8
125	DDK1056	0	0	0.0	66.7	16.7	66.7
126	HW1098 (C)	0	0	0.0	75	18.8	75
127	MACS5053	0	0	0.0	83.3	20.8	83.3
128	DDK1057	0	0	3.8	11.1	3.7	11.1
VII. Special Trial- SPL-HYPT							
129	HD3317	28.3	46.6	6.6	35	29.1	46.6
130	WH1254	37.1	38.5	3.9	26.7	26.6	38.5
131	DBW301	35.4	26.3	13.1	66.7	35.4	66.7
132	WH1270	16.1	41.1	12.9	16.7	21.7	41.1
133	HD2967 (C)	8.6	54.6	33.3	53.3	37.5	54.6
134	PBW824	24	28.4	13.9	42.6	27.2	42.6
135	UP3043	15.6	11.9	20.0	16.7	16.1	20
136	DBW187	0	17.3	21.3	13.3	13.0	21.3
137	HD3086 (C)	0	0	0.0	12.5	3.1	12.5
138	DBW303	3.3	45.5	32.9	13.3	23.8	45.5
139	DBW304	16.2	15	5.8	12.5	12.4	16.2
140	UP3042	0	24	11.8	16.6	13.1	24
140A	Infector/Sonalika (C)	38.5	43.7	48.9	83.3	53.6	83.3
141	DBW302	37.3	30.1	21.2	12.5	25.3	37.3
142	PBW825	20	46.3	16.5	11.1	23.5	46.3
143	HD3347	16.9	29.8	57.4	45	37.3	57.4
VIII. Special Trial (SPL-AST)							
144	WH1223	5.3	26.6	19.0	28.6	19.9	28.6
145	KRL19 (C)	3.3	30.7	44.8	53.3	33.0	53.3
146	Kharchia65 (C)	15	83.3	39.6	10	37.0	83.3
147	NW 7060	36	45.7	14.1	8.3	26.0	45.7
148	KRL210 (C)	0	0	0.0	75	18.8	75
149	WH 1228	20.4	52.8	16.5	16.6	26.6	52.8
150	NW 7062	0	NG	27.1	10	12.4	27.1
IX. Special Trial (SPL-VLS)							
151	PBW757 (C)	19.5	52.5	10.3	11.1	23.4	52.5
152	WR544 (C)	0	65.5	9.8	16.7	23.0	65.5
153	HD3298	4	16.1	10.9	12.5	10.9	16.1
154	HD3271	NG	50.8	24.3	11.1	28.7	50.8
155	DBW14 (C)	NG	1.3	4.5	46.7	17.5	46.7
156	DBW71 (C)	NG	51.8	23.4	12.5	29.2	51.8
157	HI1621	NG	0	19.1	16.7	11.9	19.1
158	PBW 797	NG	49.1	7.0	76.7	44.3	76.7
158A	Infector/Sonalika (C)	30.9	45.6	47.7	83.3	51.9	83.3

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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. Keeping in view the importance of powdery mildew, during 2019-20 crop season, 170 entries of AVTs and promising entries were screened against powdery mildew at hot spot locations in NHZ and NWPZ. The data of seven locations, *viz*., Almora, Pantnagar, Shimla, Dhaulakuan, Wellington, Jammu 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. 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 2019-20

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

HS 507(C), HS 562(C), HS 681, HS 680, HPW 474, UP 3069, HPW 473, HS 490(C), HD 3334, WH 1264, HD 3298*, WH 1124(C), UP 3033, HUW 838, HI 1628(I)(C), WH 1080(C), WH 1142(C), NIAW 3170(I)(C), PBW 804, DBW 187(C), K 1006(C), HD 2888(C), HI 1612(C), DBW 252(I)(C), MPO 1357(d), HI 8627(d), UAS 466(d)(I), DBW 110, WHD 964(d), DDW 48(d)*, MACS 6749, UAS 446(d)(C), MP 1358, HW 1098(C), DBW 330, DBW 328, EIGN 33, YRC 1, ONS 27, ONS 29, PMC 1, MDSN 15, VL 3021, DBW 257, HD 3277, UP 3042, DBW 302, HD 3347 and NW 7060.

Table 6.1 Powdery Mildew Screening Nursery, 2019-20

S. No.	Entry	Powdery mildew Score (0-9)								
		Almora	Pantnagar	Shimla	Dhaulakuan	Wellington	Jammu	Malan	Avg.	HS
I. Northern Hill Zone										
1	HS 507 (C)	3	3	3	4	1	4	5	3	5
2	HS 562 (C)	5	3	5	2	0	2	4	3	5
3	HPW 349 (C)	7	0	5	2	1	5	3	3	7
4	HS 668	5	1	5	4	1	6	5	4	6
5	VL 907 (C)	5	0	5	6	1	5	5	4	6
6	VL 2036	5	1	5	4	1	6	6	4	6
7	HS 681	3	1	3	2	2	4	4	3	4
8	VL 3022	3	0	1	2	0	6	3	2	6
9	HS 680	3	0	5	4	1	1	4	3	5
10	VL 3023	3	1	5	4	1	4	6	3	6
11	HPW 474	1	0	3	4	0	4	4	2	4
12	UP 3069	5	1	5	2	2	4	5	3	5
13	HPW 473	3	0	3	2	0	4	5	2	5
14	VL 892 (C)	5	7	5	6	1	5	4	5	7
15	VL 3024	5	0	5	6	2	4	3	4	6
16	HS 490 (C)	3	0	5	2	0	0	5	2	5
17	HS 679	5	0	7	2	0	6	5	4	7
II. North Western Plain Zone										
18	DBW88 (C)	5	3	7	6	0	4	4	4	7
19	DBW187(I) (C)	3	3	5	2	2	6	4	4	6

20	HD2967 (C)	3	5	5	6	0	4	5	4	6
20A	Infector	5	5	7	9	5	7	8	7	9
21	WH1105 (C)	3	3	7	2	3	3	5	4	7
22	DBW222(I) (C)	3	0	5	2	2	3	6	3	6
23	HD3086 (C)	5	5	5	2	3	2	4	4	5
24	PBW840M	5	3	7	2	5	3	4	4	7
25	PBW803	5	3	5	4	7	3	5	5	7
26	PBW550 (C)	5	3	7	9	1	8	6	6	9
27	HD3334	5	1	1	4	3	4	3	3	5
28	HD3059 (C)	5	3	5	6	3	0	3	4	6
29	HD3332	5	0	5	4	3	3	5	4	5
30	DBW173 (C)	5	3	7	4	1	4	3	4	7
31	WH1021 (C)	5	3	5	4	2	5	4	4	5
32	PBW811	1	0	7	4	1	7	4	3	7
33	DBW291	1	3	5	2	2	6	3	3	6
34	WH1264	3	0	5	2	1	4	3	3	5
35	PBW812	3	3	7	2	3	1	3	3	7
36	JKW261	5	3	7	2	2	4	3	4	7
37	DBW290	5	1	5	4	7	4	3	4	7
38	PBW771(I) (C)	5	5	7	9	7	7	4	6	9
39	PBW813	5	3	5	4	7	6	2	5	7
40	HD3331	1	1	1	2	5	7	2	3	7
40A	Infector	7	5	7	9	5	8	9	7	9
41	HD3298*	1	0	3	2	3	4	3	2	4
42	WH1124 (C)	1	3	1	2	5	5	4	3	5
43	UP3033	3	0	3	4	3	4	4	3	4
44	HUW838	3	0	3	4	2	5	2	3	5
45	HD3043 (C)	1	3	1	2	2	6	3	3	6
46	PBW644 (C)	3	0	1	4	2	6	4	3	6
47	DBW296	3	0	1	2	0	7	3	2	7
48	HI1628(I) (C)	1	0	3	4	3	0	4	2	4
49	WH1080 (C)	1	0	3	4	1	4	3	2	4
50	JAUW672	3	3	1	4	3	6	3	3	6
51	WH1142 (C)	3	3	1	2	3	5	3	3	5
52	NIAW3170(I) (C)	3	0	1	2	1	4	3	2	4
III. North Eastern Plain Zone										
53	PBW804	1	0	3	2	0	3	3	2	3
54	DBW187 (C)	3	0	3	2	2	0	2	2	3
55	K1006 (C)	3	3	1	4	3	4	2	3	4
56	DBW39 (C)	3	0	3	6	2	2	2	3	6
57	HD3249(I) (C)	1	0	3	6	2	7	2	3	7
58	HD2733 (C)	5	3	7	4	1	4	5	4	7
59	HD3171 (C)	3	0	3	9	3	6	3	4	9
60	HD2888 (C)	3	0	3	4	3	5	3	3	5
60A	Infector	5	5	7	6	5	7	9	6	9
61	HD3293*	3	3	3	9	1	6	2	4	9
62	K1317 (C)	3	0	3	2	7	2	3	3	7
63	HI1612 (C)	3	1	3	2	5	4	4	3	5
64	DBW252(I) (C)	1	0	1	2	3	4	3	2	4
IV. Central Zone										
65	TAW155	3	0	3	9	2	3	4	3	9
66	HI1636	3	3	5	9	3	5	6	5	9

67	MP1361	1	3	7	6	7	3	3	4	7
68	MACS6747	1	5	7	9	3	5	5	5	9
69	HD3377	3	7	3	6	8	5	4	5	8
70	HI1637	1	0	7	9	5	4	6	5	9
71	RAJ4541	1	5	1	4	7	3	3	3	7
72	GW513	5	5	3	9	2	5	4	5	9
73	GW322	1	5	3	9	1	2	4	4	9
74	HI1544	3	3	3	9	1	3	3	4	9
75	HI1634*	3	3	3	6	1	3	4	3	6
76	HD2932	3	0	3	9	5	3	3	4	9
77	MP3336	5	3	5	9	5	5	3	5	9
78	HD2864	3	0	5	6	3	6	3	4	6
79	CG1029*	3	5	5	9	5	6	5	5	9
80	MPO1357(d)	1	3	5	4	5	3	1	3	5
80A	Infector	5	3	5	9	7	7	8	6	9
81	HI8627(d)	1	0	1	4	3	3	1	2	4
82	UAS466(d)(I)	1	1	1	2	3	4	1	2	4
83	UAS472(d)	1	3	5	6	3	6	1	4	6
84	DBW110	3	3	3	2	3	5	3	3	5
85	MP3288	3	1	3	4	7	4	5	4	7
86	HI 8823(d)	3	3	7	6	1	4	1	4	7
87	DDW47(d)(I)	1	3	0	0	3	6	1	2	6
V. Peninsular Zone										
88	WHD964(d)	1	5	5	2	5	5	1	3	5
89	DDW48(d) *	1	0	5	4	3	4	2	3	5
90	MACS6222 (C)	3	0	7	9	2	5	6	5	9
91	MACS3949(d) (C)	1	3	7	9	5	2	3	4	9
92	HI8818(d)	1	3	5	6	5	6	3	4	6
93	UAS428(d) (C)	1	7	7	6	2	3	1	4	7
94	DDW49(d) *	5	7	7	6	2	6	1	5	7
95	GW322 (C)	3	7	7	2	1	4	5	4	7
96	GW519	3	0	7	9	1	3	4	4	9
97	HI1646	3	0	3	9	3	5	5	4	9
98	HD3090 (C)	3	3	3	6	5	4	6	4	6
99	RAJ4083 (C)	7	0	5	9	3	3	3	4	9
100	UAS3008	3	3	5	9	3	4	3	4	9
100A	Infector	5	5	3	9	5	7	6	6	9
101	MACS6749	3	3	3	4	2	4	4	3	4
102	HD2932 (C)	5	0	3	9	3	2	3	4	9
103	HI1641	3	0	3	9	5	7	3	4	9
104	HI1642	3	5	3	9	7	4	7	5	9
105	HI1633*	3	5	5	9	7	2	6	5	9
106	MACS6752	7	3	3	9	5	3	6	5	9
107	NIDW 1149(d)*	3	5	3	9	7	4	5	5	9
108	UAS446(d) (C)	1	0	3	2	5	3	5	3	5
109	HI 1605 (C)	3	3	3	2	7	6	3	4	7
110	MACS 4087(d)	5	0	3	6	7	5	3	4	7
111	MP 1358	5	0	1	4	3	4	1	3	5
112	AKDW 2997-16(d) (C)	5	0	3	6	3	0	5	3	6
113	HI8805(d)(I) (C)	1	0	3	9	0	5	4	3	9
114	UAS 472(d)	5	7	3	2	8	5	3	5	8
115	MPO 1357(d)	3	7	1	6	8	4	3	5	8

116	NIAW3170(I) (C)	3	5	1	4	5	4	4	4	5
VI. Special Trial (Dicoccum)										
117	MACS5055	3	0	1	2	2	6	2	2	6
118	MACS6222 (aest.) (C)	1	3	3	0	3	4	6	3	6
119	DDK1029 (C)	1	0	1	9	7	0	6	3	9
120	MACS5054	1	7	1	0	3	2	4	3	7
120A	Infector	5	7	7	9	3	7	8	7	9
121	DDK1058	3	0	3	0	4	5	6	3	6
122	HW1098 (C)	1	0	1	0	5	0	5	2	5
123	DDK1059	3	3	1	0	3	3	6	3	6
VII. Special Trial- SPL-HYPT										
124	DBW327	3	0	1	6	3	5	3	3	6
125	HD3086 (C)	5	0	1	6	5	6	4	4	6
126	DBW332	5	3	1	6	5	6	2	4	6
127	DBW303*	3	3	1	4	1	7	2	3	7
128	HD2967 (C)	5	3	1	6	1	3	3	3	6
129	DBW187*	1	0	3	6	1	2	3	2	6
130	DBW329	3	0	3	6	0	6	4	3	6
131	WH1252	3	3	1	6	3	7	3	4	7
132	HD3378	3	1	3	6	1	4	5	3	6
133	WH1270*	1	0	3	6	2	6	3	3	6
134	DBW333	3	3	3	4	2	6	3	3	6
135	DBW330	3	0	3	4	3	4	4	3	4
136	DBW328	3	0	5	2	2	4	3	3	5
137	DBW331	3	3	5	6	7	7	3	5	7
VIII. Resistant Entries from Previous year										
138	EIGN 33	3	1	0	2	0	4	1	2	4
139	YRC 1	3	0	0	0	1	5	1	1	5
140	HW 2436-1	3	3	0	6	7	3	6	4	7
140A	Infector	3	5	7	9	1	7	9	6	9
141	HW 2436-2	1	1	1	2	7	2	4	3	7
142	HW 3643	1	0	1	2	0	4	6	2	6
143	ONS 27	NG	0	0	0	0	4	1	1	4
144	ONS 29	3	1	0	0	0	5	1	1	5
145	PMC 1	3	0	0	0	0	4	0	1	4
146	MDSN 15	3	0	0	0	0	5	0	1	5
147	MDSN 17	3	3	7	0	1	2	0	2	7
148	HS 674	1	0	5	4	1	6	4	3	6
149	VL 3021	1	3	5	4	3	3	4	3	5
150	PBW 796	1	0	7	6	2	6	4	4	7
151	PBW 781	5	0	7	6	1	4	1	3	7
152	DBW 257	3	3	1	4	1	3	3	3	4
153	HD 3277	1	0	5	4	1	5	2	3	5
154	RAJ 4529	1	1	3	6	1	4	3	3	6
155	HD 3293	1	5	3	9	1	3	3	4	9
156	HI 1634	3	3	3	6	0	4	4	3	6
157	HI 8807 (d)	1	1	1	9	0	4	4	3	9
158	DDW 49 (d)	1	0	5	6	3	2	4	3	6
159	DDK 1056 (dic.)	3	3	1	4	3	6	5	4	6
160	DDK1057 (dic.)	3	3	3	0	1	6	4	3	6
160A	Infector	5	5	3	6	1	7	7	5	7
161	WH 1254	3	0	3	6	2	2	4	3	6

162	DBW 301	5	7	3	2	1	3	3	3	7
163	WH 1270	1	0	3	4	7	4	1	3	7
164	UP 3043	3	0	3	6	3	3	1	3	6
165	DBW 303	5	0	1	6	3	6	2	3	6
166	DBW 304	1	0	1	6	0	5	2	2	6
167	UP 3042	3	3	3	4	0	0	3	2	4
168	DBW 302	3	3	3	4	1	5	3	3	5
169	HD 3347	3	1	3	4	2	5	4	3	5
170	NW 7060	3	3	5	2	1	0	4	3	5

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PROGRAMME 7. REGION SPECIFIC DISEASES OF LIMITED IMPORTANCE

7.1 FUSARIUM HEAD BLIGHT (FHB) OR HEAD SCAB

AVT entries along with checks were evaluated under artificially inoculated conditions at Dhaulakuan and Delhi. The data at Guradaspur center could not be recorded due to lockdown imposed because of COVID-19. Disease scoring scale (0-5) has been used. A total 137 entries were evaluated and entry-wise reaction of AVTs entries (2019-2020) 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 2019-20

S. No.	Entries	Disease score (0-5)		
		Dhaulakuan	Delhi	HS
I. Northern Hill Zone				
1	HS 507 (C)	5	3	5
2	HS 562 (C)	3	4	4
3	HPW 349 (C)	3	5	5
4	HS 668	4	3	4
5	VL 907 (C)	3	4	4
6	VL 2036	3	4	4
7	HS 681	2	5	5
8	VL 3022	4	5	5
9	HS 680	4	4	4
10	VL 3023	3	5	5
11	HPW 474	2	5	5
12	UP 3069	3	4	4
13	HPW 473	4	5	5
14	VL 892 (C)	5	4	5
15	VL 3024	4	5	5
16	HS 490 (C)	3	5	5
17	HS 679	4	5	5
II. North Western Plain Zone				
18	DBW88 (C)	2	5	5
19	DBW187(I) (C)	3	4	4
20	HD2967 (C)	3	5	5
20A	Infector	4	5	5
21	WH1105 (C)	3	5	5
22	DBW222(I) (C)	2	4	4
23	HD3086 (C)	3	5	5
24	PBW840M	2	5	5
25	PBW803	4	5	5
26	PBW550 (C)	3	4	4
27	HD3334	2	5	5
28	HD3059 (C)	4	5	5
29	HD3332	3	4	4
30	DBW173 (C)	4	4	4
31	WH1021 (C)	3	4	4
32	PBW811	4	4	4
33	DBW291	4	4	4
34	WH1264	3	5	5
35	PBW812	5	4	5

36	JKW261	3	5	5
37	DBW290	2	5	5
38	PBW771(I) (C)	4	4	4
39	PBW813	3	4	4
40	HD3331	4	4	4
40A	Infector	4	5	5
41	HD3298*	4	5	5
42	WH1124 (C)	4	5	5
43	UP3033	3	NG	3
44	HUW838	3	5	5
45	HD3043 (C)	4	5	5
46	PBW644 (C)	4	4	4
47	DBW296	3	5	5
48	HI1628(I) (C)	4	5	5
49	WH1080 (C)	3	NG	3
50	JAUW672	5	4	5
51	WH1142 (C)	4	5	5
52	NIAW3170(I) (C)	3	5	5
III. North Eastern Plain Zone				
53	PBW804	2	5	5
54	DBW187 (C)	3	5	5
55	K1006 (C)	4	5	5
56	DBW39 (C)	3	5	5
57	HD3249(I) (C)	2	5	5
58	HD2733 (C)	4	NG	4
59	HD3171 (C)	3	4	4
60	HD2888 (C)	2	4	4
60A	Infector	5	5	5
61	HD3293*	4	4	4
62	K1317 (C)	3	5	5
63	HI1612 (C)	4	3	4
64	DBW252(I) (C)	4	4	4
IV. Central Zone				
65	TAW155	3	4	4
66	HI1636	3	5	5
67	MP1361	2	4	4
68	MACS6747	3	5	5
69	HD3377	4	5	5
70	HI1637	5	5	5
71	RAJ4541	4	NG	4
72	GW513	5	4	5
73	GW322	3	4	4
74	HI1544	4	4	4
75	HI1634*	5	4	5
76	HD2932	4	5	5
77	MP3336	3	5	5
78	HD2864	4	5	5
79	CG1029*	5	3	5
80	Infector	5	5	5
80A	MPO1357(d)	4	3	4
81	HI8627(d)	3	5	5
82	UAS466(d)(I)	2	4	4

83	UAS472(d)	5	3	5
84	DBW110	4	5	5
85	MP3288	4	4	4
86	HI 8823(d)	3	4	4
87	DDW47(d)(I)	3	5	5
V. Peninsular Zone				
88	WHD964(d)	3	NG	3
89	DDW48(d) *	2	3	3
90	MACS6222 (C)	3	4	4
91	MACS3949(d) (C)	3	4	4
92	HI8818(d)	4	4	4
93	UAS428(d) (C)	3	5	5
94	DDW49(d) *	2	5	5
95	GW322 (C)	4	5	5
96	GW519	4	5	5
97	HI1646	4	5	5
98	HD3090 (C)	5	3	5
99	RAJ4083 (C)	4	4	4
100	UAS3008	3	4	4
100A	Infector	5	5	5
101	MACS6749	4	5	5
102	HD2932 (C)	4	5	5
103	HI1641	5	5	5
104	HI1642	4	5	5
105	HI1633*	4	5	5
106	MACS6752	3	5	5
107	NIDW 1149(d)*	2	4	4
108	UAS446(d) (C)	4	4	4
109	HI 1605 (C)	3	5	5
110	MACS 4087(d)	4	4	4
111	MP 1358	5	NG	5
112	AKDW 2997-16(d) (C)	3	NG	3
113	HI8805(d)(I) (C)	4	NG	4
114	UAS 472(d)	3	5	5
115	MPO 1357(d)	2	5	5
116	NIAW3170(I) (C)	5	4	5
VI. Special Trial (Dicoccum)				
117	MACS5055	3	4	4
118	MACS6222 (aest.) (C)	4	3	4
119	DDK1029 (C)	3	4	4
120	MACS5054	3	4	4
120A	Infector	5	5	5
121	DDK1058	2	4	4
122	HW1098 (C)	3	4	4
123	DDK1059	4	3	4
VII. Special Trial- SPL-HYPT				
124	DBW327	4	4	4
125	HD3086 (C)	3	4	4
126	DBW332	5	5	5
127	DBW303*	4	5	5
128	HD2967 (C)	3	4	4
129	DBW187*	4	4	4

130	DBW329	5	5	5
131	WH1252	3	5	5
132	HD3378	2	4	4
133	WH1270*	5	4	5
134	DBW333	4	5	5
135	DBW330	4	4	4
136	DBW328	4	5	5
137	DBW331	3	5	5

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

Test Locations: Hisar, Ludhiana and Durgapura

Flag smut is soil and externally seed bone disease caused by *Urocyctis agropyri*. The spores of the pathogen can survive for longer period in the soil. Disease development was low at all the centers. A total 137 entries were screened and entry-wise reaction of AVTs (2019-20) has been given in Table 7.2. Data for 2nd year entries has also been given in Table 1.3.

The entries HI 8627(d), UAS 466(d)(I), UAS 472(d), HI 8823(d), DDW47(d)(I), WHD964(d), DDW48(d)*, MACS3949(d) (C), HI 8818(d), UAS 428(d)(C), DDW 49(d)*, NIDW 1149(d)*, UAS446(d) (C), MACS 4087(d), AKDW 2997-16(d)(C), HI8805(d)(I)(C), UAS 472(d), MPO 1357(d), MACS5055, DDK1029(C), MACS5054, DDK 1058, HW 1098(C) and DDK 1059 were found free at all the locations. The detail is given below:

Table 7.2. Performance of AVTs entries against flag smut (% incidence) under multilocational testing during 2019-20

S. No.	Entry	Flag smut incidence (%)				
		Hisar	Ludhiana	Durgapura	AV	HS
I. Northern Hill Zone						
1	HS 507 (C)	8.6	4.0	8.7	7.1	8.7
2	HS 562 (C)	9.3	1.6	1.3	4.1	9.3
3	HPW 349 (C)	8.3	2.7	3.2	4.7	8.3
4	HS 668	11.11	0.0	0.0	3.7	11.1
5	VL 907 (C)	12.5	0.0	0.0	4.2	12.5
6	VL 2036	13.3	1.7	4.8	6.6	13.3
7	HS 681	12.5	0.0	0.0	4.2	12.5
8	VL 3022	16.6	0.0	0.0	5.5	16.6
9	HS 680	11.1	6.2	8.8	8.7	11.1
10	VL 3023	8.6	1.9	2.1	4.2	8.6
11	HPW 474	8.3	0.0	0.0	2.8	8.3
12	UP 3069	8.6	4.1	4.5	5.7	8.6
13	HPW 473	16.6	4.7	10.4	10.6	16.6
14	VL 892 (C)	12.5	14.3	3.1	10.0	14.3
15	VL 3024	13.3	4.3	6.4	8.0	13.3
16	HS 490 (C)	14.2	6.6	10.7	10.5	14.2

17	HS 679	13.3	0.0	0.0	4.4	13.3
II. North Western Plain Zone						
18	DBW88 (C)	10.5	0.0	0.0	3.5	10.5
19	DBW187(I) (C)	13.6	1.9	1.9	5.8	13.6
20	HD2967 (C)	8.3	7.8	7.9	8.0	8.3
20A	Infector	26.6	24.6	26.3	25.8	26.6
21	WH1105 (C)	16.6	0.0	0.0	5.5	16.6
22	DBW222(I) (C)	13.25	1.7	4.8	6.6	13.3
23	HD3086 (C)	14.2	0.0	2.7	5.6	14.2
24	PBW840M	15	1.5	1.4	6.0	15.0
25	PBW803	14.6	1.8	3.4	6.6	14.6
26	PBW550 (C)	12.5	3.3	14.5	10.1	14.5
27	HD3334	16.6	3.4	7.0	9.0	16.6
28	HD3059 (C)	11.11	2.0	5.9	6.4	11.1
29	HD3332	14.57	3.1	9.5	9.1	14.6
30	DBW173 (C)	12.5	0.0	0.0	4.2	12.5
31	WH1021 (C)	8.3	0.0	0.0	2.8	8.3
32	PBW811	9.5	0.0	3.8	4.4	9.5
33	DBW291	8.3	2.1	4.1	4.8	8.3
34	WH1264	12.5	2.1	2.0	5.5	12.5
35	PBW812	13.6	4.8	6.8	8.4	13.6
36	JKW261	11.1	4.0	6.1	7.1	11.1
37	DBW290	16.6	4.3	13.6	11.5	16.6
38	PBW771(I) (C)	12.5	2.2	16.7	10.5	16.7
39	PBW813	8.6	0.0	0.0	2.9	8.6
40	HD3331	9.5	1.5	2.7	4.6	9.5
40A	Infector	21.33	23.3	34.5	26.4	34.5
41	HD3298*	7.5	3.4	13.2	8.0	13.2
42	WH1124 (C)	8.3	2.0	3.8	4.7	8.3
43	UP3033	9	3.4	5.2	5.7	8.6
44	HUW838	7.5	0.0	0.0	2.5	7.5
45	HD3043 (C)	6.6	0.0	1.4	2.7	6.6
46	PBW644 (C)	12.5	6.2	15.3	11.3	15.3
47	DBW296	11.11	3.4	6.5	7.0	11.1
48	HI1628(I) (C)	13.3	1.9	1.8	5.7	13.3
49	WH1080 (C)	14.2	4.5	5.6	8.1	14.2
50	JAUW672	12.28	1.4	2.4	5.3	12.3
51	WH1142 (C)	13.5	3.0	2.5	6.3	13.5
52	NIAW3170(I) (C)	16.6	0.0	1.6	6.1	16.6
III. North Eastern Plain Zone						
53	PBW804	12.5	0.0	0.0	4.2	12.5
54	DBW187 (C)	11.33	1.5	3.9	5.6	11.3
55	K1006 (C)	15	0.0	0.0	5.0	15.0
56	DBW39 (C)	12.5	0.0	1.8	4.8	12.5
57	HD3249(I) (C)	14.57	3.1	5.8	7.8	14.6
58	HD2733 (C)	16.3	0.0	0.0	5.4	16.3
59	HD3171 (C)	13.16	5.1	9.9	9.4	13.2
60	HD2888 (C)	16.6	5.8	17.0	13.1	17.0
60A	Infector	22.22	27.0	37.3	28.8	37.3
61	HD3293*	16.6	1.9	3.7	7.4	16.6
62	K1317 (C)	12.8	0.0	1.5	4.8	12.8
63	HI1612 (C)	14.6	2.6	3.7	7.0	14.6

64	DBW252(I) (C)	11.83	0.0	1.6	4.5	11.8
IV. Central Zone						
65	TAW155	8.3	2.7	2.7	4.6	8.3
66	HI1636	10.5	1.3	2.0	4.6	10.5
67	MP1361	14.5	1.6	1.6	5.9	14.5
68	MACS6747	13.25	4.0	6.0	7.8	13.3
69	HD3377	8.6	0.0	0.0	2.9	8.6
70	HI1637	8.3	3.5	2.3	4.7	8.3
71	RAJ4541	8.3	2.6	5.8	5.6	8.3
72	GW513	11.1	0.0	0.0	3.7	11.1
73	GW322	7.5	2.8	3.6	4.6	7.5
74	HI1544	12.6	23.1	1.0	12.2	23.1
75	HI1634*	6.83	3.1	4.0	4.6	6.8
76	HD2932	7.5	0.0	0.0	2.5	7.5
77	MP3336	6.3	0.0	0.0	2.1	6.3
78	HD2864	7.5	0.0	0.0	2.5	7.5
79	CG1029*	8.3	1.6	1.3	3.7	8.3
80	Infector	25	27.8	38.1	30.3	38.1
80A	MPO1357(d)	6	0.0	0.0	2.0	6.0
81	HI8627(d)	0	0.0	0.0	0.0	0.0
82	UAS466(d)(I)	0	0.0	0.0	0.0	0.0
83	UAS472(d)	0	0.0	0.0	0.0	0.0
84	DBW110	5.6	0.0	0.0	1.9	5.6
85	MP3288	8	0.0	0.0	2.7	8.1
86	HI 8823(d)	0	0.0	0.0	0.0	0.0
87	DDW47(d)(I)	0	0.0	0.0	0.0	0.0
V. Peninsular Zone						
88	WHD964(d)	0	0.0	0.0	0.0	0.0
89	DDW48(d) *	0	0.0	0.0	0.0	0.0
90	MACS6222 (C)	6.66	0.0	0.0	2.2	6.7
91	MACS3949(d) (C)	0	0.0	0.0	0.0	0.0
92	HI8818(d)	0	0.0	0.0	0.0	0.0
93	UAS428(d) (C)	0	0.0	0.0	0.0	0.0
94	DDW49(d) *	0	0.0	0.0	0.0	0.0
95	GW322 (C)	8.33	0.0	0.0	2.8	8.3
96	GW519	16.3	1.7	3.4	7.1	16.3
97	HI1646	12.7	1.4	1.2	5.1	12.7
98	HD3090 (C)	14.7	0.0	0.0	4.9	14.7
99	RAJ4083 (C)	13.2	0.0	3.4	5.5	13.2
100	UAS3008	11.8	3.1	4.4	6.4	11.8
100A	Infector	16.6	27.6	27.6	23.9	27.6
101	MACS6749	8.3	0.0	0.0	2.8	8.3
102	HD2932 (C)	12.5	0.0	0.0	4.2	12.5
103	HI1641	16.6	0.0	4.2	6.9	16.6
104	HI1642	12.5	1.5	1.3	5.1	12.5
105	HI1633*	8.66	0.0	0.0	2.9	8.7
106	MACS6752	7.5	3.3	4.8	5.2	7.5
107	NIDW 1149(d)*	0	0.0	0.0	0.0	0.0
108	UAS446(d) (C)	0	0.0	0.0	0.0	0.0
109	HI 1605 (C)	6.6	0.0	0.0	2.2	6.6
110	MACS 4087(d)	0	0.0	0.0	0.0	0.0
111	MP 1358	5	0.0	0.0	1.7	5.0

112	AKDW 2997-16(d) (C)	-	0.0	0.0	0.0	0.0
113	HI8805(d)(I) (C)	0	0.0	0.0	0.0	0.0
114	UAS 472(d)	0	0.0	0.0	0.0	0.0
115	MPO 1357(d)	0	0.0	0.0	0.0	0.0
116	NIAW3170(I) (C)	6.6	0.0	0.0	2.2	6.6
VI. Special Trial (Dicoccum)						
117	MACS5055	0	0.0	0.0	0.0	0.0
118	MACS6222 (aest.) (C)	8.3	0.0	0.0	2.8	8.3
119	DDK1029 (C)	0	0.0	0.0	0.0	0.0
120	MACS5054	0	0.0	0.0	0.0	0.0
120A	Infector	28.57	24.3	35.8	29.6	35.8
121	DDK1058	0	0.0	0.0	0.0	0.0
122	HW1098 (C)	0	0.0	0.0	0.0	0.0
123	DDK1059	0	0.0	0.0	0.0	0.0
VII. Special Trial- SPL-HYPT						
124	DBW327	9.11	1.7	3.4	4.7	9.1
125	HD3086 (C)	11.11	1.4	1.4	4.7	11.1
126	DBW332	10	0.0	0.0	3.3	10.0
127	DBW303*	12.5	0.0	0.0	4.2	12.5
128	HD2967 (C)	4.6	0.0	0.0	1.5	4.6
129	DBW187*	5.6	1.8	1.8	3.1	5.6
130	DBW329	7.5	2.4	2.4	4.1	7.5
131	WH1252	8.3	0.0	0.0	2.8	8.3
132	HD3378	9.11	0.0	0.0	3.0	9.1
133	WH1270*	8.6	2.0	2.0	4.2	8.6
134	DBW333	8.3	3.2	3.2	4.9	8.3
135	DBW330	11.1	5.1	8.5	8.2	11.1
136	DBW328	12.5	0.0	0	4.2	12.5
137	DBW331	13.3	0.0	0	4.4	13.3

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7.3 FOOT ROT (*Sclerotium rolfsii*)

AVT entries along with checks were evaluated at Dharwad center. AVTs (2019-2020) 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 2019-20

Free

HPW 473, VL 3024, HD2967 (C), JKW261, HI1628(I) (C), JAUW672, WH1142 (C), DBW187 (C), DBW39 (C), HD2733 (C), HD3171 (C), TAW155, HI1636, HD3377, RAJ4541, GW322, HI 8823(d), GW322 (C), UAS3008, HD2932 (C), HI1633*, MACS5055 and DDK1058

Highly resistant (upto 5 % disease):

HS 562 (C), HD3059 (C), WH1080 (C), NIAW3170(I) (C), PBW804, HD3249(I) (C), MACS6747, RAJ4083 (C), MACS6749, DBW328 and DBW331.

Resistant (5-10 % disease):
HS 668, HS 680, VL 892 (C), HD3331, HD3043 (C), K1006 (C), MP1361, GW513, HI1634*, DDW47(d)(I), GW519, HD3090 (C), MACS6752, NIDW 1149(d)*, MACS 4087(d), MPO 1357(d), DDK1029 (C) and DBW330.

Table 7.3. Performance of AVTs material against foot rot (% incidence) at Dharwad during 2019-2020

S. No.	Entries	Foot rot (%)
		Dharwad
I. Northern Hill Zone		
1	HS 507 (C)	20.0
2	HS 562 (C)	5.0
3	HPW 349 (C)	29.4
4	HS 668	5.6
5	VL 907 (C)	20.0
6	VL 2036	16.7
7	HS 681	15.0
8	VL 3022	16.7
9	HS 680	5.9
10	VL 3023	11.8
11	HPW 474	35.0
12	UP 3069	11.1
13	HPW 473	0.0
14	VL 892 (C)	5.6
15	VL 3024	0.0
16	HS 490 (C)	10.5
17	HS 679	31.3
II. North Western Plain Zone		
18.	DBW88 (C)	42.1
19.	DBW187(I) (C)	37.5
20	HD2967 (C)	0.0
21	WH1105 (C)	26.7
22	DBW222(I) (C)	78.6
23	HD3086 (C)	20.0
24	PBW840M	29.4
25	PBW803	84.2
26	PBW550 (C)	20.0
27	HD3334	35.0
28	HD3059 (C)	5.0
29	HD3332	31.3
30	DBW173 (C)	44.4
31	WH1021 (C)	36.8
32	PBW811	15.0
33	DBW291	29.4
34	WH1264	66.7
35	PBW812	66.7
36	JKW261	0.0
37	DBW290	44.4
38	PBW771(I) (C)	23.5
39	PBW813	20.0
40	HD3331	6.7
41	HD3298*	80.0
42	WH1124 (C)	60.0
43	UP3033	47.4
44	HUW838	79.0
45	HD3043 (C)	10.0
46	PBW644 (C)	30.0
47	DBW296	66.7
48	HI1628(I) (C)	0.0
49	WH1080 (C)	5.0
50	JAUW672	0.0
51	WH1142 (C)	0.0
52	NIAW3170(I) (C)	5.0
III. North Eastern Plain Zone		
53	PBW804	5.0
54	DBW187 (C)	0.0
55	K1006 (C)	5.6
56	DBW39 (C)	0.0
57	HD3249(I) (C)	5.0
58	HD2733 (C)	0.0
59	HD3171 (C)	0.0
60	HD2888 (C)	27.8
61	HD3293*	25.0
62	K1317 (C)	33.3
63	HI1612 (C)	42.1
64	DBW252(I) (C)	17.7
IV. Central Zone		
65	TAW155	0.0
66	HI1636	0.0
67	MP1361	10.0
68	MACS6747	5.0

69	HD3377	0.0
70	HI1637	21.1
71	RAJ4541	0.0
72	GW513	10.0
73	GW322	0.0
74	HI1544	18.8
75	HI1634*	5.3
76	HD2932	47.4
77	MP3336	17.7
78	HD2864	27.8
79	CG1029*	84.2
80	MPO1357(d)	37.5
81	HI8627(d)	87.5
82	UAS466(d)(I)	42.9
83	UAS472(d)	41.2
84	DBW110	15.0
85	MP3288	20.0
86	HI 8823(d)	0.0
87	DDW47(d)(I)	5.3
V. Peninsular Zone		
88	WHD964(d)	42.1
89	DDW48(d) *	57.9
90	MACS6222 (C)	25.0
91	MACS3949(d) (C)	16.7
92	HI8818(d)	36.8
93	UAS428(d) (C)	35.7
94	DDW49(d) *	30.0
95	GW322 (C)	0.0
96	GW519	10.0
97	HI1646	15.8
98	HD3090 (C)	10.0
99	RAJ4083 (C)	5.0
100	UAS3008	0.0
101	MACS6749	5.0
102	HD2932 (C)	0.0
103	HI1641	11.1
104	HI1642	31.6
105	HI1633*	0.0
106	MACS6752	10.0
107	NIDW 1149(d)*	10.0
108	UAS446(d) (C)	40.0
109	HI 1605 (C)	15.8
110	MACS 4087(d)	5.3
111	MP 1358	42.1
112	AKDW 2997-16(d) (C)	16.7
113	HI8805(d)(I) (C)	25.0
114	UAS 472(d)	25.0
115	MPO 1357(d)	10.0
116	NIAW3170(I) (C)	42.1
VI. Special Trial (Dicoccum)		
117	MACS5055	0.0
118	MACS6222 (aest.) (C)	50.0
119	DDK1029 (C)	10.0
120	MACS5054	58.8
121	DDK1058	0.0
122	HW1098 (C)	33.3
123	DDK1059	10.5
VII. Special Trial- SPL-HYPT		
124	DBW327	27.8
125	HD3086 (C)	10.5
126	DBW332	36.8
127	DBW303*	26.3
128	HD2967 (C)	10.5
129	DBW187*	45.0
130	DBW329	20.0
131	WH1252	14.3
132	HD3378	35.3
133	WH1270*	15.0
134	DBW333	16.7
135	DBW330	10.0
136	DBW328	5.0
137	DBW331	5.0

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

Test Locations: Almora, Bajoura and Malan

A total 17 AVT entries were evaluated at three locations. 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 both locations, the highest disease level as well as average was considered and has been given in Table 7.4.

AVTs 2019-20
Resistant (1-10 % disease):
VL 907 (C), HPW 473 and VL 3024

Table 7.4. Performance of AVT material against hill bunt (% incidence) under multilocational testing during 2019-2020

S. No.	Entry	Hill Bunt Incidence (%)				
		Almora	Bajura	Malan	AV	HS
I. Northern Hill Zone						
1	HS 507 (C)	3.33	18.4	11.5	11.1	18.4
2	HS 562 (C)	0	36.0	12.5	16.2	36.0
3	HPW 349 (C)	0.88	57.3	5.8	21.3	57.3
4	HS 668	0.93	50.0	27.3	26.1	50.0
5	VL 907 (C)	0	12.5	6.5	6.3	12.5
6	VL 2036	0	48.9	13.8	20.9	48.9
7	HS 681	0	9.8	37.5	15.8	37.5
8	VL 3022	5.93	28.6	4.6	13.0	28.6
9	HS 680	0	26.6	3.7	10.1	26.6
10	VL 3023	0	41.1	22.2	21.1	41.1
11	HPW 474	1.45	31.5	26.7	19.9	31.5
12	UP 3069	1.18	25.0	9.5	11.9	25.0
13	HPW 473	0.85	19.7	4.9	8.5	19.7
14	VL 892 (C)	2.73	43.5	100	48.7	100.0
15	VL 3024	1.52	7.5	7.7	5.6	15.0
16	HS 490 (C)	1.3	3.4	26.5	10.4	26.5
17	HS 679	1.1	15.6	13.9	10.2	17.0

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PROGRAMME 8. CROP HEALTH

8.1 Pre- Harvest Crop Health Monitoring

Wheat crop health was rigorously monitored during the crop season 2019-20. Major focus was on the occurrence of yellow rust in NWPZ and surveillance for wheat blast. Status of other diseases and insect pests was also monitored during these surveys. 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 58th All India Wheat and Barley Workers' Meet held held at IARI, RS, Indore during August 24-26, 2019. Advisory for stripe rust management was issued regularly. Information on wheat crop health was disseminated through the *"Wheat Crop Health Newsletter",* Vol. 25 (Issues 1 to 4) which was issued during the crop season and also uploaded on ICAR-IIWBR website (www.iiwbr.org). The overall crop health status was good throughout in the country. The yellow rust could not make any negative impact on wheat production and was very well managed at initiation in adjoining districts in Punjab close to foot hills of H.P., although, most of the time conducive weather for diseae development prevailed in the northen part of India as compared to previous cropping session. Besides this, other exotic diseases and pathotypes like Ug99 race of stem rust and wheat blast were not reported from any part of the country.

Wheat rust occurrence in Northern States

- The first occurrence of yellow rust in crop season 2019-20 is reported from the three fields in Anandpur Sahib Block of district Rupnagar in villages Chandesar and Darolli (hethlii) on verities HD 3086, PBW 677 and WH 711 on 26.12.2019. Later, in month of January few reports of yellow rust are from only foot hills in Punjab namely Rupnagar, Anandpur Sahib, Kiratpur Sahib block, Chamkour Sahib block, Hoshiarpur and Gurdaspur.
- The first report of leaf rust was observed on variety HD 3086 in village Rurki Kalan of SBS Nagar on 23.12.2019. Three days, incidence of leaf rust was also observed in Ajaouli and Dhuklii in villages of Anandpur Sahib block of Rupnagar, Punjab on varieties Champion and HD3086, respectively.
- In Haryana, the first incidence of yellow rust of wheat was reported on WH 711 variety from Hussaini village and another on HD 2967 in Dhanaura village (Naraingarh block, Ambala district) on Janurary 25, 2020.
- In Jammu, yellow rust was first reported on 2nd Feb, 2020 on variety HD 2967.
- Brown rust disease of wheat was first observed on 10th Februrray, 2020 in RS Pura block, Jammu on cultivar PBW 175.
- In Himachal Pradesh, yellow Rust disease was noticed on 11.02.2020 at Haler of Lambagaon block of district Kangra on varieties HD 3086, WH 1105 and PBW 677.

Besides the yellow rust, leaf rust incidence was observed in traces on off type wheat plants in Satara, Sangli, Kolhapur and Dhule districts of Maharashtra state in the month of Januray, 2020. Similarly, reports of occurances of leaf rust was received from Dharwad, Navalgund, Gadag, Saudatti, and Ramdurg talukas of Hubli on variety Amruth in the same month. During the month of February, leaf rust and stem rust incidence was observed in farmers' field in Satara and Pune district of Maharastra. Both the rust leaf and stem were also reported from few farmers filed in area of Niphad, Niphad, Kopargaon, Vaijapur, Yeola, Nashik and Sinnar. Leaf rust and stem rust were also reported from few farmers filed in Belagavi, Bagalkote, Dharwad and Gadag districts in Karnataka in Februray month. In the area of Jaipur and Dausa districts of Rajasthan, besides the yellow rust, flag smut and loose smut was also observed in minor incidence, however, in a filed at Rotashpura, Bassi (Jaipur) the flag smut incidence in the month of Februrary, 2020. Later in this month, powdery mildew disease was observed in traces in shady areas at Riyali, Himachal Pradesh. In few locations in Yammunanagar, Haryana, in small pockets infestations of powdery mildew disease have been observed. Besides diseases, insect pest infestions were also reported in the month of Decemebr, 2019 in Raikot, Lahotbadi, Kalsian, Malerkotla, Ghaour Kalan, Mehlan, Dandoli choti, Mardkhera and Galbia villages in district Sangrur (Punjab), where infestation of pink stem borer in early sown roto-

seeder wheat crop and armyworm infestation in Happy seeder sown crop after using mulcher/chopper was observed. In some areas of District Sehore near Obadullaganj, Karnataka, the root aphid and Shoot fly infestion was also observed in early sown wheat crop in the Decemebr, 2019. In Madhya Pradesh, some of the farmer's fields in Sawer, Indore, Dhar, Vidisha were found infested with cutworms and white grubs. In Maharashtram, the infestation of the root aphid was observed in few farmers field near Hol, Baramati, Pune. Aphid infestation was reported from farmer's field in the area of Satana, Kalvan, Malegaon, Dindori and Surgana tahasils in Maharastra. Minor infestation of leaf aphid was also observed in few farmers field near Hol and Baramati of Pune district. The detaled information was publidhed in *"Wheat Crop Health Newsletter"*, Vol. 25 (Issuses 1 to 4) and same were uploaded on ICAR-IIWBR website (www.iiwbr.org).

Strategy Planning Meetings

1. Management of yellow rust and Karnal bunt:

A strategy planning meetings were conducted to enhance the wheat production on "Evolving strategies for enhancing wheat production with special reference to management of wheat rusts and Karnal bunt disease" on 18th October, 2019 at Krishi Bhawan. The meeting was chaired by the Secretary, DAC&FW Govt. of India. Dr. Gyanendra Singh, PI Crop Improvement and Dr. Sudheer Kumar, PI Crop Protection from IIWBR attended the meeting. The status of yellow rust and Karnal bunt during the cropping season 2018-19 was presended in the meeting and the varietal advancement made during the season. The yellow rust is successfully managed by hosr resistance and need based application of chemicals to check further spread. Discussion was made on varietal deployment strategy to combat the yellow rust threat in the disease prone areas. Also, discussed the survey and surveillance strategy for early detection of yellow rust disease onset.

2. Alternate crop plan for blast disease:

Strategy planning meetings was also conducted on "Alternate crop plan to combat the occurrence of wheat blast like disease in the state of West Bengal" on 21.10.2019 at Taj Bengal Hotel, Kolkata. The meeting was chaired by the Agriculture Commissioner, DAC&FW, Govt. of India. Secretary (Agriculture), West Bengal presented the efforts made to combat the wheat blast threat like wheat holiday, no wheat zone, strict quarantine on Bangladesh boarder and its affects. Dr. Gyanendra Singh, PI Crop Improvement and Dr. Sudheer Kumar, PI Crop Protection from IIWBR attended the meeting. It was discussed that resistant varieties need to be promoted in the disease prone areas. Five resistant varieties identified namely DBW 187, HD 3249 and HD 2967 (irrigated and timely sown) and DBW 252 and HD 3171 (restricted irrigation and timely sown) have been recommended to be grown in disease prone areas of West Bengal. It was suggested that continuous monitoring of wheat crop is required and if any suspected symptoms are observed, it should be reported to the IIWBR immediately.

Training of wheat health management

Training was organized on "Identification and preventive measures of wheat blast and adoption strategies of resistant varieties" under the project "Survey and surveillance for wheat blast caused by *Magnaporthe oryzae* pathotype *Triticum* and strategic research to manage it" at BCKV, Kalyani on 17.12.2019. About hundreds farmers and state agriculture officers were participated in the training programme especially from Mrshidabad and Nadia district which is prone to wheat blast.

Advisory for stripe rust management:

Advisory for stripe rust management was issued for northern states as well as for wheat blast in West Bengal. 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 wheat crop health newsletter vol. 25 issues 1-4 issues were published and the information was shared with stakeholders through mail and website.

Preparedness to wheat blast

Survey were conducted in North and South West Bengal near Indo-Bangladesh boarder by team of scientist from ICAR-IIWBR, Karnal, UBKV, Cooch Behar, West Bengal and BCKV, Kalyani, Nadia, West Bengal and no wheat blast was observed. A strategy planning meeting was conducted on 21.10.2019 at Kolkata. Alternate crop plan has been implemented to combat the occurrence of wheat blast like disease in the state of West Bengal. For identification of wheat blast resistant sources, a total of 353 Indian wheat varieties and advance breeding material were screened at Jessore, Bangladesh through CIMMYT during 2018-19. Five resistant varieties identified namely DBW 187, HD 3249 and HD 2967 (irrigated and timely sown) and DBW 252 and HD 3171 (restricted irrigation and timely sown) have been recommended to be grown in disease prone areas of West Bengal. Besides this during the 2019-20, a total 350 advance breeding material and promising wheat lines were screened at Jessore, Bangladesh through CIMMYT. Out of these, 72 lines found free from infection and 66 showed the resistance against wheat blast disease. Awareness was also created in farmers to take all preventive measures available against blast and to grow the resistant varieties identified.

The screening of Indian breeding material and germplasm has been done at different host spot location under the artificial inoculated conditions through CIMMYT. A total 100, 353 and 350 advance breeding lines and germplasm have been sent for screening during 2017, 2018 and 2019, respectively. The results are summarised as below:

Total 100 entries screened against blast during at Jassore, Bangladesh at two different dates of sowing during 2018, at four locations i.e. Jassore, US, Oki and Quirassallis during 2019 and at two locations i.e. Jassore, and Quirassallis at two different dates of sowing during 2020. Out of these, no entries found free from infection across the locations and years while 25 are categories resistant on the basis of average disease upto 10% infection. The details are given as below:

Av. score upto 10% Enteries - 25	BRW 3806, DBW 173, DBW 187, DBW 189, DBW 196, DBW 222, DBW 233, DBW 237, DBW 246, DBW 252, DBW 88, HD 2967, HD 3171, HD 3043, HD 3184, HD 3249, HI 1617, HPBW 01, PBW 677, PBW 800, PBW 801, UP 2950, UP 2981, WB 2 and WH 1105

Total 353 entries screened against blast during at Jashore, Bangladesh at two different dates of sowing during 2019 and at two locations i.e. Jashore, Bangladesh and Quirassallis at two different dates of sowing during 2020. Out of these, across the locations and years, 11 entries found free from infection and 50 are categories resistant on the basis of average disease upto 10% infection. The details are given as below:

Free Entries - 11	DBW 233, DBW187, DBW301, HI1605, HUW838, MP1362, PBW820, UP3036, UP3037, WH1256 and WH1258
Av. score upto 10% Enteries - 49	DBW 168, DBW 189, DBW 196, DBW 222, DBW 246, DBW 252, DBW 277, DBW173, DBW287, DBW298, DBW300, DBW303, DBW88, DPW621-50, HD 3293, HD2967, HD3043, HD3059, HD3171, HD3249, HD3323, HD3330, HD3331, HD3334, HD3344, HI1620(I), HI1633, HI8819, HPBW 01, JKW260, K 1315, K1805, K1809, K1810, KRL429, MACS6736, MP1358, NW 7060, PBW 801, PBW802, PBW815, PBW825, TAW154, UAS3005, UAS3010, UP3042, UP3043, WH1105 and WH1270

Total 350 entries screened against blast during 2020 at Jashore, Bangladesh at two different dates of sowing, 72 entries found free from infection and 66 are categories resistant on the basis of highest score upto 10% infection. The details are given as below:

Free Entries - 70	DBW173, DBW187, DBW222, DBW303, DBW306, DBW308, DBW313, DBW316, DBW317, DBW318, DBW320, DBW325, DBW327, DBW328, DBW329, DBW332, DBW333, DBW88, HD2967, HD3043, HD3171, HD3249, HD3293, HD3334, HD3349, HD3360, HD3363, HD3368, HD3369, HD3377, HI1605, HI1653, HI1654, HS677, HS680, HS681, HUW838, JKW261, JKW270, JKW275, JKW278, K1903, MACS4087, MACS6774, MP1358, MP3526, MP3529, MP3535, NIAW3889,

	NW7094, NWS2176, NWS2180, PBW826, PBW841, PBW848, RAJ4548, UP3057, UP3058, UP3059, UP3061, UP3063, UP3065, VL2041, VL3022, VL3023, WH1105, WH1252, WH1274, WH1276 and WH1281
HS upto 10% Entries - 66	AKDW2997-16, BRW3869, BRW3877, CG1029*, CG1034, DBW110(C), DBW296, DBW311, DBW315, DBW319, DBW331, DDW47(d)(I) (C), GW1355, GW1356, HD3059, HD3331, HD3348, HD3351, HD3354, HD3359, HD3361, HD3366, HD3367, HI 8823(d), HI1637, HI8627(d) (C), HI8805, HPW470, HS675, HUW839, K1907, K1910, MP1361, MP3523, MPO1357(d), NIAW3851, NIAW3855, NIAW3882, NIAW3895, NW7088, NW7096, PBW804, PBW831, PBW834, PBW838, RAJ4546, RAJ4551, RAJ4552, Raj4554, SKW 356, TAW155, UAS3011, UAS3014, UP3054, UP3055, UP3056, UP3060, UP3062, UP3064, VL3024, WH1264, WH1270, WH1271, WH1277, WH1283, WH1284

8.2 Post Harvest Surveys

Very limites samples were collected, wherever possible, due to lockdown in the countery during the harvesting time because of COVID-19.The post harvest grain analysis for presence of Karnal bunt and black point 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. The detail report is given below:

Karnal Bunt (KB)

A total of 2438 grain samples collected from various mandies in different zones and were analyzed at cooperating centers (Table 8.1). This year very limited samples have been collected due to lockdown in the country during the harvesting time because of COVID-19 outspread. The overall 50.5% samples were found infected. The samples from Haryana showed maximum infection (57.8%). In general the Karnal bunt infection was higher in comparision to previous year because of intermittent rains during the booting and grain formation stages.

Table 8.1. Karnal bunt situation in the country during 2019-20 crop season

State	Total samples	Infected samples	Infected samples (%)	Range of grain infection (%)
Haryana	1183	684	57.8	0.05 – 4.4
Rajasthan	405	151	37.7	0.1 – 10.8
Uttarakhand	850	397	46.7	0.1 – 10.0
Total	**2438**	**1232**	**50.5**	**0.1 – 10.8**

Haryana

A total of 1183 samples collected from Haryana and analysed for presence of KB and revealed that 57.8% samples were infected with KB and range of infection was 0.05- 4.4% (Table 8.2). The KB infection was higher in this year coperivive to previous years because of raind at the time of booting.

Table 8.2. Status of Karnal bunt in Haryana during 2019-20 crop season.

Districts	Total samples	Infected samples (%)	Range of infection	Average infection
Hisar	132	54.6	0.05-3.05	0.17
Jind	87	78.2	0.05-3.50	0.56
Fatehabad	73	38.4	0.05-1.25	0.12
Sirsa	104	12.5	0.05-0.55	0.01
Rohtak	105	80.9	0.05-2.3	0.31
Bhiwani	40	37.5	0.05-0.75	0.05
Charkhi Dadri	30	80.0	0.05-4.00	0.73
Mahendergarh	40	75.0	0.05-3.5	0.65

Rewari	40	70.0	0.05-2.5	0.45
Jhajjar	75	28.0	0.05-0.60	0.03
Gurugram	30	50.0	0.05-0.25	0.08
Nuh	57	35.1	0.05-0.55	0.04
Ambala	18	88.9	0.05-0.60	0.12
Yamunanagar	25	96.0	0.05-1.25	0.29
Karnal	71	74.6	0.05-2.45	0.32
Kaithal	31	83.8	0.05-1.00	0.28
Kurukshetra	52	61.5	0.05-0.75	0.12
Panipat	58	96.5	0.05-4.40	0.92
Sonepat	48	43.7	0.05-2.15	0.28
Palwal	27	44.4	0.05-0.30	0.05
Faridabad	40	62.5	0.05-0.60	0.03
Mean	**1183**	**57.8**	**0.05-4.40**	**0.27**

(R. S. Beniwal)

Rajasthan

A total of 405 wheat grains samples were collected from fourteen different grain mandies of Rajasthan to know the status of Karnal bunt and black point diseases during Rabi, 2019-20. The samples were brought into the laboratory and examined for the incidence of Karnal bunt and black point. The data revealed that 151 samples (37.7%) were found infected with Karnal bunt with infection range 0.1-10.8 percent being maximum found in a sample collected from Chaksu mandi (Table 8.3). The highest KB infected samples were found in Bansur mandi (96.6%) followed by Khertal (67.6%), Alwar (45.0%), Lalsot (41.9%), Kotputli (40.9%), Dausa (37.04%), Tonk (37.04%), Bandikui (28.6%), Bassi (28.0%), Mandawari (26.1%), Chomu (25.0%), Chaksu (23.5%), Mahua (20.0%) and Tonk (5.3%). However, Maximum KB infected samples (77.5%) were falling in the range of 0.1-1.0 percent disease incidence, whereas, 19.9 per cent samples were in the range of 1.1-5.0. and only 2.6 per cent samples were showing >5 per cent KB incidence. Alwar, Bansur, Khertal , Kotputli and Lalsot may be considered as KB prone areas.

Table 8.3: Status of Karnal bunt during Rabi, 2019-20 in Rajasthan

S. No.	Location	Total samples	Infected samples (%)	Range of incidence (%)	Number of samples showing different level of Karnal bunt per cent incidence				
					0	0.1-1.0	1.1-5.0	5.1-10	>10
1	Alwar	20	45.0	0.1 - 2.0	11	07	02	0	0
2	Bansur	29	96.55	0.1 - 4.8	01	20	08	0	0
3	Kherthal	37	67.57	0.1 - 2.8	12	21	04	0	0
4	Dausa	27	37.04	0.2 - 1.3	17	09	01	0	0
5	Bandikui	49	28.57	0.1 - 2.1	35	11	03	0	0
6	Lalsot	31	41.94	0.1 - 1.5	18	12	01	0	0
7	Mahua	35	20.0	0.1 - 0.3	28	07	0	0	0
8	Mandawari	23	26.09	0.2 - 2.1	17	05	01	0	0
9	Bassi	25	28.00	0.1 - 8.6	17	06	01	01	0
10	Chaksu	34	23.53	01 - 10.8	26	04	02	01	01
11	Chomu	08	25.00	0.8 - 1.8	06	01	01	0	0
12	Kotputli	22	40.91	0.2 - 4.3	13	05	04	0	0
13	Tonk	27	37.04	0.1 - 2.6	17	08	02	0	0
14	Deoli	38	5.26	0.8 - 5.8	36	01	0	01	0
Grand Total		**405**	**37.7**	**0.1 -10.8**	**254**	**117**	**30**	**03**	**01**
Per cent					**62.72**	**28.89**	**7.41**	**0.74**	**0.25**

(Pradeep S. Shekhawat)

Uttarakhand

A total 850 wheat samples were analyzed, out of which 397 samples had Karnal bunt infection (Table 8.4). These samples were collected from the seed growers of four districts of Uttarakhand namely, Udham Singh Nagar, Nainital, Dehradun and Haridwar. Based on the above data this year in Uttarakhand the KB incidence is high as compared to last year.

Table 8.4: Status of Karnal bunt during Rabi, 2019-20 in Uttarakhand

Districts	Total samples	No. of infected samples	Infected Samples (%)	No. of samples in different range of infection			
				Below 0.25%	0.26-1%	1.1-5%	5.1-10%
1.Udham Singh Nagar							
a) Pantnagar	505	183	36.23	179	3	0	1
b) Kashipur	10	08	80.00	08	0	0	0
c) Bajpur	13	04	30.76	04	0	0	0
d) Khatima	117	53	45.29	53	0	0	0
2. Dehradun	44	38	86.36	38	0	0	0
3. Haridwar	46	35	76.08	35	0	0	0
4. Nainital (Kotabagh)	115	76	66.08	76	0	0	0
Total	**850**	**397**	**46.70**	**393**	**03**	**0**	**01**

(Deepshikha)

Black Point (BP)

Rajasthan

A total of 405 wheat grains samples were collected from fourteen different grain mandies of Rajasthan to know the status of Karnal bunt and black point diseases during Rabi, 2019-20. Black-point was observed in 66.2 per cent samples in the range of 0.1-1.6 per cent incidence (Table 8.5).

Table 8.5: Status of black point during Rabi, 2019-20 in Rajasthan

S. No.	Location	Total samples	Number of BP infected samples	Per cent infected samples	Range of incidence (%)
1	Alwar	20	18	90.0	0.1 - 0.9
2	Bansur	29	21	72.41	0.2 - 1.5
3	Khertal	37	18	48.6	0.1 - 0.7
4	Dausa	27	08	29.63	0.2 - 0.7
5	Bandikui	49	27	55.10	0.1 - 1.2
6	Lalsot	31	16	51.61	0.1 - 1.3
7	Mahua	35	29	82.86	0.1 - 0.7
8	Mandawari	23	19	82.61	0.3 - 1.4
9	Bassi	25	13	52.0	0.2 - 1.0
10	Chaksu	38	30	78.95	0.2 - 1.6
11	Chomu	08	06	75.0	0.2 - 0.6
12	Kotputli	22	15	68.18	0.1 - 0.7
13	Tonk	27	25	92.59	0.1 - 1.2
14	Deoli	34	23	67.6	0.1 - 1.3
	Total	**405**	**268**	**66.2**	**0.1 - 1.6**

(Pradeep S. Shekhawat)

8.3 Pathotype distribution of rust pathogens in India and Nepal during 2019-20

All the rusts of wheat and barley were observed in India and Nepal during 2019-20. Barring the widespread occurrence of stripe rust in few of the wheat growing areas of northern India, there was no noticeable occurrence of rusts of wheat and barley in other parts of India. A total of 897 samples of three rusts of wheat and barley have been pathotyped so far from India and Nepal during the year.

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

During the year 305 samples of wheat stripe rust were analyzed from seven states of India and Nepal on the sets of differentials. The Indian population of *P. striiformis* is avirulent on *Yr5*, *Yr10*, *Yr15*, and *YrSp*. Pathotype 238S119 was the most predominant among the seven pathotypes occurring on wheat and was observed in 44.06% samples. This pathotype is virulent on *Yr2*, *Yr3*, *Yr4*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr18*, *Yr19*, *Yr21*, *Yr22*, *Yr23*, *Yr25*, *YrA* and Riebesel 47/51. The population of 46S119 has declined to 33.2% followed by 110S119 in 18.98% of the samples. Among these pathotype 238S119 is most virulent as it has additional virulence for Suwon x Omar92 and Riebesel when compared with pt. 46S119. Other pathotypes 14S64, 6S0, 7S0 and 47S103(T) have occurred in 0.3% to 1.2% samples each (Table 8.6). In stripe rust of barley (*P. striiformis herdei*), 10 samples were analyzed from Himachal Pradesh, Rajasthan and Nepal. Pathotypes 0S0 (57) and 4S0 (G) were most predominant whereas 1S0 (M) was recorded in one sample only (Table 1).

Table 8.6: Pathotype distribution of stripe rust (*Puccinia striiformis*) pathotypes on wheat and barley in India and Nepal during 2019-20

S. No.	State/country	Analyzed samples	Pathotypes observed									
			238S119	110S119	46S119	14S64	6S0	7S0	47S103 (T)	1S0 (M)	0S0 (57)	4S0 (G)
1.	Himachal Pradesh	163	71	20	57	02	01	04	-	01	03	04
2.	Punjab	114	48	28	38	-	-	-	-	-	-	-
3.	Haryana	09	06	01	02	-	-	-	-	-	-	-
4.	Rajasthan	09	03	04	01	-	-	-	-	-	01	-
5.	Uttar Pradesh	01	-	01	-	-	-	-	-	-	-	-
6.	Uttarakhand	01	01	-	-	-	-	-	-	-	-	-
7.	Delhi	02	01	01	-	-	-	-	-	-	-	-
8.	Nepal	06	-	01	-	-	-	-	04	-	01	-
Total		305	130	56	98	02	01	04	04	01	05	04

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

In general, wheat stem rust occurred in Peninsular and Central India. Seven pathotypes were identified in 127 samples of stem rust pathotyped from six states (Tamil Nadu, Karnataka, Maharashtra, Gujarat, Madhya Pradesh and Uttarakhand) and Nepal. Pathotype 11 (79G31), virulent on *Sr2, Sr5, Sr6, Sr7b Sr9a, Sr9b, Sr9c, Sr9d, Sr9f, Sr9g, Sr10, Sr13, Sr14, Sr15, Sr16, Sr17, Sr18, Sr19, Sr20, Sr21, Sr28, Sr29, Sr30, Sr34, Sr36, Sr38, SrMcN* was most predominant and was recorded in 88.2% of the samples analyzed. Other six pathotypes were identified in few samples only. While pathotype 62G29(40A) occurred in 4.7%, pt. 58G15-3(40-2) was observed in 3.9% of the samples. Remaining 4 pathotypes were detected in 0.78% samples each (Table 8.7).

Table 8.7: Pathotype distribution of stem rust (*Puccinia graminis* f. sp. *tritici*) in India and Nepal during 2019-20

S. No.	States/ Countries	Number of isolates analyzed	Pathotypes observed						
			11 (79G31)	**11A** (203G15)	**15-1** (123G15)	**40A** (62G29)	**40-2** (58G13-3)	**42** (19G35)	**122** (7G11)
1	Gujarat	14	14	-	-	-	-	-	-
2	Karnataka	28	25	01	-	-	01	01	-
3	Madhya Pradesh	59	56	-	-	-	03	-	-
4	Maharashtra	17	16	-	01	-	-	-	-
5	Tamil Nadu	07	-	-	-	06	01	-	-
6	Uttarakhand	00	-	-	-	-	-	-	-
7	Nepal	02	01	-	-	-	-	-	01
Total		**127**	**112**	**01**	**01**	**06**	**05**	**01**	**01**

Brown rust of wheat (*Puccinia triticina*)

A total of 465 samples of wheat leaf rust were pathotyped during 2019-20 from 14 states of India and Nepal. Twenty three pathotype of *Puccinia triticina* were observed in varying frequencies. Indian population of *P. triticina* was avirulent on *Lr24, Lr25, Lr29, Lr32, Lr39 Lr45* and *Lr47*. Pathotype 77-9 (121R60-1) virulent on *Lr1, Lr3, Lr10, Lr11, Lr12, Lr13, Lr14a, Lr14b, Lr14ab, Lr15, Lr16, Lr17a, Lr17b, Lr18, Lr20, Lr21, Lr22a, Lr22b, Lr23, Lr26, Lr27+31, Lr30, Lr33, Lr34, Lr35, Lr36, Lr37, Lr38, Lr40, Lr44, Lr46, Lr48, Lr49, Lr67* , followed by 77-5 (121R63-1) were the most widely distributes pathotypes and were found to occur in 14 and 11 states of India, respectively and Nepal. Pathotype 77-9 was identified in 50.3% of pathotyped samples followed by 77-5(28.2%), 77-1(109R63) in 7.1% and 104-2(21R55) in 3.2% samples. Remaining 19 pathotype were each detected in less than 1% of the analyzed samples (Table 8.8). In Nepal, 10 pathotype were identified in 20 samples. Pathotype 77-9 and 77-5 were most frequent followed by 77-1. The remaining pathotype were observed in one sample each (Table 8.8).

Table 8.8 Pathotype distribution of leaf rust (*Puccinia triticina*) in India and Nepal during 2019-20

S. No	State/ Country	No. of isolates Analyzed	Pathotypes observed																						
			10-1	12-1(5R37)	12-3 (49R37)	12-4 (69R13)	12-5 (29R45)	12-8 (49R45)	20(5R27)	77-1 (109R63)	77-2 (109R31-1)	77-5 (121R63-1)	77-6 (121R55-1)	77-9 (121R60-1)	77-9+Raj1555	77-11	104-1 (21R31-1)	104-2 (21R55)	104A (21R31)	107-1	162 (93R7)	162-1(93R47)	162-2 (93R39)	162-5	1R31
1	Himachal Pradesh	15										2	1	3				8			1				
2	Jammu & Kashmir	3										1		2											
3	Punjab	23								1		2		19	1										
4	Uttar Pradesh	6										2		4											
5	Uttarakhand	14				1				1		6		5					1						
6	Madhya Pradesh	47					3			1		17		19				2	1			2	2		
7	Chhatisgarh	8								1				6					1						
8	Bihar	8										1		7											
9	West Bengal	31			1	1						5		21	3										
10	Assam	1												1											
11	Gujarat	12										5		6				1							
12	Maharashtra	62								1		11		47				1		2					
13	Karnataka	87		2			1	1		9		12		53		5		2						2	
14	Tamil Nadu	128			1			4	1	16		62	1	36			1				1				5
Other country																									
1	Nepal	20	1	1			1	1		3	1	5		5			1	1							
Total		465	1	3	2	2	5	6	1	33	1	131	2	234	4	5	2	15	3	2	2	2	2	2	5

8.4 52nd Wheat Disease Monitoring Nursery (WDMN) 2019-20

Wheat disease monitoring nursery (earlier trap plot nursery/TPN) is a logistic effective tool for monitoring the occurrence of wheat diseases especially rusts across different wheat growing zones of India. In addition, it helps in knowing the seasonal progress of the diseases in all the zones. Samples analyzed from WDMN gives an overview of area wise natural distribution and load of different rust races. The nursery also helps in understanding the area wise progress of wheat diseases and the performance of different disease resistance genes. The 52nd wheat disease monitoring nursery was conducted at 37 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 8.9).

Table 8.9: List of co-operators and locations where WDMN was planted during 2019-20

State	Co-operators	Location
Northern Hills and High-Altitude Zone		
Himachal Pradesh	R. Devlash Head, ICAR-IIWBR, RS, Shimla Bipan Sharma Dharam Pal Hanif Khan	Bajaura Flowerdale, Shimla CSKHPKV, RSS, Akrot IARI, RS, Tutikandi, Shimla IIWBR, RS, Dalang Maidan
Uttarakhand	K.K. Mishra	Hawalbagh (Almora)
Jammu & Kashmir	F. A. Mohiddin and Nazir Ahmad Bhat	Khudwani
North Western Plains Zone		
Jammu & Kashmir	M.K. Pandey M. K. Pandey and Vishal Mahajan	Udhaywalla (Jammu) Kathua
Haryana	Rajender Singh Beniwal	Hisar
Himachal Pradesh	Akhilesh Singh	Dhaulakuan
Rajasthan	P.S. Shekhawat	Bassi (Jaipur)
Punjab	Jaspal Kaur	Abohar Gurdaspur Langroya Ludhiana Ropar
Uttarakhand	Deepshikha and Kanak Srivastava	Pantnagar
North Eastern Plains Zone		
Bihar	C. S. Azad	Sabour
Jharkhand	H.C. Lal	Kanke, Ranchi
Uttar Pradesh	J.B. Khan and C. Kanchan Shyam Saran Vaish	Araul (Kanpur) B.H.U. Varanasi
Central Zone		
Chhattisgarh	S.K. Jain	Baronda, Raipur
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	Sudhir Navathe B.C. Game, B.M. Ilhe, P.P. Khandagale Swati G Bharad and B. D. Gite	A.R.S. Baner, (Pune) ARS, Niphad Akola
Karnataka	Gurudatt M. Hegde and S. V. Kulkarni	Ugar Khurd (Dharwad)
Tamil Nadu	C. Manjunatha	Wellington

There were 20 (21 for High Altitude Zone and North Hills Zone) entries in the nursery during 2019-20. 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 2019-20 crop season was as given below:

Common set of varieties for all zones

PBW752, HD2329, Agra Local, HD2160, Lal Bahadur, WL1562, HW2021 (*Lr24*/*Sr26*), HD2204, C 306, WH147, HW2008 (*Lr24*/*Sr26*), Kharchia Mutant, HP1633, DL 784-3, RNB1001

Zone specific varieties

i) North Western Plains Zone
WH1105, HD3086, HD3226, DPBW621-50 and PBW757

ii) North Eastern Plains Zone
K 8804, HD2888, DBW187, HUW468 and NW1014

iii) Central Zone
HI8663, HI1544, LOK-1, GW366 and GW 322

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 up to 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 inoculated fields. The disease situation was monitored at regular intervals and the rust disease samples from these nurseries were analyzed at ICAR-IIWBR, RS, Flowerdale, Shimla.

Disease incidence in WDMN

Information on wheat disease situation was received from Dhaulakuan, Bajaura, Akrot, Dalang Maidan, Tutikandi & Flowerdale (Shimla) in Himachal Pradesh, Udhaywalla (Jammu), Kathua & Khudwani in Jammu & Kashmir, Pantnagar & Almora in Uttarakhand, Abohar, Gurdaspur, Langroya, Ludhiana & Ropar in Punjab, Hisar (Haryana), Sabour (Bihar), Ranchi (Jharkhand), Kanpur and Varanasi in Uttar Pradesh, Vijapur & Junagadh in Gujarat, Indore & Powarkheda in Madhya Pradesh, Raipur (Chattisgarh), Jaipur (Rajasthan), Pune, Niphad & Akola in Maharashtra, Dharwad (Karnataka) and Wellington (Tamil Nadu). 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 IIWBR, RS, Shimla. It was not reported from any other zones including NEPZ and SHZ. More than 60S severity of yellow rust was reported from all the locations of NHZ and NWPZ except Tutikandi and Abohar where maximum yellow rust severity was 40S on Agra local, Lal Bahadur & WH117 (Tutukandi) and Lal Bahadur (Abohar). At least nine entries of WDMN had more than 40S severity at Almora, Bajaura, Akrot, Dalang Maidan, Khudwani, Dhaulakuan, Ropar, Gurdaspur, Langroya, Ludhiana and Pantnagar. Agra Local, Kharchia Mutant and WH147 had 100S yellow rust severity at Hisar.

Brown rust was reported from ten locations of NHZ and NWPZ *viz*. Almora and Pantnagar in Uttarakhand, Akrot and Flowerdale in Himachal Pradesh, Kathua and Jammu (Jammu), Hisar (Haryana), Langroya, Ludhiana and Abohar in Punjab. It was reported from all the locations of NEPZ except Ranchi. In central zone brown rust appeared at Raipur, Vijapur, Indore and Powerkheda and in PZ and SHZ at Dharwad, Niphad and Pune and Wellington. At Indore (CA) brown rust appeared only on Agra Local, Lal Bahadur and C-306 and other entries were brown rust free

Of the 32 locations of WDMNs, black rust was observed only at Gurdaspur in NWPZ, Powerkheda in CZ, Pune, Niphad and Dharwad in PZ and Wellington in SHZ. All the entries of WDMN were black

rust free in NHZ and NEPZ. Leaf blight was reported from WDMNs planted at Almora, Kathua, Jammu (Udhaywalla), Sabaur, Ranchi, Kanpur, Varanasi, Raipur and Niphad. Powdery mildew was observed only at Almora, Akrot, Kathua, Jammu and Dhaulakuan. Wheat loose smut was reported only from Sabour.

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 (20.01.20) followed by Kathua (22.01.20), Almora (28.01.20), Bassi (Jaipur) (05.02.20), Dhaulakuan (20.02.20), Hisar (04.03.20) and Bajaura (12.03.20). Brown rust was first observed at Wellington (28.12.19) followed by Dharwad (15.01.20), Kathua and Jammu (08.02.20), Powerkheda (13.02.20), Vijapur (17.02.20), Pune (20.02.20), Varanasi (26.02.20), Raipur (28.02.20) and Kanpur (02.03.20). Black rust was first observed at Wellington (12.01.20) followed by Dharwad (15.01.20), Pune (11.02.20) and Niphad (20.02.20).

Varietal Performance against wheat rusts

High Altitude and Northern Hills Zone

Maximum severity of yellow rust was observed at Bajaura, where eighteen entries of WDMN were showing more than 30S severity of yellow rust. However, PBW752, C306, and Barley local were yellow rust free at Bajaura. Flowerdale (Shimla) was the only center in NHZ where yellow rust was not observed on WDMN entries, though this nursery was planted during offseason. WDMN entries PBW752, C306, and Barley local were yellow rust free at Almora, Bajaura and Akrot. PBW752 was yellow rust free at all the locations of NHZ, except at Dalang Maidan during off season, and Khudwani. WDMN entries Lal Bahadur and Agra local were highly susceptible and had more than 40S yellow rust severity at all the locations of NHZ except at Flowerdale. More than 40S yellow rust severity was observed on HW2008 at all the locations of NHZ except Flowerdale and Tutikandi, Shimla. Brown rust appeared at Almora, Akrot and Flowerdale. Only two WDMN entries *viz.* PBW752 (5S) and HD2204 (5S) had brown rust infection at Almora; whereas, at Akrot six entries *viz.* HD2329 (20MS), Agra Local (20S), HD2160 (10MS), Lal Bahadur (60S), WH147 (10S) and Sonalika (20S), were showing brown rust infection.

North Western Plain Zone

Yellow rust severity was very high at Langroya, Ludhiana and Ropar in NWPZ, where at least seventeen entries had more than 40S severity of yellow rust. Similarly, fifteen entries at Dhaulakuan and Gurdaspur, thirteen entries at Bassi (Jaipur) and ten entries at Pantnagar had more than 40S yellow rust severity. WDMN entry PBW752 was yellow rust free at all the locations of NWPZ except Jammu, Hisar, Dhaulakuan, and Pantnagar, where 5S, 5S, 40S and 90S yellow rust severity, respectively, was reported on it. Similarly, PBW757 was yellow rust free at Kathua, Jammu, Hisar, Ludhiana, Abohar and Pantnagar. 100 S severity of yellow rust was observed on Agra Local, Kharchia Mutant and WH147 at Hisar. More than 40S severity of yellow rust was recorded on WH147, Agra Local and Kharchia Mutant at all the locations of NWPZ except Abohar.

Brown rust appeared at all the locations of NWPZ except Dhaulakuan, Bassi (Jaipur), Ropar and Gurdaspur. Highest brown rust severity in NWPZ was recorded on PBW757 (100S) at Pantnagar, which was brown rust free at all the locations of NWPZ except Jammu and Pantnagar. Brown rust appeared on HP1633 only at Jammu (5S) and Hisar (20S). Similarly, WDMN entries DL784-3, HW2021 and HW2008 were brown rust free at all the locations of NWPZ except at Hisar, where brown rust severity on these entries was TS, 60S and 20S, respectively. Brown rust on RNB1001 was reported only from Kathua (10S) and Jammu (10S).

Black rust was reported only from Gurdaspur in NWPZ, where three entries *viz.* Lal Bahadur (20S), WH1105 (10S) and HD3086 (10S) were infected with black rust.

North Eastern Plain Zone

Yellow rust was not observed on any of the entries of WDMN planted at NEPZ. Brown rust appeared at all the locations of NEPZ except Ranchi. At Kanpur it was reported only on entries PBW752 (20S), Agra Local (60S), Lal Bahadur (40S), WH147 (60S), K8804 (60S), HD2888 (20S) and HUW468 (40S). Kharchia Mutant (20S) was the only WDMN entry showing brown rust infection at Varanasi. Nine WDMN entries (WL1562, HW2021, HW2008, HP1633, DL784-3, RNB1001, HP1102, K8804 and 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 Junagarh (Gujarat). At Indore Agra Local (20S), Lal Bahadur (40S) and C306 (10S) were the only entries showing brown rust infection. Similarly, at Vijapur only Agra Local (TR), Lal Bahadur (TR) and Kharchia Mutant (TR) were infected with brown rust. At Powerkheda eight entries *viz.* Agra Local (10S), HD2160 (TR), Lal Bahadur (5MS), C306 (20S), WH147 (10S), DL 784-3 (TR), LOK-1 (10S) and GW 322 (TR) were infected with brown rust. Black rust was observed only at Powerkheda in central zone, where it was detected on Agra Local (40S), HD2160 (TR), Lal Bahadur (20S), C306 (20S), WH147 (40S), DL784-3 (TR), LOK-1 (20S) and GW 322 (20S). Other entries were black rust free.

Peninsular Zone and Southern Hill Zone

Yellow rust did not appear on any of the locations in these zones. Brown rust appeared at all the locations of PZ and SHZ except Akola. WDMN planted at Akola was free from all three rusts. At Dharwad brown rust appeared on all the WDMN entries except Kharchia Mutant, HD2501, HW2022 (*Sr24*/*Lr24*). Maximum brown rust severity was observed at Pune with thirteen entries showing more than 20S severity of brown rust. Brown rust severity of 80S was observed on PBW752, HD2329 and Agra Local at Pune and Wellington. Similarly, 100S brown rust severity was detected on Lal Bahadur at Wellington and Pune. WDMN entries HW2021, HW2008 and DL784-3 were brown rust free at all the locations except Dharwad where 10S, 5S and 10MS severity of brown rust was observed on these entries, respectively. Black rust was reported at all the locations of PZ and SHZ except Akola. It was observed only on Kharchia Mutant (30S) at Pune and other entries were black rust free. Similarly, PBW752 (5S) and HD2329 (10S) were the only WDMN entries showing black rust infection at Niphad. Black rust was observed on ten entries at Dharwad with just two entries i.e. Lal Bahadur (20S) and Kharchia Mutant (60S) showing more than 20S severity of black rust. At Wellington eleven entries were infected with black rust with nine entries (PBW752, HD2329, Agra Local, Lal Bahadur, C306, WH147, Kharchia Mutant, HP1633 and Bijaga Yellow) showing more than 20S severity.

Other diseases

Blights

Information on foliar blights was received from nine locations. Earliest record of blight was from Ranchi (06.01.20) followed by Almora (10.01.20), Kathua (25.02.19), Jammu and Varanasi (28.02.20), and Raipur (08.03.20). Leaf blight was reported only from Almora in the Northern hills zone, where up to 23 disease score was reported on WDMN entry Agra Local. Kathua and Jammu were the only locations in the 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 WDMN entries in NEPZ except Agra local, HW2021, WH174, HP1633 and NW1014 at Kanpur, were infected with leaf blight disease. Maximum severity of leaf blight (Up to 78) was recorded at Varanasi followed by Sabour, Ranchi and Kanpur. All WDMN entries except PBW752, C306 and Kharchia Mutant had more than 46 leaf blight score at Varanasi. In central zone leaf blight was reported only from Raipur, where blight score was recorded up to 12 on fifteen WDMN entries. In PZ and SHZ blight was reported only from Niphad, where eight entries (PBW752, HD2329, Agra Local, Lal Bahadur, WH147, HP1633, Bijaga Yellow and HW2022) had leaf blight score ranging between 01 to 24.

Powdery mildew

Powdery mildew was reported only from five locations *viz*. Almora, Akrot, Kathua, Jammu and Dhaulakuan. It was first detected at Almora on 10.01.20 followed by Dhaulakuan (17.02.20), Kathua (25.02.20) and Jammu (28.02.20). All the entries of WDMN were showing powdery mildew symptoms at Akrot and Dhaulakuan. Maximum powdery mildew severity was recorded at Akrot where all the WDMN entries except C306 and Barley local had disease 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.

Loose smut

Loose smut was detected in traces on PBW751 at Sabour on 24th February, 2020. Other entries were loose smut free at all the location.

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PROGRAMME 9. INTEGRATED PEST MANGEMENT IN WHEAT

9.1 HOST RESISTANCE AGAINST DISEASES

I. Elite Plant Pathological Screening Nursery (EPPSN), 2019-20

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: 58
Diseases: Stripe, Leaf and Stem rusts
Centres:
North: Karnal, Ludhiana, New Delhi, Pantnagar, Hisar, Durgapura, Almora, Jammu, Malan (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 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 three rusts: NIDW1158(d), HI8811(d), HI8812(d), GW1348(d), PBW822, DDW 48(d), DDW 47(d)*, HI8808(d), HI8807(d), PBW823, NIDW1149(d), HI8802(d)*, WH1270, PWB 825, VL 3020, VL 3021, PBW 796, PBW 820

Resistant to stem and leaf rusts: HPW 467, PBW 771, HD 3249, DBW 303, DBW 302, PBW 550, HI 1628, DBW 277, CG 1029, HI 1633, HI 1634, GW 509, GW 1346, MACS 5052, DDK 1056, DDK 1057, DBW 304,

Resistant to leaf and stripe rusts: PBW 752, UP 3043,

Resistant to stem and stripe rusts: PBW 821, HI 8805(d), WHD 963(d)

Table 9.1: Entries tested in Elite Plant Pathological Screening Nursery, 2019-20

S. No.	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
A. Resistant to all three rusts									
Source: AVTs Year 2018-19									
1	HPW467	3.2	10MS	2.1	10MS	0.1	TR	12.1	40S
2	PBW820	10.8	40S	0.1	TMR	0.1	TR	5.9	20S
3	PBW821	6.6	20MS	7.1	20S	11.1	40S	6.2	20S
4	PBW771	2.5	5MS	0.2	TMR	8.0	30S	13.2	40S
5	HD3249*#	1.6	5MS	2.1	5MS	2.0	10MS	13.2	40S
6	HD3277	20.8	60S	2.6	10S	8.3	20S	14.6	40S
7	NIDW1158(d)	5.5	20MR	10.1	40S	7.8	20S	3.1	20S
8	HI8811(d)	4.7	10MS	2.1	10MS	2.8	5S	7.1	40S
9	HI8812(d)	4.4	10MS	0.1	TMR	8.0	15S	6.2	40S
10	GW1348(d)	3.8	10S	4.1	20MS	6.3	15S	9.8	40S

11	PBW822	3.5	10MS	2.6	10S	2.8	5S	3.8	10S
12	DDW 48(d)	7.0	20S	5.3	10S	10.0	20S	8.3	40S
13	DDW 47(d)*	1.0	5MS	3.0	10MS	3.5	5S	5	15S
14	HI8808(d)	4.4	10MS	0.1	TR	0.3	TS	7.6	40S
15	HI8807(d)	2.2	10MS	0.3	TMS	7.6	20S	4.9	20MS
16	PBW823	2.4	10MS	0.1	TR	7.6	20S	4.3	20S
17	HI8805(d)*	3.3	10MS	1.9	5S	13.4	40S	3.6	20S
18	NIDW1149(d)	3.8	10MS	1.1	10MR	3.0	5S	2.9	10S
19	HI8802(d)*	3.8	10S	0.1	TR	9.7	30S	5.7	40S
20	WH1270	4.0	10S	3.1	10S	6.3	20S	8.3	40S
20A	Infector	66.0	100S	60.0	100S	82.5	100S	71.1	100S
21	DBW303	5.2	20MS	2.1	10MS	7.6	10S	11.4	40S
22	DBW302	1.6	10MS	0.3	TS	4.8	10S	15.9	60S
B. Resistant to stem and leaf rusts									
Source: AVTs Year 2018-19									
23	NW 7049	14.2	40S	2.6	10MS	4.3	10S	18.7	60S
24	PBW752(I) (C)	24.9	80S	5.1	10S	2.6	10S	2.9	10S
25	PBW781	24.0	80S	4.2	10MS	12.0	40S	2.2	10S
26	DBW187(I)(C)	7.2	20S	2.1	10MS	6.8	20S	6.7	40S
27	WH1239	35.2	60S	6.1	20S	11.3	30S	24.6	60S
28	WHD963(d)	6.4	10S	4.1	10MS	15.3	50S	9.7	40S
29	DBW301	20.0	40S	11.1	30S	16.3	30S	4.9	40S
30	UP3043	20.0	40S	0.2	TMR	6.0	10S	9.7	40S
31	UP3042	20.0	60S	0.1	TR	2.0	5S	15.2	40S
32	WH1223	14.9	40S	3.8	10MS	6.8	20MS	14.3	60S
33	NW7060	22.0	60S	1.1	10MR	5.0	15S	12.9	40S
34	HD3271	14.1	20S	7.7	30S	3.5	30S	11.6	60S
35	PBW797	30.0	80S	3.1	10S	2.3	10S	10.5	40S
C. Resistant to leaf and stripe rusts									
Source: AVTs Year 2018-19									
36	PBW550	3.6	10MS	1.1	5MS	4.5	10S	33.9	60S
37	HI1628*	8.0	10MS	7.0	10S	8.8	30S	18.5	60S
38	NIAW3170*	14.4	40S	5.1	20S	4.8	20S	25.6	60S
39	DBW277	10.0	20S	9.5	30S	5.3	30S	35.2	60S
40	CG1029	7.2	20MS	2.6	10MS	3.8	10S	48.6	80S
40A	Infector	70.0	100S	80.0	100S	57.5	100S	74.4	100S
41	HI1633	1.0	5MS	1.1	5MS	0.1	5MS	35.7	60S
42	HI1634	0.2	5R	0.1	TR	1.0	5MS	35.4	60S
43	GW509	2.3	10MS	2.6	10S	0.0	10S	27.9	60S
44	GW1346(d)*	0.7	5MR	0.1	TMR	2.5	10S	20	60S
45	MACS4058(d)*	13.6	40S	1.1	10MR	0.5	10MR	20	60S
46	MACS5052	1.8	10MS	0.1	TR	4.8	10S	21.7	40S
47	DDK1056	0.8	5MS	0.1	TR	1.8	5S	23.2	40S
48	MACS5053	0.0	TR	0.1	TR	10.5	30S	25.6	40S
49	DDK1057	0.0	TR	2.1	10MS	0.5	10MS	29.6	60S
50	DBW304	5.2	20MS	3.0	10MS	3.8	10S	11.6	40S
51	PBW825	0.3	5R	2.1	10MS	8.8	20S	8.6	20S
D. Resistant to stem and stripe rusts									
Source: AVTs Year 2018-19									
52	VL3020	0.3	5R	0.1	TR	1.3	5S	6.7	40S
53	VL3021	2.4	5MS	2.6	10S	1.3	10S	6.3	20S
54	HD3226(I) (C)	4.5	10S	12.6	40S	9.8	40S	10.3	40S

55	PBW796	6.9	20MS	9.8	30S	6.3	30S	9.6	60S
56	HD3317	0.4	10R	15.0	40S	2.5	40S	17.6	60S
57	WH1254	4.4	10S	0.1	TR	8.8	30S	11.9	40S
58	HI 1621	16.0	20S	20.0	40S	7.5	40S	9.9	40S
58A	Infector	70.0	100S	80.0	100S	82.5	100S	74.4	100S

COOPERATORS:

NAME	CENTRE	RUSTS
JASPAL KAUR, RITU BALA	LUDHIANA	STRIPE
R.S. BENIWAL	HISAR	LEAF
DEEPSHIKHA	PANTNAGAR	STRIPE AND LEAF
P.S. SHEKHAWAT	DURGAPURA	STRIPE AND LEAF
GURUDATT M. HEGDE	DHARWAD	STEM AND LEAF
T.L. PRAKASHA	INDORE	STEM AND LEAF
R. R. PERANE, S.G. SAWASHE, M. A. GUD	MAHABALESHWAR	STEM AND LEAF
V.K. SINGH	NEW DELHI	LEAF
K K MISHRA	ALMORA	STRIPE
M.K. PANDEY	JAMMU	STRIPE
B. M. ILHE, B.C. GAME	NIPHAD	STEM AND LEAF
SACHIN UPMANYU	MALAN	STRIPE
P. NALLATHAMBI	WELLINGTON	STEM AND LEAF
SUDHEER KUMAR, PREM LAL KASHYAP AND RAVINDER KUMAR	KARNAL (CO-ORDINATING UNIT)	STRIPE AND LEAF

II. Multiple Disease Screening Nursery, 2019-20

Thirty four 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. Centers for stem rust: Mahabaleshwar, Indore, Dharwar, Niphad and Wellington; for stripe rust: Ludhiana, Pantnagar, Hisar, Dhaulakaun, Mallan, Almora and Karnal; for leaf rust (N): Delhi, Ludhiana, Hisar and Karnal; for leaf rust (S): Mahabaleshwar, Indore, Dharwar, Niphad and Wellington; for Karnal bunt: Delhi, Dhaulakaun, Pantnagar, and Ludhiana; for leaf blight: Faizabad, Varanasi, Coochbehar, Sabour, Hisar, and Kalyani; for Head scab: Delhi, Dhaulakuan, Gurdaspur; for flag smut: Hisar, Ludhiana and Durgapura; for powdery mildew: Dhaulakaun, Malan, Jammu, Pantnagar, and Mallan; and for cereal cyst nematode: Durgapura, Hisar and Ludhiana. The head scab data from Gurdaspur not received due to COVID-19, and leaf blight data of Varansi was not considered due to erratic disease. Based on the rusts 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:

A. Resistant to stem, leaf and stripe rusts +
Resistant to all three + KB+PM+FS+FHB: HS660, GW 1339, HI 8800 (d), PBW 757, DWB 187, DBW 237
Resistant to all three rusts +LB+ KB+FS+FHB: PBW 800, PBW 763
Resistant to all three rusts +PM+FS+FHB: HS 661

B. Resistant to Stem and Leaf rust +
Resistant to Stem and Leaf rust + KB+PM+FS+FHB: GW 1346 (d), GW 492, HPW 459, MACS4059 (d), MACS 5051, GW 491, HPW 451
Resistant to Stem and Leaf rust: +LB+ KB+PM+FS+FHB: NIAW 3171, UP 3016, HI1628

Resistant to Stem and Leaf rust + LB+ KB+FS+FHB: DDK 1054
Resistant to Stem and Leaf rust + KB+FS+FHB: AKW4924, HI 1624

C. Resistant to leaf and stripe rust +
Resistant to leaf and stripe rust +KB+FS+ HB: PBW 797, PBW 801
Resistant to leaf and stripe rust +KB+PM+FS+FHB: MPO 1336

COOPERATORS

CENTERS	**COOPERATORS**
LUDHIANA	JASPAL KAUR, RITU BALA
GURDASPUR	JASPAL KAUR
ALMORA	K. K. MISHRA
HISAR	R.S. BENIWAL
DHAULAKUAN	AKHILESH SINGH
PANTNAGAR	DEEPSHIKHA
INDORE	T.L. PRAKASHA
MAHABALESHWAR	R. R. PERANE, S.G. SAWASHE, M. A. GUD
COOCHBEHAR	S. HEMBRAM
WELLINGTON	P. NALLATHAMBI
FAIZABAD	S.P. SINGH
DURGAPURA	P.S. SHEKHAWAT
JAMMU	M. K. PANDEY
DHARWAD	GURUDATT M. HEGDE
NEW DELHI	V.K. SINGH AND M.S. SAHARAN
VARANASI	S.S. VAISH
KARNAL	SUDHEER KUMAR, PREM LAL KASHYAP AND RAVINDER KUMAR (COORDINATING UNIT)
FOR CCN	
DURGAPURA	S.P. BISHNOI
HISAR	PRIYANKA DUGGAL
LUDHIANA	RAMANNA KOULAGI

Table 9.2 Reactions of different entries of Multiple Diseases Screening Nursery 2019-20 against diseases and CCN

S. No.	Entry	Stem rust		Leaf rust South		Leaf rust North		Stripe rust		LB (dd, 1-9)		KB (%)		PM (0-5)		FS (%)		FHB (%)	CCN
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	HS	HS
Sources : EPPSN 2018-19																			
A. Resistant to all three rusts																			
Source:AVT Ist Year 2017-18																			
1	GW1339	3.8	10S	2.4	5MS	0.5	5MR	6.8	20S	45	78	2	8	3	7	0	0	0.0	HS
2	GW1346(d)	3.6	20MR	0.9	10MR	4.8	10S	19.4	60S	46	68	0.4	1.5	3	5	0	0	1.0	S
3	GW492	1.1	10MR	0.1	TR	0.5	5MR	32.5	60S	46	78	2.1	4.2	3	4	0.8	2.5	2.5	HS
4	HPW441	32.9	80S	10.4	30MS	1.5	5S	10.7	40S	35	68	1.8	6.3	2	3	0.5	1.6	1.6	S
5	HPW442	28.8	60S	10.4	30S	0.5	5MR	7.8	40S	35	58	3	7.5	3	5	3	3.3	3.3	HS
6	HPW450	32.9	80S	14	30MS	1.5	5MS	11.8	60S	35	57	6.2	16.4	4	5	0.8	2.5	2.5	S
7	HPW459	8.6	20S	5.1	20S	2.6	10S	11.4	60S	45	68	6.6	18	4	5	1.3	4	4.0	S
8	HS660	14.5	20S	2.1	TR	0.1	TR	6.6	20S	35	67	2.4	3.4	2	3	1.3	2.5	2.5	S
9	K 1601	19.2	60S	12.9	20S	1	5MS	21	60S	35	57	3.6	7.8	4	5	3.1	4.7	4.7	HS
10	MACS4059(d)	3.5	10MS	4.4	20MS	1	5MS	11.9	60S	46	68	1.7	6.7	2	3	0	0	0.0	HS
11	MACS5051	0.3	5R	0.1	TR	0.6	5MR	15.3	60S	46	57	0.1	0.4	4	5	0	0	1.0	S
12	PBW800	4.2	20S	2.4	10MS	0.3	TS	0.7	5S	35	56	3.1	11.1	5	7	2.7	2.8	2.8	HS
13	UP3016	0.4	TMS	5.6	30MS	3.3	5S	26.3	60S	35	57	6.9	16	4	5	1.1	3.3	3.3	S
B. Resistant to Stem and Leaf rusts																			
Source: AVT Ist Year 2017-18																			
14	AKAW4924	4	10S	1.7	10MS	0.3	TS	22.5	60S	45	78	3.6	7.8	4	5	0.5	1.6	2.0	S
15	DBW223	18.4	60S	10.2	40S	1.3	5S	15.8	60S	46	56	2.4	4.5	3	5	0.9	2.8	2.8	S
16	HI1625	17.6	80S	4.8	20S	2	5S	28.8	80S	46	68	1.6	4	3	5	4.5	10.1	10.1	HS
17	HI1628	2.4	10MS	1.2	5S	3.8	5S	18.5	60S	36	58	3.6	10.5	3	5	3.3	4.5	4.5	S
18	HI8800(d)	5.6	60MR	0.9	5MR	0.3	TS	7.2	20S	35	68	2.1	8	4	7	0	0	1.0	S
19	NIAW3170	6.1	10S	4.6	20S	0.5	5MR	21.3	60S	35	57	0.2	0.7	3	5	1.3	4	4.0	S
20	PBW757	10.5	40S	0	TR	0	0	5.6	20S	45	67	1.2	4.5	4	5	2.6	3.5	3.5	HS
20A	INFECTOR	60	100S	84	100S	70	80S	67.5	90S	68	79	7.6	15	6	7	8.3	16.6	16.6	S
20B	A9-30-1 for LB(C)	52.5	80S	70	100S	43.3	100S	58.6	100S	67	89	6.7	12.5	5	7	7.1	14.3	14.3	S
20C	UP2338 for KB(C)	32.5	80S	31	80S	53.3	80S	54.3	80S	56	78	10.8	19	5	7	8.3	16.6	16.6	S
20D	PBW343 for PM(C)	24.5	80S	47.5	60S	40	60S	55.7	80S	46	78	6.3	12	6	7	29.3	39.5	39.5	S
20E	Sonalika for LS(C)	62.5	100S	45	100S	66.7	100S	44.3	100S	57	89	5.6	12.5	4	5	12.1	22.2	22.2	S
21	UAS466(d)	18.4	80S	18.1	80S	0.1	TR	11.5	30S	45	57	2.8	10.7	4	5	0	0	1.0	S

22	WH1235	23.6	60S	11.4	30S	1.3	5S	13.9	40S	45	68	4.7	16.5	3	5	0.7	2	2.0	S
C. Resistant to leaf and stripe rusts																			
Source: AVT Ist Year 2017-18																			
23	DBW187	9.1	40MS	2.4	10S	0	0	6	20S	35	68	5	11.3	2	5	1.5	4.5	4.5	S
24	HS661	1.2	5S	0.4	5MR	1	5MS	6.3	20S	35	68	16.2	52	4	7	1.5	4.6	4.6	HS
25	PBW797	27.2	80S	0	TR	0	0	8.8	20S	35	56	4.8	15.6	5	5	1.7	5	5.0	HS
26	PBW801	14.4	40S	1.7	10MS	3.6	10S	3.1	10S	35	67	5.7	14.3	4	5	2.2	6.7	6.7	S
27	MPO 1336	1.7	5MS	5	10MS	0.2	TMS	5.3	15S	45	68	2	8	2	3	0	0	1.0	S
28	DBW 237	5.8	20S	0	TR	5	20S	8	20S	35	67	0.6	2.3	2	3	2.8	8.3	8.3	S
D. Resistant to stem and stripe rusts																			
Source: AVT Ist Year 2017-18																			
29	DDK1054	2.7	20MR	0.3	5R	0.3	TS	12.7	40S	35	47	0.3	1.1	4	5	0.8	2.5	2.5	HS
30	GW491	2.4	20MR	3.6	10S	1.3	5MS	43.8	80S	46	68	0.9	2	3	5	1.9	5.6	5.6	S
31	HI1624	3.6	20MS	0.8	10MR	1	5MS	26.4	80S	46	68	4.6	14.7	5	5	1.5	4.6	4.6	HS
32	HPW451	1.2	5MS	6.2	30S	0.8	5MR	11.9	40S	35	67	2.2	4.7	4	5	2.2	6.6	6.6	S
33	PBW763	3.4	10MS	0	TR	0	0	4.1	10S	35	57	4.7	10	4	5	2.5	7.5	7.5	S
34	WH 1218	16.8	40S	1.6	5S	0	0	14.9	60S	45	68	4.6	17.8	2	4	2.2	6.5	6.5	HS
34A	INFECTOR	58	100S	82	100S	75	100S	63.8	100S	68	79	10.2	20	5	7	8.3	16.6	16.6	S
34B	A9-30-1 for LB(C)	52.5	100S	65	100S	33.9	100S	54.3	100S	68	89	6.5	12.6	5	7	10	20	20.0	S
34C	UP2338 for KB(C)	32.5	100S	26	60S	53.3	80S	52.9	80S	56	89	11.6	21.1	3	4	11.6	22.2	22.2	S
34D	PBW343 for PM(C)	24.5	80S	36	60S	60	100S	54.3	80S	57	78	8.1	15.5	4	5	28.6	32.8	32.8	S
34E	Sonalika for LS(C)	70	100S	47.5	100S	60	100S	48.6	100S	57	89	8.8	17.7	5	7	14.3	26.7	26.7	S

III. Screening of MDSN 2018-19 entries against loose smut during 2019-20

Thirty eighty entries of MDSN 2018-19 were inoculated with loose smut during 2018-19 crop season and expression of loose smut was observed during 2019-20 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, 2018-19, against loose smut during 2019-20 crop season

S. No.	Entry	Loose smut (%)				
		Ludhiana	Durgapura	Hisar	AV.	HS
Sources : EPPSN 2017-18						
A. Resistant to all three rusts						
Source: AVT Ist Year 2016-17						
1	DBW246	2.00	10.8	12.5	8.43	12.50
2	DBW251	0.00	36.8	5.0	13.93	36.80
3	HI8791(d)	0.00	0.8	5.0	1.93	5.00
4	HS611	0.00	10.0	4.6	4.87	10.00
5	HS645	15.71	9.8	5.0	10.17	15.71
6	PBW777	14.28	47.1	5.0	22.13	47.10
7	PBW778	0.00	19.2	16.6	11.93	19.20
8	TL3011 (T)	0.00	0.0	3.3	1.10	3.30
9	TL3012 (T)	0.00	0.0	2.5	0.83	2.50
10	TL3013 (T)	0.00	0.0	2.5	0.83	2.50
11	TL3014 (T)	0.00	0.0	2.5	0.83	2.50
12	TL3015 (T)	0.00	0.0	2.0	0.67	2.00
13	UAS462(d)	0.00	22.1	2.5	8.20	22.10
14	VL1013	23.07	3.7	4.0	10.26	23.07
15	VL3014	12.50	18.6	23.3	18.13	23.30
16	WH1233	26.77	26.4	2.5	18.56	26.77
17	B622	0.00	0.0	5.0	1.67	5.00
18	HG110	0.00	0.0	4.3	1.42	4.25
B. Resistant to Stem and Leaf rusts						
Source: AVT Ist Year 2016-17						
19	HI1620	11.12	44.3	5.0	20.14	44.30
20	DDK1052(dic)	0.00	0.0	4.5	1.50	4.50
20A	INFECTOR	12.38	-	46.66	29.52	46.66
20B	A9-30-1 for L.B.(C)	31.12	-	71.11	51.12	71.11
20C	UP 2338 for K.B.(C)	32.60	-	56.28	44.44	56.28
20D	PBW 343 for P.M.(C)	17.89	-	60	38.95	60.00
20E	Sonalika for L.S.(C)	23.45	54.3	66.66	48.14	66.66
21	DDK1053(dic)	0.00	8.8	12.5	7.10	12.50
22	HS644	0.00	11.6	5.0	5.53	11.60
23	HS646	8.00	6.3	16.6	10.30	16.60
24	MACS5047	0.00	0.0	11.1	3.70	11.11
25	MACS5049	0.00	0.0	6.6	2.20	6.60
26	MACS6677	0.00	29.0	7.5	12.17	29.00
27	VL3013	22.22	34.3	8.3	21.61	34.30
28	WH1232	16.67	44.1	2.5	21.09	44.10
29	IWP 5019	0.00	0.0	13.3	4.43	13.30
30	LINE 1172	0.00	0.0	7.5	2.50	7.50
C. Resistant to Leaf and Stripe rusts						

Source: AVT IInd Year 2016-17						
31	HI1612	7.61	27.6	7.5	14.24	27.60
Source: AVT Ist Year 2016-17						
32	HD3271	12.72	25.4	7.5	15.21	25.40
33	HI1619	31.42	8.0	8.1	15.84	31.42
34	HPW439	13.34	0.0	14.2	9.18	14.20
35	HS648	0.00	20.9	4.3	8.41	20.90
36	KRL370	28.89	11.9	11.1	17.30	28.89
37	PBW780	0.00	20.4	16.6	12.33	20.40
38	WH1316	23.07	14.4	1.6	13.02	23.07
38A	INFECTOR	25.90	-	46.66	36.28	46.66
38B	A9-30-1 for L.B.(C)	15.24	-	71.11	43.18	71.11
38C	UP 2338 for K.B.(C)	37.50	-	56.28	46.89	56.28
38D	PBW 343 for P.M.(C)	17.43	-	60	38.72	60.00
38E	Sonalika for L.S.(C)	23.67	57.8	66.66	49.38	66.66

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IV. National Genetic Stock Nursery (NGSN), 2019-20

The NGSN comprising 27 entries with confirmed sources of multiple disease resistance were planted at 20 breeding centers across different agro climatic zones of country for their utilization in breeding for resistance to biotic stresses. All 27 entries were utilized in the range of 0.0 – 50.0% by the breeding centres (Fig. 9.1). The most utilized entries at many centers were PBW 777, HS 611 and HS 645(Table 9.4). Malan and Ludhiana centers, utilized maximum 12 entries in their breeding programme followed by Pune (Fig. 9.2).

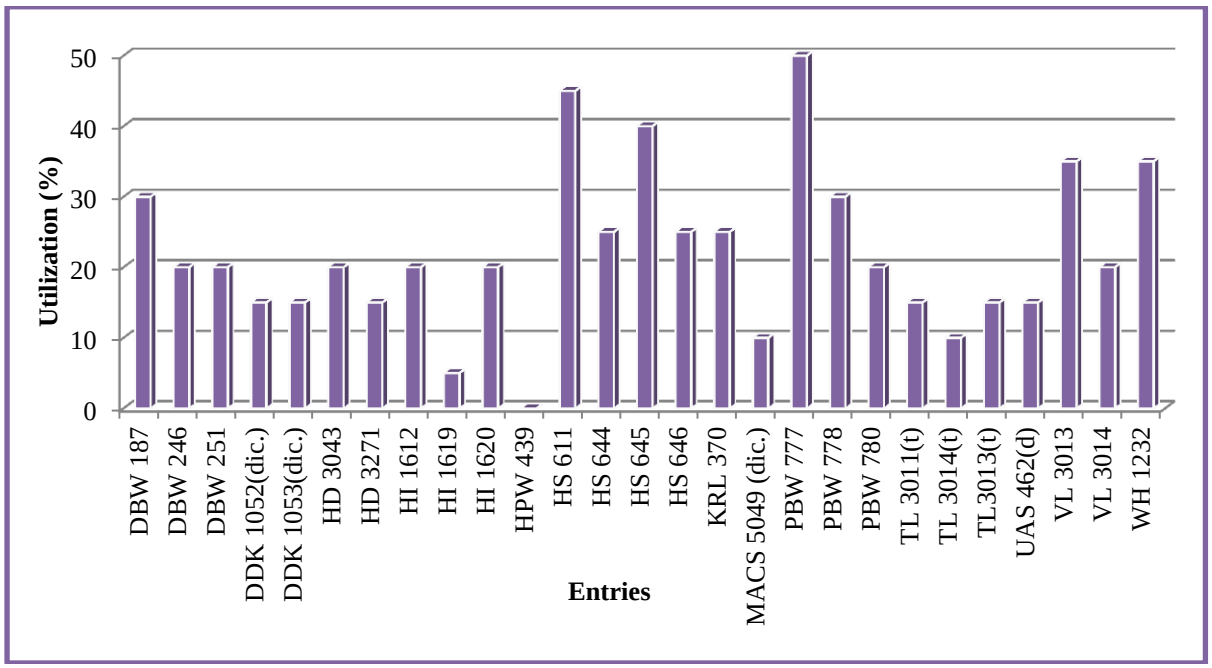

Fig. 9.1. Percent utilization of promising resistant genotypes at different breeding centres in NGSN, 2019-20

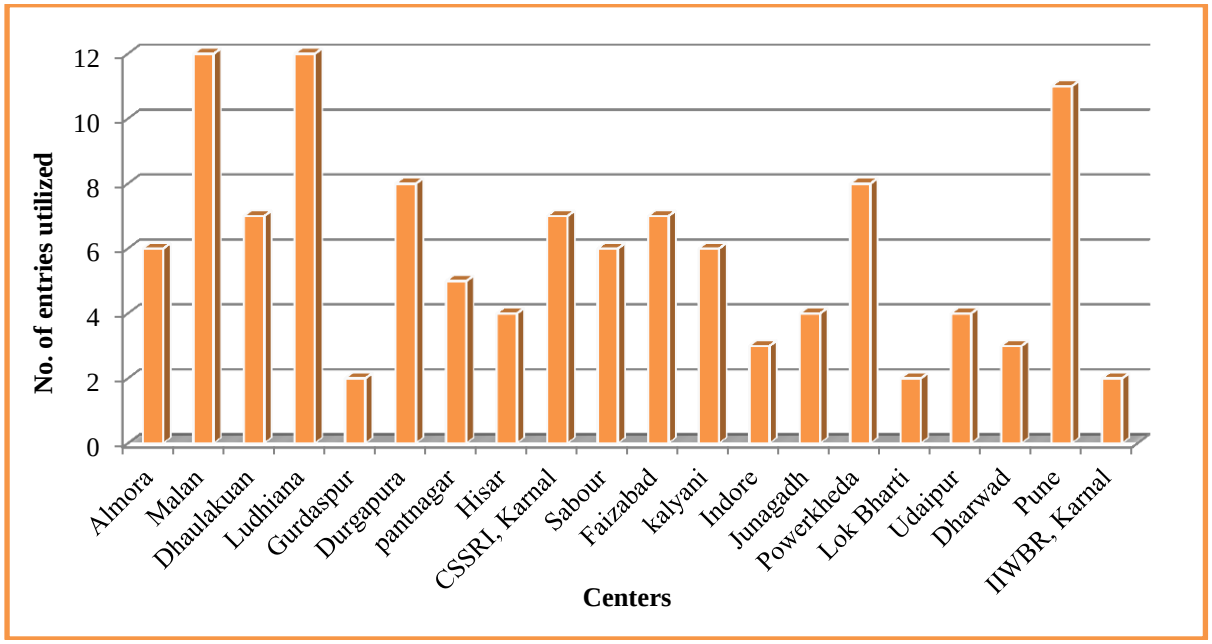

Fig. 9.2. Centre wise utilization of promising resistant genotypes from NGSN, 2019-20

Table 9.4. National genetic stock nursery (NGSN), 2019-20

S. No.	Entry	Almora	Malan	Dhaulakuan	Ludhiana	Gurdaspur	Durgapura	Pantnagar	Hisar	CSSRI, Karnal	Sabour	Faizabad	kalyani	Indore	Junagadh	Powerkheda	Lok Bharti	Udaipur	Dharwad	Pune	IIWBR, Karnal	Total
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	
1	DBW 187		1				1			1		1	1								1	6
2	DBW 246		1			1	1					1										4
3	DBW 251						1				1				1		1					4
4	DDK 1052(dic.)				1				1											1		3
5	DDK 1053(dic.)				1				1											1		3
6	HD 3043	1											1					1	1			4
7	HD 3271									1			1					1				3
8	HI 1612						1	1			1										1	4
9	HI 1619					1																1
10	HI 1620		1				1			1								1				4
11	HPW 439																					0
12	HS 611	1								1	1	1	1	1		1		1		1		9
13	HS 644	1		1			1									1				1		5
14	HS 645		1	1	1		1					1			1	1				1		8
15	HS 646			1							1	1				1				1		5
16	KRL 370							1		1		1	1						1			5
17	MACS 5049 (dic.)				1															1		2
18	PBW 777	1	1	1	1			1		1		1	1		1	1						10
19	PBW 778	1		1	1					1						1	1					6
20	PBW 780	1	1					1			1											4
21	TL 3011(t)		1		2																	3
22	TL 3014(t)		1		1																	2
23	TL3013(t)		1		2																	3
24	UAS 462(d)		1																1	1		3
25	VL 3013		1	1			1		1						1	1				1		7
26	VL 3014		1					1						1						1		4
27	WH 1232			1	1				1		1			1		1				1		7
	Total	**6**	**12**	**7**	**12**	**2**	**8**	**5**	**4**	**7**	**6**	**7**	**6**	**3**	**4**	**8**	**2**	**4**	**3**	**11**	**2**	**119**

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

9.2 Management of Diseases: Chemical Control

Stripe Rust

A. Bajaura

Evaluation of chemical fungicides namely, Picoxystrobin 7.05 % + Propiconazole 11.7 % SC, Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE, and Tebuconazole 50 % + Trifloxystrobin 25 % WG at different concentrations along with standard recommended fungicide, Propiconazole @ 0.1% were performed at Bajaura location for the management of yellow rust of wheat (cv. PBW343). Foliar application of Propiconazole@0.1% along with Picoxystrobin 7.05 % + Propiconazole 11.7 % SC @ 0.1% were found effective in controlling the yellow rust infection on PBW343 cultivar (Table 9.5). All the fungicides were found effective providing protection against rust in comparison to unsprayed control plot. Highest yield was recorded in the plot sprayed with Propiconazole @ 0.1% followed by Tebuconazole 50 % + Trifloxystrobin 25% WG @ 0.06% and Picoxystrobin 7.05 % + Propiconazole 11.7 % SC @ 0.1%, when applied at disease initiation followed by two sprays at 14 days interval on wheat foliage.

Table 9.5 : Chemical control of stripe rust of wheat at Karnal during 2019-2020

Treatments	Description of treatments	Dose (%)	ACI	Grain Yield (q/ ha)	Yield gain (%)
T1	Picoxystrobin 7.05 % + Propiconazole 11.7 % SC	0.1	6.2	22.09	89.8
T2	Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE	0.1	14.3	18.95	62.8
T3	Tebuconazole 50 % + Trifloxystrobin 25 % WG	0.06	7.2	23.11	98.5
T4	Propiconazole	0.1	5.7	27.86	139.3
T5	Control (without chemicals)	-	83.3	11.64	-
	CD (P = 0.05)		0.6	0.59	
Variety: PBW 343; Date of sowing: 19.11.2019; ACI: Average coefficient of infection; Date of Ist appearance of rust: 15.3.2020; and Date of foliar sprays: 17.03.2020 and 31.03.2020					

B. Durgapura

Field experiment was carried at Durgapura during the 2019-20 cropping season to evaluate the effects of different fungicide combinations such as Picoxystrobin 7.05 % + Propiconazole 11.7 % SC, Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE and Tebuconazole 50 % + Trifloxystrobin 25 % WG for the management of yellow rust of wheat (cv. PBW343). Highest disease protection was provided by Tebuconazole 50 % + Trifloxystrobin 25 % WG at a concentration of 0.06% followed by Tebuconazole 25.9 EC @ 0.1% and Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE @ 0.1%, when applied at the onset of diseases followed by two sprays at 2-3 weeks intervals on wheat foliage (Table 9.6). Similar trends in yield gain were recorded in the plots treated with fungicide combinations in comparison to unsprayed control plot, where grain yield of 48.96 q /ha was recorded.

Table 9.6: Chemical control of stripe rust of wheat at Durgapura during 2019-2020

Treatments	Description of treatments	Dose (%)	ACI	Grain Yield (q/ ha)	Yield gain (%)
T1	Picoxystrobin 7.05 % + Propiconazole 11.7 % SC	0.1	4.5	48.51	99.4
T2	Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE	0.1	4.2	47.40	94.8
T3	Tebuconazole 50 % + Trifloxystrobin 25 % WG	0.06	1.5	49.84	104.8
T4	Propiconazole	0.1	7.2	48.07	97.6
T5	Tebuconazole 25.9 EC	0.1	3.2	48.96	101.2
T6	Control (without chemicals)	-	80.0	24.33	
	CD (P = 0.05)		1.35	0.210	

Variety: PBW 343; ACI: Average coefficient of infection; Date of sowing: 27-11-2019; Date of foliar sprays: 25.1.2020, 10.2.2020 and 20.2.2020

C. Hisar

Three different combinations of fungicides *viz*., Picoxystrobin 7.05 % + Propiconazole 11.7 % SC, Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE, and Tebuconazole 50 % + Trifloxystrobin 25 % WG at different concentrations along with standard recommended fungicide, Propiconazole @ 0.1% were evaluated at Hisar location for the management of yellow rust of wheat (cv. HD2967) (Table 9.7). All the sprayed fungicides (Picoxystrobin 7.05 % + Propiconazole 11.7 % SC @0.1%, Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE @ 0.1% and Tebuconazole 50 % + Trifloxystrobin 25 % WG @ 0.6%) were statistically at par with standard recommended fungicide Propiconazole @0.1% and quite effective in in controlling the yellow rust infection on wheat leaf (Table 9.3). Significant yield was recorded in the plots sprayed with all the tested fungicides combinations at disease initiation followed by two sprays at 20 days interval on wheat foliage in comparison to unsprayed control plots.

Table 9.7: Chemical control of stripe rust of wheat at Hisar during 2019-2020

Treatments	Description of treatments	Dose (%)	ACI	Grain Yield (q/ ha)	Yield gain (%)
T1	Picoxystrobin 7.05 % + Propiconazole 11.7 % SC	0.1	5	23.8	64.13
T2	Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE	0.1	5	24	65.51
T3	Tebuconazole 50 % + Trifloxystrobin 25 % WG	0.06	5	23.9	64.82
T4	Propiconazole	0.1	5	21.7	49.79
T5	Control (without chemicals)	-	50	14.5	-
	CD (P = 0.05)		NS	1.87	
Variety: HD2967, ACI: Average coefficient of infection, Date of sprays: 05.2.2020 and 25.2.2020					

D. Jammu

Field experiment to evaluate the efficacy of three different fungicide combinations (*viz*., Picoxystrobin 7.05 % + Propiconazole 11.7 % SC, Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE and Tebuconazole 50 % + Trifloxystrobin 25 % WG) against yellow rust development on wheat (cv. PBW343) were conducted at Jammu location during 2019-20 (Table 9.8). Field results revealed that minimum ACI of 1.66 was recorded with Picoxystrobin 7.05% + Propiconazole 11.7% SC fungicide @ 0.1% followed by Tebuconazole 50%+ Trifloxystrobin 25% WG @ 0.6% followed by standard fungicide Propiconazole @0.1% . Picoxystrobin 7.05% + Propiconazole 11.7% SC @ 0.1% gave a mean yield gain of 62.14% with grain yield of 44.88 q/ has over unsprayed control, when applied at disease initiation followed by fours sprays at 15 days interval on wheat foliage and found best among all other treatments.

Table 9.8: Chemical control of stripe rust of wheat at Jammu during 2019-2020

Treatments	Description of treatments	Dose (%)	ACI	Grain Yield (q/ ha)	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	1.66	44.88	62.14
T2	Pyraclostrobin 133g/1 + Epoxiconaxole 50g/1 SE	0.1	17.99	40.45	46.15
T3	Tebuconazole 50%+ Trifloxystrobin 25% WG	0.06	6.1	43.47	57.04
T4	Propiconazole	0.1	8.28	42.62	53.99
T5	Control (without chemicals)	-	84.32	27.68	
	CD (P = 0.05)		4.49	1.6	
Variety: PBW 343, ACI: Average coefficient of infection, Date of Ist appearance of rust: 4.1.2020, Date of foliar sprays: 06.1.2020, 21.1.2020, 6.2.2020 and 21.2.2020					

E. Karnal

The efficacy of different fungicide formulations were tested for the management of yellow rust of wheat (cv. 343) during 2019-20 at Karnal location. Treatments were: Picoxystrobin 7.05 % + Propiconazole 11.7 % SC @ 0.1%, Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE @ 0.1, Tebuconazole 50 % + Trifloxystrobin 25 % WG @ 0.06%, Propiconazole @ 0.1% and a control treatment without fungicide application (Table 9.9). Fungicides with Tebuconazole 50 % + Trifloxystrobin 25 % WG @ 0.06% followed by Propiconazole @ 0.1%, Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE @0.1% and Picoxystrobin 7.05 % + Propiconazole 11.7 % SC @ 0.1 showed efficient control of wheat (cv. PBW 343) yellow rust (lower than 10 ACI) in comparison to unsprayed control treatment where ACI of 42.9 was recorded, when applied at disease initiation followed by two sprays at 15 days interval on wheat foliage. There was no statistical difference between different fungicidal treatments. For yield component, similar trend was followed except, all fungicide treatments significantly differed from control.

Table 9.9: Chemical control of stripe rust of wheat at Karnal during 2019-2020

Treatments	Description of treatments	Dose (%)	ACI	Grain Yield (q/ ha)	Yield gain (%)
T1	Picoxystrobin 7.05 % + Propiconazole 11.7 % SC	0.1	9.7	50.15	114.44
T2	Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE	0.1	8.2	50.88	117.55
T3	Tebuconazole 50 % + Trifloxystrobin 25 % WG	0.06	6.2	52.52	124.59
T4	Propiconazole	0.1	7.8	50.94	117.80
T5	Control (without chemicals)	-	42.9	23.39	-
	CD (P = 0.05)		NS	7.32	
Variety: PBW 343, Date of sowing: 13.11.2019, ACI: Average coefficient of infection, Date of Ist appearance of rust: 4.2.20, Date of foliar sprays: 5.2.20 and 20.2.20					

F. Ludhiana

The efficacy of different fungicidal combinations *viz*., Picoxystrobin 7.05 % + Propiconazole 11.7 % SC @ 0.1%, Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE @0.1%, Tebuconazole 50 % + Trifloxystrobin 25 % WG @0.06% along with Propiconazole @ 0.1% as a standard fungicide were evaluated against yellow rust of wheat (cv. PBW 343) under field conditions at Ludhiana location during 2019-20 (Table 9.10). All the fungicides and their doses were efficient in controlling yellow rust infection (<1ACI), except unsprayed control treatments (80 ACI). Results showed four two sprays of fungicides at 15 days intervals are necessary for the best management of yellow rust of wheat (Table 9.6). Similar trends were also observed for yield component. All the fungicide treatments and grain yield components were statistically significantly and differed from control. No toxicity of the tested fungicides was noticed.

Table 9.10: Chemical control of stripe rust of wheat at Ludhiana during 2019-2020

Treatments	Description of treatments	Dose (%)	ACI	Grain Yield (q/ ha)	Yield gain (%)
T1	Picoxystrobin 7.05 % + Propiconazole 11.7 % SC	0.1	0.13	51.27	270.69
T2	Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE	0.1	0.13	51.23	270.45
T3	Tebuconazole 50 % + Trifloxystrobin 25 % WG	0.06	0.27	52.33	278.40
T4	Propiconazole	0.1	0.27	50.18	262.86
T5	Control (without chemicals)	-	80.0	13.83	
	CD (P = 0.05)		0.56	2.17	
Variety: PBW 343, ACI: Average coefficient of infection, Date of Ist appearance of rust: 4.1.2020, Date of foliar sprays: 06.1.2020, 21.1.2020, 6.2.2020 and 21.2.2020					

G. Pantnagar

The efficacy of different fungicide combinations in controlling yellow rust disease of wheat was investigated under field conditions at Pantnagar location during 2019-20 (Table 9.11). Foliar spraying of Picoxystrobin 7.05 % + Propiconazole 11.7 % SC @ 0.1%, Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE @ 0.1% and Tebuconazole 50 % + Trifloxystrobin 25 % WG @ 0.06% after initiation of rust infection prevented rust development (ACI <1) on wheat (cv. PBW 343) and was comparable with the standard recommended fungicides Propiconazole @ 0.1% and Tebuconazole 25.9 EC @0.1%. Foliar spray application of all the fungicides has significantly reduced the yellow rust infection (average coefficient of infection, ACI <1) compared with the unsprayed control (ACI=60). Similar trends were reflected on grain yield components with three spray application being more effective in this regard. No phytotoxicity of the tested fungicides noticed.

Table 9.11: Chemical control of stripe rust of wheat at Pantnagar during 2019-2020

Treatments	Description of treatments	Dose (%)	ACI	Grain Yield (q/ ha)	Yield gain (%)
T1	Picoxystrobin 7.05 % + Propiconazole 11.7 % SC	0.1	0.13	53.03	65.71
T2	Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE	0.1	0.1	54	68.75
T3	Tebuconazole 50 % + Trifloxystrobin 25 % WG	0.06	0.06	55.4	73.13
T4	Propiconazole	0.1	0.13	52.2	63.13
T5	Tebuconazole 25.9 EC	0.1	0.23	50.06	56.44
T6	Control (without chemicals)	-	60.0	32.0	-
	CD (P = 0.05)		0.14	0.32	
Variety: PBW 343, Date of sowing: 26.11.2019 , Date of foliar sprays: 23.1.2020, 7.2.2020 and 22.2.2020, ACI: Average coefficient of infection					

Experimental trials conducted for the evaluation of different fungicides for management of yellow rust of wheat during 2019-20 at seven different locations viz., Bajaura, Durgapura, Hisar, Jammu, Karnal, Ludhiana and Pantnagar indicated that all the fungicides at their respective dosages were effective in controlling the disease (ACI <10) in comparison to unsprayed control check (ACI<40). The fungicide provided maximum disease protection against yellow rust in different locations include: Propiconazole@0.1% and Picoxystrobin 7.05 % + Propiconazole 11.7 % SC @ 0.1% at Bajaura, Tebuconazole 50 % + Trifloxystrobin 25 % WG @ 0.06% at Durgapura; Picoxystrobin 7.05 % + Propiconazole 11.7 % SC @0.1%, Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE @ 0.1% and Tebuconazole 50 % + Trifloxystrobin 25 % WG @ 0.6% at Hisar; Picoxystrobin 7.05% + Propiconazole 11.7% SC fungicide @ 0.1% and Tebuconazole 50%+ Trifloxystrobin 25% WG @ 0.6% at Jammu; Tebuconazole 50 % + Trifloxystrobin 25 % WG @ 0.06% at Karnal; Picoxystrobin 7.05 % + Propiconazole 11.7 % SC @ 0.1%, Pyraclostrobin 133 g / l + Epoxiconaxole 50 g/l SE @0.1%, Tebuconazole 50 % + Trifloxystrobin 25 % WG @0.06% and Propiconazole @ 0.1% at Ludhiana and Pantnagar, respectively. Moreover, no phytotoxicity was recorded with any of the tested concentration of fungicides on wheat plants.

Powdery mildew

A. Almora

Field experimentation was carried out to test the efficacy of different fungicides viz. Propiconazole 13.9% + Difenconazole 13.9 EC @0.1%, Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @0.1%, Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% along with standard fungicide Propiconazole @ 0.1% against powdery mildew of wheat (cv. PBW343) to find out the most effective one at Almora location during 2019-20 (Table 9.12). Results indicated that Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% followed Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1% and Propiconazole @0.1% were efficient in containing powdery mildew severity level

below 3.0, when compared with unsprayed control treatment, where disease severity was recorded upto 5.0. All the fungicide treatments were statistically significantly differed from the control treatment. Similar trends were noticed in case of grain yield component.

Table 9.12: Chemical control of powdery mildew of wheat at Almora during 2019-2020

Treatments	Description of treatments	Dose (%)	Disease Severity	Grain Yield (q/ ha)	Yield gain (%)
T1	Propiconazole 13.9% + Difenconazole 13.9 EC	0.1	3.0	30.57	25.91
T2	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC	0.1	2.33	36.94	52.14
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	1.66	42.37	74.38
T4	Propiconazole	0.1	2.33	35.71	47.07
T5	Control (without chemicals)		5	24.28	
	CD (P=0.05)		1.396		
Variety: PBW343, Date of sowing: 28.11.2019					

B. Dhaulakuan

The efficacy of different fungicidal combinations *viz*., Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @ 0.1%, Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @0.1%, Tebuconazole 50 % + Trifloxystrobin 25 % WG @0.06% along with Propiconazole @ 0.1% and Tebuconazole as a standard fungicides were evaluated against powdery mildew of wheat (cv. HS240) under field conditions at Dhaulakuan region during 2019-20 (Table 9.13). Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @0.1% followed by Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @0.1%, Propiconazole @ 0.1% and Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% was found effective in controlling powdery mildew infection (disease Severity level below 3.0), in contrast to unsprayed control treatments, where powdery mildew severity recorded above 5.0. Similar trends were also observed for yield component. All the fungicide treatments were statistically significantly and differed from control except grain yield component. No toxicity of the tested fungicides was noticed.

Table 9.13: Chemical control of powdery mildew of wheat at Dhaulakuan during 2019-2020

Treatments	Description of treatments	Dose (%)	Disease Severity	Grain Yield (q/ha)	Yield gain (%)
T1	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	1.67	25.1	20.1
T2	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC	0.1	0.67	26.8	28.2
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	2.67	22.7	8.6
T4	Propiconazole	0.1	2.0	23.2	11
T5	Tebuconazole	0.1	3.0	21.3	1.9
T6	Control (without chemicals)	-	5.33	20.9	-
	CD (P=0.05)		1.75	NS	
Variety: HS240, Date of sowing: 28.11.2019					

C. Jammu

The efficacy of different fungicide formulations were tested for the management of powdery mildew of wheat (cv. 343) during 2019-20. Treatments were: Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @ 0.1%, Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1, Tebuconazole 50 % + Trifloxystrobin 25 % WG @ 0.06%, Propiconazole @ 0.1% and a control treatment without fungicide application (Table 9.14). Fungicides Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06 showed efficient control of wheat (cv. PBW 343) powdery mildew infection (disease severity below 3.0) in comparison to other treatments and unsprayed control treatment where disease severity level recorded above 3.0, when applied at disease initiation on wheat foliage. There

was statistical difference between different fungicidal treatments and yield components. For yield component and fungicide treatments significantly differed from control treatment. No toxicity of the tested fungicides at tested dosages was observed.

Table 9.14: Chemical control of powdery mildew of wheat at Jammu during 2019-2020

Treatments	Description of treatments	Dose (%)	Disease Severity	Grain Yield (q/ha)	Yield gain (%)
T1	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	5.33	41.90	18.09
T2	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC	0.1	6.67	40.98	17.33
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	1.33	44.12	26.86
T4	Propiconazole	0.1	3.33	43.15	23.26
T5	Control (without chemicals)		8.67	35.26	
	CD (P=0.05)		1.21	1.2	
Variety: PBW343, Date of sowing: 28.11.2019					

D. Karnal

Field experiment was carried at Karnal during the 2019-20 cropping season to evaluate the effects of different fungicide combinations such as Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @ 0.1%, Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1 and Tebuconazole 50 % + Trifloxystrobin 25 % WG @ 0.06% along with standard fungicide Propiconazole @ 0.1% for the management of powdery mildew of wheat (cv. WH147). Highest disease protection (disease severity≤1.0) was provided by all the tested fungicides, when applied at the onset of disease followed by two sprays at 15 days intervals on wheat foliage. Similar trends in grain yield were recorded in the plots treated with fungicide combinations in comparison to unsprayed control plot (Table 9.15). There was statistical significant difference between different fungicidal treatments and yield components. For yield component and fungicide treatments significantly differed from control treatment. No toxicity of the tested fungicides at tested dosages was observed.

Table 9.15: Chemical control of powdery mildew of wheat at Karnal during 2019-2020

Treatments	Description of treatments	Dose (%)	Disease Severity	Grain Yield (q/ ha)	Yield gain (%)
T1	Propiconazole 13.9% + Difenconazole 13.9 EC	0.1	0.67	42.51	12.34
T2	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC	0.1	1.0	45.7	20.77
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	0.83	44.22	16.86
T4	Propiconazole	0.1	0.83	43.43	14.77
T5	Control (without chemicals)		6	37.84	-
	CD (P=0.05)		1.247	2.21	
Variety: WH 147, Date of sowing: 13.11.2019, Date of foliar sprays: 14.2.2020 and 29.2.2020					

E. Pantnagar

The effect of different fungicides (*viz*., Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @ 0.1%, Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1, Tebuconazole 50 % + Trifloxystrobin 25 % WG @ 0.06%, Propiconazole @ 0.1% and Tebuconazole @0.1%) was studied under field conditions for the management of powdery mildew of wheat (cv. 343) during 2019-20 at Pantnagar during 2019-20 (Table 9.16). Fungicides Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1% followed by Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @ 0.1%, Propiconezole @ 0.1%, Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% and Tebuconazole @ 0.1% showed efficient control of wheat (cv. PBW 343) powdery mildew infection (disease severity below 3.0) in comparison to unsprayed control treatment where disease severity level recorded above 3.0, when applied at disease initiation on wheat foliage. There was statistical

difference between different fungicidal treatments and yield components. For yield component and fungicide treatments significantly varied from control treatment. No toxicity of the tested fungicides at tested dosages was observed.

Table 9.16: Chemical control of powdery mildew of wheat at Pantnagar during 2019-2020

Treatments	Description of treatments	Dose (%)	Disease Severity	Grain Yield (q/ ha)	Yield gain (%)
T1	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	1.67	52.54	11.07
T2	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC	0.1	1.0	53.0	12.05
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	2.33	50.0	5.70
T4	Propiconezole	0.1	2.0	52.06	10.6
T5	Tebuconazole	0.1	2.66	49.0	3.50
T6	Control (without chemicals)	-	4.0	47.3	
	CD (P=0.05)		1.18	0.14	
Variety: PBW343, Date of sowing: 26.11.2019					

Experimental trials were carried out during 2019-20 at five different locations viz., Almora, Dhaulakuan, Jammu, Karnal, and Pantnagar for the evaluation of different fungicides for management of powdery mildew of wheat. The results revealed that all the fungicides at their respective dosages were effective in controlling the disease in comparison to unsprayed control check. Maximum disease protection against powdery mildew infection was provided by Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% in Almora, Jammu and Karnal locations, while Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1% was observed as highly effective molecule against wheat powdery mildew fungus at Dhaulakuan and Pantnagar location. In all the locations, no phytotoxicity was observed with any of the tested concentration of fungicides on wheat plants.

PROGRAMME 10. WHEAT ENTOMOLOGY

Wheat entomology programme covers three aspects viz. host plant resistance, integrated pest management (IPM) and stored grain pest management. During 2019-20 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 covered survey and surveillance of insect-pests and their natural enemies, effect of zinc sulphate application and organic formulations on aphid and termite infestation in wheat, and trapping efficiency of different type of insect-traps for monitoring insect-pests. Besides, studies were also conducted on influence of sowing time on the incidence and population build-up of major insect pest of wheat and management of foliar aphid and termites through bio-pestcides and chemical insecticides. The salient findlings of the experiments conducted during 2019-20 at various AICRP centres are given below.

10.1(A) HOST PLANT RESISTANCE

The results are described here in the following paragraphs.

A1: Entomological Screening Nurseries (ESN)

AVT-Entries

(a) Shoot fly

Shoot fly: Amongst 137 AVT entries tested at three locations (Ludhiana, Kanpur and Dharwad during 2019-20, 96 entries showed infestation index ofshoot fly infestation below 10%. Based on the average infestation of levels of three locations, entry DDK1059 had the lowest infestation index (3.61%). of shootfly. Entry HD3090 (C) had lowest infestation of 2.85% at Ludhiana whereas at Kanpur entry DBW303 had lowest infestation of 1.42%. Two entries viz., DDK1059 recorded lowest infestation of 3.57% at Dharwad (Table A1-10.1a).

(b) Brown wheat mite

At Ludhiana, entry HPW 349 (C) recorded the minimum mite population of 4.67/10 cm^2 area while at Durgapura location, three entries viz., HS 681, MACS3949 (d)(C) and DDK1058 recorded the minimum mite population of 9.0/10 cm^2. Based the average of two locations, entry HPW 349 (C) recorded minimum mite population of 7.5/10 cm^2 (Table A1-10.1a).

(c) Foliar wheat aphid and root aphid

Foliar aphid: The foliar wheat aphid screenings nursery consisting of 137 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 aphid score of four locations, amongst 137 AVT entries, two entries viz., DBW327 and MACS5055 scored lowest (3.6 & 3.8).

Four entries viz., PBW550 (C),NW-RI-301,CZ-RI-304 and DBW327 at Ludhiana and eight entries at Karnal HD3334, DDW47(d)(I), DDW49(d), DBW327, HD3086 (C), DBW332, DBW303 and DBW329 showed moderately resistance to foliar aphid (grade 3). At Kharibari, four entries (PBW771(I) (C),PBW813, HD3331,WH1124 (C)) and ten entries viz.,HD2967 (C),WH1021 (C),PBW644 (C),DBW296,WH1080 (C),HD3249(I) (C),MACS3949(d) (C),MACS5055,MACS6222 (aest.) (C) and DBW327 were found to be moderately resistant (grade 3). At Niphad, all the entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category (Table A1-10.1b).

Root aphid: Out of total 137 entries, four entries viz., GW513, GW322, HI1646 and HD3086 (C) showed the moderately resistance (grade 3) reaction at Ludhiana (Table A1-10.1b).

NIVT-Entries

(a) Foliar aphid:

Amongst NIVT entries, all the entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category (Table A1-10.1c).

(A2) Multiple pest screening nurseries (MPSN)

(a)Shoot fly: The average infestation index recorded at three loations (Ludhiana,Kanpur and Dharwad) of shoot fly was to be lowest (5.3%) in entry DDK1054 and the maximum score of 16.4% was recorded for GW 173 (C) (Table A2-10.1a).
(b)Brown wheat mite: The lowest population of 8.3 brown wheat mites/10 cm^2 was recorded in entry UP301610 at Ludhiana while entry PBW763 had lowest population of 9.7 mites/10 cm^2 was recorded at Durgapura (Table A2-10.1a).
(c) Foliar aphid: Based on average score of three locations, five entries MACS4059 (d),PBW800 UP3016, DBW 237 and DDK1054 showed moderately resistance to foliar aphid (Table A2-10.1b).
(d)Root aphid: At Ludhiana, one entry HI8800 (d) was found to be moderately resistant (grade 3) to root aphid (Table A2-10.1b).

Table A1-10.1a: Screening of AVT lines against Shootfly and Brown Wheat mite(Year-2019-20)

AVT No.	Entry code	Entry	Shoot fly incidence (%)				No. of brown wheat mites/10 cm sq area		
			Ludhiana	Kanpur	Dharwad	Average	Ludhiana	Durgapura	Average
I. North Hill Zone (NHZ)									
1	NHTSZ-1901	HS 507 (C)	6.3	15.0	NG	10.6	14.3	11.3	12.8
2	NHTSZ-1902	HS 562 (C)	5.7	7.3	NG	6.5	12.0	12.7	12.3
3	NHTSZ-1903	HPW 349 (C)	6.1	5.0	NG	5.5	4.7	10.3	7.5
4	NHTSZ-1904	HS 668	5.9	10.0	NG	8.0	8.3	14.7	11.5
5	NHTSZ-1905	VL 907 (C)	5.1	9.4	NG	7.2	10.0	13.3	11.7
6	NHTSZ-1906	VL 2036	6.0	9.0	NG	7.5	13.7	10.7	12.2
7	NHLSZ-1901	HS 681	5.5	13.3	47.6	22.1	9.0	9.0	9.0
8	NHLSZ-1902	VL 3022	5.4	5.0	34.3	14.9	11.0	11.3	11.2
9	NHLSZ-1903	HS 680	6.0	7.6	57.8	23.8	13.7	14.0	13.8

10	NHLSZ-1904	VL 3023	5.5	5.2	20.4	10.4	13.7	15.7	14.7
11	NHLSZ-1905	HPW 474	5.3	6.7	44.4	18.8	12.3	13.0	12.7
12	NHLSZ-1906	UP 3069	6.0	7.9	21.5	11.8	11.0	12.7	11.8
13	NHLSZ-1907	HPW 473	5.2	8.7	7.1	7.0	11.3	10.3	10.8
14	NHLSZ-1908	VL 892 (C)	4.8	7.3	31.7	14.6	13.0	14.7	13.8
15	NHLSZ-1909	VL 3024	5.4	4.7	28.4	12.8	12.0	17.3	14.7
16	NHLSZ-1910	HS 490 (C)	5.7	10.0	22.2	12.7	11.7	14.0	12.8
17	NHLSZ-1911	HS 679	5.4	10.0	29.4	14.9	15.0	13.3	14.2
II. North Western Plain Zone (NWPZ)									
18	NW-TS-101	DBW88 (C)	6.1	8.3	26.6	13.7	12.7	12.0	12.3
19	NW-TS-102	DBW187(I) (C)	5.6	4.9	31.2	13.9	12.7	10.3	11.5
20	NW-TS-103	HD2967 (C)	4.7	10.0	31.9	15.5	11.3	13.0	12.2
20A	**INFECTOR**		8.3	12.7	15.1	**12.0**	21.3	19.3	**20.3**
21	NW-TS-104	WH1105 (C)	4.9	11.2	7.3	7.8	10.0	11.0	10.5
22	NW-TS-105	DBW222(I) (C)	6.4	3.3	10.0	6.6	13.7	13.7	13.7
23	NW-TS-106	HD3086 (C)	5.3	9.3	4.6	6.4	8.7	14.3	11.5
24	NW-TS-107	PBW840M	5.7	12.0	NG	8.8	14.0	16.3	15.2
25	NW-TS-108	PBW803	5.3	6.7	11.6	7.8	15.0	10.7	12.8
26	NW-TS-109	PBW550 (C)	5.7	11.7	29.1	15.5	14.3	13.3	13.8
27	NW-LS-201	HD3334	6.4	10.2	20.6	12.4	11.3	12.0	11.7
28	NW-LS-202	HD3059 (C)	4.7	11.4	33.8	16.6	13.3	14.7	14.0
29	NW-LS-203	HD3332	5.6	8.6	19.1	11.1	9.3	13.0	11.2
30	NW-LS-204	DBW173 (C)	5.6	10.3	20.5	12.1	13.7	12.0	12.8
31	NW-LS-205	WH1021 (C)	6.2	10.0	13.0	9.7	15.3	14.3	14.8
32	NW-LS-206	PBW811	6.3	10.5	19.4	12.1	12.0	13.7	12.8
33	NW-LS-207	DBW291	5.5	5.0	19.1	9.9	14.7	12.0	13.3
34	NW-LS-208	WH1264	5.4	10.0	6.4	7.3	13.3	13.3	13.3
35	NW-LS-209	PBW812	5.4	5.0	21.8	10.7	13.7	10.0	11.8
36	NW-LS-210	JKW261	5.3	6.7	11.1	7.7	15.0	12.0	13.5
37	NW-LS-211	DBW290	5.4	3.5	3.9	4.2	12.7	15.7	14.2
38	NW-LS-212	PBW771(I) (C)	5.5	5.4	9.5	6.8	13.3	11.3	12.3
39	NW-LS-213	PBW813	6.3	3.6	7.2	5.7	13.0	14.0	13.5
40	NW-LS-214	HD3331	5.3	2.0	7.1	4.8	13.7	16.7	15.2
40A	**INFECTOR**		8.6	5.9	10.3	8.2	21.7	20.3	**21.0**
41	NW-LS-215	HD3298*	4.7	7.6	8.3	6.9	10.7	13.7	12.2
42	NW-LS-216	WH1124 (C)	6.2	8.3	5.3	6.6	13.3	11.3	12.3
43	NW-LS-217	UP3033	5.1	3.9	7.0	5.3	15.7	15.0	15.3
44	NW-RI-301	HUW838	5.8	7.8	11.6	8.4	13.0	11.3	12.2
45	NW-RI-302	HD3043 (C)	5.2	1.9	6.0	4.4	13.7	13.0	13.3
46	NW-RI-303	PBW644 (C)	5.9	12.0	9.6	9.2	8.7	14.7	11.7
47	NW-RI-304	DBW296	5.2	13.3	11.0	9.8	14.0	17.0	15.5
48	NW-RI-305	HI1628(I) (C)	5.6	3.3	10.3	6.4	15.0	16.3	15.7
49	NW-RI-306	WH1080 (C)	4.5	5.0	16.5	8.7	14.3	15.7	15.0
50	NW-RI-307	JAUW672	5.5	9.0	21.6	12.1	11.3	13.0	12.2
51	NW-RI-308	WH1142 (C)	5.6	7.6	10.0	7.7	13.3	12.7	13.0
52	NW-RI-309	NIAW3170(I) (C)	4.9	7.9	21.1	11.3	9.3	14.0	11.7
III. North Eastern Plain Zone (NEPZ)									
53	NE-IR-TS-101	PBW804	6.1	6.5	6.6	6.4	13.7	15.0	14.3
54	NE-IR-TS-102	DBW187 (C)	5.2	6.9	4.6	5.6	15.3	10.3	12.8
55	NE-IR-TS-103	K1006 (C)	5.5	4.5	3.7	4.6	12.7	11.0	11.8
56	NE-IR-TS-104	DBW39 (C)	5.4	3.5	4.9	4.6	15.7	13.7	14.7
57	NE-IR-TS-105	HD3249(I) (C)	5.7	16.1	4.3	8.7	13.7	14.3	14.0
58	NE-IR-TS-106	HD2733 (C)	4.9	3.3	4.7	4.3	11.7	13.0	12.3

59	NE-RI-TS-301	HD3171 (C)	6.5	3.7	4.4	4.8	14.0	14.3	14.2
60	NE-RI-TS-302	HD2888 (C)	6.4	6.9	5.2	6.2	12.7	12.7	12.7
60A	**INFECTOR**		8.2	12.3	9.1	9.8	20.0	21.7	**20.8**
61	NE-RI-TS-303	HD3293*	6.1	6.9	9.9	7.6	13.0	13.0	13.0
62	NE-RI-TS-304	K1317 (C)	5.7	6.2	9.1	7.0	13.3	14.7	14.0
63	NE-RI-TS-305	HI1612 (C)	5.8	10.2	12.7	9.6	12.7	12.3	12.5
64	NE-RI-TS-306	DBW252(I) (C)	5.9	6.5	11.9	8.1	10.3	10.0	10.2
IV. Central Zone (CZ)									
65	CZ-TS-101	TAW155	5.4	8.5	7.1	7.0	12.6	15.6	14.2
66	CZ-TS-102	HI1636	6.8	7.1	7.4	7.1	10.6	13.0	11.8
67	CZ-TS-103	MP1361	5.7	9.5	14.0	9.7	12.3	12.6	12.5
68	CZ-TS-104	MACS6747	5.3	14.3	9.0	9.6	13.3	10.6	12.0
69	CZ-TS-105	HD3377	5.7	16.1	19.8	13.9	11.6	9.3	10.5
70	CZ-TS-106	HI1637	5.7	10.0	16.7	10.8	14.6	12.0	13.3
71	CZ-TS-107	RAJ4541	5.4	12.9	10.8	9.7	11.6	14.6	13.2
72	CZ-TS-108	GW513	6.8	10.0	17.2	11.3	10.0	13.6	11.8
73	CZ-TS-109	GW322	4.8	3.9	23.8	10.8	13.6	12.0	12.8
74	CZ-TS-110	HI1544	5.5	1.7	29.7	12.3	12.6	10.6	11.7
75	CZ-LS-201	HI1634*	5.6	5.0	22.2	10.9	13.0	13.3	13.2
76	CZ-LS-202	HD2932	5.6	1.7	37.7	15.0	13.0	15.0	14.0
77	CZ-LS-203	MP3336	4.8	13.3	25.3	14.5	10.0	14.0	12.0
78	CZ-LS-204	HD2864	6.8	5.0	17.5	9.8	13.3	14.3	13.8
79	CZ-LS-205	CG1029*	4.9	3.6	11.6	6.7	15.6	10.6	13.2
80	CZ-RI-301	MPO1357(d)	4.9	3.6	9.8	6.1	12.0	11.3	11.7
80A	**INFECTOR**		7.8	14.3	12.7	**11.6**	20.3	20.3	**20.3**
81	CZ-RI-302	HI8627(d)	4.8	5.7	9.5	6.7	13.0	13.6	13.3
82	CZ-RI-303	UAS466(d)(I)	5.5	3.5	11.9	6.9	13.3	10.0	11.7
83	CZ-RI-304	UAS472(d)	5.1	5.3	21.9	10.8	12.6	9.6	11.2
84	CZ-RI-305	DBW110	5.5	1.7	10.1	5.8	10.3	11.3	10.8
85	CZ-RI-306	MP3288	5.1	5.0	6.3	5.5	12.6	15.0	13.8
86	CZ-RI-307	HI 8823(d)	6.2	7.0	25.0	12.7	10.6	14.0	12.3
87	CZ-RI-308	DDW47(d)(I)	5.9	3.5	11.0	6.8	12.3	13.3	12.8
IV. Peninsular Zone (PZ)									
88	PZ-TS-101	WHD964(d)	6.4	3.8	19.6	9.9	13.3	16.0	14.7
89	PZ-TS-102	DDW48(d) *	5.3	14.8	11.5	10.5	11.6	12.6	12.2
90	PZ-TS-103	MACS6222 (C)	6.0	3.8	10.2	6.7	14.6	10.6	12.7
91	PZ-TS-104	MACS3949(d) (C)	5.5	13.3	6.9	8.6	11.6	9.0	10.3
92	PZ-TS-105	HI8818(d)	5.3	7.1	10.4	7.6	10.0	11.3	10.7
93	PZ-TS-106	UAS428(d) (C)	6.2	5.8	18.2	10.1	13.6	15.6	14.7
94	PZ-TS-107	DDW49(d) *	5.6	5.2	18.0	9.6	12.6	14.0	13.3
95	PZ-TS-108	GW322 (C)	4.8	1.7	11.2	5.9	13.0	16.0	14.5
96	PZ-LS-201	GW519	6.3	1.9	10.9	6.4	13.0	12.3	12.7
97	PZ-LS-202	HI1646	4.6	5.6	12.5	7.6	10.0	13.6	11.8
98	PZ-LS-203	HD3090 (C)	2.9	1.8	7.0	3.9	13.3	12.0	12.7
99	PZ-LS-204	RAJ4083 (C)	6.2	4.8	21.2	10.7	15.6	11.6	13.7
100	PZ-LS-205	UAS3008	6.2	0.0	18.7	8.3	12.0	10.3	11.2
100A	**INFECTOR**		7.8	9.3	9.5	**8.9**	20.3	19.3	**19.8**
101	PZ-LS-206	MACS6749	6.1	4.8	7.1	6.0	12.7	13.7	13.2
102	PZ-LS-207	HD2932 (C)	5.1	4.9	11.3	7.1	10.7	15.0	12.8
103	PZ-LS-208	HI1641	5.5	8.5	13.0	9.0	9.7	14.7	12.2
104	PZ-LS-209	HI1642	5.8	13.1	12.7	10.6	9.7	12.3	11.0
105	PZ-LS-210	HI1633*	6.1	12.9	18.1	12.4	11.0	17.7	14.3
106	PZ-LS-211	MACS6752	6.9	13.7	13.6	11.4	16.3	14.3	15.3

107	PZ-RI-301	NIDW 1149(d)*	5.9	8.9	17.0	10.6	9.0	15.0	12.0
108	PZ-RI-302	UAS446(d) (C)	5.8	14.4	16.2	12.1	12.3	14.3	13.3
109	PZ-RI-303	HI 1605 (C)	6.2	11.1	9.1	8.8	14.0	12.0	13.0
110	PZ-RI-304	MACS 4087(d)	5.4	8.3	10.8	8.2	15.0	11.7	13.3
111	PZ-RI-305	MP 1358	6.1	8.6	18.1	10.9	13.3	10.3	11.8
112	PZ-RI-306	AKDW 2997-16(d) (C)	5.7	4.1	19.6	9.8	13.3	12.0	12.7
113	PZ-RI-307	HI8805(d)(I) (C)	6.0	1.8	15.1	7.6	11.7	16.0	13.8
114	PZ-RI-308	UAS 472(d)	5.7	5.1	16.6	9.1	15.3	14.3	14.8
115	PZ-RI-309	MPO 1357(d)	5.3	5.6	12.2	7.7	13.7	13.7	13.7
116	PZ-RI-310	NIAW3170(I) (C)	5.4	3.7	12.4	7.2	11.7	11.3	11.5
V. Special Trial (Dicoccum)									
117	Spl-DIC-101	MACS5055	5.2	11.8	16.8	11.3	14.3	10.0	12.2
118	Spl-DIC-102	MACS6222 (aest.) (C)	5.3	4.2	12.9	7.5	14.0	15.7	14.8
119	Spl-DIC-103	DDK1029 (C)	5.0	11.8	10.5	9.1	14.3	12.3	13.3
120	Spl-DIC-104	MACS5054	4.6	5.3	25.6	11.8	15.3	11.0	13.2
120A	**INFECTOR**		7.3	10.6	7.9	8.6	20.7	20.3	**20.5**
121	Spl-DIC-105	DDK1058	5.9	1.7	12.3	6.6	12.3	9.0	10.7
122	Spl-DIC-106	HW1098 (C)	4.8	8.5	9.2	7.5	12.3	11.3	11.8
123	Spl-DIC-107	DDK1059	5.9	1.7	3.3	3.6	16.3	10.7	13.5
VI. Special Trial (SPL-HYPT)									
124	SPL-HYPT-1	DBW327	5.5	4.3	5.0	4.9	16.0	14.7	15.3
125	SPL-HYPT-2	HD3086 (C)	5.7	7.9	7.9	7.2	15.3	12.3	13.8
126	SPL-HYPT-3	DBW332	4.5	4.8	5.1	4.8	11.7	10.0	10.8
127	SPL-HYPT-4	DBW303*	5.6	1.4	7.4	4.8	13.0	11.3	12.2
128	SPL-HYPT-5	HD2967 (C)	5.9	1.7	12.4	6.6	13.0	15.7	14.3
129	SPL-HYPT-6	DBW187*	5.8	1.6	17.0	8.1	13.3	12.0	12.7
130	SPL-HYPT-7	DBW329	6.3	7.2	7.6	7.0	12.0	14.7	13.3
131	SPL-HYPT-8	WH1252	5.2	13.3	8.3	9.0	13.0	11.3	12.2
132	SPL-HYPT-9	HD3378	5.3	3.9	7.3	5.5	13.0	17.7	15.3
133	SPL-HYPT-10	WH1270*	4.7	14.2	6.3	8.4	13.3	14.3	13.8
134	SPL-HYPT-11	DBW333	7.2	7.5	17.8	10.8	13.0	10.7	11.8
135	SPL-HYPT-12	DBW330	5.1	10.0	13.2	9.4	12.3	13.0	12.7
136	SPL-HYPT-13	DBW328	6.0	7.9	7.0	7.0	13.0	15.3	14.2
137	SPL-HYPT-14	DBW331	5.7	4.8	11.3	7.3	13.3	12.0	12.7

Table A1-10.1b: Screening of AVT lines against foliar wheat aphid and root aphid (2019-20)

AVT No.	Entry code	Entry	Foliar aphid score (1-5 scale)					Average score	Maximum Score	Root aphid No./ plant) Ludhiana Control only
			Ludhiana	Karnal	Kharibari	Niphad	Shillongani			
I. North Hill Zone (NHZ)										
1	NHTSZ-1901	HS 507 (C)	5	4	5	5	4	4.6	5	4
2	NHTSZ-1902	HS 562 (C)	5	5	5	5	4	4.8	5	5
3	NHTSZ-1903	HPW 349 (C)	5	5	5	5	4	4.8	5	5
4	NHTSZ-1904	HS 668	4	5	5	5	4	4.6	5	5
5	NHTSZ-1905	VL 907 (C)	4	4	5	5	4	4.4	5	4
6	NHTSZ-1906	VL 2036	5	5	5	5	4	4.8	5	5
7	NHLSZ-1901	HS 681	5	5	5	5	4	4.8	5	5
8	NHLSZ-1902	VL 3022	4	5	5	5	4	4.6	5	4
9	NHLSZ-1903	HS 680	4	3	5	4	4	4.0	5	4
10	NHLSZ-1904	VL 3023	5	5	5	4	4	4.6	5	5
11	NHLSZ-1905	HPW 474	5	5	4	4	3	4.2	5	5
12	NHLSZ-1906	UP 3069	4	4	4	4	4	4.0	4	5
13	NHLSZ-1907	HPW 473	4	4	4	4	4	4.0	4	5
14	NHLSZ-1908	VL 892 (C)	4	4	5	4	4	4.2	5	5
15	NHLSZ-1909	VL 3024	5	3	5	5	4	4.4	5	5
16	NHLSZ-1910	HS 490 (C)	4	4	5	4	4	4.2	5	5
17	NHLSZ-1911	HS 679	5	5	5	5	4	4.8	5	5
II. North Western Plain Zone (NWPZ)										
18	NW-TS-101	DBW88 (C)	4	4	4	4	4	4.0	4	4
19	NW-TS-102	DBW187(I) (C)	4	4	5	5	5	4.6	5	4
20	NW-TS-103	HD2967 (C)	5	4	4	5	3	4.2	5	5
20A	**INFECTOR**		**5**	**5**	**5**	**5**	**5**	**5.0**	**5**	**5**
21	NW-TS-104	WH1105 (C)	4	4	5	5	5	4.6	5	4
22	NW-TS-105	DBW222(I) (C)	4	3	4	5	4	4.0	5	4
23	NW-TS-106	HD3086 (C)	5	5	4	5	4	4.6	5	5
24	NW-TS-107	PBW840M	5	5	4	5	4	4.6	5	5
25	NW-TS-108	PBW803	4	4	4	5	4	4.2	5	4
26	NW-TS-109	PBW550 (C)	3	4	5	5	4	4.2	5	4
27	NW-LS-201	HD3334	4	3	5	5	4	4.2	5	4
28	NW-LS-202	HD3059 (C)	4	4	5	5	5	4.6	5	4
29	NW-LS-203	HD3332	4	4	5	5	4	4.4	5	4
30	NW-LS-204	DBW173 (C)	5	5	5	5	4	4.8	5	5
31	NW-LS-205	WH1021 (C)	4	5	5	5	3	4.4	5	4
32	NW-LS-206	PBW811	5	5	5	5	4	4.8	5	5
33	NW-LS-207	DBW291	4	4	5	5	5	4.6	5	4
34	NW-LS-208	WH1264	4	4	4	5	4	4.2	5	3
35	NW-LS-209	PBW812	4	5	4	5	4	4.4	5	4
36	NW-LS-210	JKW261	4	5	5	5	4	4.6	5	4
37	NW-LS-211	DBW290	4	4	4	5	4	4.2	5	4
38	NW-LS-212	PBW771(I) (C)	5	5	3	5	4	4.4	5	5
39	NW-LS-213	PBW813	5	5	3	5	4	4.4	5	4
40	NW-LS-214	HD3331	5	5	3	5	4	4.4	5	5
40A	**INFECTOR**		**5**	**5**	**5**	**5**	**5**	**5.0**	**5**	**5**
41	NW-LS-215	HD3298*	5	5	5	5	4	4.8	5	5

42	NW-LS-216	WH1124 (C)	5	5	3	5	5	4.6	5	5
43	NW-LS-217	UP3033	4	4	5	5	4	4.4	5	5
44	NW-RI-301	HUW838	3	4	5	5	4	4.2	5	5
45	NW-RI-302	HD3043 (C)	4	4	5	5	5	4.6	5	5
46	NW-RI-303	PBW644 (C)	4	4	5	5	3	4.2	5	5
47	NW-RI-304	DBW296	4	3	4	5	3	3.8	5	5
48	NW-RI-305	HI1628(I) (C)	4	3	5	5	4	4.2	5	5
49	NW-RI-306	WH1080 (C)	4	4	4	5	3	4.0	5	5
50	NW-RI-307	JAUW672	4	4	5	5	4	4.4	5	5
51	NW-RI-308	WH1142 (C)	4	4	5	5	4	4.4	5	5
52	NW-RI-309	NIAW3170(I) (C)	4	4	5	5	4	4.4	5	5
III. North Eastern Plain Zone (NEPZ)										
53	NE-IR-TS-101	PBW804	5	5	5	5	4	4.8	5	5
54	NE-IR-TS-102	DBW187 (C)	5	5	5	5	4	4.8	5	5
55	NE-IR-TS-103	K1006 (C)	5	5	4	5	4	4.6	5	5
56	NE-IR-TS-104	DBW39 (C)	5	4	4	5	4	4.4	5	5
57	NE-IR-TS-105	HD3249(I) (C)	5	4	5	5	3	4.4	5	5
58	NE-IR-TS-106	HD2733 (C)	5	5	4	5	5	4.8	5	5
59	NE-RI-TS-301	HD3171 (C)	4	4	5	5	4	4.4	5	5
60	NE-RI-TS-302	HD2888 (C)	5	5	5	5	4	4.8	5	5
60A	**INFECTOR**		**5**	**5**	**5**	**5**	**5**	**5.0**	**5**	**5**
61	NE-RI-TS-303	HD3293*	5	4	5	5	4	4.6	5	5
62	NE-RI-TS-304	K1317 (C)	5	5	5	5	5	5.0	5	5
63	NE-RI-TS-305	HI1612 (C)	4	5	5	5	5	4.8	5	4
64	NE-RI-TS-306	DBW252(I) (C)	5	5	5	5	4	4.8	5	4
IV. Central Zone (CZ)										
65	CZ-TS-101	TAW155	5	5	5	5	4	4.8	5	4
66	CZ-TS-102	HI1636	5	5	5	5	4	4.8	5	5
67	CZ-TS-103	MP1361	5	4	5	5	4	4.6	5	5
68	CZ-TS-104	MACS6747	4	4	5	5	4	4.4	5	4
69	CZ-TS-105	HD3377	4	5	5	5	4	4.6	5	4
70	CZ-TS-106	HI1637	5	5	5	5	4	4.8	5	4
71	CZ-TS-107	RAJ4541	5	4	5	5	4	4.6	5	5
72	CZ-TS-108	GW513	4	4	4	5	4	4.2	5	3
73	CZ-TS-109	GW322	4	4	4	5	4	4.2	5	3
74	CZ-TS-110	HI1544	4	4	4	5	4	4.2	5	4
75	CZ-LS-201	HI1634*	5	5	5	5	5	5.0	5	4
76	CZ-LS-202	HD2932	5	5	5	5	5	5.0	5	5
77	CZ-LS-203	MP3336	4	4	5	4	5	4.4	5	4
78	CZ-LS-204	HD2864	4	5	5	5	4	4.6	5	4
79	CZ-LS-205	CG1029*	4	5	5	5	4	4.6	5	4
80	CZ-RI-301	MPO1357(d)	5	5	5	5	4	4.8	5	5
80A	**INFECTOR**		**5**	**5**	**5**	**5**	**5**	**5.0**	**5**	**5**
81	CZ-RI-302	HI8627(d)	5	5	5	5	4	4.8	5	5
82	CZ-RI-303	UAS466(d)(I)	4	3	5	5	5	4.4	5	4
83	CZ-RI-304	UAS472(d)	3	3	5	4	5	4.0	5	4
84	CZ-RI-305	DBW110	4	3	5	5	4	4.2	5	4
85	CZ-RI-306	MP3288	4	4	5	5	5	4.6	5	4
86	CZ-RI-307	HI 8823(d)	4	5	5	5	4	4.6	5	4
87	CZ-RI-308	DDW47(d)(I)	5	3	5	5	4	4.4	5	5
IV. Peninsular Zone (PZ)										
88	PZ-TS-101	WHD964(d)	5	5	5	5	4	4.8	5	5
89	PZ-TS-102	DDW48(d) *	5	5	5	5	4	4.8	5	5

90	PZ-TS-103	MACS6222 (C)	5	4	5	5	4	4.6	5	5
91	PZ-TS-104	MACS3949(d) (C)	5	4	5	5	3	4.4	5	4
92	PZ-TS-105	HI8818(d)	4	4	4	5	4	4.2	5	4
93	PZ-TS-106	UAS428(d) (C)	5	5	4	4	4	4.4	5	4
94	PZ-TS-107	DDW49(d) *	4	3	4	5	4	4.0	5	4
95	PZ-TS-108	GW322 (C)	5	4	4	4	4	4.2	5	5
96	PZ-LS-201	GW519	4	4	4	4	4	4.0	4	5
97	PZ-LS-202	HI1646	4	4	4	4	5	4.2	5	3
98	PZ-LS-203	HD3090 (C)	4	4	4	5	5	4.4	5	4
99	PZ-LS-204	RAJ4083 (C)	4	4	4	5	4	4.2	5	4
100	PZ-LS-205	UAS3008	4	5	4	5	4	4.4	5	4
100A	**INFECTOR**		**5**	**5**	**5**	**5**	**4**	**4.8**	**5**	**5**
101	PZ-LS-206	MACS6749	5	5	5	5	4	4.8	5	5
102	PZ-LS-207	HD2932 (C)	5	5	5	5	4	4.8	5	4
103	PZ-LS-208	HI1641	5	5	5	5	4	4.8	5	4
104	PZ-LS-209	HI1642	5	5	5	5	4	4.8	5	5
105	PZ-LS-210	HI1633*	4	4	4	5	4	4.2	5	4
106	PZ-LS-211	MACS6752	4	4	5	5	4	4.4	5	4
107	PZ-RI-301	NIDW 1149(d)*	4	4	4	5	5	4.4	5	4
108	PZ-RI-302	UAS446(d) (C)	4	5	5	5	4	4.6	5	4
109	PZ-RI-303	HI 1605 (C)	5	5	4	5	4	4.6	5	4
110	PZ-RI-304	MACS 4087(d)	5	5	5	5	4	4.8	5	5
111	PZ-RI-305	MP 1358	5	5	4	5	4	4.6	5	5
112	PZ-RI-306	AKDW 2997-16(d) (C)	5	5	5	5	4	4.8	5	5
113	PZ-RI-307	HI8805(d)(I) (C)	5	5	4	5	4	4.6	5	5
114	PZ-RI-308	UAS 472(d)	4	4	4	5	4	4.2	5	4
115	PZ-RI-309	MPO 1357(d)	5	4	4	5	4	4.4	5	5
116	PZ-RI-310	NIAW3170(I) (C)	4	4	4	4	5	4.2	5	4
V. Special Trial (Dicoccum)										
117	Spl-DIC-101	MACS5055	4	4	4	4	3	3.8	4	4
118	Spl-DIC-102	MACS6222(aest.)	5	5	5	5	3	4.6	5	5
119	Spl-DIC-103	DDK1029 (C)	5	5	5	5	4	4.8	5	5
120	Spl-DIC-104	MACS5054	5	5	5	5	4	4.8	5	5
120A	**INFECTOR**		**5**	**5**	**5**	**5**	**4**	**4.8**	**5**	**5**
121	Spl-DIC-105	DDK1058	4	5	5	5	4	4.6	5	4
122	Spl-DIC-106	HW1098 (C)	4	4	4	5	5	4.4	5	4
123	Spl-DIC-107	DDK1059	4	4	4	5	4	4.2	5	4
VI. Special Trial (SPL-HYPT)										
124	SPL-HYPT-1	DBW327	3	3	4	5	3	3.6	5	4
125	SPL-HYPT-2	HD3086 (C)	4	3	4	5	5	4.2	5	3
126	SPL-HYPT-3	DBW332	4	3	4	5	4	4.0	5	4
127	SPL-HYPT-4	DBW303*	5	3	4	5	4	4.2	5	5
128	SPL-HYPT-5	HD2967 (C)	5	5	4	5	4	4.6	5	5
129	SPL-HYPT-6	DBW187*	5	4	4	5	4	4.4	5	4
130	SPL-HYPT-7	DBW329	4	3	5	5	4	4.2	5	4
131	SPL-HYPT-8	WH1252	4	4	5	5	4	4.4	5	4
132	SPL-HYPT-9	HD3378	4	5	5	5	4	4.6	5	4
133	SPL-HYPT-10	WH1270*	4	5	5	5	4	4.6	5	4
134	SPL-HYPT-11	DBW333	5	3	5	5	4	4.4	5	5
135	SPL-HYPT-12	DBW330	5	4	5	5	5	4.8	5	5
136	SPL-HYPT-13	DBW328	5	4	5	5	4	4.6	5	5
137	SPL-HYPT-14	DBW331	5	4	5	5	4	4.6	5	5

Table A1-10.1c: Screening of NIVT lines against foliar wheat aphids (Year-2019-20)

NIVT No.	Entry code	Entry	Foliar aphid score (1-5 scale)				
			Ludhiana	Karnal	Niphad	Average Score	Highest Score
NIVT-1A							
1	N-101	Raj4548	5	5	5	5.0	5
2	N-102	UP3052	5	5	5	5.0	5
3	N-103	HD3348	4	5	5	4.7	5
4	N-104	DBW334	4	4	4	4.0	4
5	N-105	UP3053	5	5	5	5.0	5
6	N-106	HUW 839	4	5	5	4.7	5
7	N-107	K1901	5	5	4	4.7	5
8	N-108	HD3352	5	5	4	4.7	5
9	N-109	KRL1810	5	5	4	4.7	5
10	N-110	DBW309	4	4	4	4.0	4
11	N-111	PBW828	4	4	4	4.0	4
12	N-112	K1006 (C)	4	4	4	4.0	4
13	N-113	HD3349	5	4	4	4.3	5
14	N-114	PBW841	5	5	4	4.7	5
15	N-115	HD2967 (C)	4	4	5	4.3	5
16	N-116	PBW829	5	5	5	5.0	5
17	N-117	DBW308	5	5	5	5.0	5
18	N-118	AAI-W29	5	5	4	4.7	5
19	N-119	HD3353	5	5	5	5.0	5
20	N-120	DBW306	4	4	5	4.3	5
20A	**INFECTOR**		5	5	5	5.0	5
21	N-121	WH1284	5	5	5	5.0	5
22	N-122	UP3051	5	5	5	5.0	5
23	N-123	WH1272	5	4	5	4.7	5
24	N-124	HD3350	5	4	5	4.7	5
25	N-125	HD3086 (C)	5	5	5	5.0	5
26	N-126	Raj4547	5	5	5	5.0	5
27	N-127	UP3054	4	4	5	4.3	5
28	N-128	NW7079	5	5	5	5.0	5
29	N-129	PBW827	4	5	5	4.7	5
30	N-130	HD3351	4	5	5	4.7	5
31	N-131	DBW187 (C)	5	5	5	5.0	5
32	N-132	PBW826	4	5	5	4.7	5
33	N-133	Raj4546	4	5	5	4.7	5
34	N-134	WH1273	4	5	5	4.7	5
35	N-135	DBW307	4	5	5	4.7	5
36	N-136	WH1271	5	5	5	5.0	5
NIVT-1B							
37	N-201	WH1274	5	5	5	5.0	5
38	N-202	JKW275	5	5	5	5.0	5
39	N-203	K1905	4	5	5	4.7	5
40	N-204	UP3055	5	5	5	5.0	5
40A	**INFECTOR**		5	5	5	5.0	5
41	N-205	NW7093	5	4	5	4.7	5
42	N-206	Raj4549	4	4	5	4.3	5
43	N-207	K1903	4	4	5	4.3	5
44	N-208	PBW830	4	5	5	4.7	5
45	N-209	PBW831	4	5	5	4.7	5

46	N-210	NW7094	4	5	5	4.7	5
47	N-211	UP3057	4	4	5	4.3	5
48	N-212	WH1283	4	4	4	4.0	4
49	N-213	Raj4550	4	4	5	4.3	5
50	N-214	DBW313	5	4	5	4.7	5
51	N-215	BRW3877	5	4	5	4.7	5
52	N-216	DBW312	5	4	5	4.7	5
53	N-217	UP3056	4	4	4	4.0	4
54	N-218	NW7088	5	4	5	4.7	5
55	N-219	HD3355	4	4	5	4.3	5
56	N-220	HUW841	4	4	5	4.3	5
57	N-221	K1904	4	4	5	4.3	5
58	N-222	HD3356	4	4	5	4.3	5
59	N-223	AAI-W22	4	4	5	4.3	5
60	N-224	HD3357	4	4	5	4.3	5
60A	**INFECTOR**		5	5	**5**	5.0	5
61	N-225	HUW840	5	5	5	5.0	5
62	N-226	HD2967 (C)	5	5	5	5.0	5
63	N-227	KRL1803	5	5	5	5.0	5
64	N-228	KRL1808	4	4	4	4.0	4
65	N-229	JKW277	3	4	5	4.0	5
66	N-230	HD3086 (C)	4	4	5	4.3	5
67	N-231	DBW187 (C)	4	4	5	4.3	5
68	N-232	BRW3869	4	4	5	4.3	5
69	N-233	HD3354	5	4	5	4.7	5
70	N-234	DBW311	4	4	5	4.3	5
71	N-235	K1006 (C)	5	5	5	5.0	5
72	N-236	DBW310	4	4	5	4.3	5
NIVT-2							
73	N-301	GW521	4	4	4	4.0	4
74	N-302	MP3535	4	4	4	4.0	4
75	N-303	MACS6478 (C)	4	4	5	4.3	5
76	N-304	RVW4301	4	4	5	4.3	5
77	N-305	UAS3012	5	4	5	4.7	5
78	N-306	NWS2176	5	4	5	4.7	5
79	N-307	RVW4304	5	4	5	4.7	5
80	N-308	HI1544 (C)	5	4	5	4.7	5
80A	**INFECTOR**		5	**5**	**5**	5.0	5
81	N-309	DBW314	5	4	4	4.3	5
82	N-310	HI1650	4	4	4	4.0	4
83	N-311	HD3376	5	5	4	4.7	5
84	N-312	GW322 (C)	5	5	5	5.0	5
85	N-313	HI1648	4	4	5	4.3	5
86	N-314	WH1275	3	4	5	4.0	5
87	N-315	MACS3735	4	4	5	4.3	5
88	N-316	UAS3011	4	4	5	4.3	5
89	N-317	GW522	4	4	5	4.3	5
90	N-318	NIAW3889	5	5	5	5.0	5
91	N-319	HI1649	5	4	5	4.7	5
92	N-320	NIAW3882	4	4	5	4.3	5
93	N-321	AKAW5099	4	4	4	4.0	4
94	N-322	HD3359	5	5	4	4.7	5
95	N-323	MP1369	5	5	4	4.7	5

96	N-324	UP3058	4	4	4	4.0	4
97	N-325	HI1647	4	4	4	4.0	4
98	N-326	MACS6764	5	4	4	4.3	5
99	N-327	PBW832	5	4	5	4.7	5
100	N-328	GW523	4	4	5	4.3	5
100A	**INFECTOR**		5	4	**5**	4.7	5
101	N-329	MP1370	4	4	4	4.0	4
102	N-330	CG1034	4	4	4	4.0	4
103	N-331	MACS6768	5	5	4	4.7	5
104	N-332	Raj4551	5	4	4	4.3	5
105	N-333	DBW315	5	5	4	4.7	5
106	N-334	MP3526	4	4	4	4.0	4
107	N-335	MP1371	5	4	4	4.3	5
108	N-336	MACS6222 (C)	4	4	4	4.0	4
NIVT-3A							
109	N-401	K1907	4	4	4	4.0	4
110	N-402	HD3361	4	4	4	4.0	4
111	N-403	DBW335	4	4	4	4.0	4
112	N-404	HD3362	4	4	5	4.3	5
113	N-405	WH1278	5	5	4	4.7	5
114	N-406	DBW173 (C)	4	4	5	4.3	5
115	N-407	UP3065	5	5	4	4.7	5
116	N-408	NW7092	4	4	4	4.0	4
117	N-409	HD3363	5	4	5	4.7	5
118	N-410	PBW836	5	4	5	4.7	5
119	N-411	DBW317	4	4	5	4.3	5
120	N-412	K1908	5	4	5	4.7	5
120A	**INFECTOR**		4	4	**5**	4.3	5
121	N-413	HD3364	4	4	5	4.3	5
122	N-414	PBW834	5	4	5	4.7	5
123	N-415	HUW842	4	4	5	4.3	5
124	N-416	UP3059	5	4	5	4.7	5
125	N-417	Raj4552	5	4	4	4.3	5
126	N-418	HD3360	5	4	5	4.7	5
127	N-419	UP3061	5	4	5	4.7	5
128	N-420	HD3365	4	4	5	4.3	5
129	N-421	WH1276	5	5	5	5.0	5
130	N-422	Raj4554	4	4	5	4.3	5
131	N-423	UP3060	4	4	5	4.3	5
132	N-424	HI1563 (C)	5	5	5	5.0	5
133	N-425	PBW833	5	5	5	5.0	5
134	N-426	DBW316	4	4	5	4.3	5
135	N-427	HD3059 (C)	4	4	5	4.3	5
136	N-428	DBW107 (C)	5	5	5	5.0	5
137	N-429	NW8000	5	5	5	5.0	5
138	N-430	PBW835	4	5	4	4.3	5
139	N-431	Raj4553	4	5	5	4.7	5
140	N-432	JKW278	4	5	5	4.7	5
140A	**INFECTOR**		5	4	**5**	4.7	5
141	N-433	WH1277	5	4	4	4.3	5
142	N-434	DBW318	5	4	5	4.7	5
143	N-435	DBW319	5	4	5	4.7	5
144	N-436	JKW270	5	4	5	4.7	5

NIVT-3B							
145	N-501	LOK77	5	5	5	5.0	5
146	N-502	HD3366	4	4	5	4.3	5
147	N-503	MP3527	5	4	5	4.7	5
148	N-504	NIAW3895	4	4	4	4.0	4
149	N-505	MP1372	5	4	4	4.3	5
150	N-506	CG1035	4	4	5	4.3	5
151	N-507	HD3367	4	4	5	4.3	5
152	N-508	WH1279	4	4	5	4.3	5
153	N-509	HI1651	4	4	5	4.3	5
154	N-510	HI1652	4	4	5	4.3	5
155	N-511	RVW4309	4	4	5	4.3	5
156	N-512	NWS2180	4	4	5	4.3	5
157	N-513	MACS6774	5	4	5	4.7	5
158	N-514	HD2932 (C)	5	4	5	4.7	5
159	N-515	UAS3013	4	4	5	4.3	5
160	N-516	AKAW5080	4	4	4	4.0	4
160A	**INFECTOR**		5	5	**5**	5.0	5
161	N-517	DBW320	5	4	5	4.7	5
162	N-518	CG1037	5	5	5	5.0	5
163	N-519	GW527	4	4	5	4.3	5
164	N-520	MACS6769	4	4	5	4.3	5
165	N-521	HD2864 (C)	4	4	5	4.3	5
166	N-522	GW525	5	5	5	5.0	5
167	N-523	NIAW3898	5	5	5	5.0	5
168	N-524	MP3529	5	4	5	4.7	5
169	N-525	PBW837	5	4	5	4.7	5
NIVT-4							
170	N-601	PWU5	4	4	5	4.3	5
171	N-602	HI8713 (C)	5	5	5	5.0	5
172	N-603	HI8826	4	5	5	4.7	5
173	N-604	MACS4106	5	5	5	5.0	5
174	N-605	UAS473	4	4	5	4.3	5
175	N-606	HI8828	4	4	5	4.3	5
176	N-607	MPO1375	4	5	4	4.3	5
177	N-608	MACS4100	4	5	5	4.7	5
178	N-609	WHD965	4	4	5	4.3	5
179	N-610	NIDW1348	5	5	5	5.0	5
180	N-611	DDW53	5	4	5	4.7	5
180A	**INFECTOR**		5	5	**5**	5.0	5
181	N-612	HI8829	5	4	5	4.7	5
182	N-613	PDW360	5	4	5	4.7	5
183	N-614	HI8825	4	5	5	4.7	5
184	N-615	HI8827	4	4	5	4.3	5
185	N-616	HI8737 (C)	4	5	5	4.7	5
186	N-617	DDW54	4	4	5	4.3	5
187	N-618	MACS3949 (C)	5	4	5	4.7	5
188	N-619	UAS474	5	5	5	5.0	5
189	N-620	PBND4812	4	4	5	4.3	5
190	N-621	GW1355	3	5	5	4.3	5
191	N-622	GW1354	4	5	5	4.7	5
192	N-623	NIDW1345	4	4	5	4.3	5
193	N-624	MPO1374	4	4	5	4.3	5

194	N-625	MPO1373	5	5	5	5.0	5
NIVT-5A							
195	N-701	WH1280	4	4	5	4.3	5
196	N-702	HD3368	5	4	5	4.7	5
197	N-703	HD3369	4	5	5	4.7	5
198	N-704	DBW321	4	4	5	4.3	5
199	N-705	BRW3863	4	5	5	4.7	5
200	N-706	WH1281	4	4	5	4.3	5
200A	**INFECTOR**		5	4	5	4.7	5
201	N-707	DBW324	5	4	5	4.7	5
202	N-708	HD3171 (C)	5	5	5	5.0	5
203	N-709	UP3063	5	5	5	5.0	5
204	N-710	JAUW683	5	4	5	4.7	5
205	N-711	K1910	5	5	5	5.0	5
206	N-712	PBW644 (C)	5	5	5	5.0	5
207	N-713	HI1654	4	4	5	4.3	5
208	N-714	K1317 (C)	3	5	5	4.3	5
209	N-715	NW7096	4	4	5	4.3	5
210	N-716	DBW323	4	5	5	4.7	5
211	N-717	HI1653	4	4	5	4.3	5
212	N-718	PBW848	4	5	5	4.7	5
213	N-719	PBW839	4	4	5	4.3	5
214	N-720	HUW843	4	4	5	4.3	5
215	N-721	PBW838	4	4	5	4.3	5
216	N-722	DBW322	4	5	5	4.7	5
217	N-723	WH1142 (C)	4	4	5	4.3	5
218	N-724	BCW5	5	5	5	5.0	5
219	N-725	UP3062	4	5	5	4.7	5
NIVT-5B							
220	N-801	DBW326	5	5	5	5.0	5
220A	**INFECTOR**		5	5	**5**	5.0	5
221	N-802	GW528	4	4	5	4.3	5
222	N-803	MP1367	4	4	5	4.3	5
223	N-804	UAS446(d) (C)	4	4	5	4.3	5
224	N-805	UAS475(d)	4	4	5	4.3	5
225	N-806	DDW55(d)	4	4	5	4.3	5
226	N-807	MACS6753	4	4	5	4.3	5
227	N-808	HD3372	5	5	5	5.0	5
228	N-809	HI1605 (C)	5	5	5	5.0	5
229	N-810	DBW110 (C)	4	4	5	4.3	5
230	N-811	HI8830(d)	4	4	5	4.3	5
231	N-812	HI1655	4	4	5	4.3	5
232	N-813	HD3371	4	4	5	4.3	5
233	N-814	GW1356(d)	4	4	5	4.3	5
234	N-815	NIAW3855	5	5	5	5.0	5
235	N-816	HI8627(d) (C)	4	4	5	4.3	5
236	N-817	HI8831(d)	5	5	5	5.0	5
237	N-818	MP3523	4	4	5	4.3	5
238	N-819	NIAW3851	5	5	5	5.0	5
239	N-820	CG1036	5	5	5	5.0	5
240	N-821	UAS3014	5	4	5	4.7	5
240A	**INFECTOR**		5	**5**	**5**	5.0	5
241	N-822	MP1368	4	4	5	4.3	5

242	N-823	MACS6755	4	4	5	4.3	5
243	N-824	AKAW5088	4	4	5	4.3	5
244	N-825	DBW325	5	4	5	4.7	5
IVT (Hill Zone)							
245	NHIVT-1901	HS 507 (C)	5	5	5	5.0	5
246	NHIVT-1902	SKW 356	5	5	5	5.0	5
247	NHIVT-1903	VL 2042	5	4	5	4.7	5
248	NHIVT-1904	HPW 471	5	5	5	5.0	5
249	NHIVT-1905	HS 675	4	5	5	4.7	5
250	NHIVT-1906	HPW 472	5	4	5	4.7	5
251	NHIVT-1907	VL 2039	4	4	5	4.3	5
252	NHIVT-1908	HS 677	4	5	4	4.3	5
253	NHIVT-1909	HS 676	5	5	5	5.0	5
254	NHIVT-1910	UP 3064	5	4	5	4.7	5
255	NHIVT-1911	HS 678	5	4	5	4.7	5
256	NHIVT-1912	HS 562 (C)	4	4	5	4.3	5
257	NHIVT-1913	HPW 470	4	5	5	4.7	5
258	NHIVT-1914	HPW 469	4	5	5	4.7	5
259	NHIVT-1915	VL 2041	4	5	5	4.7	5
260	NHIVT-1916	VL 2040	4	4	5	4.3	5
260A	**INFECTOR**		5	5	5	5.0	5

Table A2-10.1a:Screening of MPSN nursery against shoot fly and brown wheat mite (2019-20)

MDSN No.	**Entry**	**Shoot fly incidence (%)**				**No. of brown wheat mites/10 cm sq area**		**Average**
Sources : EPPSN 2018-19		**Ludhiana**	**Kanpur**	**Dharwad**	**Average**	**Ludhiana**	**Durgapura**	
A. Resistant to all three rusts								
Source:AVT Ist Year 2017-18								
1	GW1339	5.9	4.5	17.4	9.3	14.0	12.3	13.2
2	GW1346(d)	5.2	12.5	12.5	10.1	10.0	11.0	10.5
3	GW492	4.6	18.8	11.1	11.5	12.0	13.7	12.8
4	HPW441	5.4	14.3	10.0	9.9	9.7	10.3	10.0
5	HPW442	6.8	16.7	8.2	10.6	12.3	14.0	13.2
6	HPW450	7.4	18.8	13.5	13.2	11.7	11.7	11.7
7	HPW459	5.7	17.9	9.8	11.1	13.7	15.7	14.7
8	HS660	6.0	x	20.0	13.0	17.3	13.0	15.2
9	K 1601	6.0	17.1	8.7	10.6	16.7	10.0	13.3
10	MACS4059(d)	5.8	13.3	14.5	11.2	16.0	11.3	13.7
11	MACS5051	5.7	10.7	9.0	8.5	16.0	13.7	14.8
12	PBW800	6.8	12.5	14.6	11.3	16.0	14.0	15.0
13	UP3016	5.8	10.7	9.6	8.7	8.3	12.7	10.5
B. Resistant to Stem and Leaf rusts								
Source:AVT Ist Year 2017-18								

14	AKAW4924	4.9	11.5	15.4	10.6	13.0	15.7	14.3
15	DBW223	6.6	12.5	10.8	10.0	12.7	13.0	12.8
16	HI1625	5.3	7.7	11.7	8.2	14.3	12.7	13.5
17	HI1628	5.4	14.3	10.0	9.9	14.3	10.0	12.2
18	HI8800(d)	5.3	13.3	7.2	8.6	14.3	14.7	14.5
19	NIAW3170	6.0	15.6	11.2	10.9	11.7	17.0	14.3
20	PBW757	4.4	16.7	21.6	14.2	13.7	15.3	14.5
20A	GW 173	-	16.7	7.5	12.1	x	x	x
20B	IWP 72	-	13.3	6.8	10.1	21.0	19.7	20.3
20C	Sonalika	7.2	16.7	6.9	10.3	x	x	x
20D	A-9-30-1		12.0	8.1	10.0	x	x	x
21	UAS466(d)	6.2	10.7	11.3	9.4	17.0	13.7	15.3
22	WH1235	5.3	9.1	9.7	8.0	13.3	10.3	11.8
C. Resistant to Leaf and Stripe rusts								
Source:AVT Ist Year 2017-18								
23	DBW187	5.8	4.2	16.9	9.0	14.7	14.7	14.7
24	HS661	5.9	14.3	36.7	19.0	13.3	10.0	11.7
25	PBW797	5.3	11.7	16.5	11.1	12.0	12.3	12.2
26	PBW801	5.7	11.4	12.9	10.0	13.0	14.0	13.5
27	MPO 1336	5.7	10.7	10.7	9.0	13.7	13.7	13.7
28	DBW 237	4.4	13.3	15.2	11.0	15.3	12.0	13.7
D.Resistant to stem and Stripe rusts								
Source:AVT Ist Year 2017-18								
29	DDK1054	5.3	0.0	10.7	5.3	15.0	16.7	15.8
30	GW491	5.8	3.3	12.5	7.2	11.3	14.0	12.7
31	HI1624	4.7	6.7	8.7	6.7	10.3	12.7	11.5
32	HPW451	6.0	12.5	7.2	8.6	9.0	11.3	10.2
33	PBW763	5.8	10.7	14.9	10.5	13.0	9.7	11.3
34	WH 1218	6.7	3.3	15.7	8.6	11.7	13.0	12.3
34A	GW 173	-	15.6	17.2	16.4	x	x	x
34B	IWP 72	-	13.3	14.8	14.1	19.3	21.3	20.3
34C	Sonalika	7.2	15.0	2.6	8.3	x	x	x
34D	A-9-30-1	-	10.0	4.0	7.0	x	x	x

Table A2-10.1b: Screening of MPSN nursery against foliar aphid and root aphid (Year-2019-20)

MDSN No.	**Entry**	**Foliar aphid score (1-5 scale)**				**Average score**	**Maximum Score**	**Root Aphid Score (1-5)**
Sources : EPPSN 2018-19		**Ludhiana**	**Karnal**	**Kharibari**	**Niphad**			
A. Resistant to all three rusts								
Source:AVT Ist Year 2017-18								
1	GW1339	4	4	5	5	4.5	5	5
2	GW1346(d)	5	4	5	4	4.5	5	4
3	GW492	5	4	5	4	4.5	5	4
4	HPW441	4	4	5	4	4.3	5	4

5	HPW442	4	4	5	4	4.3	5	4
6	HPW450	5	5	5	4	4.8	5	4
7	HPW459	5	4	3	4	4.0	5	5
8	HS660	5	4	3	4	4.0	5	5
9	K 1601	5	4	4	4	4.3	5	5
10	MACS4059(d)	5	3	3	4	3.8	5	5
11	MACS5051	5	4	4	4	4.3	5	4
12	PBW800	4	4	3	4	3.8	4	5
13	UP3016	4	4	3	4	3.8	4	4
B. Resistant to Stem and Leaf rusts								
Source:AVT Ist Year 2017-18								
14	AKAW4924	4	4	4	5	4.3	5	4
15	DBW223	4	4	3	5	4.0	5	4
16	HI1625	5	4	5	5	4.8	5	4
17	HI1628	4	4	5	4	4.3	5	4
18	HI8800(d)	4	4	5	4	4.3	5	3
19	NIAW3170	4	4	5	4	4.3	5	4
20	PBW757	5	5	5	5	5.0	5	5
20A	GW 173	-	5	5	5	5.0	5	-
20B	IWP 72	-	5	5	5	5.0	5	-
20C	Sonalika	5	5	5	5	5.0	5	-
20D	A-9-30-1	-	5	5	5	5.0	5	5
21	UAS466(d)	4	4	5	5	4.5	5	4
22	WH1235	4	4	4	4	4.0	4	5
C. Resistant to Leaf and Stripe rusts								
Source:AVT Ist Year 2017-18								
23	DBW187	4	3	4	5	4.0	5	4
24	HS661	5	5	4	5	4.8	5	4
25	PBW797	4	4	4	5	4.3	5	4
26	PBW801	5	4	4	5	4.5	5	4
27	MPO 1336	5	5	5	4	4.8	5	5
28	DBW 237	4	4	3	4	3.8	4	4
D. Resistant to Stem and Stripe rusts								
Source:AVT Ist Year 2017-18								
29	DDK1054	3	3	5	4	3.8	5	4
30	GW491	4	4	5	5	4.5	5	4
31	HI1624	4	4	5	5	4.5	5	5
32	HPW451	4	4	5	4	4.3	5	4
33	PBW763	5	4	5	4	4.5	5	5
34	WH 1218	4	4	5	4	4.3	5	4
34A	GW 173	-	5	5	5	5.0	5	-
34B	IWP 72	-	5	5	5	5.0	5	-
34C	Sonalika	5	5	5	5	5.0	5	-
34D	A-9-30-1	-	5	5	5	5.0	5	5

10.2 (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 was recorded and indicated as grades or percent damage inflicted to crop. The peak period of pest activity and its severity of damage was also be recorded.

Centre: Ludhiana

In order to monitor the insect pest of wheat, survey of Punjab state were undertaken during 2019-20 crop season. The moderate incidence of wheat aphid was observed in the month of second fortnight of February and first fortnight of March throughout the state of Punjab. Intensive surveys carried out in the state of Punjab revealed the presence of pink stem borer and armyworm infestation in south western districts of Punjab particularly in residue managed wheat fields in the month of December. The severe incidence of pink stem borer and armyworm was observed in some of the fields in district Sangrur and Patiala where farmers had ploughed their field and re-sown the crop. It was observed that the damage of these insects was particularly high in early sown wheat crop (October sown). Another important observation from the surveillance programme was that pink stem borer and armyworm damage was higher in those fields where long duration rice varieties were cultivated in previous crop season in rice-wheat cropping system. Following is the detail of pink stem borer and armyworm damage observed in different parts of Punjab (Table B1-10.2a).

Centre: Niphad

The data regarding survey of the pest infesting wheat and their natural enemies are presented in (Table B1-10.2b). Survey was carried out in the villages of Nasik and adjoining district Ahemednagar and Aurangabad at different crop stages. Heavy incidence of aphids was recorded during the servey. The *Coccinellid* & *Chrysoperla carnea* predator grubs and beetles feeding on the aphid were also observed. The incidence of jassids was recorded in medium intensity.

Centre: Vijapur

Survey of wheat & barley fields were carried out in the state during the crop season. The termite damage in wheat fields remained low throughout the crop season. While, the incidence of aphids was low to moderate during ear head stage of the crop. The population of *H. armigera*, pink stem borer and surface grasshopper were very low. The appearance of minor pests like spodoptera, 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

In Kanpur, the incidence of shootfly was observed 2 per cent for wheat variety PBW-343 and HD-2967. The incidence of termite was observed 8 per cent in same varieties of wheat. At Arol (Kanpur), the termite infestation was observed 10% in wheat varieties namely, DBW 39 and HUW 234. Moderate infestation of foliar aphid was on barley variety namely, 'Barley Local' while the shootfly infestation was observed 2% at the village Arol (Kanpur). The moderate incidence of pink stem borer was observed in irrigated crop one per cent in variety HD-2967 (Table B1-10.2c).

Centre: Karnal

In Haryana, many reports of attack of pink stem borer and army worm came in the month of December from Yamunanagar, Ambala, Krushestra, Kunjpura, Ladwa etc.The incidence of these lepidopterous pests was reported around 5-7% in these areas. Termites and rot aphid was also reported during November and December which was around 2-5%. Starting from January, incidence of aphids started and it was minimal in the beginning with 5-6 aphids/tiller but in February, higher infestation of aphids (60-85 aphids/tiller on an average) was observed in the fields. Natural enemies, wasps, spiders and the grubs and adults of coccinellid beetles were seen during February and March frequently in the fields.

Table B1-10.2a: District wise report of insect-pest incidence early growth stages of wheat in the month of December

District	Number of reports of pest incidence				
	Pink stem borer	Army worm	Root aphid	AW+PSB	Total
Sangrur	54	8	3	5	70
Barnala	2	-	-	-	2
Faridkot	2	-	1	-	3
Jalandhar	3	-	-	-	3
Mansa	2	-	-	-	2
Ferozepur	1	-	-	-	1
Gurdaspur	10	1	-	1	12
Moga	3	-	1	14*	18
Fatehgarh Sahib	2	2	1	-	5
Bathinda	5	-	-	-	5
Sri Muktsar Sahib	1	-	-	-	1
Ludhiana	1	-	7	-	1
Ropar	1	-	-	-	1
Hoshiarpur	8	1	-	-	9
Kapurthala	-	-	4	-	4
Patiala	-	1	-	-	1
SBS Nagar	-	1	-	-	1
Pathankot	-	1	-	-	1

* low incidence (1-2%) cases in 14 villages

Table B1-10.2c: Survey of wheat and barley pests and their natural enemies during 2019-20 (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
25.01.2020 Oil Seed Farm, Kalyanpur, Kanpur	Irrigated Irrigated	10 10	PBW343 and HD2967 PBW343 and HD2967	Shootfly Termite	Minor Major	2% 8%	*Coccinella-septumpuntata* -	Adult -
31.01.2020 Araul (Kanpur)	Irrigated Irrigated	10 10	DBW 39 HUW 234 Barley-local	Termite Barley aphid	Major Major	10% 25-30 aphid/plant	- *Coccinella-septumpuntata*	- Adult
10.02.2020 Daleep Nagar (Kanpur	Irrigated Irrigated	10 10	PBW343 & DBW17 Barley-	Termite Barley aphid	Major Major	12% 55 aphid	- *Coccinella-septumpuntata*	- -

Dehat)	Irrigated Irrigated	10 10	K551 PBW343 HD2967	Shootfly Pink stemborer	Minor Minor	2% 1%	- Swan	- Adult
25.01.2020 Oil Seed Farm, Kalyanpur, Kanpur	Irrigated Irrigated	10 10	PBW343 and HD2967 PBW343 and HD2967	Shootfly Termite	Minor Major	2% 8%	*Coccinella-septumpuntata* -	Adult -

Table B1-10.2d: Survey of wheat insect- pests and their natural enemies during 2019-20 (Centre: Shillongani)

Locality & Date	Area surveyed (Rainfed/ irrigated)	No. of Samples observed	Variety & stage of growth	Crop pests		Natural Enemy
				Name	Status	
Bhakatgaon, Nagaon 22-01-20	Rainfed	15	HD 3086 Vegetative	Cutworm (*Agrotis ipsilon*)	3 - 4 % (Minor)	
10-02-20		15	- do -	No pest observed	-	
05-03-20		15	- do -	No pest observed		
17-03-20		15	Reproductive	Stem borer (*Sesamia inferens*)	4 – 6 % White ear head (Minor)	Coccinellid beetles, Both Grub & Adults 1. *Micraspis discolor* 2. *Coccinella septempuctata*(Syrphid Fly, *Ischidon scutellaris*
28-03-20		15	- do -	Stem borer (*Sesemia inference*)	8 – 9 % White ear head (Minor)	
				Grain Aphid (*Sitobion miscanthi*)	16-18 % earhead infested. 10-12 aphid/ earhead (Major)	
				Heliothis armigera	Sporadic (Minor)	
Hojai 13.03.20	Rainfed	20	HD 3086 Reproductive	Stem borer (*Sesamia inferens*)	10-12 % White ear head (Minor)	Coccinellid Beetles & Grub
				Grain Aphid	14-16 % earhead	

				(*Sitobion miscanthi*)	infested. 14-16 aphid/earhead (Major)	
				Heliothis armigera	Sporadic (Minor)	
Morigaon 16.03.20	Rainfed	20	HD 3086 Reproductive	Stem borer (*Sesamia inferens*)	18-20 % White ear head (major)	Coccinellid Beetles & Grub
				Grain Aphid (*Sitobion miscanthi*)	20-25 % earhead infested. 10-15 aphid/ earhead (Major)	

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

Centre: Ludhiana

The field experiment was conducted in the experimental area of Department of Plant Breeding and Genetics, PAU, Ludhiana. The crop was sown using 100 kg/ha of PBW 725 in Randomized Block Design at four different dates of sowing i.e. early (first fortnight of November), timely (second fortnight of November) and late (first fortnight of December) and very late (second fortnight of December) during 2019-20. Each treatment was replicated thrice. The data on major pest viz. foliage feeding aphids, termites and pink stem borer etc. were recorded at peak period of activity of respective pest. The first incidence and population build of aphids were recorded by counting the number of aphids tiller from randomly selected five tillers from each plot during peak period of their activity in the months of February-March. The observation on termite damage was recorded by counting damaged and total tillers from one-meter row length. These observations were recorded from five different spots at weekly intervals from each plot at 3, 4 and 5 WAS. The relative abundance and damage of PSBin wheat was examined in a separate experiment and PBW 625 was sown using Happy seeder The observations on PSB damage was recorded by counting damaged and total tillers from one-meter row length. These observations were recorded from five different spots at weekly intervals from each plot starting from 3 weeks old crop **(**Table B2-10.2a).

1. **Termite damage**: The termite damage recorded at seedling stage in different dates of sowing indicated that early sown crop (first week of Nov 2019) suffered more termite damage as compared to timely, late and very late sown crop. At earing stage, again termite damage was highest (2.94%) in early sown crop followed by timely (2.68%) and late sown (2.56%) and very late sown (2.16%) crop.
2. **Aphid incidence**: The aphids first appeared in first week of January in early sown crop and second week of January in 15 Nov. sown crop while it appeared in third week of January in other two sowing times. The data recorded indicated that the aphid incidence got delayed with the delay in sowing time. The peak of aphid incidence was recorded in 9th standard meteorological weeks (SMW) of 2020 in early sown wheat. However, it was 10th SMW for timely and late sown crop and 11th SMW for very late sown crop.

3. **Pink stem borer Damage**: The pink stem borer damage was higher in early (1.46-3.98%) and timely sown (1.05-3.62%) crop as compared to late (0.83-3.12%) and very late sown crop (0.86-2.23%).

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 (Table B2-10.2b).

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 0.2 and 0.7 aphids/plant, respectively during 51st standard week. The population reached to its peak during 9th Standard week on D1 (17.67 aphids/plant) and during 9th standard week on D2 sown crop (17.61 aphids/plant) in the month of February. In case of D3 (1st Dec.) and D4 (31 Dec.) sown crops, the aphid appeared during 1ststandard week with incidence of 0.2 and 0.3 aphids/plant, respectively. The aphid population reached peaked during 10th & 11th standard weeks on D3 and D4 sown crops, respectively with aphid incidence as 19.1 and 18.7 aphids/plant, respectively (Table B2-11.2c).

2. Termite damage: The termite damage was first recorded at seedling stage on D1 and D2 sown crops with infestation of 4.1 to 3.7% damaged effective tillers / m row, respectively during 51th standard week. The early sown crop (first week of Nov 2019) suffered more termite damage as compared to timely, late and very late sown crop. At heading stage, again termite damage was highest in early sown crop f

3. Pink stem borer Damage: The damage was first recorded at seedling stage on D1 and D2 sown crops with infestation of 4.1to 3.8% damage, respectively during 51th standard week. The early sown crop (first week of Nov 2019) suffered more termite damage as compared to timely, late and very late sown crop Table B2-10.2b.

Centre: Kharibari

An experiment was conducted at Regional Research sub-station (Terai Zone) UBKV, Kharibari, Darjeeling. The wheat variety HD2967 was sown on 1st week of December'2019, 15th December'2019 and 01st January'2020. The experiment was laid out in Randomized Block Design with four replication and the plots of 5m X 4m length.

The mean number of aphid population was record from randomly selected fifteen tagged plants per plot taking their 10 cm twigs. The observations were taken at weekly intervals starting from 46th standard week and continuing upto 14th standard week. These recorded data were correlated with various abiotic parameters like temperature (Maximum and Minimum), Relative Humidity (Maximum and Minimum) and rainfall for determining the relationship of prevailing environmental factors with population fluctuation of aphid (Table B2-10.2c).

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

Centre: Ludhiana

The efficiency of different types of traps viz. sticky-traps and tray-traps to capture aphids and their placement height in the crop was tested in the fields of Experimental Area of Department of Plant Breeding and Genetics, PAU, Ludhiana. The aphid population [(alate (winged) and apterous (wingless)] forms of aphids captured in traps were recorded at weekly interval at the peak period of their activity.

The observation recorded indicated that the higher numbers of aphids were trapped in yellow colour traps as compared to blue colour traps.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 B3-10.2a).

Centre: Karnal

The data revealed significant differences among various treatments regarding captured number of aphids. The observation recorded indicated that the higher numbers of aphids were trapped in yellow colour traps as compared to blue colour traps.Yellow sticky traps installed at 100 cm height recorded maximum average number of aphids i.e 142.7 as against the minimum average number of captured aphids i.e 44.0 aphids recorded in blue tray trap installed at 150 cm height. The highest (642 aphids) seasonal total captured aphids were recorded in yellow sticky trap installed at 100 cm height while minimum (198 aphids) were recorded in blue tray trap installed at 150 cm height. 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 B3-10.2b).

Table B2-10.2a: Effect of sowing dates on population build of major insect-pests in wheat during 2019-20 (Centre-Ludhiana)

Standard Weeks	Rain-fall (mm)	Temperature (^{0}C)		Relative humidity (%)		Mean Aphid incidence (Aphids/plant/tiller)				Termite damage (% affected tillers/meter row)				Pink stem borer damage (% affected tillers/meter row)			
		Max	Min	Max	Min	Ist DOS (1 Nov)	IInd DOS (16 Nov.)	IIIrd DOS (1Dec)	IVth DOS (16 Dec.)	Ist DOS (1 Nov)	IInd DOS (16 Nov.)	IIIrd DOS (1 Dec)	IVth DOS (16 Dec.)	Ist DOS (1 Nov)	IInd DOS (16 Nov.)	IIIrd DOS (1 Dec)	IVth DOS (16 Dec.)
50	46.8	16.2	9.4	95.0	69.0	-	-	-	-	-	-	-	-	-	-	-	-
51	0.0	13.6	8.1	94.0	74.0	0	0	0	0	4.01	3.53	2.99	2.74	3.98	3.62	3.12	2.23
52	46.8	10.3	5.4	89.0	75.0	0	0	0	0	3.97	3.75	3.46	2.94	3.43	2.33	1.88	1.46
1	13.4	16.3	5.7	93.0	63.0	0.4	0	0	0	3.80	3.52	2.94	2.56	1.46	1.05	0.83	0.86
2	20.0	15.1	7.1	93.0	69.0	0.2	0.4	0	0	-	-	-	-	-	-	-	-
3	0.0	16.1	7.4	93.0	67.0	0.8	0.6	0.2	0.3	-	-	-	-	-	-	-	-
4	6.4	18.3	6.2	93.0	55.0	2.3	1.2	0.6	0	-	-	-	-	-	-	-	-
5	0.0	17.5	5.7	95.0	59.0	3.2	2.4	1.6	1.2	-	-	-	-	-	-	-	-
6	71.0	18.9	4.9	94.0	49.0	10.53	9.08	7.24	5.68	-	-	-	-	-	-	-	-
7	0.0	23.0	7.8	93.0	45.0	11.98	9.94	6.93	6.27	-	-	-	-	-	-	-	-
8	6.0	23.4	12.0	85.0	51.0	13.15	12.19	8.21	7.77	2.94	2.68	2.56	2.16	-	-	-	-
9	0.0	24.8	13.1	93.0	53.0	17.67	16.83	16.09	10.86	-	-	-	-	-	-	-	-
10	29.4	21.1	10.8	88.0	61.0	10.75	17.61	18.89	15.84	-	-	-	-	-	-	-	-
11	17.8	23.3	11.8	87.0	55.0	8.53	14.42	18.22	19.51	-	-	-	-	-	-	-	-
12	3.0	27.5	14.6	87.0	50.0	0.77	1.79	2.96	4.16	-	-	-	-	-	-	-	-
13	18.8	26.2	15.3	90.0	53.0	0.22	0.8	1.2	1.5	-	-	-	-	-	-	-	-
14	0.0	29.1	14.4	81.0	37.0	0	0	0.4	0.2	-	-	-	-	-	-	-	-

Table B2-10.2b: Effect of sowing dates on population build of major insect-pests in wheat 2019-20 (Centre-Karnal)

Standard Weeks	Rain-fall (mm)	Temperature (^{0}C)		Relative humidity (%)		Mean Aphid incidence (Aphids/plant/tiller)				Termite damage (% affected tillers/meter row)				Pink stem borer damage (% affected tillers/meter row)			
		Max	Min	Max	Min	Ist DOS (1 Nov)	IInd DOS (16 Nov.)	IIIrd DOS (1Dec)	IVth DOS (16 Dec.)	Ist DOS (1 Nov)	IInd DOS (16 Nov.)	IIIrd DOS (1Dec)	IVth DOS (16 Dec.)	Ist DOS (1 Nov)	IInd DOS (16 Nov.)	IIIrd DOS (1 Dec)	IVth DOS (16 Dec.)
50	24.2	19.9	9.5	97.0	67.9	-	-	-	-	-	-	-	-	-	-	-	-
51	0	14.3	7.8	98.6	84.6	0.0	0.0	0.0	0.0	4.1	3.7	-	-	4.1	3.8	-	-
52	0	10.6	5.8	98.7	83.7	0.0	0.0	0.0	0.0	4.1	3.9	3.1	2.9	3.6	2.5	3.3	2.4
1	0	16.4	3.9	99.6	60.4	0.2	0.7	0.0	0.0	3.9	3.7	3.6	3.1	1.6	1.2	2.0	1.6
2	42	15.1	8.0	96.1	78.6	0.5	0.6	0.0	0.0	-	-	3.1	2.7	-	-	1.0	1.0
3	10.6	15.3	7.5	99.3	84.0	0.9	0.9	0.2	0.4	-	-	-	-	-	-	-	-
4	0	15.7	5.9	98.7	70.4	2.0	1.4	0.8	0.9	-	-	-	-	-	-	-	-
5	21.8	16.4	6.5	100.0	78.9	3.1	2.6	1.8	1.4	-	-	-	-	-	-	-	-
6	0	18.2	3.9	100.0	59.3	9.5	9.3	7.4	5.9	-	-	-	-	-	-	-	-
7	0	21.5	7.4	94.0	56.4	9.7	11.2	7.1	6.5	1.8	1.0	0.5	1.4	-	-	-	-
8	21.4	23.0	10.2	96.1	58.0	15.2	12.4	8.4	8.0	2.5	2.3	2.2	2.1	-	-	-	-
9	1.1	23.8	11.4	97.6	67.5	19.7	17.0	16.3	11.1	-	-	-	-	-	-	-	-
10	74.2	23.5	10.9	93.0	69.1	13.2	17.8	19.1	16.0	-	-	-	-	-	-	-	-
11	61.6	23.5	11.2	96.3	62.6	9.6	14.6	17.4	18.7	-	-	-	-	-	-	-	-
12	0	26.5	12.8	96.4	56.9	0.6	2.0	3.2	4.4	-	-	-	-	-	-	-	-
13	24.8	27.7	15.0	94.6	61.0	0.5	1.0	1.4	1.7	-	-	-	-	-	-	-	-
14	0	29.8	13.4	86.7	41.9	0.0	0.0	0.8	0.0	-	-	-	-	-	-	-	-

Table B2-10.2c: Effect of sowing dates on population build of major insect pests in wheat 2019-20 (Centre-Kharibari)

Standard Weeks	Rain fall in mm	Relative humidity		Temperature ^{0}C		Mean aphid incidence (Aphids/plant/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	90.14	45.29	28.27	12.70	0	0	0
49	0.00	90.86	48.14	27.30	12.13	0	0	0
50	0.00	89.71	41.71	28.21	11.11	16	0	0
51	0.97	94.43	53.00	24.43	11.60	19.75	0	0
52	0.00	90.43	51.00	24.44	9.39	41.30	22.15	0
53	0.00	91.43	41.57	25.06	7.69	65.25	45.95	0
1	0.00	89.71	39.29	25.93	8.64	107.21	85.26	0
2	0.00	91.00	40.57	26.80	9.47	135.45	95.45	12.25
3	0.00	89.71	43.14	26.70	10.56	182.36	155.45	55.26
4	0.00	90.71	38.71	25.99	10.84	280.75	255.68	102.54
5	1.60	91.57	52.71	25.60	11.20	325.46	275.35	165.55
6	0.29	89.86	39.14	27.71	11.54	210.56	225.15	209.10
7	0.00	89.86	57.43	25.30	13.33	142.12	185.35	175.50
8	2.69	91.14	61.43	24.80	12.41	95.24	140.20	110.25
9	0.40	88.86	47.43	26.54	12.13	59.35	95.10	87.85
10	0.00	87.43	40.14	30.97	15.06	34.85	55.25	52.45
11	0.46	87.29	38.86	31.49	15.17	16.30	30.30	32.20
12	1.23	87.57	48.14	31.07	15.76	9.55	15.65	15.60
13	8.83	89.43	54.14	29.64	16.07	4.35	8.45	7.95
14	0.21	87.71	48.00	28.27	12.70	2.10	3.20	3.10
Yield q/ha						23.50	18.55	16.45

Centre: Karnal

The data revealed significant differences among various treatments regarding captured number of aphids. The observation recorded indicated that the higher numbers of aphids were trapped in yellow colour traps as compared to blue colour traps.Yellow sticky traps installed at 100 cm height recorded maximum average number of aphids i.e 142.7 as against the minimum average number of captured aphids i.e 44.0 aphids recorded in blue tray trap installed at 150 cm height. The highest (642 aphids) seasonal total captured aphids were recorded in yellow sticky trap installed at 100 cm height while minimum (198 aphids) were recorded in blue tray trap installed at 150 cm height. 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 B3-10.2b).

Centre: Niphad

The data revealed significant differences among various treatments regarding captured number of aphids, jassids and Natural enemies. Yellow sticky trap installed at 60 cm height recorded maximum (66.67, 132.33, 238.00, 89.00 and 76.33) number of captured aphids at 47, 54, 61, 68 and 75 days after sowing as against the minimum number of captured aphids were recorded in blue tray trap installed at 20 cm height (8.33, 18.33, 26.33, 10.00 and 0.00), similar aphid capturing trend was observed in Yellow sticky trap installed at height 120 cm. 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 B3-10.2c).

Data revealed that the highest (677.33) seasonal total number of captured aphids were recorded in yellow sticky trap installed at 60 cm height while lowest of 69.00 were recorded in blue tray traps installed at 20cm height.

Data regarding captured jassids in various types of traps are presented in Table 4. It revealed that the highest (552.33) seasonal total captured jassids were recorded in yellow sticky trap installed at 60 cm height. The population of the jassids was not observed in blue colored tray trap during growing season of the crop installed at 10 and 20 cm height. Blue sticky trap installed at 120 cm height recorded very less of 5.67 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 B3-10.2d).

Data regarding natural enemies are presented in Table 5 revealed that the maximum 77.67 and 53.33 season's total captured natural enemies were recorded on yellow sticky trap installed at 60 and 120 cm height respectively. It showed that the yellow colored traps were also preferred by natural enemies (Table B3-10.2e).

Data regarding grain yield are presented in Table 6 revealed that the various traps showed the non significant differences for yield. The yellow sticky traps installed at 60 cm height recorded highest (43.52 q/ha) grain yield. It was followed by the treatment of yellow sticky traps installed at 120cm height (42.54 q/ha). The tray trap of blue colored installed at 20 cm height recorded minimum yield of 36.09 q/ha (Table B3-10.2e).

Table B3-10.2a: Relative abundance of aphids captured in different types of trap during 2019-20 (Centre: Ludhiana)

Treatment	Number of aphids captured per trap at different dates of observation								Season total	Av. Mean
	6 SMW (5-2-20)	7 SMW	8 SMW	9 SMW (26-2-20)	10 SMW (4-3-20)	11 SMW (11-3-20)	12 SMW (18-3-20)	13 SMW (25-3-20)		
Yellow sticky trap X 100 cm height	12	21	43	69	121	155	114	67	602	133.8
Yellow sticky trap X 150 cm height	9	15	32	55	95	123	94	44	467	103.8
Blue sticky trap X 100 cm height	6	12	38	44	73	93	68	32	366	81.3
Blue sticky trap X 150 cm height	5	5	22	30	55	82	48	14	261	58.0
Yellow tray trap X 100 cm height	12	14	38	54	107	132	101	54	512	113.8
Yellow tray trap X 150 cm height	8	7	26	40	88	112	84	28	393	87.3
Blue tray trap X 100 cm height	3	4	10	21	65	67	47	17	234	52.0
Blue tray trap X 150 cm height	0	0	6	11	50	46	35	10	158	35.1

Table B3-10.2b: Relative abundance of aphids captured in different types of trap during 2019-20 (Centre: Karnal)

Treatment	Number of aphids captured per trap at different dates of observation								Season total	Av. Mean
	6 SMW (3-2-20)	7SMW (10-2-20)	8 SMW (17.02.20)	9 SMW (24-2-20)	10 SMW (2-3-20)	11 SMW (09-3-20)	12 SMW (16-3-20)	13 SMW (23-3-20)		
Yellow sticky trap X 100 cm height	17	26	48	74	126	160	119	72	642	142.7
Yellow sticky trap X 150 cm height	14	20	37	60	100	128	99	49	507	112.7
Blue sticky trap X 100 cm height	11	17	43	49	78	98	73	37	406	90.2
Blue sticky trap X 150 cm height	10	10	27	35	60	87	53	19	301	66.9
Yellow tray trap X 100 cm height	17	19	43	59	112	137	106	59	552	122.7
Yellow tray trap X 150 cm height	13	12	31	45	93	117	89	33	433	96.2
Blue tray trap X 100 cm height	8	9	15	26	70	72	52	22	274	60.9
Blue tray trap X 150 cm height	5	5	11	16	55	51	40	15	198	44.0

Table B3-10.2c: Relative abundance of aphids captured in different types of trap during 2019-20 (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	0.00 (1.00)	0.00 (1.00)	2.00 (1.73)	24.33 (5.03)	65.67 (8.16)	132.33 (11.55)	238.00 (15.46)	89.00 (9.49)	76.33 (8.79)	13.67 (3.83)	5.67 (2.58)	30.33 (5.60)	677.33	56.44
T2	Yellow sticky trap X 120 cm height	0.00 (1.00)	0.00 (1.00)	3.33 (2.08)	20.00 (4.58)	50.67 (7.19)	116.00 (10.82)	181.67 (13.52)	72.00 (8.54)	112.67 (10.66)	6.67 (2.77)	3.33 (2.08)	47.67 (6.98)	614.00	51.17
T3	Blue sticky trap X 60 cm height	0.00 (1.00)	0.00 (1.00)	2.33 (1.83)	16.67 (4.20)	45.00 (6.78)	73.67 (8.64)	146.67 (12.15)	54.67 (7.46)	15.67 (4.08)	6.67 (2.77)	3.33 (2.08)	0.00 (1.00)	364.67	30.39
T4	Blue sticky trap X 120 cm height	0.00 (1.00)	0.00 (1.00)	1.67 (1.63)	12.67 (3.70)	40.67 (6.45)	67.33 (8.27)	132.67 (11.56)	48.00 (7.00)	16.33 (4.16)	3.33 (2.08)	3.00 (2.00)	0.00 (1.00)	325.67	27.14
T5	Yellow tray trap X 10 cm height	0.00 (1.00)	0.00 (1.00)	1.33 (1.53)	9.00 (3.16)	22.67 (4.86)	51.00 (7.21)	76.33 (8.79)	27.67 (5.35)	2.00 (1.73)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	190.00	15.83
T6	Yellow tray trap X 20 cm height	0.00 (1.00)	0.00 (1.00)	1.00 (1.41)	6.67 (2.77)	16.67 (4.20)	34.00 (5.92)	56.67 (7.59)	20.33 (4.62)	2.33 (1.83)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	137.67	11.47
T7	Blue tray trap X 10 cm height	0.00 (1.00)	0.00 (1.00)	1.00 (1.41)	5.33 (2.52)	11.00 (3.46)	19.33 (4.51)	34.67 (5.97)	11.67 (3.56)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	83.00	6.92
T8	Blue tray trap X 20 cm height	0.00 (1.00)	0.00 (1.00)	0.33 (1.15)	5.67 (2.58)	8.33 (3.06)	18.33 (4.40)	26.33 (5.23)	10.00 (3.32)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	69.00	5.75
	SE ±	--	--	**0.148**	**0.162**	**0.167**	**0.225**	**0.266**	**0.124**	**0.079**	**0.186**	**0.094**	**0.068**	--	--
	CD at 5%	--	--	**0.449**	**0.489**	**0.505**	**0.681**	**0.806**	**0.377**	**0.240**	**0.563**	**0.283**	**0.206**	--	--

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

Table B3-10.2d: Relative abundance of jassids captured in different types of trap during 2019-20 (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	57.67 (7.66)	141.67 (11.94)	114.33 (10.74)	78.33 (8.91)	56.67 (7.59)	51.00 (7.21)	21.33 (4.73)	16.67 (4.20)	14.67 (3.96)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	552.33	46.03
T2	Yellow sticky trap X 120 cm height	33.67 (5.89)	105.00 (10.30)	65.00 (8.12)	41.67 (6.53)	34.33 (5.94)	38.00 (6.24)	13.33 (3.79)	13.33 (3.79)	9.67 (3.27)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	354.00	29.50
T3	Blue sticky trap X 60 cm height	3.67 (2.16)	8.33 (3.06)	9.67 (3.27)	5.00 (2.45)	3.67 (2.16)	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)	30.33	2.53
T4	Blue sticky trap X 120 cm height	1.67 (1.63)	0.00 (1.00)	0.00 (1.00)	2.33 (1.83)	1.67 (1.63)	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)	5.67	0.47
T5	Yellow tray trap X 10 cm height	3.33 (2.08)	7.67 (2.94)	7.33 (2.89)	5.00 (2.45)	3.33 (2.08)	2.67 (1.91)	1.67 (1.63)	2.33 (1.83)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	33.33	2.78
T6	Yellow tray trap X 20 cm height	2.67 (1.91)	4.67 (2.38)	3.33 (2.08)	2.67 (1.91)	2.33 (1.83)	1.00 (1.41)	0.67 (1.29)	0.67 (1.29)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	18.00	1.50
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 +	**0.119**	**0.101**	**0.131**	**0.118**	**0.125**	**0.089**	**0.111**	**0.195**	**0.104**	**--**	**--**	**--**	**--**	**--**
	CD at 5%	**0.359**	**0.306**	**0.398**	**0.357**	**0.379**	**0.270**	**0.336**	**0.589**	**0.315**	**--**	**--**	**--**	**--**	**--**

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

Table B3-10.2e: Relative abundance of natural enemies captured in different types of traps during 2019-20 (Centre: Niphad)

TN	Treatment Details	Number of natural enemies captured per trap at												Season total	Av. Mean	Yield (q/ha)
		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	2.33 (1.83)	8.67 (3.11)	7.67 (2.94)	9.67 (3.27)	10.00 (3.32)	9.00 (3.16)	17.33 (4.28)	7.00 (2.83)	4.67 (2.38)	1.33 (1.53)	0.00 (1.00)	0.00 (1.00)	77.67	6.47 (2.73)	43.52
T2	Yellow sticky trap X 120 cm height	1.33 (1.53)	3.00 (2.00)	2.67 (1.91)	5.67 (2.58)	7.67 (2.94)	9.00 (3.16)	12.00 (3.61)	4.33 (2.31)	7.00 (2.83)	0.67 (1.29)	0.00 (1.00)	0.00 (1.00)	53.33	4.44 (2.33)	42.54
T3	Blue sticky trap X 60 cm height	0.67 (1.29)	0.00 (1.00)	1.00 (1.41)	2.00 (1.73)	1.67 (1.63)	3.33 (2.08)	4.67 (2.38)	2.67 (1.91)	1.67 (1.63)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	17.67	1.47 (1.57)	39.01
T4	Blue sticky trap X 120 cm height	0.00 (1.00)	1.33 (1.53)	0.67 (1.29)	0.33 (1.15)	1.00 (1.41)	2.33 (1.83)	4.33 (2.31)	1.67 (1.63)	1.33 (1.53)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	13.00	1.08 (1.44)	39.93
T5	Yellow tray trap X 10 cm height	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.33 (1.15)	2.00 (1.73)	1.33 (1.53)	0.67 (1.29)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	4.33	0.36 (1.17)	40.76
T6	Yellow tray trap X 20 cm height	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.33 (1.15)	0.00 (1.00)	0.00 (1.00)	0.33 (1.15)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.67	0.06 (1.03)	39.60
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 (1.00)	38.55
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 (1.00)	36.09
	SE +	**0.117**	**0.128**	**0.110**	**0.144**	**0.140**	**0.168**	**0.151**	**0.124**	**0.151**	--	--	--	--	--	2.498
	CD at 5%	**0.354**	**0.387**	**0.332**	**0.434**	**0.424**	**0.510**	**0.457**	**0.376**	**0.458**	--	--	--	--	--	NS

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

B4. Effect of zinc sulphate application alone or in combination with pesticides on aphid incidence in wheat (**Centres:** Ludhiana, Niphad, Karnal)

Treatment details:

S.N.	Treatments
1	RDF(Recommended date) of NPK
2	RDF(Recommended date) of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage
3	RDF(Recommended date) of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage
4	RDF(Recommended date) of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage mixed with Actra 25 WG (thiamethxam) @ 50 g/ha
5	RDF(Recommended date) of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage mixed with Actra 25 WG (thiamethoxam) @ 50 g/ha
6	RDF(Recommended date) of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage mixed with Actra 25 WG (thiamethoxam) @ 50 g/ha and propiconazole @ 500 ml/ha
7	RDF(Recommended date) of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage mixed with Actra 25 WG (thiamethoxam) @ 50 g/ha and propiconazole @ 500 ml/ha
8	Untreated control (No application)

Observations:

I	Aphid incidence at peak period of its activity
II	Nutrient status of soil before and after harvest
III	Nutrient status of plants and grains at harvest
IV	Yield attributes, Grain and biological yield

Centre: Ludhiana

Effect of zinc sulphate as foliar application was tested to determine its effect on aphid abundance and their coccinellid predators in wheat. Soil application rate of zinc sulphate was kept as 25 kg/ha in all treatments. The foliar application were made at milky grain stage @ 0.5% alone and in combination with thiamethoxam 25 WG @ 50 g/ha and propiconazole @ 500 ml/ha. Observations were recorded on population of aphids per plant, natural enemies (adult and grubs)/m^2 in each plot and yield per treatment, were recorded at the time of harvest. The observations indicated that one or two sprays of $ZnSo_4$mixed with thiamethoxam effectively reduced the aphid population. Although some reduction in aphid control was observed when thiamethoxam was mixed with $ZnSo_4$ but statistically it was not significant. Similarly, $ZnSo_4$ can also be mixed with propiconazole + thiamethoxam without any adverse affect. The coccinellid predators were also not adversely effected by application of one or two sprays of $ZnSo_4$ mixed with insecticides and fungicides at reproductive stages of wheat crop.(Table B4-10.2a).

Centre: Karnal

The data revelaed that treatment of RDF of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage mixed with thiamethoxam 25 WG @ 50 g/ha and propiconazole @ 500 ml/ha was most effective treatment in reducing the aphid population followed by treatment of RDF of NPK + one Foliar sprays of ZnSO4@0.5% at flag leaf and milk stage mixed with thiamethoxam 25 WG @ 50 g/ha and propiconazole @ 500 ml/ha. Mixing $ZnSo_4$ can be done with propiconazole + thiamethoxam without any compatibility issues. No harmful effect was seen on the coccinellid predators by application of one or two sprays of ZnSo4 mixed with insecticides and fungicides at reproductive stages of wheat crop.Higher yields were obtained from treatments of one or two sprays of ZnSo4 mixed with thiamethoxam (Table B4-10.2b).

Centre: Niphad

Data presented revealed that, application of recommended dose of fertilizer alone and of RDF with Zinc Sulphate foliar application also RDF with zinc sulphate mixed with systemic insecticide thiamethoxam 25 WG and fungicide propiconazole in wheat shows no significance on population of aphids at 40 days after sowing but found significantly superior over untreated control at 60 and 75 days after sowing, but all other treatments were found equally effective in controlling aphid population. The similar trend was observed in the cumulative average mean. The treatment with RDF of NPK + one spray of ZnSo4 @ 0.5 % at milk stage mixed with Actra 25 WG (thiamethoxam) @ 50 g/ha and Propiconazole @ 500 ml/ha recorded the highest yield of wheat grains 53.02 q/ha and found significantly superior over all the other treatments except the treatment with RDF of NPK + Two spray of ZnSo4 @ 0.5 % at flag leaf and milk stage mixed with Actra 25 WG (thiamethoxam) @ 50 g/ha and the treatment with RDF (Recommended date) of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage mixed with Actra 25 WG (thiamethxam) @ 50 g/ha which were found at par with it and recorded grain yield of 51.85 and 49.63 q/ha, respectively(Table B4-10.2c).

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 presented revealed that the first appearance of the pests was noticed in the fourth week of January that continued till the second week of March with peak incidence during third week of February.

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 10.39 per cent parasitism by *Campolatis chlorideae* on *H. armigera* larvae (Table B5-10.2a).

Centre: Ludhiana

The data on aphid incidence was recorded by randomly selecting ten individual tillers from 500 m^2 area while moving in a diagonal path in the field. The population of *Coccinella septempunctata* was recorded in 1 m^2 area around the individual plant. Weekly observations were recorded to study the first incidence and population build-up of aphid and coccinellid beetle.

Population dynamics of Wheat aphid: The aphid first appeared on 16.01.2020 on wheat crop and it started rising and reached its peak on 12.03.2020. Thereafter population of wheat aphid started declining and it drastically decreased after 01.04.2020. The population of Coccinellid beetle remained low up to 05.03.2020 and thereafter it started rising and reach its peak on 26.03.2020 (two weeks after the peak period of activity of wheat aphid) (Table B5-10.2b).

Population dynamics of barley aphid: The aphid population first appeared on 09.01.2020 on barley crop and it started rising and reached its peak on 12.03.2020. Thereafter aphid population started declining and became very low after 01.04.2020. The population of coccinellid beetles remained low up to 27.02.2020 and thereafter it stated rising and reached its peak on 26.03.2020. Thus, it can be concluded from the data that coccinellid beetle appeared after the peak period of aphid infestation on wheat and barley crop (Table B5-10.2c).

Table B4-10.2a: Effect of zinc sulphate application alone or in combination with pesticides on aphid incidence in wheat (Centre: Ludhiana)

Treatments	Number of aphids/ earhead				Number of coccinellids/m^2				Grain yield (q/ha)
	Before spray 1day	After spray			Before spray 1day	After spray			
		1 Day	2 Days	7 Days		1 Day	2 Days	7 Days	
RDF (Recommended date) of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage	21.00	20.43	18.93	17.53	2.51	2.60	2.86	3.33	56.02
RDF of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage	20.93	16.83	16.00	14.90	2.48	2.36	2.85	2.70	56.10
RDF of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage mixed with thiamethoxam 25 WG @ 50 g/ha	22.00	3.00	2.86	3.26	2.38	0.88	0.73	1.30	57.18
RDF of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage mixed with thiamethoxam 25 WG @ 50 g/ha	21.03	2.73	2.66	2.83	2.42	1.16	0.50	0.86	57.32
RDF of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage mixed with thiamethoxam 25 WG @ 50 g/ha and propiconazole @ 500 ml/ha	21.76	4.06	3.46	2.66	2.41	1.06	0.53	1.21	58.65
RDF of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage mixed with thiamethoxam 25 WG @ 50 g/ha and propiconazole @ 500 ml/ha	20.96	3.36	2.76	2.13	2.25	0.93	0.48	1.11	58.75
Untreated control (Recommended NPK)	20.56	21.00	20.90	21.56	2.35	3.16	2.86	3.26	54.30
CD (p =0.05)	NS	0.80	0.62	0.70	NS	0.29	0.47	0.50	0.68

Date of sowing : 23.11.2019
Date of harvest :02.05.2020
Replications : Three
Plot size : 7.5 m^2
Variety : PBW 725

Table B4-10.2b: Effect of zinc sulphate application alone or in combination with pesticides on aphid incidence in wheat (Centre:Karnal)

Treatments	Number of aphids/ earhead				Number of coccinellids/m^2				Grain yield (q/ha)
	Before spray	Days after spray			Before spray	After spray			
	1	1	2	7	1	1	2	7	
RDF (Recommended date) of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage	22.19	21.62	20.12	18.72	3.70	3.79	4.05	4.52	57.21
RDF of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage	22.12	18.02	17.19	16.09	3.67	3.55	4.04	3.89	57.29
RDF of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage mixed with thiamethoxam 25 WG @ 50 g/ha	23.19	4.19	4.05	4.45	3.57	2.07	1.92	2.49	58.37
RDF of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage mixed with thiamethoxam 25 WG @ 50 g/ha	22.22	3.92	3.85	4.02	3.61	2.35	1.69	2.05	58.51
RDF of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage mixed with thiamethoxam 25 WG @ 50 g/ha and propiconazole @ 500 ml/ha	22.95	5.25	4.65	3.85	3.60	2.25	1.72	2.40	59.84
RDF of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage mixed with thiamethoxam 25 WG @ 50 g/ha and propiconazole @ 500 ml/ha	22.15	4.55	3.95	3.32	3.44	2.12	1.67	2.30	59.94
Untreated control (Recommended NPK)	21.75	22.19	22.09	22.75	3.54	4.35	4.05	4.45	55.49
CD (p =0.05)	0.60	0.42	0.50	0.30	0.09	0.27	0.30	0.48	0.53

Date of sowing : 14.11.2019 Plot size : 7.5 m^2 Variety: HD 2967
Date of harvest : 20.04.2020 Replications : Three

Table B4-10.2c: Effect of zinc sulphate application alone or in combination with pesticides on aphid incidence in wheat (Centre: Niphad)

Treatments	Av. population of survived foliage feeding wheat aphids per shoot				Yield (q/ha)
	40 DAS	60 DAS	75 DAS	Mean	
RDF(Recommended date) of NPK	30.33 (5.59)	19.67 (4.53)	16.33 (4.16)	22.11 (4.80)	**43.02**
RDF(Recommended date) of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage	31.20 (5.67)	19.07 (4.43)	15.40 (4.04)	21.89 (4.77)	**46.43**
RDF(Recommended date) of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage	23.53 (4.88)	19.53 (4.51)	15.33 (4.04)	19.47 (4.49)	**43.03**
RDF(Recommended date) of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage mixed with Actra 25 WG (thiamethxam) @ 50 g/ha	28.60 (5.40)	22.13 (4.74)	17.47 (4.27)	22.73 (4.85)	**49.63**
RDF(Recommended date) of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage mixed with Actra 25 WG (thiamethoxam) @ 50 g/ha	31.80 (5.71)	19.07 (4.45)	16.20 (4.14)	22.36 (4.82)	**51.85**
RDF(Recommended date) of NPK + One Foliar spray of $ZnSO_4$@0.5% at milk stage mixed with Actra 25 WG (thiamethoxam) @ 50 g/ha and propiconazole @ 500 ml/ha	29.13 (5.49)	19.07 (4.45)	14.33 (3.91)	20.84 (4.66)	**53.02**
RDF(Recommended date) of NPK + Two Foliar sprays of $ZnSO_4$@0.5% at flag leaf and milk stage mixed with Actra 25 WG (thiamethoxam) @ 50 g/ha and propiconazole @ 500 ml/ha	31.53 (5.69)	19.60 (4.52)	16.27 (4.15)	22.47 (4.84)	**44.74**
Untreated control (No application)	41.40 (6.51)	32.07 (5.74)	24.47 (5.01)	32.64 (5.79)	**37.71**
SE+	**0.303**	**0.160**	**0.163**	**0.119**	**1.781**
CD 0.5%	**NS**	**0.486**	**0.494**	**0.360**	**5.389**

DAS=Days after sowing Figures in parentheses indicate $\sqrt{n+1}$transformed value

Table B5-10.2a: 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.	28/01/20	2	5	0	11.29	*Campoletis chlorideae*
2.	03/02/20	1	8	1		
3.	10/02/20	1	11	1		
4.	18/02/20	1	14	1		
5.	24/02/20	1	10	1		
6.	02/03/20	1	5	1		
7.	11/03/20	1	5	1		
8.	18/03/20	0	4	0		
9.	28/01/20	2	0	0		

Centre: Niphad

The weekly observations on wheat aphids were recorded along with different weather parameters. Data revealed that the maximum (151.10) number of aphids/shoot/plant were observed in 5th Meteorological week when the maximum and minimum temperatures were 25.9 and 9.8 °C, respectively with relative humidity of 91 and 47 per cent at morning and evening, respectively. The incidence of jassids on wheat was also recorded which was very low. The maximum (9.20) population of the jassids/plant was recorded in 6thmeteorological week when the maximum and minimum temperatures were 25.7 and 10.4 °C, respectively. The maximum (3.40) natural enemies/m^2 were recorded in 7thMW when maximum and minimum temperature were 26.8 and 11.7°C respectivelywith average humidity of65 per cent (Table B5-10.2d).

Centre: Karnal

Population dynamics of Wheat aphid: The aphid first appeared on 06.1.2020 on wheat crop and it started rising and reached its peak (69.5 aphids/plant) on 09.03.2020 (Table B5-10.2g.). Thereafter population of wheat aphid started declining. The population of Coccinellid beetle started from 03-02-2020 and reaches its peak (12.5 beetles/m^2) on 02.03.2020.

Population dynamics of barley aphid: The aphid population was higher as compared to wheat during the whole crop season (Table B5-10.2h.). It first appeared on 16.01.2020 on barley crop and it started rising and reached its first peak (92.7 aphids/plant) on 16.03.2020. The population of coccinellid beetles remained low up to 25.02.2019 (the peak period of activity of barley aphid) and thereafter it stated rising and reached its peak (16.5 beetles/m^2) on 16.03.2020. Thereafter its population started declining. Thus, it can be concluded from the data comparatively higher population of aphid appeared on barley as compared to wheat crop.

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 aphid incidence, termite and pink stem borer (PSB) damage between IPM module and farmer's practices differed significantly. The termite damage varied 3.76-3.85 per cent in farmer's practices

while it was only 0.36-0.71 per cent in IPM field. Similarly the PSB damage was 2.86-3.28 per cent in farmer's practice while it was 0.63-0.66 in IPM field. The aphid incidence remained below economic threshold level of 5 aphids per earhead in IPM field while it ranged from 11.73-13.33 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 also 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. The coccinellid beetles/m2 was found to significant higher in IPM field as compared to farmer's practice. The incidence of brown wheat mite was comparatively higher in farmer's practice as compared to IPM plots. (Table B6.10.2a)

Centre: Niphad

The data presentedrevealed that the IPM module recorded 15.90, 9.70 and 7.70 aphids/shoot/plant at 45, 60 and 75 days after sowingas against 37.80, 98.50 and 41.50 aphids/shoot/plant in farmer practice respectively. The population of jassids recorded very low in IPM plot 0.70, 0.40 and 0.40 per plant as against 7.80, 1.70 and 0.60 per plant in farmers practice plot at 45, 60 and 75 days after sowing respectively. Shoot fly infestation was not observed in IPM plot but was 4% and 6 % in non IPM at 30 and 45 days after sowing . The optimum population of natural enemies was recorded in both plot of IPM and farmer practices since 45 to 75 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 64.58 q/ha was recorded in IPM treated plot as against38.06 q/ha in farmers practice plot, with considerable differences in plant height, ear head length number of spikelet per spike number of grains per spike and 1000 grain weight (Table B6-10.2b).

Centre: Karnal

The data indicated that population of aphids, 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. 168.0 aphids/shoot in FP treatment, and even infestation of termites and pink stem borer was highest (7.89% & 4.69%, respectively) as compared to IPM treatment. The highest grain yield of 52.21 q/ha was recorded in IPM treated plot and lowest (49.56 q/ha) in farmers practice plot (Table B6-10.2c).

Centre: Kharibari

The data indicated that the population of insect-pests in IPM module treatment was higher than Farmer’s practice treatment (Table B6-10.2d).

Centre: Durgapura

The data indicated that the population of insect-pests in IPM module treatment was higher than Farmer’s practice treatment (Table B6-10.2e).

Table B5-10.2b: Pest modeling for foliage aphids and their natural enemies during 2019-20 (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.
09.01.2020	0	0	0	0	0	0	0	0	0	0	**0**	0	1	0	0.2
16.01.2020	1	2	0	0	4	0	0	1	0	0	**0.8**	1	2	5	3.5
23.01.2020	0	1	0	0	0	0	1	0	1	0	**0.3**	3	5	0	4.7
30.01.2020	2	0	2	0	2	0	2	0	1	0	**0.9**	11	11	6	8.2
06.02.2020	2	0	0	0	2	2	3	3	0	0	**1.2**	11	10	11	10.8
13.02.2020	3	3	1	5	1	1	2	3	0	0	**1.9**	14	15	11	14.8
22.02.2020	6	2	1	3	8	1	5	8	9	3	**4.6**	11	15	16	16
27.02.2020	4	11	9	7	8	11	7	4	12	9	**8.2**	22	21	24	19.7
5.03.2020	11	12	9	13	20	14	11	16	11	18	**13.5**	22	25	26	23.4
12.03.2020	14	15	19	16	18	14	18	16	12	21	**16.3**	31	26	28	26.8
19.03.2020	11	6	7	9	12	11	17	12	5	6	**9.6**	11	14	17	17.1
26.03.2020	1	3	4	6	8	11	4	7	9	5	**5.8**	11	9	8	10
01.04.2020	1	2	0	0	2	0	3	0	2	4	**1.4**	0	1	4	4.4
	Plant No.(Coccinellid beetle/sq m area)											Collateral host (Barley)			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Avg.	P1	P2	P3	Avg.
09.01.2020	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0**
16.01.2020	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0**
23.01.2020	0	0	0	0	0	0	0	0	0	0	**0**	1	0	0	**0.1**
30.01.2020	0	0	0	1	0	0	0	0	0	0	**0.1**	0	0	0	**0**
06.02.2020	1	1	0	1	0	1	0	1	0	0	**0.5**	0	1	0	**0.1**
13.02.2020	0	0	3	0	0	0	0	0	1	0	**0.4**	1	0	0	**0.4**
22.02.2020	1	0	0	0	0	0	0	0	0	0	**0.1**	0	1	0	**0.3**
27.02.2020	1	0	0	1	1	0	0	0	1	1	**0.5**	1	1	1	**0.6**
05.03.2020	1	1	3	1	1	1	4	0	0	1	**1.3**	2	1	3	**1.9**
12.03.2020	2	0	1	1	2	1	1	1	2	1	**1.2**	1	3	3	**2.7**
19.03.2020	2	3	5	1	1	6	2	5	3	6	**3.4**	1	2	5	**2.4**
26.03.2020	3	5	7	8	4	6	1	3	5	4	**4.6**	4	6	9	**6.2**
01.04.2020	2	3	5	6	1	1	0	0	0	0	**1.8**	1	1	1	**0.6**

Table B5-10.2c: Pest modeling for foliage aphids and their natural enemies during 2019-20 (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.
09.01.2020	0	1	0	0	1	0	0	0	0	0	**0.2**	0	0	0	**0**
16.01.2020	1	2	5	7	9	3	5	0	1	2	**3.5**	1	2	0	**0.8**
23.01.2020	3	5	0	5	7	9	2	4	5	7	**4.7**	0	1	0	**0.3**
30.01.2020	11	11	6	7	9	8	8	9	2	11	**8.2**	2	0	2	**0.9**
06.02.2020	11	10	11	19	7	9	10	11	13	7	**10.8**	2	0	0	**1.2**
13.02.2020	14	15	11	10	16	17	18	11	16	20	**14.8**	3	3	1	**1.9**
22.02.2020	11	15	16	17	20	21	11	14	17	18	**16**	6	2	1	**4.6**
27.02.2020	22	21	24	18	18	18	19	20	22	15	**19.7**	4	11	9	**8.2**
5.03.2020	22	25	26	27	26	21	30	19	20	18	**23.4**	11	12	9	**13.5**
12.03.2020	31	26	28	29	27	33	27	21	25	21	**26.8**	14	15	19	**16.3**
19.03.2020	11	14	17	18	18	20	21	17	17	18	**17.1**	11	6	7	**9.6**
26.03.2020	11	9	8	6	11	18	10	11	7	9	**10**	1	3	4	**5.8**
01.04.2020	0	1	4	5	6	4	7	5	5	7	**4.4**	1	2	0	**1.4**
Date	Plant No.(Coccinellid beetle/sq m area)											Collateral host (wheat)			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Avg.	P1	P2	P3	Avg.
09.01.2020	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0**
16.01.2020	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0**
23.01.2020	1	0	0	0	0	0	0	0	0	0	**0.1**	0	0	0	**0**
30.01.2020	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	**0.1**
06.02.2020	0	1	0	0	0	0	0	0	0	0	**0.1**	1	1	0	**0.5**
13.02.2020	1	0	0	1	0	1	0	1	0	0	**0.4**	0	0	3	**0.4**
22.02.2020	0	1	0	1	0	1	0	0	0	0	**0.3**	1	0	0	**0.1**
27.02.2020	1	1	1	1	2	0	0	0	0	0	**0.6**	1	0	0	**0.5**
05.03.2020	2	1	3	0	3	0	3	3	4	0	**1.9**	1	1	3	**1.3**
12.03.2020	1	3	3	3	1	3	3	4	4	2	**2.7**	2	0	1	**1.2**
19.03.2020	1	2	5	5	6	2	0	0	0	3	**2.4**	2	3	5	**3.4**
26.03.2020	4	6	9	2	5	7	8	6	7	8	**6.2**	3	5	7	**4.6**
01.04.2020	1	1	1	0	0	0	0	1	2	0	**0.6**	2	3	5	**1.8**

Table B5-10.2d: Population dynamics of wheat aphid during 2019-20 (Centre: Niphad)

Date of observation	MW	Plant No. (No. of aphids/tiller)											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
'17-23	**51**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0	26.5	11.9	89	81
'24-31	**52**	0	0	3	0	5	0	0	2	0	0	**1.00**	0	0	0	**0.00**	0.0	26.5	13.5	88	69
'Jan. 1-7	**01**	13	19	27	16	18	16	20	13	18	20	**18.00**	9	5	7	**7.00**	0.0	26.0	10.8	85	46
'8-14	**02**	20	21	27	18	17	22	22	16	32	20	**21.50**	10	13	9	**10.67**	0.0	26.7	11.4	90	51
'15-21	**03**	65	35	46	69	63	73	88	87	89	59	**67.40**	25	36	29	**30.00**	0.0	23.8	8.5	88	48
'22-28	**04**	140	116	118	115	120	152	81	151	161	160	**131.40**	58	40	61	**53.00**	0.0	28.8	12.2	92	46
'29-4	**05**	160	152	161	153	114	156	164	162	154	135	**151.10**	56	64	60	**60.00**	0.0	25.9	9.8	91	47
'Feb. 5-11	**06**	84	120	116	114	91	58	89	97	87	79	**93.50**	46	32	48	**42.00**	0.0	25.7	10.4	85	37
'12-18	**07**	48	38	40	37	44	45	27	38	31	34	**38.20**	18	12	22	**17.33**	0.0	26.8	11.7	88	42
'19-25	**08**	18	16	24	20	12	10	10	12	8	10	**14.00**	0	0	0	**0.00**	0.0	30.0	11.3	87	33
'26-4	**09**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	29.3	10.3	85	25
'Mar. 5-11	**10**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	29.1	11.5	87	28
'12-18	**11**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	29.2	11.0	84	34

Table B5-10.2e: Population dynamics of jassids during 2019-20 (Centre: Niphad)

Date of observation	MW	Plant No. (No. of jassids/tiller)											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
17-23	**51**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.00**	0.0	26.5	11.9	89	81
24-31	**52**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	26.5	13.5	88	69
Jan. 1-7	**01**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	26.0	10.8	85	46
8-14	**02**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	26.7	11.4	90	51
15-21	**03**	2	0	2	0	1	2	0	2	2	0	**1.10**	0	0	0	**0.00**	0.0	23.8	8.5	88	48
22-28	**04**	0	2	0	0	0	0	0	2	0	0	**0.40**	0	0	0	**0.00**	0.0	28.8	12.2	92	46
29-4	**05**	0	2	6	5	1	0	4	6	4	3	**3.10**	0	0	0	**0.00**	0.0	25.9	9.8	91	47
Feb. 5-11	**06**	4	12	11	14	11	8	9	7	7	9	**9.20**	0	0	0	**0.00**	0.0	25.7	10.4	85	37
12-18	**07**	4	3	0	7	4	5	9	11	4	7	**5.40**	0	0	0	**0.00**	0.0	26.8	11.7	88	42
19-25	**08**	1	1	6	2	3	1	1	3	0	0	**1.80**	0	0	0	**0.00**	0.0	30.0	11.3	87	33
26-4	**09**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	29.3	10.3	85	25
Mar. 5-11	**10**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	29.1	11.5	87	28
12-18	**11**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	29.2	11.0	84	34

Table B5-10.2f: Population dynamics of *coccinellid* beetle during 2019-20 (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
17-23	**51**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.00**	0.0	26.5	11.9	89	81
24-31	**52**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	26.5	13.5	88	69
Jan. 1-7	**01**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	26.0	10.8	85	46
8-14	**02**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	26.7	11.4	90	51
15-21	**03**	4	2	2	4	2	5	4	2	4	1	**3.00**	0	0	0	**0.00**	0.0	23.8	8.5	88	48
22-28	**04**	5	2	1	2	2	2	2	1	4	4	**2.50**	0	0	0	**0.00**	0.0	28.8	12.2	92	46
29-4	**05**	3	4	3	4	3	3	3	4	2	3	**3.20**	0	0	0	**0.00**	0.0	25.9	9.8	91	47
Feb. 5-11	**06**	5	2	3	2	1	2	2	3	4	3	**2.70**	0	0	0	**0.00**	0.0	25.7	10.4	85	37
12-18	**07**	4	5	2	4	3	6	3	2	2	3	**3.40**	0	0	0	**0.00**	0.0	26.8	11.7	88	42
19-25	**08**	3	2	3	3	2	2	2	3	2	2	**2.40**	0	0	0	**0.00**	0.0	30.0	11.3	87	33
26-4	**09**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	29.3	10.3	85	25
Mar. 5-11	**10**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	29.1	11.5	87	28
12-18	**11**	0	0	0	0	0	0	0	0	0	0	**0.00**	0	0	0	**0.00**	0.0	29.2	11.0	84	34

Table B5-10.2g: Population dynamics of wheat aphid and Coccinellid beetle during 2019-20 (Location-Karnal)

Date of observation	Plant No.(No. of aphids/tiller) on wheat											Collateral host (Barley)			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Av.	P1	P2	P3	Av.
06.01.2020	5	8	5	4	6	5	6	7	9	5	6.0	10	18	11	13.0
13.01.2020	7	10	6	6	8	7	8	9	11	7	7.9	14	15	17	15.3
20.01.2020	11	8	8	15	13	10	13	11	12	14	11.5	19	30	24	24.3
27.01.2020	16	15	13	21	22	16	20	21	24	29	19.7	34	49	34	39.0
03.02.2020	18	31	26	18	17	23	21	9	15	20	19.8	40	40	48	42.7
10.02.2020	38	26	22	29	23	31	40	44	19	17	28.9	54	40	50	48.0
17.02.2020	30	44	28	32	32	43	50	33	30	33	35.5	71	53	49	57.7
24.02.2020	60	41	61	32	42	29	34	48	49	40	43.6	63	82	50	65.0
02.03.2020	71	38	62	21	82	52	70	62	54	70	58.2	93	72	120	95.0
09.03.2020	90	56	73	44	53	68	50	82	93	86	69.5	40	24	43	35.7
16.03.2020	68	41	43	32	51	55	32	54	21	73	47.0	17	32	17	22.0
23.03.2020	7	9	10	5	2	4	9	0	14	6	6.6	14	13	10	12.3
30.03.2020	5	8	7	5	0	0	4	0	2	1	3.2	7	9	5	7.0
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.
06.01.2020	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0.0
13.01.2020	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0.0
20.01.2020	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0.0
27.01.2020	0	0	0	0	0	0	0	0	0	0	0.0	0	7	8	5.0
03.02.2020	5	0	6	7	0	5	5	5	5	4	4.2	5	9	6	6.7
10.02.2020	8	5	4	5	4	6	9	12	5	5	6.3	8	7	4	6.3
17.02.2020	9	8	7	6	8	11	9	4	6	7	7.5	6	11	8	8.3
24.02.2020	27	4	17	11	5	6	10	5	5	9	9.9	8	10	18	12.0
02.03.2020	20	11	18	19	9	18	6	8	9	7	12.5	11	10	17	12.7
09.03.2020	15	8	16	10	5	8	15	16	14	8	11.5	15	20	10	15
16.03.2020	7	11	8	12	8	6	16	10	8	5	9.1	8	10	15	11
23.03.2020	4	2	5	0	4	6	4	5	2	0	5.0	5	8	9	5.4
30.03.2020	0	2	1	0	2	4	2	1	0	0	3.8	2	0	4	3.4

Table B5-10.2h: Population dynamics of barley aphid and Coccinellid beetle during 2019-20 (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.
06.01.2020	7	5	6	8	7	8	7	5	7	9	6.9	0	2	1	1.0
13.01.2020	9	7	8	10	9	10	9	7	9	11	8.9	4	3	2	3.0
20.01.2020	17	12	14	12	27	22	32	27	17	17	19.7	15	13	13	13.7
27.01.2020	18	27	47	17	37	17	32	37	27	42	30.1	32	17	22	23.7
03.02.2020	42	37	52	62	37	67	51	42	37	47	47.4	22	32	37	30.3
10.02.2020	32	22	82	52	82	40	32	52	22	37	45.3	42	57	52	50.3
17.02.2020	34	24	84	54	84	42	34	54	24	39	47.3	47	62	42	50.3
24.02.2020	62	77	97	52	47	82	102	47	107	62	73.5	52	82	72	68.7
02.03.2020	62	72	102	42	82	87	52	77	67	102	74.5	54	84	74	70.7
09.03.2020	82	112	97	117	107	82	127	52	67	84	92.7	82	68	87	79.0
16.03.2020	15	13	27	12	16	14	22	32	17	27	19.5	15	17	18	16.7
23.03.2020	4	6	9	2	5	7	8	6	7	8	6.2	3	5	7	5.0
30.03.2020	1	1	1	0	0	0	0	1	2	0	0.6	2	3	5	3.3
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.
06.01.2020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.01.2020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.01.2020	0	0	0	0	0	0	0	0	0	0	0.0	7	7	7	7.0
27.01.2020	0	0	8	8	0	7	0	0	0	0	2.3	10	10	10	10.0
03.02.2020	6	0	7	8	0	6	6	6	6	0	4.5	12	10	11	11.0
10.02.2020	9	6	5	6	0	7	10	13	6	6	6.8	16	10	11	12.3
17.02.2020	10	9	8	7	9	12	10	5	7	8	8.5	11	18	10	13.0
24.02.2020	28	5	18	12	6	7	11	6	6	10	10.9	13	14	16	14.3
02.03.2020	16	9	17	11	6	9	16	17	15	9	12.5	15	16	13	14.7
09.03.2020	16	9	17	11	6	9	16	17	15	9	12.5	14	15	17	15.3
16.03.2020	21	12	19	20	10	19	7	9	10	8	13.5	13	7	15	11.7
23.03.2020	5	6	9	2	5	7	5	6	6	7	7.3	5	4	2	3.6
30.03.2020	0	0	1	1	0	0	0	1	2	0	3.2	2	3	4	3.0

Table B6-10.2a: Effect of treatments of IPM modules on pests of wheat (Centre: Ludhiana)

S. No.	Days after sowing	Treatments	Avg. no. aphids/ shoot	Avg. lady bird beetle /m^2	Avg. termite infestation (%)	Avg. no. of mites/10 cm^2	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	0.36 (3.60)*	-	0.63 (3.50)*
		FP	0	0	3.85 (11.31)*	-	2.86 (9.73)*
		t value	-	-	(1.27)	-	(1.64)
3.	45	IPM	0	0	0.71 (3.93)*	-	0.66 (3.40)*
		FP	0	0	3.76 (11.18)*	-	3.28 (10.41)*
		t value	-	-	(1.58)	-	(1.91)
4.	60	IPM	0	0	0	-	0
		FP	0	0	0	-	0
		t value	-	-		-	
5.	75	IPM	0	0	0	-	0
		FP	0-1	0	0	-	0
		t value					
6.	90	IPM	0	0	0	-	0
		FP	0-2	0	0	-	0
		t value					
7.	105	IPM	2.53 (1.74)	0	0	-	0
		FP	11.73 (3.48)	0	0	-	0
		t value	(0.64)	-	-	-	
8.	At earhead stage	IPM	1.80 (1.56)**	4.00 (2.12)**	0	3.20 (1.94)**	0
		FP	13.33 (3.77)**	1.46 (1.47)**	0	13.66 (3.80)**	0
		t value	(0.39)	(0.44)	-	(0.49)	-
9.	Yield (qt/ha)	IPM	57.35 (7.63)				
		FP	52.26 (7.29)				
		t value	(0.17)				

IPM = Integrated Pest Management; FP = Farmers Practice

* Figures in parentheses are arcsine transformed means ** Figures in parentheses are square root transformed means

Table B6-10.2b: Effect of treatments of IPM modules on pests of wheat (Centre: Niphad)

SN	Days after sowing	Treat Ments	% Shoot fly damage	Av. No. of aphids/shoot/plant	Av. No. of jassids/plant	Av. No. of natural enemies/m^2	Termite Damage %	Stem borer % infested tillers
1.	**30**	**IPM**	0.00	0.00	0.00	0.00	0.00	0.00
		FP	4.00	0.00	6.00	0.00	0.00	0.00
2.	**45**	**IPM**	00	15.90	0.70	3.20	0.00	0.00
		FP	6.00	37.80	7.80	8.70	0.00	0.00
3.	**60**	**IPM**	0.00	9.70	0.40	7.00	0.00	0.00
		FP	0.00	98.50	1.70	9.60	0.00	0.00
4.	**75**	**IPM**	0.00	7.70	0.40	3.30	0.00	0.00
		FP	0.00	41.50	0.60	3.30	0.00	0.00
5.	**90**	**IPM**	0.00	0.00	0.00	0.00	0.00	0.00
		FP	0.00	0.00	0.00	0.00	0.00	0.00
6.	**At maturity**	**IPM**	0.00	0.00	0.00	0.00	0.00	0.00
		FP	0.00	0.00	0.00	0.00	0.00	0.00

Characters / Treatments	Yield q/ha	Plant height (cm)	Earhead length (cm)	No. of spikelet/spike	No. of grains/spike	1000 grain weight (g)
IPM	64.58	78.20	11.46	15.44	54.00	46.88
FPControl	38.06	66.80	9.62	13.60	37.00	44.72

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

Table B6-10.2c: 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	19	0.00	0.00	0.00	2.56	0.00	
		FP	27	0.00	0.00	0.00	4.40	2.25	
2.	40	IPM	79	0.00	0.00	2.36	5.33	1.05	IPM 52.21
		FP	130	0.00	0.00	3.58	7.14	3.21	
3.	50	IPM	85	0.00	0.00	3.23	3.45	0.96	
		FP	168	0.00	0.00	5.45	7.89	4.69	
4.	60	IPM	67	0.00	0.00	5.21	0.00	0.00	
		FP	83	0.00	0.00	14.58	0.00	0.00	FP (Non IPM) 49.56
5.	70	IPM	55	0.00	0.00	16.21	0.00	0.00	
		FP	63	0.00	0.00	15.23	0.00	1.24	
6.	80	IPM	13	0.00	0.00	9.21	0.00	0.00	
		FP	17	0.00	0.00	15.23	0.00	0.00	

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

Table B6-10.2d: Effect of IPM modules on incidence and infestation of major insect-pests of wheat 2019-20 (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	45.50	4				6
		FP	52.25	2				4
		t value						
2	30	IPM	35.85	4				4
		FP	30.35	0				3
		t value						
3	45	IPM	30.65	4				2
		FP	25.75	1				0
		t value						
4	60	IPM	20.55	3				0
		FP	10.90	1				0
		t value						
5	75	IPM	10.55	5				0
		FP	4.85	0				0
		t value						
6	90	IPM	5.75	4				2
		FP	2.50	2				4
		t value						
7	At maturity	IPM	2.15	6				0
		FP	1.25	3				0
		t value						
8	Yield (qt/ha)	IPM	18.55					18.55
		FP	17.65					17.65
		t value						

Table B6-10.2e: Effect of IPM modules on incidence and infestation of major insect-pests of wheat 2019-20 (Centre-Durgapura)

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 cm^2 of leaf area	% pink stem borer infestation
1.	Pre-count	IPM	-	-		-	-	-
		FP	-	-		-	-	-
		t value						
2.	30	IPM	-	-	3.32	-	-	-
		FP	-	-	6.52	-	-	-
		t value						
3.	45	IPM	-	-	4.39	-	-	-
		FP	-	-	8.81	-	-	-
		t value						
4.	60	IPM	-	-	5.31	-	-	-
		FP	-	-	9.59	-	-	-
		t value						
5.	75	IPM	1.33	0.66	7.11	-	-	-
		FP	14.66	2.00	10.98	-	-	-
		t value						
6.	90	IPM	2.66	2.00	8.12	-	8.66	-
		FP	20.33	3.00	15.51	-	17.33	-
		t value						-
7.	At maturity	IPM	2.33	0.66	9.33	-	9.33	-
		FP	12.66	1.33	17.51	-	14.66	
		t value						
8.	Yield (q/ha)	IPM	39.32					
		FP	28.59					
		t value	-					

B7. Effect of organic treatments on the incidence of major insect-pests and natural enemies
(Centres: Ludhiana and Karnal)
Keeping in view of the interest of farmers about zero budget farming, effect of organic treatments viz., Neemastra, Bramhastra, Agniastra, Deshparni, Fermented butter milk and Cow urine were evaluated against major insect-pests of wheat and natural enemies.

Centre: Ludhiana

Keeping in view the interest of zero budget farming, organic treatments viz. Neem astra, Bramastra, Agniastra and Darshpani were tested in replicated trial at Experimental Area of Department of Plant Breeding and Genetics by growing wheat variety PBW 725 in the plots of 6 rows of 6 m length. For recording observations, five tillers 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 different treatments one day before spray (Table B7). When observed one day after spray, Bramastra @7.5% sprayed plots recorded minimum (7.33 aphids/earhead) and was at par all other organic treatments sprayed @ 7.5% dosage. The 7.5% dosage was statistically at par with 5.0% dose of different organic treatment and recorded fewer aphids than 2.5% dosages. Similar trend was observed two and seven days after treatment. Higher Grain yield (q/ha) was also recorded in plots treated with 7.5% treatment of organically prepared products.(Table B7-10.2a).

Centre: Karnal

Aphid population did not differ significantly among all treatments one day before spray. When observed one day after spray, among the tested organic treatments, treatment of Bramastra @7.5% sprayed plots and Agniastra @ 7.5% recorded minimum (9.58 & 9.87 aphids/earhead, respectively). Almost similar trends were observed two days, seven and fifteen days after spray, acetamiprid was

the best treatment, however the best control of aphids was obtaibed through the treatment of Thiamethoxam 25 WG@ 50 g/ha.
Maximum Grain yield (q/ha) was recorded in plots treated with Bramastra @7.5% sprayed plots i.e. 57.45 q/ha However, all the applied treatments recorded higher than grain yield than untreated check (54.69 q/ha) (Table B7-10.2b).

B8. Management of aphids through foliar application of new chemical molecules
(**Centres:** Ludhiana, Karnal, Kharibari, Niphad and Vijapur)

Centre: Ludhiana

The wheat variety PBW 725 was grown on 22th Nov.2019 in the plots of 6 rows of 6 m length in a replicated trial sown under irrigated conditions at Experimental Area of Department of Plant Breeding and Genetics, PAU, Ludhiana. Seven different insecticides were sprayed when the aphid population exceeded 4-5 aphids/earhead and untreated check plot was kept for comparison. For recording observations, five tillers 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 different treatments one day before spray. When observed one day after spray, thiamethoxam sprayed plots recorded minimum (1.71 aphids/earhead) and was at par all other treatments and significantly better than all other insecticidal treatments. Two days after spray, minimum aphid/tillers (1.03) were recorded in Sulfoxaflor which were at par with all other treatment. Beta-cyfluthrin 25 SC recorded minimum aphid population seven and fifteen days after treatment. Maximum Grain yield (q/ha) was recorded in plots treated with thiamethoxam (59.64) followed by Sulfoxaflor (59.55) treated plots. However, all the insecticidal treatments recorded higher than grain yield than untreated check (56.22) (Table B8-10.2a).

Centre:Karnal

Aphid population did not differ significantly among all treatments one before spray. After day of spraing, treatment of Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC(Alika) @ 150 g/ha recorded minimum number of aphids(4.85 aphids/tiller) followed by treatment of Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon) @ 400 ml/ha which recorded 4.91 aphids/tiller. After 2 days of spraing of 12.6% + Lambda cyhalothrin 9.5% ZC(Alika) @ 150 g/ha was most found be most effective followed by Sulfoxaflor 12% SC@250 ml/ha. Same trend was seen after 7 and 15 days of spraing. Overall three treatments were found be most effective in checking aphid population. These were Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC(Alika) @ 150 g/ha, Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon) @ 400 ml/ha and Sulfoxaflor 12% SC@250 ml/ha
Though, the maximum grain yield recorded under treatment of Thiamethoxam 25% WG (57.28 q/ha) treated plots followed by the treatment of Sulfoxaflor 12% SC(57.20 q/ha).However, all the insecticidal treatments recorded higher than grain yield than untreated check (53.87) (Table B8-10.2b)

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., Thiamethoxam 12.6% + Lambda Cyhalothrin 9.5% ZC(Alika), Thiamethoxam 25% WG, Lambda Cyhalothrin 5% EC, Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon), Imidacloprid 17.8 SL, *Beta-cyfluthrin 25 SC, Sulfoxaflor 12% SC,*. The wheat variety HD 2697 was sown on 1st week of December'2019 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 3). The reduction in the wheat aphid population build up of *Rhopalosiphum maidis* due to application of Thiamethoxam 12.6% + Lambda Cyhalothrin 9.5% ZC(Alika), Thiamethoxam 25% WG, Lambda Cyhalothrin 5% EC, Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon), Imidacloprid 17.8 SL, *Beta-cyfluthrin 25 SC*, *Sulfoxaflor 12% SC* was found to be 85.70% to 100% , respectively, over untreated control.
Grain yield (q/ha) obtained was maximum from Thiamethoxam 25% WG (20.85)treated plots followed by Thiamethoxam 12.6% + Lambda Cyhalothrin 9.5% ZC(Alika) (20.50), Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon) (20.35), and *Sulfoxaflor 12% SC* (19.45), Imidacloprid 17.8 SL (19.25), Lambda Cyhalothrin 5% EC (18.75) and *Beta-cyfluthrin 25 SC* (18.50) treated plots. However, all the insecticidal treatments recorded higher than grain yield than untreated check (15.45) (Table B8-10.2c).

Centre: Niphad

The data revealed that the average population of aphids survived at 1st day after spray showing no significance among the treatments. The data at 2 days after spray showed that the treatment with Beta-Cyfluthrin 9% + Imidacloprid 21% (Solomon) @ 150 ml/ha was found significantly superior over all other treatments except the treatment with Sulfoxaflor 12% SC @ 250 ml/ha and Beta-Cyfluthrin 25 SC @ 1450 ml/ha which were found at par with it. But at 7th days after spray the treatment with Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon) @ 400 ml/ha was found significantly superior over all the treatments while, the treatment with Lambda cyhalothrin 5% EC @ 500 ml/ha, Imidacloprid 17.8 SL @ 400 ml/ha and Beta-cyfluthrin 25 SC @ 1450 ml/ha were found equally effective with it. Similar trend was also observed at 15 days after spray. During the experiment the uniform population of *Coccinellids and Crysoperlla carnia* was observed. Also no significance were observed in the wheat yield. The treatment with Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon) recorded the highest yield of 47.07 q/ha as against 32.89 q/ha in untreated control(Table B8-10.2d).

Centre: Vijapur

An experiment on management of aphids through foliar application of new bio-chemical molecules was conducted at Wheat Research Station, Vijapur under irrigated condition. The barley variety RD 2052 was sown on 26-11-2019.The results are summarized in table 4. Aphid populations did not differ statistically among all treatments during 24hrs before spraying. On 1st day after spray, there were overall decreased in numbers of aphids/shoot in all the treatments as compared to untreated check. While, after 2nd day of spray the minimum aphid population was noticed in Beta-Cyfluthrin 9 % + Imidacloprid 21 % (Solomon) and it was at par with all other treatments except untreated check. On 7th day after spray, minimum no. of aphid population was recorded under Sulfoxaflor 12 % SC and it was at par with all the treatments except untreated check.Observation taken after 15th day after spray showed that significantly the lowest aphid population was reported in treatment of Beta-Cyfluthrin 9 % + Imidacloprid 21 % (Solomon) and it was at par with all the treatments except untreated check. Thus, all the insecticidal treatments achieved significantly lower aphid populations than untreated check. The grain yield (q/ha) showed non significant differences among all the treatments. Though, the maximum grain yield increase over check was recorded under treatment of Beta-Cyfluthrin 9 % + Imidacloprid 21 % (Solomon) followed by the treatments of Lambda cyhalothrin 5 % EC and Acetamiorid 20 SP (Table B8-10.2e).

Table B7-10.2a: Effect of organic treatments on the incidence of major insect-pests and natural enemies dring 2019-20 (Centre: Ludhiana)

S. No.	Treatments	Dose ml or g / ha	Aphid population per earhead				Coccinellids/m^2 15 days after spray	Grain Yield (q/ha)
			Before spray	After spray				
			1 day	1 day	2 days	7 days		
1	Neemastra	2.5%	12.50	9.89 (3.29)	9.76 (3.28)	11.93 (3.59)	2.18 (1.78)	53.82
2	Neemastra	5.0%	12.30	8.51 (3.08)	8.31 (3.05)	10.05 (3.32)	2.05 (1.74)	54.44
3	Neemastra	7.5%	12.30	7.74 (2.95)	7.76 (2.96)	8.95 (3.15)	2.06 (1.74)	55.02
4	Bramhastra	2.5%	12.47	9.87 (3.29)	9.30 (3.20)	10.89 (3.44)	2.15 (1.77)	53.60
5	Bramhastra	5.0%	12.24	8.15 (3.02)	8.34 (3.05)	9.57 (3.25)	1.98 (1.72)	54.80
6	Bramhastra	7.5%	12.15	7.33 (2.88)	7.01 (2.83)	8.31 (3.05)	2.03 (1.74)	55.20
7	Agniastra	2.5%	12.07	10.00 (3.31)	10.20 (3.34)	10.95 (3.45)	2.17 (1.78)	53.51
8	Agniastra	5.0%	12.45	8.84 (3.13)	8.82 (3.13)	9.65 (3.26)	1.98 (1.72)	54.53
9	Agniastra	7.5%	12.43	7.62 (2.93)	7.50 (2.91)	8.91 (3.14)	1.92 (1.71)	54.80
10	Deshparni	2.5%	12.53	9.81 (3.28)	10.00 (3.31)	10.98 (3.46)	2.13 (1.76)	53.20
11	Deshparni	5.0%	12.74	8.34 (3.05)	8.52 (3.08)	9.71 (3.27)	1.97 (1.72)	54.17
12	Deshparni	7.5%	12.55	7.86 (2.96)	7.82 (2.97)	9.11 (3.17)	1.91 (1.70)	54.84
13	Thiamethoxam 25 WG	50 g/ha	12.40	2.14 (1.77)	1.42 (1.55)	1.54 (1.57)	0.94 (1.39)	57.11
14	Untreated control		12.45	12.64 (3.69)	12.46 (3.67)	13.26 (3.77)	2.31 (1.82)	52.44
CD (p=0.05)			NS	(0.14)	(0.14)	(0.10)	(0.05)	2.17

* Figures within parentheses are transformed means

Date of sowing : 22.11.2019
Date of insecticidal application : 10.03.2020
Date of harvest : 03. 05.2020

Plot size : 7.5 m^2
Variety : PBW 725
Replications : Three

Table B7-10.2b: Effect of organic treatments on the incidence of major insect-pests and natural enemies dring 2019-20 (Centre: Karnal)

S. No.	Treatments	Dose ml or g / ha	Aphid population per earhead				Coccinellids/m^2 15 days after spray	Grain Yield (q/ha)
			Before spray	After spray				
			1 day	1 day	2 days	7 days		
1	Neemastra	2.5%	13.21	12.14 (3.62)	12.01 (3.61)	14.18 (3.90)	4.43 (2.33)	56.07
2	Neemastra	5.0%	13.30	10.76 (3.43)	10.56 (3.40)	12.3 (3.65)	4.23 (2.29)	56.69
3	Neemastra	7.5%	12.99	9.99 (3.32)	10.01 (3.32)	11.2 (3.49)	4.31 (2.30)	57.27
4	Bramhastra	2.5%	12.85	12.12 (3.62)	11.55 (3.54)	13.14 (3.76)	4.40 (2.32)	55.85
5	Bramhastra	5.0%	13.01	10.40 (3.38)	10.59 (3.40)	11.82 (3.58)	4.23 (2.29)	57.05
6	Bramhastra	7.5%	12.96	9.58 (3.25)	9.26 (3.20)	10.56 (3.40)	4.28 (2.30)	57.45
7	Agniastra	2.5%	12.86	12.25 (3.64)	12.45 (3.67)	13.20 (3.77)	4.42 (2.33)	55.76
8	Agniastra	5.0%	12.99	11.09 (3.48)	11.07 (3.47)	11.90 (3.59)	4.23 (2.29)	56.78
9	Agniastra	7.5%	13.05	9.87 (3.30)	9.75 (3.28)	11.16 (3.49)	4.17 (2.27)	57.05
10	Deshparni	2.5%	13.07	12.06 (3.61)	12.25 (3.64)	13.23 (3.77)	4.38 (2.32)	55.45
11	Deshparni	5.0%	12.96	10.59 (3.40)	10.77 (3.43)	11.96 (3.60)	4.22 (2.28)	56.42
12	Deshparni	7.5%	12.87	10.11 (3.33)	10.07 (3.33)	11.36 (3.52)	4.16 (2.27)	57.09
13	Thiamethoxam 25 WG	50 g/ha	12.92	4.39 (2.32)	3.67 (2.16)	3.79 (2.19)	3.19 (2.05)	59.36
14	Untreated control		12.91	14.89 (3.99)	14.71 (3.96)	15.51 (4.06)	4.56 (2.36)	54.69
CD (p=0.05)			NS	(0.16)	(0.12)	(0.16)	(0.09)	(2.25)

* Figures within parentheses arc transformed means

Date of sowing : 14.11.2019
Date of insecticidal application : 07.03.2020
Date of harvest : 15. 05.2020

Plot size : 7.5 m^2
Variety : HD 2967
Replications : Three

Table B8-10.2a: Efficacy of various insecticides and their combinations against foliar aphid during 2019-20 (Centre: Ludhiana)

S. No.	Treatments	Dose ml or g / ha	Aphid population per earhead					Grain Yield (q/ha)
			Before spray	After spray				
			1 day	1 day	2 days	7 days	15 days	
1	Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC(Alika)	150 ml	17.63	1.78 (1.66)	1.13 (1.45)	1.08 (1.44)	1.50 (1.58)	59.06
2	Thiamethoxam 25% WG	50	17.70	1.71 (1.64)	1.12 (1.45)	1.15 (1.46)	1.53 (1.59)	59.64
3	Lambda cyhalothrin 5% EC	500	17.76	1.78 (1.66)	1.11 (1.45)	1.09 (1.44)	1.59 (1.60)	59.24
4	Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon)	400	17.65	1.90 (1.70)	1.14 (1.46)	1.24 (1.49)	1.33 (1.52)	58.80
5	Imidacloprid 17.8 SL	400	17.80	1.96 1.72)	1.03 (1.42)	1.17 (1.47)	1.41 (1.52)	58.84
6	Beta-cyfluthrin 25 SC	1450	17.91	1.87 (1.69)	1.18 (1.47)	1.04 (1.43)	1.33 (1.52)	59.28
7	Sulfoxaflor 12% SC	250 ml	17.90	1.88 (1.70)	1.03 (1.43)	1.23 (1.49)	1.61 (1.61)	59.55
8	Untreated control	-	17.81	19.00 (4.47)	19.63 (4.54)	19.28 (4.50)	16.71 (4.20)	56.22
CD (p=0.05)			NS	(0.09)	(0.10)	(0.14)	(0.13)	0.96

* Figures within parentheses arc transformed means

Date of sowing : 22.11.2019
Date of insecticidal application : 05.03.2020
Date of harvest : 02. 05.2020
Plot size : 7.5 m^2
Variety : PBW 725
Replications : Three

Table B8-10.2b: Efficacy of various insecticides and their combinations against foliar aphid during 2019-20 (Centre: Karnal)

S. No.	Treatments	Dose ml or g / ha	Aphid population per earhead					Average	Grain Yield (q/ha)
			Before spray	After spray					
			1 day	1 day	2 days	7 days	15 days		
1	Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC(Alika)	150 ml	15.01	4.85(2.42)	4.64(2.37)	3.43(2.10	2.22(1.79)	3.79(2.19)	56.71
2	Thiamethoxam 25% WG	50	14.69	5.62(2.57)	5.41(2.53)	4.20(2.28)	2.99(2.00)	4.56(2.36)	57.29
3	Lambda cyhalothrin 5% EC	500	14.99	5.95(2.64)	5.74(2.60)	4.53(2.35)	3.32(2.08)	4.89(2.43)	56.89
4	Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon)	400	14.92	4.91(2.43)	4.70(2.39)	3.49(2.12)	2.28(1.81)	3.85(2.20)	56.45
5	Imidacloprid 17.8 SL	400	14.98	4.99(2.45)	4.78(2.40)	3.57(2.14)	2.36(1.83)	3.93(2.22)	56.49
6	Beta-cyfluthrin 25 SC	1450	15.00	5.02(2.45)	4.81(2.41)	3.60(2.14)	2.39(1.84)	3.96(2.23)	56.93
7	Sulfoxaflor 12% SC	250 ml	15.08	4.88(2.42)	4.67(2.38)	3.46(2.11)	2.25(1.80)	3.82(2.19)	57.20
8	Untreated control	-	14.95	17.99(4.36)	17.78(4.33)	17.57(4.31)	17.36(4.28)	17.78(4.33)	53.87
CD (p=0.05)			NS	(0.11)	(0.14)	(0.12)	(0.16)	(0.19)	0.10

* Figures within parentheses arc transformed means

Date of sowing : 22.11.2019
Date of insecticidal application : 05.03.2020
Date of harvest : 02. 05.2020
Plot size : 7.5 m^2
Variety : PBW 725
Replications : Three

Table B8-10.2c: Efficacy of various insecticides and their combinations against foliar aphid during 2019-20 (Centre: Kharibari)

Name of Treatment	Dose gm/ml /ha.	Before spray Population	Mean no. population of survived foliage feeding wheat aphids/shoot/plant												Yield (qt/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*			
Thiamethoxam 12.6% + Lambda Cyhalothrin 9.5% ZC(Alika)	**150**	76.50 8.75	50.75 (7.12	35.65 5.97	12.45 3.53	2.15 1.47	25.25	98.21	30.25 5.55	20.15 4.54	8.10 2.93	0.00 0.71	0.00 0.71	7.06	100.00	20.50	32.69
Thiamethoxam 25% WG	**50**	78.95 8.89	65.15 8.07	35.15 5.93	22.15 4.71	4.95 2.22	31.85	96.01	31.15 5.63	21.45 4.69	12.25 3.57	2.35 1.69	0.00 0.71	9.01	100.00	20.85	34.95
Lambda Cyhalothrin 5% EC	**500**	80.65 8.98	62.25 7.89	47.15 6.87	30.95 5.56	12.50 3.54	38.21	90.13	30.45 5.56	22.65 4.81	15.15 3.96	7.45 2.82	2.95 1.86	12.05	92.40	18.75	21.36
Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon)	**400**	80.45 8.97	53.36 7.30	35.35 5.95	20.45 4.52	3.65 1.91	28.20	97.11	28.75 5.41	20.15 4.54	10.20 3.27	3.45 1.99	0.00 0.71	8.45	100.00	20.35	31.72
Imidacloprid 17.8 SL	**400**	75.35 8.68	53.75 7.33	35.95 6.00	20.20 4.49	6.85 2.62	29.19	94.21	38.75 6.26	25.25 5.07	15.15 3.96	5.20 2.39	2.10 1.61	11.93	95.75	19.25	24.60
Beta-cyfluthrin 25 SC	**1450**	80.15 8.95	65.15 8.07	46.20 6.80	30.50 5.52	9.15 3.02	37.75	92.73	35.35 5.99	28.85 5.42	20.15 4.54	13.75 3.77	6.45 2.64	17.30	85.70	18.50	19.74
Sulfoxaflor 12% SC	**250**	75.75 8.70	52.15 7.22	39.35 6.27	20.56 4.53	10.15 3.19	30.55	91.47	32.45 5.74	22.45 4.79	12.45 3.60	5.65 2.48	0.00 0.71	10.14	100.00	19.45	25.89
Untreated check	**-**	79.92 8.94	86.15 9.28	102.15 10.11	115.45 10.74	125.56 11.21			145.15 12.07	150.50 12.29	165.35 12.88	170.75 13.09	185.15 13.63			15.45	
SEm±		**1.23**	**1.01**	**0.99**	**0.93**	**0.53**			**1.05**	**0.95**	**0.54**	**0.45**	**0.78**				
CD at 5%		**2.30**	**2.08**	**2.06**	**2.00**	**1.50**			**2.12**	**2.02**	**1.53**	**1.39**	**1.83**				

*DAT- Days After Treatment, ** Figures in parenthesis are Square root transformed value,

Date of Sowing: 06.12.19 Plot size: Six rows of 6meters length at 25cm apace

Date of Insecticide Application: 1st 08-01-2020 and IInd 09-02-2020 Variety: HD 2967

Date of harvest: 12-04-2020 Replication: Three

Table B8-10.2d: Efficacy of various insecticides and their combinations against foliar aphid and natural enemies during 2019-20 (Centre: Niphad)

Tr. No.	AV population of foliage feeding aphids survived per shoot per plant					AV population of *Coccinellid* per sq.m.					AV population of *Crysoperlla carnia* per sq.m.					Grain Yield	
	Pre count	1 DAS	2 DAS	7 DAS	15 DAS	Pre count	1 DAS	2 DAS	7 DAS	15 DAS	Pre count	1 DAS	2 DAS	7 DAS	15 DAS	Kg/plot	q/ha
1	109.60 (10.49)	82.40 (9.13)	64.47 (8.09)	20.60 (4.64)	12.60 (3.68)	18.33 (4.39)	13.67 (3.83)	14.00 (3.87)	3.67 (2.16)	3.33 (2.08)	7.00 (2.82)	8.33 (3.05)	2.67 (1.91)	2.00 (1.73)	1.33 (1.52)	3.16	43.85
2	109.40 (10.50)	83.60 (9.19)	61.27 (7.89)	20.60 (4.64)	13.07 (3.75)	18.33 (4.38)	16.33 (4.16)	15.67 (4.08)	5.33 (2.51)	3.33 (2.08)	9.67 (3.26)	8.67 (3.11)	2.00 (1.73)	2.33 (1.82)	1.67 (1.63)	3.24	44.95
3	100.07 (10.03)	78.53 (8.92)	58.80 (7.73)	15.00 (4.00)	10.67 (3.38)	22.67 (4.86)	15.33 (4.03)	15.33 (4.04)	5.67 (2.58)	3.67 (2.16)	10.67 (3.41)	8.67 (3.10)	2.00 (1.73)	2.00 (1.73)	1.33 (1.52)	3.03	42.09
4	100.60 (10.08)	80.07 (9.00)	44.27 (6.72)	14.33 (3.92)	7.93 (2.98)	17.00 (4.24)	17.00 (4.23)	13.67 (3.81)	5.33 (2.50)	3.33 (2.07)	7.67 (2.94)	8.33 (3.05)	2.00 (1.73)	2.00 (1.72)	1.67 (1.63)	3.32	46.07
5	99.60 (10.02)	81.93 (9.08)	59.93 (7.79)	15.73 (4.09)	8.73 (3.11)	19.67 (4.53)	16.00 (4.12)	13.33 (3.78)	4.67 (2.37)	4.33 (2.31)	9.00 (3.15)	8.00 (3.00)	2.33 (1.82)	2.00 (1.73)	1.67 (1.63)	3.23	44.78
6	94.13 (9.75)	79.73 (8.98)	53.67 (7.39)	16.73 (4.19)	10.47 (3.38)	22.00 (4.79)	18.00 (4.35)	16.00 (4.12)	3.67 (2.16)	4.00 (2.24)	8.33 (3.05)	9.33 (3.21)	2.67 (1.91)	2.33 (1.82)	2.00 (1.73)	3.04	42.17
7	105.07 (10.28)	82.33 (9.13)	53.40 (7.34)	21.73 (4.77)	13.00 (3.72)	20.67 (4.65)	16.33 (4.16)	16.33 (4.16)	4.00 (2.22)	3.67 (2.15)	10.33 (3.36)	8.67 (3.10)	2.67 (1.91)	2.00 (1.73)	1.33 (1.52)	2.94	40.85
8	110.00 (10.54)	77.27 (8.84)	77.27 (8.84)	38.67 (6.29)	22.13 (4.81)	18.00 (4.35)	21.33 (4.72)	14.33 (3.92)	6.00 (2.64)	5.00 (2.45)	9.67 (3.26)	9.33 (3.21)	2.33 (1.82)	2.00 (1.67)	1.67 (1.63)	2.37	32.89
SE+	**0.306**	**0.224**	**0.241**	**0.187**	**0.171**	**0.185**	**0.160**	**0.121**	**0.135**	**0.101**	**0.127**	**0.130**	**0.072**	**0.137**	**0.105**	**0.237**	**3.284**
CD@5%	**NS**	**NS**	**0.729**	**0.567**	**0.518**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

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

Table B8-10.2e: Efficacy of various insecticides and biopesticides against foliar aphid during 2019-20 (CentreVijapur)

Sr. No.	Treatment	Doses g.a.i./ha	Aphid population per shoot					Grain yield (q/ha)	Yield increase over check (q/ha)
			Before spray (days)	After spray (days)					
				1st	2nd	7th	15th		
1	Thiamethoxam 12.6 % + Lambda cyhalothrin 9.5% ZC (Alika)	33.15 (18.9+14.25)	20.27	9.07a	5.87a	3.60a	1.13a	57.75	29.37
2	Thiamethoxam 25 % WG	12.5	15.60	9.80a	6.67a	3.87a	2.13a	55.94	25.31
3	Lambda cyhalothrin 5 % EC	25	18.27	9.67a	6.27a	3.87a	0.80a	58.70	31.50
4	Beta-Cyfluthrin 9 % + Imidacloprid 21 % (Solomon)	(8.49+19.81 % w/w)	17.40	7.67a	5.80a	2.53a	0.53aa	64.13	43.66
5	Imidacloprid 200 SL (Confidor 17.8)	20	21.20	9.00a	5.47a	3.27a	2.40a	53.19	19.15
6	Acetamiorid 20 SP	20	17.93	8.40a	5.40a	3.33a	1.07a	58.62	31.32
7	Sulfoxaflor 12 % SC	30	17.13	9.70a	6.27a	2.47a	1.53a	57.25	28.25
8	Untreated Check	-	19.67	23.00b	25.47b	29.87b	27.47b	44.64	-
		S. Em ±	1.53	1.07	1.01	1.04	0.85	4.03	
		C.D. at 5%)	NS	3.23	3.07	3.15	2.57	NS	
		C.V. %	14.42	17.10	20.88	27.28	31.69	12.41	

Figures followed with same letter(s) are not differed statistically

Date of sowing : 26/11/2019
Date of insecticide application : 06/01/2020
Date of harvesting : 23/03/2020
Design : R.B.D Replications : Three
Spacing : 23 cm between row No. of rows / plot : 6
Plot size : Gross: 6.0m x 1.38m Net : 5.0m x 0.92m
Variety : RD 2052 Condition : Irrigated

Table B8-10.2f: Efficacy of various insecticides and biopesticides against foliar aphid during 2019-20 (Centre: Kanpur)

S.No.	Treatments	Actual dose ml/g/ha	Aphid population per main shoot					Grain yield (q/ha)	Increase yield (q/ha) over untreated
			Before spray	After spray					
			1 day	1day	2 days	7 days	15 days		
1.	Imidacloprid (17.8% SL)	100ml	11.16	7.66 (16.11)	5.80 (13.94)	6.86 (15.23)	6.19 (14.42)	52.66	10.22
2.	Flubendamide (Fame 480 SC)	250ml	10.92	7.09 (15.45)	5.33 (13.31)	6.40 (14.65)	5.61 (23.26)	53.99	11.55
3.	Acetamiprid 20SP	100g	10.17	6.84 (15.12)	4.05 (11.54)	4.43 (12.11)	3.72 (11.09)	55.57	13.13
4.	Chlorantaniliprid (Coragen) 18.5 SC	100ml	11.2	12.81 (20.96)	12.69 (20.88)	21.83 (27.83)	11.92 (20.18)	50.89	8.45
5.	Azadirachtian 1500ppm	3ml/lit.	10.23	15.30 (23.03)	18.06 (25.18)	31.57 (34.20)	31.67 (34.27)	45.78	3.34
6.	*Beauveria bassiana*	5.0g/lit.	10.75	9.28 (17.76)	11.72 (20.00)	10.33 (18.72)	10.27 (18.63)	51.55	9.11
7.	*Metarhizium anisopliae*	3.0g/lit.	9.37	10.31 (18.72)	15.67 (23.34)	27.20 (231.44)	26.53 (30.98)	49.33	6.89
8.	Control	-	11.03	18.65 (25.62)	27.30 (31.50)	89.58 (71.19)	78.45 (62.37)	42.44	-
S.Em ±		-	NS	0.186	0.436	0.406	1.674	1.182	-
CD 5%		-	NS	0.568	1.334	1.244	5.127	3.619	-

Date of sowing : 24.11.2019
Date of insecticidal application : 27.01.2020
Date of harvest : 30.04.2020
Design : R.B.D.
Plot size : 3 m x 5m = 15 Sqm
Variety : K551
No. of rows/plot : 23
Replication : Three

Centre: Kanpur

The experiment was conducted under irrigated condition at research farm Nawabganj C.S.A. Univ., Kanpur. The barley variety K 551 was sown on 24.11.2019 in plot of 23 rows of 3m length. These were total of 8 treatments including untreated check and each was replicated thrice. For recording the observation, five shoots were randomly selected in each plot and observation were recorded 24 hr before spray and thereafter at 1, 2, 7 and 15 days interval on these plants.

The number of aphids recorded 24 hr. before spray did not differ significantly but after one day of application of insecticides, it was observed that acetamiprid 20SP and flubendamide 480 SC and spray after one day recorded 6.84 and 7.09 aphids population and were at par imidacloprid 17.8%SL and *Beauveria bassiana* 7.66 and 9.28 aphids in insecticidal treatments. The aphid population per shoot lowers than untreated control (18.65). Similarly 2days, 7days and 15 days after spray against all these insecticide were at par with each other and better than untreated checks.

Grain yield q/ha was maximum (55.37q/ha and 53.99q/ha) from acetamiprid 20SP and fludendamide 480 SC respectively, followed by imidacloprid 17.8%SL and *Beauveria bassiana* (52.66 q/ha and 51.55 q/ha). However all the insecticidal treatment recorded significantly higher than untreated check (Table B8-10.2f).

B9. Management of termites, aphids and seed borne diseases of wheat through seed treatment of chemical molecules combinations (Centres: Durgapura, Kanpur, Ludhiana and Vijapur)

B9a. Management of termites through seed treatment

Centre:Ludhiana

The trial was conducted in the rainfed fields at New experimental area, Dept. of Plant Breeding and Genetics, PAU Ludhiana. The wheat variety PBW 660 was sown on 5th Nov 2019. Before sowing, the seeds were treated with seven different insecticides separately by spraying on the spreaded layer of equal quantity of seed on polythene sheet. The treated seed was dried overnight before sowing. The treatments included pre-mixed pesticides combination of imidacloprid 18.5%+ hexaconazole 1.5% FS and tank mixing of imidacloprid 600FS, thiamethoxam 25 WG, tebuconazole and hexaconazole along with untreated check. Each treatment 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 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 lowest termite damage was recorded in pre-mixed insecticide imidacloprid 18.5%+ hexaconazole 1.5% FS followed by tank mixture of Imidacloprid 600FS + Tebuconazole.

At ear head stage, the per cent damaged effective tillers per meter row (in marked spots) were minimum in the plot treated with pre-mixed insecticide imidacloprid 18.5%+ hexaconazole 1.5% FS (1. 58 %) treated plots and it was on par with all the other treatments except untreated check. The numbers of damaged effective tillers/ha were also lowest in plots treated with pre-mixed insecticide imidacloprid 18.5%+ hexaconazole 1.5% FS (8833). All these insecticide treated plots recorded significantly lower number of damaged tillers/ha as compare to untreated check except tebuconazole and hexaconazole treatments alone.

The grain yield (q/ha) obtained was maximum in plot treated with pre-mixed insecticide imidacloprid 18.5%+ hexaconazole 1.5% FS (53.20 q/ha) and it was at par with all insecticidal seed treatment and it was significantly higher yield than the untreated check (48.17 q/ha)**(**Table B9a-10.1a).

Centre: Vijapur

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 significant among the treatments however, the maximum and minimum per cent damaged effective tillers/meter row was observed in untreated check and in treatment of fipronil 5 SC @ 0.3 g a.i./kg seed respectively which was at par with treatments of thiamethoxam 25 WG @ 0.8 g a.i./kg and thiamethoxam 30 FS @ 0.72 g a.i./kg. The result of number of damaged effective tillers/ha revealed that significantly the lowest damage was recorded in treatment of fipronil 5 SC @ 0.3 g a.i./kg seed and other treatments were at par with this 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 thiamethoxam 30 FS @ 0.72 g a.i./kg seed (Table B8a-10.1b & c).

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 during the*rabi* season 2019-20 and the results are summarized in Table 1. 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 weeks after sowing in all the treatments but more in Biocontrol agent *Beauveria bassiana*4.21%, 5.31% and 5.72% and in untreated check was 12.77%, 13.65% and 15.59% respectively. Percent damaged effective tiller/m row was maximum in untreated check (28.38%), whereas it was minimum in the treatment of Imidacloprid 600 FS (Dose, 2 ml/kg seed) (0.91%) which was at par with fipronil (Dose, 6.0 ml/kg seed) (1.02%). The number of damaged effective tillers were maximum in treatment of biocontrol agent, *Beauveria bassiana*(26231.00) and minimum in treatment of imidacloprid 600 FS (3912.00) while in untreated check were 45506.00.The maximum grain yield (gm /m/row) was recorded in the plot treated with imidacloprid 600 FS (Dose, 2 ml/kg seed) (35.87 q/ha.) as compared to untreated check (14.51)(Table B8a-10.2d).

Centre:Kanpur

The incidence of termite after 3 weeks of sowing was not seen in any of the treatments accept untreated plot i.e. 2.44 per cent. The incidence of termite after 4 weeks of sowing range from 0.44 to 0.74 per cent, while in untreated plot it was 3.32 per cent. The incidence of termite after 5 weeks of sowing range from 1.15 to 1.71 per cent, while in untreated plot it was 3.46 per cent, significantly less damaged shoot were recorded in treated plot with fipronil 5SC and *Beaveria bassiana*, which was at par Thiamethoxam 70WS and imidacloprid 600FS (48%). Minimum damage of effective tiller per meter row was recorded in the treated plots with fipronil 5SC and *Beaveria bassiana*. Which was at par Thiamethoxsam 70WS and imadacloprid 600FS (48%). Manimum damage of effective tiller per

meter row was recordrd 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 3100.00 to 4233.33 while it was 73343.33 untreated plots. The minimum damaged number of effective tillers/ha were recorded in fipronil 5SC and *Beaveria bassiana* followed by Thiamethoxam 70WS 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 5SC and *Beaveria bassiana*, followed by Thiamethoxam 70 WS and imidacloprid 600 FS (48%).

The result concluded that insecticide fipornil 5SC @ 6.0ml/kg of seed and *Beaveria bassiana* @ 5.0g/lit were superior to Thiamethoxam 70WS @ 1.0 ml/kg, imidacloprid 600 FS (48%) @ 2.0ml, Clothianidin 50WDG @ 1.5gm, Thiamethoxam 25WG 3.2 gm/kg of seed and *Metarhizium anisopliae* @ 3.0g/lit.(Table B8a-10.2e).

Experiment B8b: Management of termites through broadcast application in standing crop

Centre: Vijapur

An experiment on eco-friendly management of termite through broadcast application in standing wheat crop was conducted under irrigated condition at Wheat Research Station, Vijapur. The different treatments were broadcasted 3 weeks after emergence of seedling. There was no termite damage observed in all the treatments after 3rd, 4th and 5th weeks of sowing including untreated check. At ear head stage, the percent damaged effective tillers/m row were zero in all the insecticides broadcasted plots. However, all the bio-pesticides recorded significantly less percent damaged effective tillers/m row than untreated check. The number of damaged effective tillers/ha was significantly higher in untreated check whereas among the insecticidal treatments, it was significantly the minimum in fipronil 5 SC @ 80 g a.i./ha which was at par with fipronil 0.3 G @ 60 g a.i./ha, fipronil + imidacloprid 40 % WG (Lacenta) @ 400 g a.i./ha and imidacloprid 600 FS @ 180 g a.i./ha treatments. While there were significantly low termite damage reported in bio-pesticides as compared to untreated check. None of the insecticidal treatments significantly affected the grain yield(g/m row and q/ha). However, grain yield on the basis of q/ha was the maximum recorded in the plot treated with fipronil 5 SC (Table B8b-10.2a).

C. STORED GRAIN PEST MANAGEMENT

C1. Evaluation of different packaging bags for storage insect-pest infestation and its effect wheat seed quality (Centre: Karnal**)**

As it was a new trial finalized during last year's work plan. Now trial is being intiated in May, 2020 at Karnal only and results are yet to come & will be presented next year.

Table B9a-10.2a: Management of termites through seed treatment of chemical molecules combinations (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	Imidacloprid 600FS + Tebuconazole	4 ml + 2 ml	49.60	1.22 (6.33)	1.29 (6.51)	1.30 (6.53)	1.71 (7.51)	9833 (99.15)	51.99
2	Thiamethoxam 25 WG+ Tebuconazole	3 g +2 ml	49.50	1.80 (7.71)	2.04 (8.21)	1.81 (7.73)	2.18 (8.48)	11666 (108.00)	51.40
3	Thiamethoxam 25WG	3 gm	49.83	1.89 (7.89)	2.18 (8.48)	2.02 (8.16)	2.42 (8.94)	13583 (116.55)	50.90
4	Tebuconazole	2 ml	49.63	3.77 (11.20)	3.71 (11.10)	3.74 (11.15)	3.81 (11.24)	23833 (154.26)	48.81
5	Imidacloprid 600 FS	2 ml	49.60	1.27 (6.47)	1.35 (6.61)	1.09 (5.98)	1.95 (8.03)	10583 (102.87)	52.50
6	Imidacloprid 18.5%+ Hexaconazole 1.5% FS	4 ml + 2 ml	49.80	1.15 (6.13)	1.13 (6.08)	1.04 (5.85)	1.58 (7.22)	8833 (93.95)	53.20
7	Hexaconazole 1.5% FS	4 ml + 2 ml	46.80	3.88 (11.35)	3.79 (11.23)	3.78 (11.21)	3.93 (11.43)	24166 (155.44)	48.64
8	Untreated control	-	49.40	3.90 (11.85)	3.98 (11.13)	3.94 (11.44)	4.49 (12.22)	25333 (159.15)	48.17
CD (p=0.05)			NS	(0.55)	(0.51)	(0.64)	(0.62)	(5.07)	1.19

* Figures in parentheses are transformed means

Date of sowing : 05-11-2019
Date of insecticidal application : 04-11-2019
Date of harvest : 01-05-2020
Plot size : 40 m^2
Variety : PBW 660
Replications : Three

Table B9a-10.2b: Management of termites through seed treatment of chemical molecules combinations during 2019-20 (Location: Vijapur)

Sr. No.	Treatment	Dose ml or g /kg seed	Plant popul. /m row length	Confirmative test for seed germination	Per cent damaged shoots/m row after 3rd to 5th weeks afters owing	% Damaged effective tillers/m row	No. of damaged effective tillers/ha	Aphid population per shoot		Grain yield	
								65 DAS	72 DAS	g/m	q/ha
1.	Imidacloprid 600 FS + Tebuconazole 2 DS(2 % w/w- Raxil)	1 ml + 2 ml	60	85.33	0.00	0.00	1528*a (3623)	1.00ab	2.27a	110	56.10
2.	Thiamethoxam 25 WG + Tebuconazole 2 DS(2 % w/w- Raxil)	3 g + 2 ml	62	86.67	0.00	0.00	2200b (7850)	0.47a	2.07a	110	54.35
3.	Thiamethoxam 25 WG	3 g	61	83.00	0.00	0.00	2132b (7246)	1.20ab	1.73a	111	54.68
4.	Tebuconazole 2 DS(2 % w/w- Raxil)	2 ml	61	83.00	0.00	0.00	2637c (11272)	1.47ab	3.80ab	111	51.73
5.	Imidacloprid 600 FS	2 ml	58	83.00	0.00	0.00	1630a (4227)	1.93bc	3.60ab	107	54.85
6.	Imidacloprid 18.5 % + Hexaconazole 1.5 % FS(Neonix)	4 ml	58	85.00	0.00	0.00	1542a (3824)	1.67b	2.67a	103	56.06
7.	Hexaconazole 5 % EC	2 ml	62	84.33	0.00	0.00	2506c (10266)	2.00b	5.60bc	107	51.79
8.	Untreated Check	-	61	86.00	0.00	0.00	4553d (34219)	2.87c	6.67c	109	50.83
	S.Em.± C.D. at 5% C.V.%		3.00 NS 8.62	4.32 NS 8.85	- - -	- - -	60 183 -	0.38 1.15 -	0.85 2.58 -	7 NS 10.82	3.25 NS 10.46

* 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 : 25/11/2019 Date of sowing : 26/11/2019

Date of Plant population count : 09 /12/2019 Date of harvesting : 21/03/2020

Design : R.B.D Replications: Three Spacing : 23 cm between row No. of rows / plot: 12

Plot size : Gross : 14.0m x 2.76 m Net: 13.0m x 1.84m Variety: GW 496 Condition : Irrigated

Table B9a-10.2c: Management of termites through seed treatment of chemical molecules combinations during 2019-20 (Location: Vijapur)

Sr. No.	Treatment	Dose g a.i./ kg seed	Plant population /m row length	Confirmative test for seed germination	Per cent damaged shoots/m row after sowing (week)			% Damaged effective tillers/m row	No. of damaged effective tillers/ha	Grain yield	
					3rd	4th	5th			g/m	q/ha
1	Thiamethoxam 25 WG	0.80	59	86.33	0.00	0.00	0.00	0.00* (0.00)	4470**d (48216)	95	42.84
2	Thiamethoxam 30 FS	0.72	55	84.33	0.00	0.00	0.00	0.00 (0.00)	3134cd (24108)	87	43.76
3	Fipronil 5 SC	0.30	56	86.33	0.00	0.00	0.00	0.00 (0.00)	539a (557)	99	46.67
4	Imidacloprid 600 FS *	1.20	60	85.00	0.00	0.00	0.00	0.00 (0.00)	1580b (6271)	87	45.93
5	Clothianidin 50 WDG	0.75	57	87.33	0.00	0.00	0.00	6.11 (1.14)	2722c (18395)	91	44.18
6	*Beauveria bassiana* (g/kg seed)	5	59	85.00	0.00	0.00	0.00	9.21 (2.57)	3625d (32748)	87	43.74
7	*Metarhizium anisopliae* (g/kg seed)	3	60	86.33	0.00	0.00	0.00	6.96 (1.50)	2807cd (20485)	95	43.92
8	Bifenthrin 10 EC	0.20	60	88.33	0.00	0.00	0.00	0.00 (0.00)	539a (557)	101	47.70
9.	Fipronil+Imidacloprid 40 % WG (Lacenta)	1.20	59	87.00	0.00	0.00	0.00	0.00 (0.00)	911ab (1812)	85	46.14
10.	Untreated Check	-	60	90.00	0.00	0.00	0.00	22.38 (14.67)	5853e (82637)	81	42.64
	S.Em.+		3	4.03	-	-	-	1.95	277	6	2.87
	C.D. at 5%		NS	NS	-	-	-	NS	823	NS	NS
	C.V.%		-	-	-	-	-	-	-	11.77	11.10

* 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 : 25/11/2019; Date of sowing : 26/11/2019; Date of Plant population count : 09 /12/2019; Date of harvesting : 21/03/2020
Design : R.B.D; Replications: Three; Spacing: 23 cm between row; No. of rows / plot: 12; Plot size : Gross:14.0m x 2.76 m; Net: 13.0m x 1.84m;
Variety: GW 496; Condition: Irrigated

Table B9a-10.2d: Management of termites through seed treatment of chemical molecules combinations during 2019-20(Centre:Durgapura)

Treatments	Dose ml or gm/Kg Seed	Plant population/m row	Per cent damaged shoot/m row			Percent damaged tillers/m row at ear head stage	No. of damaged effective tillers/ ha	Grain yield q/ha
			3WAS	4WAS	5WAS			
Thiamethoxam 25 WG	3.2	41.33	0.95 (5.59)*	1.02 (5.79)	1.51 (7.05)	3.23 (10.26)	8410.66	27.50
Thiamethoxam 75 WS	1.0	41.66	1.45 (6.91)	1.69 (7.44)	1.85 (7.80)	3.54 (10.77)	8637.33	25.35
Fipronil 5 SC	6.0	42.33	0.48 (3.96)	0.59 (4.36)	0.78 (5.04)	1.02 (5.77)	4872.33	32.37
Imidacloprid 600 FS	2	42.66	0.37 (3.47)	0.41 (3.65)	0.49 (3.99)	0.91 (5.45)	3912.00	35.87
Clothianidin 50 WDG	1.5	41.33	0.62 (4.51)	0.78 (5.04)	0.97 (5.61)	1.37 (6.71)	6672.66	30.45
Beauveria bassiana	5.0	41.33	4.21 (11.83)	5.31 (13.31)	5.72 (13.81)	10.42 (18.81)	26231.00	20.59
Metarhizium anisopliae	3.0	41.66	3.32 (10.49)	3.72 (11.10)	3.96 (11.41)	8.12 (16.52)	23113.00	21.39
Control	-	40.33	12.77 (20.92)	13.65 (21.66)	15.59 (23.21)	28.38 (32.17)	45506.00	14.51
CD @ 5 %	-	N/A	0.62	0.98	1.61	1.90	123.84	1.77
Sem	-	0.37	0.20	0.32	0.53	0.62	40.43	0.58
CV		1.54	4.138	6.10	9.39	8.05	0.44	3.85

*Figures in parentheses are angular transformed value

Table B9a-10.2e: Eco-friendly management of termitethrough seed treatment during 2019-20 (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	33.47	0	0.43 (3.76)	1.23 (6.29)	1.35 (6.80)	3266.66 (57.15)	114.69	39.25
2.	Thiamethoxam 70WS	1.0ml	32.53	0	0.70 (4.80)	1.62 (7.27)	1.74 (7.49)	3888.89 (62.36)	105.77	34.03
3.	Fipronil 5 SC (regent)	6.0ml	35.80	0	0.41 (3.67)	1.10 (6.02)	1.23 (6.29)	2500.00 (50.00)	119.61	40.00
4.	Imidacloprid 600 FS (48%)	2.0ml	31.73	0	0.47 (3.93)	1.30 (6.55)	1.46 (7.04)	3666.67 (60.55)	111.10	37.58
5.	Clothianidin 50 WDG	1.5g	36.47	0	0.50 (4.05)	1.52 (6.29)	1.53 (7.04)	3833.33 (61.91)	107.71	36.01
6.	*Beauveria bassiana*	5.0g/ltr	33.67	0	0.75 (4.97)	1.73 (7.49)	1.76 (7.71)	3855.56 (62.09)	104.80	31.18
7.	*Metarhizium anisopliae*	3.0g/ltr	36.33	0	0.79 (5.10)	1.76 (7.71)	1.79 (7.71)	4183.33 (64.68)	101.44	30.92
8.	Control		34.67	2.34	3.28 (10.47)	3.37 (10.63)	3.50 (10.78)	14333.33 (119.72)	73.37	28.50
	SEm+				0.227	0.125	0.159	0.975	0.358	0.445
	CD at 5%				0.321	0.391	0.488	3.110	1.159	1.361

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

Date of sowing	:	24.11.2019	Plot size Gross	: 4 x 5m = 20 Sqm.	
Date of insecticidal application	:	23.11.2019	Design	: R.B.D.	
Date of plant population counts	:	21.12.2019	Variety	: K1317	
Date of harvest	:	02.05.2020	No. of rows/plot	: 23	
Irrigated/ Unirrigated	:	Unirrigated	Replication	: Three	

Table B8b-10.2a: Management of termites through broadcast application in standing crop during 2019-20 (Location: Vijapur)

Sr. No.	Treatment	Dose g a.i./ ha	Per cent damaged shoots/m row after sowing (week)			% Damaged effective tillers/ m row	No. of damaged effective tillers/ha	Grain yield	
			3rd	4th	5th			g/m	q/ha
1.	Fipronil 5 SC	80	0.00	0.00	0.00	0.00*a (0.00)	884**a (1672)	97	49.58
2.	Thiamethoxam 30FS	75	0.00	0.00	0.00	0.00a (0.00)	1288bc (3763)	99	44.57
3.	Imidacloprid 600 FS	180	0.00	0.00	0.00	0.00a (0.00)	1169ab (3066)	98	46.36
4.	Fipronil 0.3 G broadcast at the time of sowing	60	0.00	0.00	0.00	0.00a (0.00)	1119ab (2787)	96	46.89
5.	Fipronil+Imidacloprid 40 % WG (Lacenta)	400	0.00	0.00	0.00	0.00a (0.00)	1144ab (2926)	96	45.07
6.	*Beauveria bassiana* g/ha	500	0.00	0.00	0.00	6.54c (1.31)	2009d (10452)	74	40.23
7.	*Metarhizium anisopliae* g/ha	500	0.00	0.00	0.00	5.32bc (0.83)	1909d (8779)	76	43.10
8.	*Beauveria bassiana* in furrow at sowing g/ha	500	0.00	0.00	0.00	4.46bc (0.65)	1667cd (6689)	89	43.13
9.	*Metarhizium anisopliae* in furrow at sowing g/ha	500	0.00	0.00	0.00	3.85b (0.47)	1478b (5156)	90	43.72
10.	Untreated Check	-	0.00	0.00	0.00	11.98d (4.35)	6099e (89186)	71	39.06
	S.Em ±		-	-	-	0.80	128	7	2.94
	C.D. at 5%		-	-	-	2.38	380	NS	NS
	C.V.%		-	-	-	-	-	13.71	11.52

* 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 sowing : 26/11/2019 Date of insecticide application : 16/12/2019

Date of harvesting : 21/03/2020 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

CO-OPERATORS OF ENTOMOLOGY PROGRAMME

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PROGRAMME 11: NEMATOLOGY

11.1 Crop Health Survey

Rajasthan

Farmers field were surveyed in four districts of Rajasthan for studying the incidence and intensity of Cereal Cyst Nematode (CCN). Diseased fields were randomly observed 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 from low to moderate incidence in surveyed area i.e. Ajmer, Dausa, Jaipur and Sikar districts. A large number of infested fields were observed some villages of Jaipur district. Post-harvest survey was also conducted to observe the infestation of Ear Cockle disease in various grain market of Jaipur district and ECN was not found in collected grain sample of wheat.

Hisar

Crop health monitoring survey for nematodes was done in Bhiwani and Dadri districts. The results revealed that out of 35 samples, 9 samples were found infested with cereal cyst nematode with 25.71 % (9/35) frequency of occurrence. Number of cysts ranged from 1-13 per 200 cc soil. Other plant parasitic nematodes which were found associated with wheat crop were *Pratylenchus* sp., *Tylenchorhynchus* sp., *Hoplolaimus* sp. and *Helicotylenchus* sp. (Table 11.1). Wheat seed gall nematode (*Anguina tritici*) was not recorded from any samples.

Table 11.1: Community analysis of PPNs associated with wheat in Bhiwani and Dadri districts

Nematode species	Frequency of Occurrence	Density range
Heterodera avenae	25.71 (9/35)	05-230
Pratylenchus sp.	17.14 (06/35)	15-83
Tylenchorhynchus sp.	40.00 (14/35)	45-295
Hoplolaimus sp.	31.42 (11/35)	24-130
Helicotylenchus sp.	08.57 (3/35)	05-26
Anguina tritici	-	-
Tylenchus sp.	-	-

Ludhiana

Thirty three soil and root samples were collected from ten localities to know the different plant parasitic nematode associated with the wheat crop in Punjab. *Heterodera avenae* cyst, species of *Meloidogyne, Tylenchorhynchus, Hirschmanniella, Helicotylenchus* and *Hoploloaimus* were recorded. Hetrodera cysts were recorded from Mehal Kalan (Barnala District), Bhucho Mandi & Karamgarh Sattran (Bathinda District), and Nihal khera (Fazilka District). The number of cysts recorded was ranged with 1 to 3 cysts/200 cc soil with 25-50% frequency of occurrence. Root knot nematode was also recorded up to 120 larvae/200cc soil and *Tylenchorhynchus* was recorded from all the collected with the highest of 320 larvae/200cc soil (Table 11.2).

Table 11.2: Prevalence of Cereal cyst nematode in wheat crop in Punjab (2019-2020)

S. No	Village/ Locality	No. of samples collected	Number of nematodes / 200 ml soil; Range (Frequency of occurrence, %)					
			H. avenae (cysts)	*Meloidogyne* (Larvae)	*Tylenchorhynchus*	*Hirschmanniella*	*Helicotylenchus*	*Hoploloaimus*
1	Rakba	4	0	60-120 (50.00)	120-320 (100.00)	60-80 (50.00)	20 (25.00)	20 (25.00)
2	Halwara	4	0	30-50 (50.00)	80-180 (100.00)	40-6 (50.00)	30 (25.00)	-
3	Mehal Kalan	4	1-2 (50.00)	30-50 (50.00)	110-320 (100.00)	30-40 (50.00)	150 (25.00)	-
4	Wazid Kalan	4	0	30-50 (50.00)	190-260 (100.00)	50-80 (50.00)	20-30 (50.00)	-
5	Bhucho Mandi	4	1-3 (50.00)	-	120-230 (100.00)	60-100 (50.00)	30-50 (50.00)	-
6	Buladewala	4	0	-	190-260 (100.00)	40-80 (50.00)	30 (25.00)	15 (25.00)
7	Karamgarh Sattran	3	2 (33.33)	60-80 (66.66)	130-260 (100.00)	70-110 (66.66)	40-60 (66.66)	-
8	Chappian Wali	6	0	30-60 (50.00)	80-190 (100.00)	50-80 (50.00)	-	-
9	Sito gunno	4	0	40-60 (50.00)	80-220 (100.00)	60-80 (50.00)	-	30 (25.00)
10	Nihal khera	4	1 (25.00)	40-90 (75.00)	120-160 (100.00)	80-90 (50.00)	-	20 (25.00)
	Total	**33**	**1-3**	**30-120**	**80-320**	**30-110**	**20-60**	**15-30**

11.2. Studies of Pathotypes of *Heterodera avenae*:

The pathotypes studies of cereal cyst nematode were carried out during the crop season 2019-20 against Jaipur population of cereal cyst nematode, *Heterodera avenae*. Out of 26 International differentials of wheat, barley and oat, twelve showed resistant reaction i.e. AUS-15854, AUS-7869, AUS-15895, Psathia, KVL-191, Harlan, Dalmitsche, Morocco, P-313221, Martin, Siri, La-estanzuella while rest showed susceptible reaction. Reaction on various test Assortment revealed that Jaipur Population of CCN is Pathotype Ha 21 (Table 11.3).

Table 11.3. Reaction of *Heterodera avenae* of Jaipur population on International differentials

S. No.	International Differentials	Reactions	S. No.	International Differentials	Reactions
1	AUS-15854	R	14	Ogrlitsche	S
2	AUS-15807	S	15	Dalmitsche	R
3	AUS-7869	R	16	Harta	S
4	AUS-15895	R	17	Emir	S
5	AUS-4930	S	18	Morocco	R
6	AUS-498	S	19	Gelliune	S
7	Loros	S	20	P-313221	R
8	IK2 Light	S	21	Martin	R

9	Psathia	R	22	Varda	S
10	Capa	S	23	Siri	R
11	Ortalan	S	24	La-estanzuella	R
12	KVL-191	R	26	L-62	S
13	Harlan	R	26	Nidar-2	S
Pathotype: Ha 21, Rating scale: 0 -5%= resistant; 6 -100% = susceptible					

11.3 Host resistance

Resistance against *Heterodera avenae*

Ludhiana Centre

One hundred thirty seven 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 seven entries namely, HS 681, WH1124, WH1080, DBW39, WHD964 (d), MACS6752 and DBW303 have shown moderately resistant reaction. Rest of the entries were either susceptible or highly susceptible to CCN (Table 11.4).

Durgapura Centre

One hundred thirty seven wheat germplasms (AVT) were screened in naturally sick field against cereal cyst nematode, *Heterodera avenae* (Pathotypes Ha 21) of RARI, Durgapura, Jaipur. The inoculums level was 4.8 L/gm of soil. Out of 137 germplasm, none of the entry showed resistant or moderately resistant reaction, all fall in susceptible or highly susceptible category (Table 11.4).

Hisar centre

A total 137 entries of wheat were screened against cereal cyst nematode, *Heterodera avenae* under screen house conditions using nematode infested soil, two entries VL907 (C) and PBW812 were found moderately resistant and remaining were either susceptible or highly susceptible (Table 11.4).

Table 11.4 Screening of AVT entries CCN during 2019-20 at different locations.

AVT No.	Entry	Ludhiana	Durgapura	Hisar	HS
1	HS 507 (C)	S	HS	HS	HS
2	HS 562 (C)	S	HS	HS	HS
3	HPW 349 (C)	S	HS	HS	HS
4	HS 668	S	HS	S	HS
5	VL 907 (C)	S	S	MR	S
6	VL 2036	S	HS	HS	HS
7	HS 681	MR	HS	HS	HS
8	VL 3022	S	HS	S	HS
9	HS 680	S	HS	HS	HS
10	VL 3023	S	S	S	S
11	HPW 474	S	S	S	S
12	UP 3069	S	HS	HS	HS
13	HPW 473	S	HS	HS	HS
14	VL 892 (C)	S	S	HS	HS
15	VL 3024	S	S	HS	HS
16	HS 490 (C)	S	HS	HS	HS
17	HS 679	S	S	HS	HS
18	DBW88 (C)	S	HS	HS	HS
19	DBW187(I) (C)	S	S	S	S
20	HD2967 (C)	S	HS	HS	HS
20A	Infector	S	-	-	S

21	WH1105 (C)	S	HS	S	HS
22	DBW222(I) (C)	S	S	HS	HS
23	HD3086 (C)	S	S	S	S
24	PBW840M	S	S	HS	HS
25	PBW803	S	HS	S	HS
26	PBW550 (C)	S	S	HS	HS
27	HD3334	S	HS	HS	HS
28	HD3059 (C)	S	HS	S	HS
29	HD3332	S	S	HS	HS
30	DBW173 (C)	S	S	S	S
31	WH1021 (C)	S	HS	S	HS
32	PBW811	S	S	HS	HS
33	DBW291	S	HS	S	HS
34	WH1264	S	HS	S	HS
35	PBW812	S	S	MR	S
36	JKW261	S	S	S	S
37	DBW290	S	S	HS	HS
38	PBW771(I) (C)	S	S	S	S
39	PBW813	S	HS	S	HS
40	HD3331	S	HS	S	HS
40A	Infector	S	-	-	S
41	HD3298*	S	S	S	S
42	WH1124 (C)	MR	S	HS	HS
43	UP3033	S	HS	HS	HS
44	HUW838	S	S	S	S
45	HD3043 (C)	S	HS	S	HS
46	PBW644 (C)	S	HS	ND	HS
47	DBW296	S	HS	S	HS
48	HI1628(I) (C)	S	HS	S	HS
49	WH1080 (C)	MR	S	HS	HS
50	JAUW672	S	S	S	S
51	WH1142 (C)	S	HS	ND	HS
52	NIAW3170(I) (C)	S	HS	HS	HS
53	PBW804	S	S	HS	HS
54	DBW187 (C)	S	S	S	S
55	K1006 (C)	S	S	HS	HS
56	DBW39 (C)	MR	S	S	S
57	HD3249(I) (C)	S	HS	HS	HS
58	HD2733 (C)	S	HS	HS	HS
59	HD3171 (C)	S	S	S	S
60	HD2888 (C)	S	HS	HS	HS
60A	Infector	S	-	-	S
61	HD3293*	S	HS	S	HS
62	K1317 (C)	S	HS	S	HS
63	HI1612 (C)	S	HS	S	HS
64	DBW252(I) (C)	S	HS	S	HS
65	TAW155	S	S	S	S
66	HI1636	S	HS	HS	HS
67	MP1361	S	HS	HS	HS
68	MACS6747	S	S	S	S
69	HD3377	S	S	S	S
70	HI1637	S	S	S	S

71	RAJ4541	S	S	HS	HS
72	GW513	S	HS	S	HS
73	GW322	S	S	S	S
74	HI1544	S	HS	S	HS
75	HI1634*	S	HS	HS	HS
76	HD2932	S	S	S	S
77	MP3336	MR	S	S	S
78	HD2864	S	S	S	S
79	CG1029*	S	S	S	S
80	MPO1357(d)	S	S	HS	HS
80A	Infector	S	-	-	S
81	HI8627(d)	S	S	HS	HS
82	UAS466(d)(I)	S	S	S	S
83	UAS472(d)	S	S	S	S
84	DBW110	S	S	S	S
85	MP3288	S	S	S	S
86	HI 8823(d)	S	S	HS	HS
87	DDW47(d)(I)	S	S	S	S
88	WHD964(d)	S	HS	S	HS
89	DDW48(d) *	S	S	S	S
90	MACS6222 (C)	S	HS	S	HS
91	MACS3949(d) (C)	S	S	S	S
92	HI8818(d)	S	S	S	S
93	UAS428(d) (C)	S	S	S	S
94	DDW49(d) *	S	S	HS	HS
95	GW322 (C)	S	S	HS	HS
96	GW519	S	S	HS	HS
97	HI1646	S	S	HS	HS
98	HD3090 (C)	S	S	S	S
99	RAJ4083 (C)	S	S	S	S
100	UAS3008	S	S	HS	HS
100A	Infector	S	-	-	S
101	MACS6749	S	HS	HS	HS
102	HD2932 (C)	S	S	HS	HS
103	HI1641	S	S	S	S
104	HI1642	S	S	HS	HS
105	HI1633*	S	S	S	S
106	MACS6752	S	HS	S	HS
107	NIDW 1149(d)*	S	HS	S	HS
108	UAS446(d) (C)	S	HS	S	HS
109	HI 1605 (C)	S	S	S	S
110	MACS 4087(d)	S	S	HS	HS
111	MP 1358	MR	HS	HS	HS
112	AKDW 2997-16(d) (C)	S	S	S	S
113	HI8805(d)(I) (C)	S	S	HS	HS
114	UAS 472(d)	S	S	S	S
115	MPO 1357(d)	S	S	S	S
116	NIAW3170(I) (C)	S	S	HS	HS
117	MACS5055	S	S	HS	HS
118	MACS6222 (aest.) (C)	S	S	S	S
119	DDK1029 (C)	S	S	HS	HS
120	MACS5054	S	HS	S	HS

120A	Infector	S	-	-	S
121	DDK1058	S	HS	HS	HS
122	HW1098 (C)	S	S	S	S
123	DDK1059	S	HS	HS	HS
124	DBW327	S	S	S	S
125	HD3086 (C)	S	S	HS	HS
126	DBW332	S	S	S	S
127	DBW303*	S	S	S	S
128	HD2967 (C)	S	S	HS	HS
129	DBW187*	MR	S	S	S
130	DBW329	S	HS	HS	HS
131	WH1252	S	HS	S	HS
132	HD3378	S	HS	S	HS
133	WH1270*	S	S	S	S
134	DBW333	S	S	S	S
135	DBW330	S	S	HS	HS
136	DBW328	S	S	S	S
137	DBW331	S	S	S	S

Resistance against rice root nematode (*Meloidogyne graminicola*)

Ludhiana center

One hundred thirty seven AVT and thirty four MDSN entries were screened for resistance against *M. 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.

11.4 Multiple Disease/ Pest Screening Nursery (MDSN)

Hisar

In multiple disease screening nurseries (MDSN), 34 entries were screen against cereal cyst nematode. Four entries gave moderately resistant reaction while 30 entries were found either susceptible or highly susceptible.

Durgapura

Thirty four wheat germplasms (MDSN) were screened against cereal cyst nematode, *Heterodera avenae*. The inoculums level was 4.9 L/gm of soil. Out of 34 germplasm none was found resistant and moderately resistant, all were found susceptible and highly susceptible.

Ludhiana

Thirty four entries were evaluated for resistance to cereal cyst nematode, *H. avenae* and none were found resistant. Only six entries namely GW1339, PBW800, AKAW4924, DBW187, MPO 1336 and HI1624 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 as well as sick plot.

11.5 Integrated CCN Management

Hisar

The experiment on evaluation of eco-friendly approaches for the management of cereal cyst nematode was conducted in screen house in earthen pots. Nematode infested soil was filled after diluting the soil with dune sand to make the initial inoculums of 10 cysts/kg pots. Sowing of wheat var. HD-2967 was done on 13-11-2019 and two plants were maintained in each pot. There were 14

treatments (T_1-Untreated check, T_2-Treated Check (Carbofuran 2 kg a.i. per ha), T_3-Chalcone C_1 @ 10 ppm conc., T_4-Chalcone C_1 @ 20 ppm conc., T_5-Chalcone C_1 @ 40 ppm conc., T_6-Chalcone C_2 @ 10 ppm conc., T_7-Chalcone C_2 @ 20 ppm conc., T_8-Chalcone C_2 @ 40 ppm conc., T_9-Chalcone C_1 @ 10 ppm + ½ dose of Carbofuran, T_{10}-Chalcone C_1 @ 20 ppm + ½ dose of Carbofuran, T_{11}-Chalcone C_1 @ 40 ppm + ½ dose of Carbofuran, T_{12}-Chalcone C_2 @ 10 ppm+ ½ dose of Carbofuran, T_{13}-Chalcone C_2 @ 20 ppm+ ½ dose of Carbofuran, T_{14}-Chalcone C_2 @ 40 ppm+ ½ dose of Carbofuran). Observation on number of cysts was recorded, 110 days after sowing. The results revealed that all the treatments reduced number of cysts/plant over untreated check. The maximum reduction of nematode population was observed in Chalcone C_1 @ 20 ppm conc. + half dose of Carbofuran (1 kg a.i. per ha) while maximum plant growth parameters were recorded in Chalcone C_1 @ 40 ppm conc. + half dose of Carbofuran (1 kg a.i. per ha). Maximum number of cysts and minimum plant growth parameters were recorded in untreated check.

Ludhiana

Two formulation of Chalcone was tried for nematicidal properties. Chalcone are precursor compound for flavonids biosynthesis in plants and they can also be synthesized in laboratory. Chalcone is possess, a broad spectrum of biological activities including antioxidative, antibacterial, antiviral, insecticide and nematicides. Inoculum level was kept 5 cysts of cereal cyst nematode per pot containing 200cc soil. The crop after attaining the age of maturity (mid march) was examined for count the cyst/plant in each treatment. The results revealed that all the treatments reduced the number of cysts/plant over control (Table 11.5). The maximum reduction of population was observed in Chalcone C2 @40 ppm conc. +half dose of Carbofuran (67.8 %) with high grain yield. Half dose of carbofuran with Chalcone C2 @40 ppm conc. showed its overall superiority by preventing larval penetration/infection and better plant growth. Chalcone ($C_{15}H_{12}O$) and their derivative demonstrate a wide range of biological activities including nematicidal.

Table 11.5: Management of cereal cyst nematode through Chalcone in wheat

S. No.	Treatments	Mean number of cysts per 200cc soil	Population reduction over control (%)
1	Untreated Check	28	0
2	Treated Check(carbofuarn 2kg ai/ha)	6	78.5
3	Chalcone C1 @10 ppm conc.	19	32.1
4	Chalcone C1 @20 ppm conc.	16	42.8
5	Chalcone C1 @40 ppm conc.	14	50
6	Chalcone C2 @10 ppm conc.	17	39.2
7	Chalcone C2 @20 ppm conc.	15	46.4
8	Chalcone C2 @40 ppm conc.	12	57.1
9	Chalcone C1 @10 ppm conc. +half dose of carbofuran	16	42.8
10	Chalcone C1 @20 ppm conc. +half dose of carbofuran	15	46.4
11	Chalcone C1 @40 ppm conc. +half dose of carbofuran	13	53.5
12	Chalcone C2 @10 ppm conc. +half dose of carbofuran	13	53.5
13	Chalcone C2 @20 ppm conc. +half dose of carbofuran	11	60.7
14	Chalcone C2 @40 ppm conc. +half dose of carbofuran	9	67.8

Cooperators:

Name	Center
Priyanka Duggal	Hisar
S. P. Bisnoi	Durgapura
Ramanna Koulagi	Ludhiana
Sudheer Kumar, D.P. Singh, PL Kashyap	Karnal (Coordinating unit)

Annexure 1: Seedling response, *Sr* genes in AVTs against the pathotypes of *Puccinia graminis tritici* (wheat stem/black rust) during 2019-20 at ICAR-IIWBR, RS, Flowerdale, Shimla

S. No.	Variety/ Line	Pathotypes																				*Sr* genes/ resistance
		11	11A	15-1	21	21A-2	24A	34-1	40A	40-1	40-2	40-3	42B	117	117A-1	117-1	117-2	117-6	117-3	122	184	295	
1	HS 507 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+*
2	HS 562 (C)	MS	R	R	R	S	R	R	MR	S	S	MS	R	R	R	R	R	R	R	MS	R	R	*Sr8a+9b+2+*
3	HPW 349 (C)	R	R	R	R	S	R	R	MR	MR	R	S	R	R	R	R	R	S	R	MR	R	R	*Sr7b+2+*
4	HS 668	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
5	VL 907 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
6	VL 2036	MR	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	MR	R	R	*Sr30+5+*
7	HS 681	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+*
8	VL 3022	MR	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr31+*
9	HS 680	R	R	R	R	MR	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	*Sr31+*
10	VL 3023	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
11	HPW 474	MS	R	R	R	MS	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr30+5+*
12	UP 3069	R	MR	R	R	S	R	R	MR	MR	R	MS	R	R	R	R	R	MR	R	R	R	R	*Sr7b+*
13	HPW 473	MS	NG	MS	R	S	R	R	S	S	S	S	MR	MR	MR	R	S	S	MS	R	S	MS	*Sr7b+*
14	VL 892 (C)	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr30+11+*
15	VL 3024	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+*
16	HS 490 (C)	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	*Sr28+9b+*
17	HS 679	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+*
18	DBW88 (C)	S	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	MS	R	R	*Sr11+2+*
19	DBW187(I) (C)	S	R	R	R	R	R	R	R	R	R	S	MR	R	R	R	R	R	R	R	R	R	*Sr5+11+*
20	HD2967 (C)	R	R	S	R	MR	R	R	R	R	R	S	R	R	R	R	R	S	R	R	R	R	*Sr8a+11+2*
21	WH1105 (C)	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr11+2+*
22	DBW222(I) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
23	HD3086 (C)	S	S	S	R	S	R	R	S	R	R	S	R	R	R	R	R	R	R	S	R	S	*Sr7b+2+*
24	PBW840M	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+*
25	PBW803	S	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	MS	R	R	*Sr30+5+*
26	PBW550 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
27	HD3334	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+*
28	HD3059 (C)	S	R	R	R	R	R	R	R	MS	R	MS	R	R	R	MR	R	R	R	R	R	R	*Sr11+2+*
29	HD3332	S	S	MR	R	MS	R	R	MS	R	MS	S	R	MR	R	R	R	S	R	R	R	R	*Sr13+7b+*
30	DBW173 (C)	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
31	WH1021 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+2+*
32	PBW811	R	MR	MS	R	MR	R	R	R	R	S	MS	R	R	R	R	R	S	R	MR	R	R	*Sr9b+11+*
33	DBW291	S	R	R	R	R	R	R	S	MR	R	S	R	R	R	R	R	R	R	S	R	S	*Sr5+11+7b+*
34	WH1264	S	MR	R	R	R	R	R	MR	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr7b+*

35	PBW812	S	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr30+11+*
36	JKW261	S	S	MR	R	S	R	R	MS	R	S	S	MR	MR	R	R	R	S	R	R	R	MS	*Sr13+7b+*
37	DBW290	R	R	S	R	S	R	R	MR	R	S	S	R	R	R	R	R	S	R	R	MS	R	*Sr13+9b+*
38	PBW771(I) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
39	PBW813	R	R	R	R	R	R	R	MS	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr8a+11+*
40	HD3331#WB	R	R	S	R	MS	R	R	MR	R	R	S	S	R	R	R	R	R	R	R	MS	R	*Sr13+7b+*
41	HD3298*	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr30+*
42	WH1124 (C)	S	S	S	R	S	R	R	R	MR	S	S	R	R	R	R	R	S	R	S	R	MR	*Sr7b+2+*
43	UP3033	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+*
44	HUW838#WB	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr5+8a+11+*
45	HD3043 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	*Sr31+2+*
46	PBW644 (C)	MR	R	R	R	R	R	R	MS	R	R	S	R	R	R	R	R	R	R	MR	R	MR	*Sr11+2+*
47	DBW296	R	R	S	R	MS	R	R	MR	R	R	S	MR	R	MR	S	MS	MS	R	MR	R	R	*Sr13+7b+*
48	HI1628(I) (C)	R	R	R	R	MS	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr2*+R
49	WH1080 (C)	R	R	MS	R	MR	R	R	MS	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr9e+2+*
50	JAUW672	S	S	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	MR	R	R	R	*Sr9b+13*
51	WH1142 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
52	NIAW3170(I)(C)	R	R	S	R	MR	R	R	MR	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr8a+2+*
53	PBW804	R	R	MS	R	S	R	R	MR	R	R	S	R	MR	MR	R	MR	MS	R	R	R	R	*Sr13+7b+*
54	DBW187 (C)	S	R	R	R	R	R	R	R	R	R	MS	R	MR	R	R	R	R	R	R	R	R	*Sr5+11+*
55	K1006 (C)	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	MR	R	R	R	R	R	R	*Sr8a+9b+11+*
56	DBW39 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
57	HD3249(I) (C)	S	R	R	R	R	R	R	R	R	R	S	MR	MR	R	R	R	R	MR	MR	R	R	*Sr11+2+*
58	HD2733 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
59	HD3171 (C)	MS	R	R	R	R	MR	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr11+7b+2+*
60	HD2888 (C)	S	R	R	R	R	R	R	R	MR	R	S	R	R	R	R	R	MR	R	R	R	R	-*
61	HD3293*	S	R	R	R	S	R	R	R	R	R	MS	R	R	R	R	R	MR	R	R	R	R	*Sr13+*
62	K1317 (C)	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
63	HI1612 (C)	S	MR	MS	R	S	MR	R	MR	R	S	S	R	MS	MS	MS	R	MS	MR	MR	R	MR	*Sr7b+2+*
64	DBW252(I) (C)	MR	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr8a+5+11+2+*
65	TAW155	MR	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr30+5+*
66	HI1636	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+*
67	MP1361	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr28+*
68	MACS6747	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+*
69	HD3377[B]	S	R	R	R	MR	R	R	S	R	MS	S	R	R	R	R	R	S	R	S	R	MR	*Sr7b+*
70	HI1637	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+*
71	RAJ4541[B]	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+*
72	GW513	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+*
73	GW322	S	R	R	R	R	R	R	R	R	R	S	R	R	R	MR	R	R	R	MS	R	R	*Sr11+2+*
74	HI1544	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+2+*R
75	HI1634[Q*]	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*

76	HD2932	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr11+*
77	MP3336	S	R	R	R	R	R	R	R	R	S	MR	R	MR	R	S	R	R	MR	MR	R	MS	*Sr11+2+*
78	HD2864	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+*
79	CG1029*	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	*Sr24+*
80	MPO1357(d)	R	R	R	R	R	MR	R	R	R	R	MR	MR	R	R	MS	MS	MS	MR	R	R	R	*Sr11+7b+*
81	HI8627(d)	R	R	R	R	R	MS	R	R	MR	R	MR	R	R	MS	MS	S	MR	MR	R	MR	R	*Sr9e+2+*
82	UAS466(d)(I)	R	R	S	R	R	MS	R	MS	R	R	MR	MR	R	S	S	S	S	S	R	R	R	*Sr11+2+*
83	UAS472(d)	R	R	R	R	R	S	R	MR	R	R	MR	MR	R	S	S	S	S	S	R	MS	R	*Sr7b+*
84	DBW110	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
85	MP3288	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+2+*R
86	HI 8823(d)	R	R	R	R	R	MR	R	R	R	R	MR	R	R	S	MR	S	S	MR	R	S	R	*Sr11+*
87	DDW47(d)(I)	R	R	MS	R	R	MS	R	R	S	R	MR	R	R	S	S	MR	S	S	R	R	R	*Sr11+7b+2+*
88	WHD964(d)	R	R	S	R	S	R	R	R	S	S	S	R	R	S	S	S	S	S	R	S	R	*Sr7b+*
89	DDW48(d)Q*	R	R	R	R	R	R	R	MR	R	R	R	S	MR	S	S	S	S	S	MS	R	MS	*Sr7b+2+*
90	MACS6222 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+*R
91	MACS3949(d)(C)	R	R	MR	R	R	R	R	S	S	R	MR	R	R	S	S	MS	S	S	R	MR	R	*Sr7b+2+*
92	HI8818(d)	R	R	R	R	R	MR	R	R	R	R	R	R	R	S	MR	R	S	R	R	MS	R	*Sr11+7b+*
93	UAS428(d) (C)	R	R	R	R	R	S	R	S	MS	R	MR	R	R	S	S	S	S	MS	R	S	R	*Sr7b+*
94	DDW49(d)Q*	R	R	S	R	MS	MS	R	S	S	S	S	R	R	S	S	S	S	S	R	S	R	*Sr7b+2+*
95	GW322 (C)	S	R	R	R	R	MR	R	S	R	R	MR	R	R	R	S	R	R	S	MR	R	MS	*Sr11+2+*
96	GW519	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+*
97	HI1646	S	R	R	R	R	R	R	MS	MR	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr5+8a+11+*
98	HD3090 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
99	RAJ4083 (C)	R	R	R	R	R	R	R	MS	MR	R	S	R	R	R	R	R	R	R	R	R	R	*Sr11+*
100	UAS3008	S	R	R	R	R	R	R	MR	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr5+11+*
101	MACS6749	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+*
102	HD2932 (C)	R	R	R	R	R	R	R	MR	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr11+*
103	HI1641	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
104	HI1642	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
105	HI1633*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
106	MACS6752	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
107	NIDW 1149(d)*	R	R	R	R	R	R	R	MR	S	R	MR	S	R	MS	MS	R	MS	R	MR	R	MS	*Sr11+2+*
108	UAS446(d) (C)	R	R	R	R	R	MR	R	MS	S	R	R	R	R	MS	MS	S	S	MS	R	MR	R	*Sr11+2+*
109	HI 1605 (C)	MS	R	R	R	MR	R	R	S	R	R	S	R	R	R	R	MS	R	R	R	R	R	*Sr11+*
110	MACS 4087(d)	R	R	R	R	R	R	R	MR	S	R	R	MR	S	MR	MS	R	MS	R	MS	MS	S	*Sr11+7b+*
111	MP 1358	S	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	MR	S	*Sr11+*
112	AKDW 2997-16(d) (C)	S	S	MR	MR	MR	R	R	S	S	S	S	S	MR	S	S	R	S	MR	MS	S	MS	*Sr7b+2+*
113	HI8805(d)(I) (C)	R	R	R	R	R	MS	R	R	S	R	R	R	R	S	R	R	S	R	R	MR	R	*Sr13+11+2+*
114	UAS 472(d)	R	R	R	R	R	MR	R	R	S	R	MR	S	R	S	S	MR	S	MR	R	S	R	*Sr11+2+*
115	MPO 1357(d)^{Q}	R	R	R	R	R	MS	R	MS	MS	R	R	R	R	R	S	S	MS	R	R	MR	R	*Sr11+7b+*

116	NIAW3170(I) (C)	R	R	R	R	MR	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr8a+2+*
117	MACS5055	R	S	R	R	R	MR	R	MR	S	R	R	S	MR	R	R	S	S	R	R	R	R	*Sr13+7b+*
118	MACS6222 (aest.) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+* R
119	DDK1029 (C)	R	S	R	R	R	MR	R	R	MS	R	R	MR	MS	R	MR	MR	S	R	MR	MS	R	*Sr11+2+*
120	MACS5054	R	S	R	R	R	MS	R	R	R	R	R	MR	S	MR	MS	MS	S	MR	MR	MS	MS	*Sr11+7b+*
121	DDK1058	R	MS	R	R	R	MR	R	R	R	R	R	R	MS	MR	MR	R	S	R	R	MR	R	*Sr11+7b+*
122	HW1098 (C)	MR	R	R	R	R	R	R	R	R	R	R	R	S	MS	MR	MR	S	R	R	MS	MR	*Sr11+2+*
123	DDK1059	R	S	R	R	R	S	R	R	MS	R	R	S	S	MS	R	R	S	R	R	MR	MS	*Sr7b+*
124	DBW327	MS	S	S	R	MR	R	R	R	R	R	S	R	R	R	R	R	MR	R	R	R	R	*Sr13+5+*
125	HD3086 (C)	S	S	S	R	S	R	R	S	R	R	S	R	R	R	R	R	R	R	S	R	S	*Sr7b+2+*
126	DBW332	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R		R	R	R	R
127	DBW303*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
128	HD2967 (C)	MR	R	MR	R	MR	R	R	R	R	R	S	R	R	R	R	R	S	R	R	R	R	*Sr8a+11+2+*
129	DBW187*	S	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	S	*Sr5+11+*
130	DBW329	MS	R	R	R	R	R	R	R	R	R	S	R	R	MS	R	R	R	R	R	R	R	*Sr9b+11+*
131	WH1252	R	R	R	R	R	R	R	R	R	R	S	R	MS	R	MR	R	S	R	R	R	R	*Sr9e+7b+*
132	HD3378	S	R	R	MR	R	R	MS	MR	R	R	S	R	MR	R	R	R	MS	R	MR	MR	R	*Sr7b+11+*
133	WH1270*	R	R	R	R	R	R	R	R	R	S	S	R	R	R	R	R	S	R	R	R	MR	*Sr13+*
134	DBW333	MR	R	R	R	R	R	R	R	R	R	S	R	S	R	R	R	R	R	R	R	R	*Sr28+11+*
135	DBW330	MR	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr28+11+*
136	DBW328	MS	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr5+11+*
137	DBW331	R	R	S	R	R	R	R	R	R	R	S	R	R	R	R	R	S	R	R	R	R	*Sr9e+*

Annexure 2: Seedling response, *Lr* genes in AVTs against the pathotypes of *Puccinia triticina* (wheat leaf/ brown rust) during 2019-20 at ICAR-IIWBR, RS, Flowerdale, Shimla

S. No.	Variety/ Line	Pathotypes																					*Lr* gene/s	Remarks
		11	12A	12-3	12-5	12-7	77	77-1	77-2	77-5	77-7	77-8	77-9	77-10	77A-1	104-2	104-4	104-1	106	107-1	108-1	162-1	162A	
1	HS 507 (C)	R	R	R	R	R	R	R	NG	R	S	NG	MR	NG	R	R	MR	R	R	R	R	R	R	*Lr*26+1+	
2	HS 562 (C)	R	R	R	R	S	R	MS	R	S	S	R	S	S	R	S	R	S	R	R	R	R	R	*Lr*23+	
3	HPW 349 (C)	R	R	R	R	R	MR	R	R	S	S	R	S	S	R	MS	R	MR	R	R	R	R	R	*Lr*13+10+	
4	HS 668	R	R	R	R	R	R	R	R	S	S	R	S	R	R	S	R	R	R	R	R	R	R	*Lr*26+23+1+3+	
5	VL 907 (C)	R	R	R	R	R	R	R	R	R	R	R	S	R	R	MR	S	R	R	R	R	R	R	*Lr*26+	
6	VL 2036	R	R	R	MS	MR	R	R	R	R	R	R	R	R	R	S	S	MS	R	R	R	MR	R	*Lr*23+10+2a+	
7	HS 681	R	R	R	R	R	R	R	R	S	MS	R	R	MR	R	S	S	R	R	R	R	R	R	*Lr*26+23+1+	
8	VL 3022	R	R	R	R	R	R	R	R	MS	R	R	MS	S	R	R	R	R	R	R	R	R	R	*Lr*26+23+1+	
9	HS 680	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Lr*26+23+10+1+	
10	VL 3023	R	R	R	R	R	R	R	R	S	R	R	MS	R	R	S	MR	R	R	R	R	R	R	*Lr*26+23+	
11	HPW 474	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	S	R	S	R	R	R	R	R	*Lr*13+10+3+2a+	
12	UP 3069	R	MR	S	R	MS	S	S	S	S	MS	S	S	S	S	S	S	S	R	MS	R	R	R	-	
13	HPW 473	R	S	S	S	S	S	S	MS	S	S	S	S	S	S	S	R	S	R	R	R	S	MR	*Lr*13+3+	
14	VL 892 (C)	R	S	R	R	R	R	R	R	S	S	MS	S	S	R	R	S	S	R	R	R	R	R	*Lr*13+10+	
15	VL 3024	NG	NG	R	R	NG	R	R	R	R	R	R	MS	S	R	MS	R	R	R	R	R	R	R	*Lr*26+23+10+1+	
16	HS 490 (C)	R	S	R	R	R	R	R	R	S	MR	R	S	S	R	S	R	S	R	R	R	R	R	*Lr*23+10+3+	
17	HS 679	R	R	R	R	R	R	R	R	S	R	R	MS	R	R	S	S	R	R	R	R	R	R	*Lr*26+23+1+	
18	DBW88 (C)	R	R	R	R	R	R	R	MS	S	S	R	S	S	R	R	R	R	R	R	R	R	R	*Lr*13+10+3+	
19	DBW187(I)(C)	R	R	R	R	R	R	R	R	R	MS	R	S	MS	R	R	R	R	R	R	R	R	R	*Lr*23+10+1+	
20	HD2967 (C)	R	R	R	R	R	R	R	R	S	R	R	S	S	R	R	R	R	R	R	R	R	R	*Lr*23+	
21	WH1105 (C)	R	R	R	R	R	S	NG	MS	S	S	R	MR	MS	NG	R	R	R	R	R	R	NG	R	*Lr*13+	
22	DBW222(I)(C)	R	R	MS	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Lr*26+23+	
23	HD3086 (C)	R	R	R	R	S	R	S	S	S	S	R	S	S	R	S	R	S	R	R	R	MS	R	*Lr*13+10+3+	
24	PBW840M	R	R	R	R	R	R	R	R	R	R	NG	R	R	R	R	R	R	R	R	R	R	R	*Lr*26+	R
25	PBW803	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MS	R	S	R	R	R	R	R	*Lr*23+3+2a	
26	PBW550 (C)	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
27	HD3334	R	R	R	R	R	R	MX	R	S	MS	NG	MS	MR	R	R	S	R	R	R	R	R	R	*Lr*26+23+1+	
28	HD3059 (C)	R	R	R	R	R	R	R	MS	S	S	R	S	S	R	R	R	R	R	R	R	R	R	*Lr*13+3+	
29	HD3332	R	R	R	R	R	R	R	R	S	R	R	S	S	S	S	S	R	R	R	R	R	R	*Lr*13+10+	
30	DBW173 (C)	R	R	R	R	R	R	NG	R	MS	S	R	S	S	R	R	R	R	R	R	R	R	R	*Lr*26+10+3+	
31	WH1021 (C)	R	R	R	R	R	R	R	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*26+1+	
32	PBW811	R	R	R	R	R	S	R	R	S	R	R	S	R	S	S	R	R	R	R	R	R	R	*Lr*13+	
33	DBW291	R	R	R	R	R	R	R	R	S	S	R	S	S	S	MS	S	R	R	R	R	R	R	*Lr*13+10+1+	
34	WH1264	R	M	R	R	S	R	R	R	R	R	R	R	R	R	S	S	MS	R	R	MR	R	R	*Lr*13+10+	
35	PBW812	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MS	R	S	R	R	R	R	R	*Lr*23+3+2a	
36	JKW261	R	S	R	MR	MS	R	R	R	R	R	R	MR	R	R	R	S	MR	R	R	R	R	R	*Lr23+13+*	
37	DBW290	R	R	R	R	MS	R	R	R	MS	R	R	R	R	R	S	S	MS	R	R	R	S	MS	*Lr*13+10+	
38	PBW771(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*26+23+1+	R
39	PBW813	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-	R

40	HD3331#WB	R	R	R	MS	MS	S	R	MR	S	R	R	S	S	R	S	R	S	R	R	R	R	R	*Lr23+13+3+*	
41	HD3298*	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	S	S	S	R	R	R	R	R	*Lr23+2a*	
42	WH1124 (C)	R	R	R	R	MS	R	S	MS	S	MS	R	S	S	R	S	R	S	R	R	R	R	R	*Lr*13+10+3+	
43	UP3033	R	R	R	R	MS	R	R	R	S	R	R	R	R	R	MS	R	R	R	R	R	R	R	*Lr*26+10+3+	
44	HUW838#WB	R	MR	NG	R	R	R	MS	MS	S	MS	R	R	S	NG	S	R	R	R	MR	R	R	R	*Lr*13+10+3+	
45	HD3043 (C)	R	R	R	R	MS	R	S	R	S	S	R	S	S	R	S	S	R	R	R	R	MS	R	*Lr*26+23+	
46	PBW644 (C)	R	R	R	R	R	R	R	MS	S	R	R	S	S	MS	S	S	S	R	R	R	R	R	*Lr*13+1+	
47	DBW296	R	S	R	MS	S	R	R	MS	S	R	R	MS	S	S	S	S	S	R	R	R	R	R	*Lr*23+13+10+	
48	HI1628(I) (C)	R	R	R	R	R	S	R	MS	S	R	R	S	S	S	R	S	S	R	R	R	R	R	*Lr*13+10+	
49	WH1080 (C)	R	R	R	S	MS	S	R	S	S	MR	R	S	S	S	S	R	S	R	R	R	S	R	*Lr*13+3+	
50	JAUW672	R	R	R	MS	MS	S	R	MS	S	S	R	S	S	R	S	S	S	R	R	R	R	R	*Lr*23+13+	
51	WH1142 (C)	R	R	R	R	MS	R	R	R	S	MS	R	R	R	R	S	R	R	R	R	R	S	R	*Lr*26+23+10+3+	
52	NIAW3170(I) (C)	R	R	R	R	R	R	R	S	S	R	R	MS	S	R	R	S	R	R	R	R	R	R	*Lr*13+10+1+	
53	PBW804	R	S	R	S	S	S	R	S	S	R	R	R	S	R	S	S	S	R	R	R	R	R	*Lr*13+	
54	DBW187 (C)	R	R	R	R	R	R	R	R	MS	MS	R	S	MS	R	R	R	R	R	R	R	R	R	*Lr*23+10+1+	
55	K1006 (C)	R	R	R	R	R	S	R	R	S	S	R	S	S	MR	S	S	R	R	R	R	R	R	*Lr*13+1+	
56	DBW39 (C)	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	S	R	R	R	R	R	R	*Lr*26+23+10+	
57	HD3249(I) (C)	R	R	R	R	R	R	R	R	S	R	R	S	S	R	R	R	R	R	R	R	R	R	*Lr*13+10+	
58	HD2733 (C)	R	R	MS	S	S	R	R	R	M	R	R	S	S	R	S	S	R	R	R	R	R	R	*Lr*26+34+	
59	HD3171 (C)	R	S	R	R	MS	NG	R	MS	MS	R	R	S	S	R	R	R	R	R	R	R	R	R	*Lr*23+13+10+	
60	HD2888 (C)	R	R	R	R	R	R	R	R	S	R	R	S	R	R	S	S	R	R	R	R	R	R	Seed*	
61	HD3293*	R	R	R	R	MR	R	R	R	R	R	R	S	MS	R	M	S	MS	R	R	R	R	R	*Lr*13+10+	
62	K1317 (C)	R	R	R	R	R	S	R	MS	S	R	MS	S	S	R	S	S	S	R	R	R	R	R	*Lr*26+1+	
63	HI1612 (C)	R	S	R	R	R	R	R	R	S	R	R	R	R	R	S	S	S	R	R	R	R	R	*Lr*23+	
64	DBW252(I)(C)	R	R	R	R	R	R	R	R	S	R	R	MS	S	R	R	S	R	R	R	R	R	R	*Lr*13+10+	
65	TAW155	R	R	R	R	R	R	R	R	S	MS	R	R	R	S	R	R	R	R	R	R	R	R	*Lr*13+10+1+2a+	
66	HI1636	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*24+	R
67	MP1361	R	R	R	R	R	R	R	R	R	R	R	MS	R	S	R	R	R	R	R	R	R	R	*Lr*13+10+1+	
68	MACS6747	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*24+	R
69	HD3377[B]	R	R	R	R	R	R	R	MR	S	S	R	S	S	R	R	R	R	R	R	R	R	R	*Lr*23+1+	
70	HI1637	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*24+	R
71	RAJ4541[B]	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*24+	R
72	GW513	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*24+	R
73	GW322	R	R	R	R	R	S	R	MS	S	MS	R	S	MS	MS	R	R	R	R	R	R	R	R	*Lr*13+1+	
74	HI1544	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	NG	NG	*Lr*24+	R
75	HI1634[Q*]	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
76	HD2932	R	S	S	S	S	S	R	S	S	S	S	S	S	R	S	S	S	R	S	NG	S	MS	*Lr*13+	
77	MP3336	R	S	S	R	S	R	R	S	S	S	R	S	R	R	S	S	R	R	R	R	R	R	*Lr*13+	
78	HD2864	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*24+	R
79	CG1029*	R	R	R	R	R	NG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	NG	*Lr*24+	R
80	MPO1357(d)	R	S	R	S	S	R	R	R	R	R	R	R	R	R	S	S	MS	S	R	R	R	R	*Lr*23+	
81	HI8627(d)	S	S	R	MS	MS	R	S	R	R	R	R	MR	R	R	S	S	MS	R	R	R	MR	S	*Lr*13+	
82	UAS466(d)(I)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	*Lr*13+	
83	UAS472(d)	S	S	MS	MS	R	R	MS	R	MS	R	R	R	R	R	S	S	R	R	R	R	R	MS	-	
84	DBW110	NG	R	NG	R	R	R	R	S	S	NG	S	NG	R	NG	R	S	R	R	R	R	R	R	*Lr*23+10+	
85	MP3288	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*24+	R

86	HI 8823(d)	S	S	MS	S	S	R	MS	R	MS	R	R	MS	R	R	S	S	MS	R	R	R	MS	MS	-	
87	DDW47(d)(I)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
88	WHD964(d)	R	S	R	S	MS	R	R	R	MS	R	R	MS	R	NG	S	S	S	R	R	R	R	R	*Lr*23+13+	
89	DDW48(d)Q*	S	R	R	R	R	R	R	R	R	R	R	S	S	R	R	S	R	S	R	R	R	R	-	
90	MACS6222(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*24+	R
91	MACS3949(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
92	HI8818(d)	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*23+10+	
93	UAS428 (d) (C)	MS	S	R	S	S	R	R	R	S	R	R	MS	S	R	S	S	S	R	R	R	R	R	*Lr*23+	
94	DDW49 (d)Q*	R	S	R	S	MS	R	R	R	R	R	R	S	R	R	S	S	MS	R	R	R	MS	R	*Lr*18+	
95	GW322 (C)	R	R	R	R	R	S	R	S	S	S	R	S	S	S	R	MS	R	R	R	R	R	R	*Lr*13+1+	
96	GW519	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*24+	R
97	HI1646	R	R	R	R	R	R	S	R	S	S	R	S	S	R	R	S	R	R	R	R	R	R	*Lr*13+10+1+	
98	HD3090 (C)	R	R	R	R	R	NG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*26+	R
99	RAJ4083 (C)	R	S	R	R	R	S	MS	R	S	S	MS	S	S	R	S	S	S	R	R	R	R	R	*Lr*13+	
100	UAS3008	R	R	R	R	R	MS	R	R	S	R	R	MS	MS	S	R	S	R	R	R	R	R	R	*Lr*13+1+	
101	MACS6749	R	R	R	R	R	R	R	R	R	R	NG	R	R	R	R	R	R	R	R	R	R	R	*Lr*24+	R
102	HD2932 (C)	R	S	S	S	S	S	R	S	S	S	S	S	S	R	S	S	S	R	S	NG	S	MS	*Lr*13+	
103	HI1641	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
104	HI1642	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	HI1633*	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
106	MACS6752	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	NIDW 1149(d)*	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	S	S	R	R	R	R	R	R	*Lr*23+	
108	UAS446(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
109	HI 1605 (C)	R	M	S	S	MR	S	S	R	S	R	MS	S	S	R	S	S	S	R	R	R	MS	MS	*Lr*13+	
110	MACS 4087(d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-	R
111	MP 1358	R	R	R	R	R	R	R	R	S	NG	R	S	MS	R	R	R	R	R	R	R	R	R	*Lr*23+10+	
112	AKDW 2997-16(d) (C)	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MS	R	*Lr*23+	
113	HI8805(d)(I)(C)	S	S	R	MR	S	R	R	R	R	R	R	R	R	R	S	S	MR	R	R	R	R	R	*Lr*23+	
114	UAS 472(d)	S	S	MS	MS	MR	R	MS	R	MS	R	R	R	R	R	S	S	MS	S	R	R	S	MS	-	
115	MPO 1357(d)[Q]	R	S	R	S	S	R	R	R	R	R	R	R	R	R	S	S	MS	S	R	R	R	R	*Lr*23+	
116	NIAW3170(I)(C)	R	R	R	R	R	R	R	MS	MS	MS	R	S	MS	R	R	S	R	R	R	R	R	R	*Lr*13+10+1+	
117	MACS5055	S	MS	R	R	R	R	R	R	S	R	R	MS	R	S	R	S	MS	S	R	R	R	R	*Lr*23+	
118	MACS6222 (aest.) (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*24+	R
119	DDK1029 (C)	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	MS	R	R	S	R	*Lr*13+	
120	MACS5054	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S	MS	MS	R	R	R	R	-	
121	DDK1058	S	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	S	R	R	R	R	-	
122	HW1098 (C)	MS	S	MS	R	R	NG	R	R	MR	R	R	R	R	R	R	S	R	S	R	R	NG	R	*Lr*18+	
123	DDK1059	MR	R	MS	MR	R	R	R	R	R	R	R	R	R	R	R	S	R	S	R	R	R	R	-	
124	DBW327	R	R	R	R	R	R	R	MS	S	MS	R	S	S	R	R	S	R	R	R	R	R	R	*Lr*23+1+	
125	HD3086 (C)	R	R	R	R	S	R	S	S	S	S	R	S	S	R	S	R	S	R	R	R	MS	R	*Lr*13+10+3+	
126	DBW332	R	R	R	R	R	S	R	R	MR	MS	R	R	R	R	R	R	R	R	R	R	R	R	*Lr*13+1+	
127	DBW303*	R	R	MS	R	R	S	R	MS	S	R	R	MS	R	S	R	R	MS	R	R	R	R	R	*Lr*13+	
128	HD2967 (C)	R	R	R	R	R	R	R	R	R	R	R	S	S	R	R	R	R	R	R	R	R	R	*Lr*23+	
129	DBW187*	R	R	R	R	R	R	R	R	MR	S	R	MS	MR	R	S	R	R	R	R	R	R	R	*Lr*23+10+1+	

130	DBW329	R	R	R	R	R	S	R	S	S	R	R	S	S	S	MS	S	R	R	R	R	R	R	*Lr*13+1+	
131	WH1252	R	S	S	S	MS	S	R	S	S	R	R	S	S	S	S	S	S	R	R	R	R	R	*Lr*13+	
132	HD3378	R	R	R	R	R	R	R	MS	S	S	R	S	S	R	S	S	R	R	R	R	R	R	*Lr*23+1+	
133	WH1270*	R	R	R	R	R	MS	R	MS	S	R	R	S	NG	R	R	R	R	R	R	R	R	R	*Lr*23+	
134	DBW333	R	R	R	R	R	R	MS	R	S	R	R	R	MS	S	R	S	R	R	R	R	R	R	*Lr*13+10+1+	
135	DBW330	R	R	R	R	R	MS	R	R	R	R	R	S	MS	R	R	M	R	R	R	R	R	R	*Lr*13+10+	
136	DBW328	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Lr*23+10+1+	
137	DBW331	R	R	R	R	R	R	R	R	MR	R	R	R	S	R	R	R	R	R	R	R	R	R	*Lr*23+10+1+	

Annexure 3: Seedling response, *Yr* genes in AVTs against the pathotypes of *Puccinia striiformis* (wheat stripe/ yellow rust) during 2019-20 at ICAR-IIWBR, RS, Flowerdale, Shimla

S. No.	Variety / Line	Pathotypes																*Yr* gene/s
		110S119	238S119	T	111S68	7S0	110S247	78S84	110S84	46S119	79S4	P	6S0	79S68	L	K	N	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	HS 507 (C)	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
2	HS 562 (C)	S	S	S	R	R	S	R	R	S	R	S	R	R	S	S	S	*YrA+*
3	HPW 349 (C)	S	S	S	R	R	S	MS	MS	S	R	S	MX	R	MS	S	MS	*Yr2+*
4	HS 668	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
5	VL 907 (C)	S	S	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	*Yr9+*
6	VL 2036	S	S	S	R	R	MS	S	S	R	R	S	R	R	R	MS	R	*Yr2+*
7	HS 681	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
8	VL 3022	MS	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+A+*
9	HS 680	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
10	VL 3023	S	S	R	R	R	S	R	R	S	R	R	R	R	R	R	R	*Yr9+A+*
11	HPW 474	S	S	MS	R	R	MS	MS	R	R	R	R	R	MS	R	R	R	*Yr2+*
12	UP 3069	MS	S	MR	R	R	R	R	R	MS	R	R	R	R	R	R	R	*YrA+*
13	HPW 473	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	*YrA+*
14	VL 892 (C)	R	S	S	R	R	MS	MS	R	R	R	MS	R	MS	R	MS	R	*Yr2+*
15	VL 3024	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
16	HS 490 (C)	R	S	MR	R	R	MS	R	R	R	R	MS	R	R	R	R	R	*YrA+*
17	HS 679	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
18	DBW88 (C)	S	S	MS	R	R	R	MS	R	R	R	R	R	R	R	R	R	*Yr2+*
19	DBW187(I) (C)	S	S	S	MS	R	S	MS	MS	S	R	S	R	S	S	MR	R	*Yr2+*
20	HD2967 (C)	S	S	S	R	R	S	MS	R	S	R	S	R	R	S	S	R	*Yr2+*
21	WH1105 (C)	S	S	MS	R	R	R	MS	R	R	R	R	R	R	R	R	R	*Yr2+*
22	DBW222(I) (C)	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
23	HD3086 (C)	S	S	S	R	R	MS	MS	MS	S	R	S	R	R	R	S	R	*Yr2+*
24	PBW840M	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+A+*
25	PBW803	S	S	S	R	R	R	MS	R	MS	R	MS	R	R	R	MS	R	*Yr2+*
26	PBW550 (C)	S	S	R	R	R	S	S	S	R	R	R	R	R	R	R	R	*Yr9+*
27	HD3334	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+A+*
28	HD3059 (C)	S	S	R	MS	R	S	MS	R	MS	R	MS	R	R	R	R	R	*Yr2+*
29	HD3332	S	S	S	MS	R	S	S	MS	S	R	S	R	R	MS	S	R	*Yr2+*
30	DBW173 (C)	S	S	R	R	R	MS	S	R	R	R	R	R	R	R	R	R	*Yr9+*
31	WH1021 (C)	S	S	R	R	R	S	S	R	R	R	R	R	R	R	R	R	*Yr9+*
32	PBW811	S	S	S	MS	R	S	S	S	S	R	S	R	R	R	S	R	*Yr2+*

33	DBW291	S	S	MS	R	R	MS	MS	R	R	R	R	R	R	R	R	R	*Yr2+*
34	WH1264	MS	S	S	R	R	S	MS	R	S	R	S	R	R	R	MS	R	*Yr2+*
35	PBW812	S	S	S	R	R	S	MS	R	MS	R	S	R	R	R	MR	R	*Yr2+*
36	JKW261	S	S	S	R	MS	MS	S	S	R	R	MS	MR	MS	S	R	R	-
37	DBW290	S	S	S	R	R	S	MS	R	S	R	S	R	MS	R	S	R	*Yr2+*
38	PBW771(I) (C)	S	S	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Yr9+A+*
39	PBW813	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	Resistant
40	HD3331#WB	S	S	S	MS	R	S	S	MS	R	S	MS	R	MS	R	MS	R	*Yr2+*
41	HD3298*	S	S	MS	R	R	S	MS	R	R	R	MS	R	R	R	R	R	*Yr2+*
42	WH1124 (C)	S	S	S	R	R	R	MS	R	S	R	S	R	MS	R	MS	R	*Yr2+*
43	UP3033	S	S	R	R	R	S	S	R	R	R	R	R	R	R	R	R	*Yr9+*
44	HUW838#WB	S	R	MS	R	R	R	MS	MS	S	R	R	R	R	R	R	R	*Yr2+*
45	HD3043 (C)	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+A+*
46	PBW644 (C)	S	S	R	S	R	R	S	S	R	S	S	R	MS	R	R	R	*Yr2+*
47	DBW296	S	S	S	R	R	S	S	S	S	R	S	R	R	R	S	R	*Yr2+*
48	HI1628(I) (C)	S	S	S	MS	R	S	S	S	S	R	S	R	MS	MS	S	R	*Yr2+*
49	WH1080 (C)	S	S	S	R	R	S	S	R	S	R	S	MS	R	R	S	R	*Yr2+*
50	JAUW672	S	S	S	R	R	S	R	R	MS	R	S	R	R	R	S	R	*YrA+*
51	WH1142 (C)	S	S	R	R	R	R	S	R	S	R	R	R	R	R	R	R	*Yr9+*
52	NIAW3170(I)(C)	S	S	S	S	R	S	S	S	S	MS	S	MR	MS	S	S	R	-
53	PBW804	S	S	S	R	MR	S	S	S	S	R	S	MS	R	S	S	R	-
54	DBW187 (C)	S	S	S	MS	R	S	MS	MS	S	R	S	R	S	S	MR	R	*Yr2+*
55	K1006 (C)	S	S	S	S	MR	S	S	S	S	S	MS	MS	MS	R	S	MS	-
56	DBW39 (C)	S	S	R	R	R	S	MS	R	S	R	R	R	R	R	R	R	*Yr9+*
57	HD3249(I) (C)	S	S	S	R	R	S	S	MS	S	R	S	R	R	S	S	R	*Yr2+*
58	HD2733 (C)	S	S	R	R	R	S	S	MR	S	R	R	R	R	R	R	R	*Yr9+18+*
59	HD3171 (C)	S	S	R	MS	R	MS	S	R	MS	R	MS	R	R	R	R	R	*Yr2+*
60	HD2888 (C)	S	S	S	R	R	S	R	R	MS	R	R	R	MR	R	MS	R	-
61	HD3293*	S	S	S	R	R	S	R	R	MS	R	R	R	R	R	R	R	*Yr2+*
62	K1317 (C)	S	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+A+*
63	HI1612 (C)	S	S	S	R	R	S	S	MR	S	R	MS	R	R	MS	S	R	*Yr2+*
64	DBW252(I) (C)	S	S	R	R	R	S	S	R	MS	R	S	R	R	R	R	R	*Yr2+*
65	TAW155	S	S	MS	R	R	MS	MS	R	MS	R	S	R	R	R	R	R	*Yr2+*
66	HI1636	S	S	S	S	S	S	S	S	S	MR	S	R	MS	S	S	MR	-
67	MP1361	S	R	S	MR	R	MS	R	R	S	S	MS	R	MR	R	R	R	*Yr2+*
68	MACS6747	S	S	S	MS	MR	S	S	MS	MS	S	MS	MS	S	MS	S	MS	-
69	HD3377[B]	S	S	MS	MS	R	MS	R	R	R	S	MS	R	R	MS	R	R	*Yr2+*
70	HI1637	S	S	S	MS	R	S	S	S	S	R	S	MS	R	S	S	R	-
71	RAJ4541[B]	S	S	S	MS	R	S	MS	S	S	MS	S	R	R	S	S	R	*Yr2+*
72	GW513	S	S	R	MS	R	MS	S	S	R	S	MR	R	S	MS	R	R	*Yr2+*
73	GW322	S	S	S	S	MR	S	S	S	MS	R	MS	MR	MS	R	R	R	-

74	HI1544	S	S	R	S	MR	MR	S	S	MS	S	MS	MS	S	MS	MS	MS	-
75	HI1634^{Q*}	S	S	R	R	R	S	S	S	S	R	R	R	R	R	R	R	*Yr9+*
76	HD2932	S	S	S	S	R	S	S	S	S	R	S	R	R	S	S	R	-
77	MP3336	S	S	S	S	R	MS	S	S	S	MR	S	MS	MS	S	S	MS	-
78	HD2864	S	S	S	S	R	S	S	S	S	R	S	R	MR	S	MS	MS	*Yr2+*
79	CG1029*	S	S	S	S	R	S	S	MS	S	R	S	R	MR	MR	S	R	*Yr2+*
80	MPO1357(d)	S	S	MS	R	R	R	MS	MR	MS	R	R	R	R	R	R	R	*Yr2+*
81	HI8627(d)	S	S	MS	R	R	R	MS	R	S	R	MR	R	R	R	R	R	*Yr2+*
82	UAS466(d)(I)	S	S	R	R	R	R	R	R	S	R	MR	R	R	R	R	R	-
83	UAS472(d)	S	S	S	R	R	MR	MS	MS	S	R	MS	R	R	R	S	R	*Yr2+*
84	DBW110	S	-	S	R	R	R	S	S	R	R	S	R	R	R	S	R	*Yr2+*
85	MP3288	S	S	MS	R	R	MS	S	S	MS	R	MR	MR	R	R	MS	R	*Yr2+*
86	HI 8823(d)	S	S	S	R	MR	R	S	MS	S	R	S	R	R	MR	R	R	-
87	DDW47(d)(I)	S	S	MR	R	MS	R	R	R	S	R	R	R	R	R	R	R	-
88	WHD964(d)	S	S	MS	R	MS	MR	S	MS	S	RS	MS	R	R	R	R	R	-
89	DDW48(d)Q*	S	S	MS	R	R	MR	MR	MS	R	R	R	R	R	R	R	R	*Yr2+*
90	MACS6222 (C)	S	S	MR	R	R	S	S	S	S	R	S	R	R	R	R	R	*Yr2+*
91	MACS3949(d) (C)	S	S	S	R	MS	R	MS	R	S	R	S	R	R	R	R	R	*Yr2+*
92	HI8818(d)	S	S	MS	R	R	S	S	R	R	R	S	R	R	R	R	R	*Yr2+*
93	UAS428(d) (C)	S	S	S	MS	MR	MS	S	S	S	S	S	R	S	R	S	S	-
94	DDW49(d)Q*	S	S	MS	MS	S	MS	S	MS	MS	R	S	MS	R	R	R	R	-
95	GW322 (C)	S	R	S	MS	MS	S	S	S	S	S	MS	MS	R	MS	R	S	-
96	GW519	S	S	S	S	R	S	S	S	S	S	S	R	S	MS	S	R	*Yr2+*
97	HI1646	S	S	S	R	R	S	S	R	MS	R	S	R	R	R	S	R	*Yr2+*
98	HD3090 (C)	S	S	R	R	R	R	S	S	R	R	R	R	R	R	R	R	*Yr9+*
99	RAJ4083 (C)	S	S	S	MS	R	S	S	S	R	MS	R	R	R	R	S	R	*Yr2+*
100	UAS3008	S	S	S	S	R	MS	S	S	S	R	MS	R	R	R	S	R	*Yr2+*
101	MACS6749	S	S	S	S	MS	S	S	S	S	MS	S	MS	MS	R	S	R	-
102	HD2932 (C)	S	S	S	S	R	S	S	S	S	R	S	R	R	S	S	R	-
103	HI1641	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	-
104	HI1642	S	S	S	MR	R	S	R	R	S	R	S	R	R	S	S	R	*YrA+*
105	HI1633*	S	S	R	R	R	MS	S	S	S	R	R	R	R	R	R	R	*Yr9+*
106	MACS6752	S	S	MS	S	MS	S	S	S	S	S	S	S	S	S	S	S	-
107	NIDW1149(d)*	MS	MS	S	S	R	S	S	S	MS	S	S	R	R	R	R	R	*Yr2+*
108	UAS446(d) (C)	MS	S	MR	R	MS	MR	MS	R	S	R	MS	MR	R	R	R	R	-
109	HI 1605 (C)	S	S	R	S	R	MS	R	MS	R	R	R	R	R	R	R	R	*Yr2+*
110	MACS 4087(d)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	-
111	MP 1358	S	S	S	S	R	S	R	R	R	R	MS	R	R	R	R	R	*YrA+*
112	AKDW 2997-16(d) (C)	MS	S	S	S	S	S	S	MS	S	S	S	MS	MS	S	S	MR	-
113	HI8805(d)(I) (C)	S	S	MS	R	MS	S	S	R	S	R	MS	R	R	R	R	R	-

114	UAS 472(d)	S	S	MS	R	MR	MS	S	MS	S	R	S	MS	R	R	R	R	*Yr2+*
115	MPO1357(d)[Q]	S	S	MS	R	R	R	MS	MR	MS	R	R	R	R	R	R	R	*Yr2+*
116	NIAW3170(I) (C)	S	S	S	S	R	S	S	S	S	R	S	MS	MR	S	S	R	-
117	MACS5055	S	MS	MS	MS	MS	MS	S	MS	MS	MS	MS	MS	MS	MR	MS	MR	-
118	MACS6222 (aest.) (C)	S	S	MR	R	R	S	S	S	S	R	S	R	R	R	R	R	*Yr2+*
119	DDK1029 (C)	MS	MS	MS	MS	S	MS	S	MS	S	MS	S	MS	MS	MR	MS	MR	-
120	MACS5054	MS	MS	MS	MS	S	MS	S	MS	S	MS	S	MS	MS	MR	MS	R	-
121	DDK1058	MR	MS	MS	MS	MS	MS	MS	S	MS	MS	MS	MS	MR	MS	MS	R	-
122	HW1098 (C)	MS	MS	MS	R	R	R	R	MS	R	MR	R	R	R	R	R	R	*Yr2+*
123	DDK1059	MS	MS	MS	MS	S	MS	MS	MS	S	S	S	MS	MS	MR	MS	R	-
124	DBW327	S	S	MS	S	R	S	MS	R	R	R	S	R	MS	MS	R	R	*Yr2+*
125	HD3086 (C)	S	S	S	R	R	S	S	R	MS	R	S	R	R	R	MS	R	*Yr2+*
126	DBW332	S	S	R	R	R	MS	R	R	R	R	S	R	R	R	R	R	*YrA+*
127	DBW303*	S	S	R	R	R	MS	MS	R	R	R	MS	R	R	R	R	R	*Yr2+*
128	HD2967 (C)	S	S	S	R	R	S	R	R	MS	R	S	R	S	S	S	R	*Yr2+*
129	DBW187*	S	S	S	MS	R	S	MS	MS	S	R	S	R	S	S	MR	R	*Yr2+*
130	DBW329	S	S	MS	MS	R	MS	MS	R	R	R	R	R	R	R	R	R	*Yr2+*
131	WH1252	S	S	S	R	R	S	S	MS	R	R	S	R	R	MS	R	R	*Yr2+*
132	HD3378	S	S	S	S	MS	S	S	S	S	R	S	MS	MS	S	S	MS	-
133	WH1270*	S	S	S	R	R	R	S	MS	S	R	S	R	R	R	R	R	*Yr2+*
134	DBW333	S	S	MR	R	R	MS	MS	R	MS	R	S	R	R	MS	R	R	*Yr2+*
135	DBW330	S	S	S	MS	R	S	S	S	S	R	S	R	R	R	R	R	*Yr2+*
136	DBW328	S	S	MR	R	R	MS	MR	R	MS	R	S	R	MS	R	R	R	*Yr2+*
137	DBW331	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-

Annexure 4: Reaction of AVT wheat genotypes at seedling stage against pathotypes of *Puccinia graminis tritici* (wheat stem/black rust) during 2019-20 at Mahabaleshwar

S. No.	Entries	Pathotypes											
		11	24A	40	40- A	42	42B	117- 2	117- 4	117- 5	117- 6	122	295
Central Zone (CZ)													
1	TAW155	R	S	R	S	R	R	R	R	R	S	R	R
2	HI1636	R	R	R	R	R	R	R	R	R	R	R	R
3	MP1361	R	R	R	S	R	R	R	R	R	S	R	R
4	MACS6747	R	R	R	R	S	R	R	R	R	R	S	R
5	HD3377	S	R	R	R	S	S	R	R	R	R	S	R
6	HI1637	R	R	R	R	R	R	R	R	R	R	R	R
7	RAJ4541	R	R	R	R	R	R	R	R	R	R	R	R
8	GW513	R	R	R	R	S	R	R	R	R	R	S	R
9	GW322	R	R	R	S	S	R	R	R	S	R	S	R
10	HI1544	R	R	R	R	R	R	R	R	R	R	R	R
11	HI1634*	R	R	R	R	R	R	R	R	R	R	R	R
12	HD2932	R	R	R	S	R	R	S	NG	R	S	R	R
13	MP3336	R	R	R	R	S	R	S	S	R	S	S	R
14	HD2864	R	R	R	R	R	R	S	R	R	R	R	R
15	CG1029*	R	R	R	R	NG	R	R	R	R	R	R	R
16	MPO1357(d)	R	R	NG	R	NG	R	R	R	R	R	R	R
17	HI8627(d)	R	R	R	R	R	R	NG	NG	R	R	R	R
18	UAS466(d)(I)	R	R	R	R	R	S	NG	NG	R	S	R	R
19	UAS472(d)	R	R	R	S	R	R	NG	NG	R	R	R	R
20	DBW110	NG	R	NG	R	R	R	NG	NG	R	R	R	NG
21	MP3288	R	R	R	R	R	R	R	R	R	R	R	R
22	HI 8823(d)	R	R	R	S	R	R	R	R	R	R	R	R
23	DDW47(d)(I)	R	R	R	R	R	NG	R	R	R	S	R	R
Peninsular Zone (PZ)													
24	WHD964(d)	R	S	R	S	R	S	S	R	S	S	S	S
25	DDW48(d) *	R	S	R	R	R	R	R	S	R	R	R	R
26	MACS6222 (C)	R	R	R	R	R	R	R	R	R	R	R	R
27	MACS3949(d) (C)	R	R	R	S	R	R	S	R	R	R	R	R

28	HI8818(d)	R	R	R	R	R	R	R	R	R	R	R	R
29	UAS428(d) (C)	R	R	R	R	R	R	R	R	R	S	R	R
30	DDW49(d) *	S	S	S	S	S	S	R	R	R	S	S	S
31	GW322 (C)	S	R	R	S	R	R	R	R	R	S	R	R
32	GW519	R	R	R	R	R	R	S	R	R	R	R	R
33	HI1646	R	S	R	S	R	S	S	R	S	S	S	R
34	HD3090 (C)	R	R	R	R	R	R	R	R	R	R	R	R
35	RAJ4083 (C)	S	R	R	S	R	R	R	S	S	R	S	R
36	UAS3008	S	R	R	S	R	R	S	R	S	S	R	S
37	MACS6749	R	R	R	R	R	R	R	R	R	R	R	R
38	HD2932 (C)	R	S	R	S	R	R	R	R	R	S	R	R
39	HI1641	R	R	R	R	R	R	R	R	R	R	R	R
40	HI1642	R	R	R	R	R	R	R	R	R	R	R	R
41	HI1633*	R	R	R	R	R	R	R	R	R	R	R	R
42	MACS6752	R	R	R	R	R	R	R	R	R	R	R	R
43	NIDW 1149(d)*	R	R	R	R	R	R	R	S	R	R	R	R
44	UAS446(d) (C)	R	R	R	R	R	R	S	R	R	R	R	R
45	HI 1605 (C)	R	R	R	S	R	R	S	S	S	S	R	R
46	MACS 4087(d)	R	R	R	R	S	S	S	S	R	S	S	R
47	MP 1358	R	R	R	R	R	R	S	S	R	R	R	R
48	AKDW 2997-16(d)(C)	S	R	R	R	S	S	R	R	S	S	S	R
49	HI8805(d)(I) (C)	R	R	R	R	R	R	R	R	R	R	R	R
50	UAS 472(d)	R	R	R	R	R	R	S	R	R	R	R	R
51	MPO 1357(d)	R	R	R	R	R	R	R	R	R	R	R	R
52	NIAW3170(I) (C)	R	NG	R	R	R	R	R	R	S	R	S	R

Annexure 5: Reaction of AVT wheat genotypes at seedling stage against pathotypes of *Puccinia triticina* (wheat leaf/ brown rust) during 2019-20 at Mahabaleshwar

S. No.	Entries	Pathotypes								
		12-4	12-5	77-1	77-4	77-5	77-9	104A	104-1	108
Central Zone (CZ)										
1	TAW155	R	R	S	R	R	S	R	R	S
2	HI1636	R	R	R	R	R	R	R	R	R
3	MP1361	R	R	R	R	R	R	R	R	R
4	MACS6747	R	R	R	R	R	R	R	R	R
5	HD3377	R	R	S	S	R	S	R	R	R
6	HI1637	R	R	R	R	R	R	R	R	R
7	RAJ4541	R	R	R	R	R	R	R	R	R
8	GW513	R	R	R	R	R	R	R	R	R
9	GW322	R	R	R	R	R	S	R	R	R
10	HI1544	R	R	R	R	R	R	R	R	R
11	HI1634*	R	R	R	R	R	R	R	R	R
12	HD2932	S	S	R	R	S	S	R	S	S
13	MP3336	S	S	S	R	S	S	R	R	S
14	HD2864	R	R	R	R	R	R	R	R	R
15	CG1029*	R	R	R	R	R	R	R	R	R
16	MPO1357(d)	R	R	R	R	R	R	R	R	R
17	HI8627(d)	R	S	R	S	R	R	R	R	R
18	UAS466(d)(I)	R	R	R	R	S	R	R	R	R
19	UAS472(d)	R	R	S	R	S	S	R	R	R
20	DBW110	R	NG	R	R	S	NG	R	NG	R
21	MP3288	R	R	R	R	R	R	R	R	R
22	HI 8823(d)	R	S	R	R	S	R	R	R	R
23	DDW47(d)(I)	R	R	R	R	R	R	R	R	R
Peninsular Zone (PZ)										
24	WHD964(d)	R	R	R	R	R	R	R	R	R
25	DDW48(d) *	R	R	R	R	R	R	R	R	R
26	MACS6222 (C)	R	R	R	R	R	R	R	R	R
27	MACS3949(d) (C)	R	R	R	R	R	R	R	R	R
28	HI8818(d)	R	R	R	R	R	R	R	R	R

29	UAS428(d) (C)	R	R	R	R	R	R	R	R	R
30	DDW49(d) *	S	S	R	S	S	S	S	S	R
31	GW322 (C)	R	R	S	R	S	S	R	R	R
32	GW519	R	R	R	R	R	R	R	R	R
33	HI1646	R	R	S	R	R	S	R	R	S
34	HD3090 (C)	R	R	R	R	R	R	R	R	R
35	RAJ4083 (C)	R	R	S	R	R	S	R	R	R
36	UAS3008	R	R	S	R	R	S	R	R	R
37	MACS6749	R	R	R	R	R	R	R	R	R
38	HD2932 (C)	S	S	S	S	S	S	S	S	S
39	HI1641	R	R	R	R	R	R	R	R	R
40	HI1642	R	R	R	R	R	R	R	R	R
41	HI1633*	R	R	R	R	R	R	R	R	R
42	MACS6752	R	R	R	R	R	R	R	R	R
43	NIDW 1149(d)*	R	R	R	R	R	R	R	R	R
44	UAS446(d) (C)	R	R	R	R	R	R	R	R	R
45	HI 1605 (C)	S	S	S	R	R	S	R	R	R
46	MACS 4087(d)	R	R	R	R	R	R	R	R	R
47	MP 1358	R	R	S	S	R	S	R	R	R
48	AKDW 2997-16(d) (C)	R	R	R	R	R	R	R	R	R
49	HI8805(d)(I) (C)	R	R	R	R	R	R	R	R	R
50	UAS 472(d)	R	R	R	R	R	R	R	R	R
51	MPO 1357(d)	R	R	R	R	R	R	R	R	R
52	NIAW3170(I) (C)	R	R	S	R	R	S	R	R	S

Annexure 6: Reaction of NIVT wheat genotypes at seedling stage against pathotypes of *Puccinia graminis tritici* (wheat stem/black rust) during 2019-20 at Mahabaleshwar

S. No.	Entries	Pathotypes											
		11	24A	40	40- A	42	42B	117- 2	117- 4	117- 5	117- 6	122	295
NIVT-4													
1	PWU5	R	R	R	R	R	S	R	R	R	R	R	R
2	HI8713 (C)	S	R	R	R	R	S	R	R	R	R	R	R
3	HI8826	R	R	R	R	R	R	R	R	R	R	R	R
4	MACS4106	R	R	S	R	R	R	R	R	R	R	R	R
5	UAS473	R	R	R	R	R	S	R	R	R	R	R	R
6	HI8828	R	R	R	R	R	R	R	R	R	R	R	R
7	MPO1375	R	R	R	R	R	R	R	R	R	R	R	NG
8	MACS4100	S	S	R	S	S	S	S	R	S	S	R	S
9	WHD965	R	R	R	R	R	S	R	R	S	R	R	R
10	NIDW1348	R	R	R	R	R	R	R	S	R	R	R	R
11	DDW53	R	R	R	S	R	R	R	R	R	R	R	R
12	HI8829	R	R	R	R	R	R	R	R	R	R	R	R
13	PDW360	S	R	R	R	R	S	R	S	R	R	R	R
14	HI8825	R	R	R	R	R	R	R	R	R	R	R	R
15	HI8827	NG	R	R	R	R	S	R	R	R	R	R	R
16	HI8737 (C)	R	R	R	R	R	R	R	S	R	R	R	R
17	DDW54	R	R	R	R	R	R	S	S	R	R	R	S
18	MACS3949 (C)	R	S	R	S	R	S	S	R	R	R	R	R
19	UAS474	R	S	R	R	R	S	R	R	R	R	R	R
20	PBND4812	R	R	R	R	R	S	R	S	R	R	R	R
21	GW1355	S	R	R	R	S	R	R	R	R	R	R	R
22	GW1354	R	R	R	R	R	R	R	R	R	R	R	R
23	NIDW1345	R	R	R	R	R	S	R	R	R	R	R	R
24	MPO1374	R	R	R	R	R	S	R	R	R	R	R	R
25	MPO1373	S	S	S	S	R	S	S	R	R	S	R	S
NIVT-5B													
26	DBW326	R	S	R	R	R	R	R	R	R	R	R	R
27	GW528	R	R	R	R	R	R	R	R	R	R	R	R
28	MP1367	R	R	R	R	R	R	R	R	R	R	R	R

29	UAS446(d) (C)	R	R	R	R	R	R	S	R	R	R	R	R
30	UAS475(d)	S	R	R	R	R	R	S	R	S	R	R	R
31	DDW55(d)	S	R	R	R	R	NG	R	R	NG	R	S	S
32	MACS6753	R	R	R	R	R	R	R	R	R	R	R	R
33	HD3372	S	R	R	R	R	R	R	R	R	R	R	R
34	HI1605 (C)	R	R	R	R	S	R	R	R	R	R	R	R
35	DBW110 (C)	R	R	R	R	S	R	R	R	R	R	R	R
36	HI8830(d)	R	R	R	R	R	R	R	R	R	R	R	R
37	HI1655	R	R	R	R	R	R	R	R	R	R	R	R
38	HD3371	R	S	S	R	R	R	R	R	R	R	R	R
39	GW1356(d)	R	S	R	R	R	R	S	R	S	S	R	R
40	NIAW3855	R	S	R	R	R	R	R	R	R	R	S	R
41	HI8627(d) (C)	R	R	R	R	R	R	R	R	R	R	R	R
42	HI8831(d)	R	S	R	R	R	R	R	R	R	R	R	R
43	MP3523	R	R	S	R	R	R	S	S	R	R	R	R
44	NIAW3851	R	S	S	R	R	R	R	R	R	R	R	R
45	CG1036	R	R	R	R	R	R	R	R	R	R	R	R
46	UAS3014	R	R	R	R	R	R	R	R	R	R	R	R
47	MP1368	R	R	R	R	R	R	R	R	R	R	R	R
48	MACS6755	R	R	R	R	R	R	R	R	R	R	R	R
49	AKAW5088	R	R	R	R	R	S	R	R	R	S	R	R
50	DBW325	R	R	R	R	S	R	R	R	R	R	R	R

Annexure 7: Reaction of NIVT wheat genotypes at seedling stage against pathotypes of *Puccinia triticina* (wheat leaf/ brown rust) during 2019-20 at Mahabaleshwar

S. No.	Entries	Pathotypes								
		12-4	12-5	77-1	77-4	77-5	77-9	104A	104-1	108
NIVT-4										
1	PWU5	R	S	S	S	S	S	S	S	R
2	HI8713 (C)	R	S	R	R	S	R	R	R	S
3	HI8826	R	S	R	R	R	R	R	R	R
4	MACS4106	R	S	R	R	S	R	R	R	R
5	UAS473	R	R	R	R	R	R	R	R	R
6	HI8828	R	R	R	R	R	R	R	R	R
7	MPO1375	R	R	R	R	R	R	R	S	R
8	MACS4100	R	R	R	R	R	R	R	R	R
9	WHD965	R	R	R	R	R	R	R	R	R
10	NIDW1348	R	S	R	R	R	R	R	R	R
11	DDW53	R	R	R	S	R	R	R	R	R
12	HI8829	R	R	R	R	R	R	R	R	R
13	PDW360	R	NG	R	R	R	R	R	NG	R
14	HI8825	S	S	R	S	S	R	R	S	S
15	HI8827	R	R	R	R	R	R	R	R	R
16	HI8737 (C)	S	S	R	R	R	R	R	R	R
17	DDW54	S	S	R	S	S	R	R	S	R
18	MACS3949 (C)	R	R	R	R	R	R	R	R	R
19	UAS474	R	R	R	R	R	R	R	R	R
20	PBND4812	S	S	S	R	R	R	R	S	S
21	GW1355	R	R	R	R	R	R	R	R	S
22	GW1354	R	R	R	R	R	R	R	R	R
23	NIDW1345	S	S	R	R	R	R	R	R	R
24	MPO1374	R	R	R	R	R	R	R	R	R
25	MPO1373	S	S	R	S	R	R	S	R	S
NIVT-5B										
26	DBW326	S	S	S	R	R	S	S	R	S
27	GW528	R	R	R	R	R	R	R	R	R
28	MP1367	R	R	R	R	R	R	R	R	R

29	UAS446(d) (C)	R	R	R	R	S	R	R	R	R
30	UAS475(d)	R	S	R	R	R	R	R	R	R
31	DDW55(d)	R	R	R	R	R	R	R	R	R
32	MACS6753	R	R	R	R	R	R	R	R	R
33	HD3372	R	R	S	R	R	S	R	R	R
34	HI1605 (C)	S	R	R	R	R	S	R	R	R
35	DBW110 (C)	S	NG	R	NG	R	S	R	R	R
36	HI8830(d)	R	R	R	R	R	R	R	R	R
37	HI1655	R	R	R	R	R	R	R	R	R
38	HD3371	R	R	R	R	S	R	R	R	R
39	GW1356(d)	S	S	S	R	S	R	R	R	R
40	NIAW3855	S	S	S	R	S	R	R	R	R
41	HI8627(d) (C)	R	R	R	R	R	R	R	R	S
42	HI8831(d)	S	S	R	S	S	S	R	R	R
43	MP3523	R	R	S	R	R	S	R	R	S
44	NIAW3851	S	S	S	R	S	S	R	R	S
45	CG1036	R	R	R	R	R	R	R	R	R
46	UAS3014	R	R	S	R	R	R	R	R	R
47	MP1368	R	R	R	R	R	S	R	R	S
48	MACS6755	R	R	S	R	R	R	R	R	R
49	AKAW5088	S	S	S	R	R	R	R	R	S
50	DBW325	R	S	S	R	R	S	R	NG	S

Annexure 8: Disease response of IPPSN entries during 2019-20

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
ARI, Pune												
1	IPPSN2019-1	MACS 6775	54.2	100S	41.3	60S	38.0	60S	62.5	80S	46	89
2	IPPSN2019-2	MACS 6776	61.3	100S	47.7	80S	30.0	60S	62.5	100S	35	57
3	IPPSN2019-3	MACS 6777	53.4	80S	23.3	40S	20.0	40S	55.0	80S	46	78
4	IPPSN2019-4	MACS 6778	38.3	80S	17.1	60S	13.8	40S	60.0	100S	36	58
5	IPPSN2019-5	MACS 6779	5.3	20S	0.8	5MS	0.6	5MR	33.1	60S	57	99
6	IPPSN2019-6	MACS 6780	18.7	40S	14.0	40S	24.4	40S	43.8	80S	47	89
7	IPPSN2019-7	MACS 6781	10.1	40S	16.3	80S*	16.4	20S	44.3	80S	57	99
8	IPPSN2019-8	MACS 6782	4.1	10S	3.1	10S	5.2	20S	35.0	60S	46	89
9	IPPSN2019-9	MACS 6783	13.5	40S	20.7	80S	13.6	30S	31.3	60S	47	99
10	IPPSN2019-10	MACS 6784	1.7	5S	0.4	5MR	2.0	10S	28.9	60S	46	78
11	IPPSN2019-11	MACS 6785	3.8	20S	1.4	10MS	4.8	20S	30.1	60S	45	57
12	IPPSN2019-12	MACS 6786	3.1	10MS	0.1	TMR	0.2	TS	35.4	60S	46	78
13	IPPSN2019-13	MACS 6787	18.1	60S	18.1	40S	10.2	20S	75.0	100S	46	78
14	IPPSN2019-14	MACS 6788	10.2	40S	1.4	5MS	18.0	40S	33.4	80S	47	78
15	IPPSN2019-15	MACS 6789	1.3	5S	0.7	5MS	2.0	10S	28.8	80S	46	89
16	IPPSN2019-16	MACS 6790	21.7	40S	22.8	80S	24.4	60S	58.8	80S	46	78
17	IPPSN2019-17	MACS 6791	1.4	10MR	1.2	5S	4.0	20S	53.8	80S	46	78
18	IPPSN2019-18	MACS 6792	4.0	40MR	10.9	60S*	3.0	10S	33.9	60S	47	68
19	IPPSN2019-19	MACS 6793	2.2	20MR	0.8	5MS	4.4	20S	56.3	80S	36	46
20	IPPSN2019-20	MACS 6794	12.0	40S	16.1	80S*	0.6	5MR	55.0	80S	47	58
20A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**90.0**	**100S**	**84.0**	**100S**	**77.5**	**100S**	**68**	**99**
21	IPPSN2019-21	MACS 6795	4.6	20S	6.8	20S	0.2	TS	65.0	80S	56	79
22	IPPSN2019-22	MACS 6796	1.2	10MR	3.0	10S	0.2	TS	29.0	60S	56	78
23	IPPSN2019-23	MACS 4107	13.3	60S*	0.8	10MR	0.6	5MR	36.4	80S	46	58
24	IPPSN2019-24	MACS 4108	14.3	60S	0.7	10MR	2.0	10S	14.4	40S	45	58
25	IPPSN2019-25	MACS 4109	17.7	100S*	4.1	20S	2.0	10S	19.3	60S	35	78
26	IPPSN2019-26	MACS 4110	7.7	40S	5.4	20S	2.4	10S	15.1	40S	46	78
27	IPPSN2019-27	MACS 4111	13.7	40S	2.1	10MS	2.0	10S	6.9	20S	47	89
28	IPPSN2019-28	MACS 4112	19.4	80S	3.1	10S	4.8	20S	6.3	20S	45	78
29	IPPSN2019-29	MACS 4113	19.3	100S	1.5	10MS	8.4	20S	3.8	10MS	47	89
30	IPPSN2019-30	MACS 4114	22.3	100S	1.4	10MS	2.0	5S	6.8	20S	47	78
31	IPPSN2019-31	MACS 4115	31.8	100S	3.2	10S	2.0	10S	6.9	20S	46	68
32	IPPSN2019-32	MACS 4116	22.4	100S	3.4	20S	2.4	10S	12.4	40S	46	68
33	IPPSN2019-33	MACS 5056	6.7	40S	3.4	20S	4.0	20S	35.9	60S	45	89
34	IPPSN2019-34	MACS 5057	4.7	20S	1.4	20MR	4.0	20S	38.8	60S	46	89
35	IPPSN2019-35	MACS 5058	6.2	20S	0.1	TR	1.0	5MS	28.5	60S	46	89
CSAUA&T, Kanpur												
36	IPPSN2019-36	KA1901	10.7	40S	11.5	30MS	0.6	5MR	21.1	60S	57	78
37	IPPSN2019-37	KA1902	26.0	100S	41.7	80S	28.0	60S	53.1	80S	46	78
38	IPPSN2019-38	KA1903	20.8	100S	11.8	40S	4.0	20S	24.4	60S	46	68
39	IPPSN2019-39	KA1904	33.3	100S	27.4	80S	28.4	60S	57.6	80S	57	99
40	IPPSN2019-40	KA1905	20.4	100S	19.7	40S	21.2	40S	27.4	60S	46	78
40A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**93.3**	**100S**	**76.0**	**80S**	**80.0**	**100S**	**68**	**99**
41	IPPSN2019-41	KA1906	31.0	100S	37.7	60S	23.6	60S	62.5	80S	35	57
42	IPPSN2019-42	KA1907	30.3	100S	43.7	100S	23.6	60S	55.0	80S	46	68
43	IPPSN2019-43	KA1908	37.4	100S	38.7	100S	18.0	40S	50.0	80S	46	78
44	IPPSN2019-44	KA1909	20.0	100S	2.7	10MS	20.0	40S	39.5	80S	46	68
45	IPPSN2019-45	KA1910	21.4	100S	24.7	80S	18.0	40S	35.8	80S	35	46
46	IPPSN2019-46	KA1911	30.7	80S	26.1	80S	16.4	40S	48.1	80S	46	78
47	IPPSN2019-47	KA1912	31.5	100S	16.3	40S	14.8	40S	45.1	80S	56	89
48	IPPSN2019-48	KA1913	21.4	60S	11.8	40S	13.6	30S	27.5	60S	24	36
49	IPPSN2019-49	KA1914	37.7	100S	26.0	60S	22.0	40S	50.6	80S	46	78
50	IPPSN2019-50	KA1915	31.0	60S	8.2	40MS	2.4	10S	17.8	40S	45	89
51	IPPSN2019-51	KA1916	36.0	100S	31.0	60S	20.0	40S	56.3	80S	57	89
52	IPPSN2019-52	KA1917	58.3	100S	54.0	80S	32.0	40S	57.5	80S	46	58
53	IPPSN2019-53	KA1918	29.3	80S	17.5	60S	17.0	40S	40.0	80S	35	68
54	IPPSN2019-54	KA1919	23.3	80S	6.4	20S	8.0	20S	38.8	80S	46	78
55	IPPSN2019-55	KA1920	22.3	80S	14.4	40S	3.8	10S	40.6	80S	46	78

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
56	IPPSN2019-56	KA1921	20.6	80S	18.1	80S	10.0	40S	22.1	80S	45	78
57	IPPSN2019-57	KA1922	17.9	80S	15.3	60S	19.0	40S	41.4	80S	47	78
58	IPPSN2019-58	KA1923	17.7	60S	14.7	80S*	3.2	10S	52.5	80S	47	89
59	IPPSN2019-59	KA1924	16.7	60S	16.1	60S	1.0	5S	27.0	60S	56	89
60	IPPSN2019-60	KA1925	28.3	100S	32.2	80S	16.8	40S	50.0	80S	46	58
60A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**93.3**	**100S**	**80.0**	**100S**	**75.0**	**100S**	**68**	**99**
61	IPPSN2019-61	KA1926	5.1	20MS	2.7	10MS	0.2	TS	18.8	40S	25	46
62	IPPSN2019-62	KA1927	15.8	40S	1.4	10MS	2.0	10S	18.9	60S	45	78
63	IPPSN2019-63	KA1928	18.4	60S	15.4	80S*	1.4	5S	31.4	60S	45	78
64	IPPSN2019-64	KA1929	23.7	80S	6.9	40S	1.4	5MS	14.0	40S	46	89
65	IPPSN2019-65	KA1930	20.2	100S	1.0	5S	1.0	5S	19.5	60S	46	78
66	IPPSN2019-66	KA1931	21.4	100S	7.4	40S	0.6	5MR	35.0	80S	46	89
67	IPPSN2019-67	KA1932	12.8	60S*	3.4	10S	0.6	5MR	21.9	60S	46	78
68	IPPSN2019-68	KA1933	45.0	100S	32.0	80S	21.6	40S	38.8	80S	46	78
69	IPPSN2019-69	KA1934	31.5	100S	25.1	60S	22.0	40S	53.8	80S	46	89
70	IPPSN2019-70	KA1935	11.1	60S*	12.4	40S	1.0	5S	33.3	60S	46	89
71	IPPSN2019-71	KA1936	3.7	20S	18.0	80S	8.0	20S	23.8	60S	46	68
72	IPPSN2019-72	KA1937	11.6	60S*	14.0	80S*	2.0	10S	26.8	60S	46	78
73	IPPSN2019-73	KA1938	22.7	100S	13.6	80S*	0.2	TS	35.1	80S	35	46
74	IPPSN2019-74	KA1939	42.0	100S	32.1	100S	26.0	40S	42.5	80S	46	68
75	IPPSN2019-75	KA1940	27.4	100S	11.7	20S	15.0	40S	58.8	80S	46	68
76	IPPSN2019-76	KA1941	25.7	100S	16.7	40S	4.2	10S	50.1	80S	46	78
77	IPPSN2019-77	KA1942	5.8	20S	18.5	80S	2.4	10S	37.5	80S	46	78
78	IPPSN2019-78	KA1943	22.8	60S	7.2	30S	1.2	5S	12.9	40S	36	68
79	IPPSN2019-79	KA1944	29.7	60S	14.9	60S	3.2	10S	48.9	80S	56	78
80	IPPSN2019-80	KA1945	17.6	80S	22.7	40S	22.0	40S	60.0	80S	46	68
80A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**90.0**	**100S**	**80.0**	**100S**	**80.0**	**100S**	**78**	**99**
CSKHPKV, Palampur												
81	IPPSN2019-81	PW 1901 (BARC)	11.7	40MS	6.2	20S	0.6	5MR	31.4	60S	56	78
82	IPPSN2019-82	PW 1902	23.4	40S	9.4	40S	0.6	5MR	17.6	60S	46	78
83	IPPSN2019-83	PW 1903	6.2	20S	7.5	40S	1.2	5S	14.1	60S	46	78
84	IPPSN2019-84	PW 1904	18.8	60S	24.9	80S	16.0	40S	22.5	80S	46	78
85	IPPSN2019-85	PW 1905	42.2	80S	19.7	100S*	0.2	TS	19.9	60S	46	58
86	IPPSN2019-86	PW 1906	29.5	100S	19.4	80S	0.2	TS	28.4	60S	46	78
87	IPPSN2019-87	PW 1907	31.6	100S	31.0	100S	16.0	40S	26.9	60S	47	78
88	IPPSN2019-88	PW 1908	16.7	40S	16.2	60S	0.4	5MR	23.1	80S	46	78
89	IPPSN2019-89	PW 1909	8.4	20MS	10.3	40S	0.0	0	22.3	60S	46	78
90	IPPSN2019-90	PW 1910	31.8	80S	76.7	100S	28.0	60S	41.9	80S	35	68
91	IPPSN2019-91	PW 1911	8.8	20S	4.4	10S	0.4	5MR	24.1	60S	46	78
92	IPPSN2019-92	PW 1912	9.4	20S	11.1	40MS	0.2	TS	18.1	60S	46	78
93	IPPSN2019-93	PW 1913	6.9	40S	23.7	80S	24.2	60S	31.9	80S	35	67
94	IPPSN2019-94	PW 1914	10.0	30MS	7.7	40MS	4.0	10S	21.9	80S	35	68
95	IPPSN2019-95	PW 1915	7.4	30MS	10.3	40S	0.2	TS	18.8	60S	46	78
96	IPPSN2019-96	BW 275	5.1	20S	14.2	80S*	4.0	20S	20.9	60S	36	78
97	IPPSN2019-97	BW 276	13.4	60S*	17.4	80S	0.2	TS	14.0	60S	35	46
98	IPPSN2019-98	BW 277	10.7	20S	20.7	60S	24.2	40S	27.3	80S	46	78
99	IPPSN2019-99	BW 278	13.6	40S	10.6	20S	0.6	5MR	14.9	60S	35	78
100	IPPSN2019-100	BW 279	17.9	80S	11.1	20S	1.0	5S	15.9	60S	34	56
100A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**90.0**	**100S**	**76.0**	**80S**	**80.0**	**100S**	**78**	**99**
101	IPPSN2019-101	DW 261	4.4	20S	15.1	60S	0.2	TS	20.5	60S	46	89
102	IPPSN2019-102	DW 262	15.0	40S	13.1	60S	1.0	5S	31.0	60S	46	78
103	IPPSN2019-103	DW 263	3.4	20MS	12.2	60S*	4.8	10S	23.0	80S	35	46
104	IPPSN2019-104	DW 264	14.4	40S	3.3	10S	0.8	5MS	13.9	60S	36	68
105	IPPSN2019-105	DW 265	0.8	5MS	14.1	40S	19.6	40S	16.8	80S	36	78
106	IPPSN2019-106	DW 266	26.3	60S	17.4	80S	18.0	40S	28.1	80S	46	78
107	IPPSN2019-107	DW 267	12.3	40S	11.8	40S	12.0	40S	33.8	80S	35	78
108	IPPSN2019-108	DW 268	17.5	60S	2.6	10S	1.0	5S	18.6	60S	46	78
109	IPPSN2019-109	DW 269	9.4	60MS*	15.3	80S	0.2	TS	19.1	60S	46	68
110	IPPSN2019-110	DW 270	31.8	100S	6.3	20S	6.2	10S	18.1	60S	46	89
IARI, Delhi												
111	IPPSN2019-111	IARI - 19 - 1	14.3	40S	19.4	60S	9.6	20S	27.5	60S	46	78

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
112	IPPSN2019-112	IARI - 19 - 2	29.7	80S	20.8	40S	4.8	10S	50.0	80S	46	78
113	IPPSN2019-113	IARI - 19 - 3	33.8	80S	9.1	40S	2.0	10S	31.4	60S	47	89
114	IPPSN2019-114	IARI - 19 - 4	2.0	10MS	10.0	60S*	1.4	5S	34.4	60S	45	78
115	IPPSN2019-115	IARI - 19 - 5	50.0	80S	24.0	80S	1.0	5MS	29.4	80S	45	78
116	IPPSN2019-116	IARI - 19 - 6	1.9	10MS	2.7	20MS	2.0	10S	29.4	60S	46	78
117	IPPSN2019-117	IARI - 19 - 7	13.0	20S	5.1	20S	2.8	10S	25.6	60S	46	89
118	IPPSN2019-118	IARI - 19 - 8	25.0	40S	4.2	10MS	4.0	10S	9.6	40S	46	78
119	IPPSN2019-119	IARI - 19 - 9	33.3	80S	4.7	20S	2.0	10S	16.7	40S	47	89
120	IPPSN2019-120	IARI - 19 - 10	18.3	40S	18.5	80S	12.2	20S	20.6	60S	56	89
120A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**80.0**	**100S**	**78**	**99**
121	IPPSN2019-121	IARI - 19 - 11	9.0	20S	6.2	30MS	5.4	20MS	12.1	20S	46	89
122	IPPSN2019-122	IARI - 19 - 12	43.0	100S	9.8	20S	6.2	20S	16.5	60S	45	89
123	IPPSN2019-123	IARI - 19 - 13	23.0	60S	0.9	5S	1.0	5S	23.9	60S	45	78
124	IPPSN2019-124	IARI - 19 - 14	44.0	100S	4.7	10S	1.0	5S	23.5	60S	45	89
125	IPPSN2019-125	IARI - 19 - 15	15.7	40S	2.7	10MS	2.0	5S	6.5	20S	46	78
126	IPPSN2019-126	IARI - 19 - 16	24.7	60S	9.1	30S	2.2	5S	5.3	10S	45	89
127	IPPSN2019-127	IARI - 19 - 17	2.7	10MS	3.4	20MS	2.2	10S	5.5	20S	35	68
128	IPPSN2019-128	IARI - 19 - 18	44.3	100S	4.1	20MS	0.6	5MR	23.6	60S	46	89
129	IPPSN2019-129	IARI - 19 - 19	44.0	100S	20.7	60S	20.8	40S	25.0	60S	47	89
130	IPPSN2019-130	IARI - 19 - 20	55.0	100S	15.0	40S	7.0	10S	22.6	60S	46	89
131	IPPSN2019-131	IARI - 19 - 21	31.6	100S	6.5	10S	1.2	5S	2.9	10MS	46	99
132	IPPSN2019-132	IARI - 19 - 22	11.8	40S	3.2	10S	4.8	20S	2.8	10S	46	99
133	IPPSN2019-133	IARI - 19 - 23	39.0	100S	21.1	60S	18.8	40S	27.5	60S	36	89
134	IPPSN2019-134	IARI - 19 - 24	29.3	80S	8.7	20S	22.4	40S	31.3	60S	36	78
135	IPPSN2019-135	IARI - 19 - 25	29.0	80S	1.4	10MS	0.0	0	5.5	20MS	36	78
136	IPPSN2019-136	IARI - 19 - 26	20.0	40S	5.4	20MS	1.0	5MS	12.0	40S	35	78
137	IPPSN2019-137	IARI - 19 - 27	6.0	20S	2.2	10MS	0.8	5MS	36.3	80S	56	89
138	IPPSN2019-138	IARI - 19 - 28	50.7	100S	6.8	20S	0.2	TS	26.9	60S	46	89
139	IPPSN2019-139	IARI - 19 - 29	8.3	20S	2.7	10MS	2.0	10S	23.1	60S	46	78
140	IPPSN2019-140	IARI - 19 - 30	40.0	80S	12.7	40S	18.0	40S	12.6	60S*	36	78
140A	**INFECTOR**	**INFECTOR**	**80.0**	**100S**	**83.3**	**100S**	**80.0**	**100S**	**77.5**	**100S**	**68**	**99**
141	IPPSN2019-141	IARI - 19 - 31	38.7	80S	14.3	60S	16.0	40S	35.0	60S	46	89
142	IPPSN2019-142	IARI - 19 - 32	10.0	40S	8.0	20S	2.0	10S	22.3	60S	45	78
143	IPPSN2019-143	IARI - 19 - 33	15.5	40S	22.7	40S	11.2	30S	22.0	60S	36	68
144	IPPSN2019-144	IARI - 19 - 34	23.3	40S	7.5	20S	2.0	10S	25.0	60S	35	68
145	IPPSN2019-145	IARI - 19 - 35	16.0	60S	12.4	40S	2.2	10S	0.6	5MS	46	89
146	IPPSN2019-146	IARI - 19 - 36	28.7	60S	4.6	10S	2.8	5S	15.6	60S	36	89
147	IPPSN2019-147	IARI - 19 - 37	20.7	40S	23.3	60S	8.2	20S	20.1	60S	45	89
148	IPPSN2019-148	IARI - 19 - 38	46.3	100S	25.0	80S	10.0	30S	18.0	40S	46	89
149	IPPSN2019-149	IARI - 19 - 39	3.4	20MS	0.1	TR	0.2	TS	49.4	80S	46	99
150	IPPSN2019-150	IARI - 19 - 40	14.8	80S*	10.4	40S	1.4	10MR	38.6	80S	46	99
151	IPPSN2019-151	IARI - 19 - 41	2.4	10S	1.7	10S	1.2	5S	53.1	80S	46	99
152	IPPSN2019-152	IARI - 19 - 42	3.6	20S	0.8	5MS	1.2	5S	60.0	80S	46	99
153	IPPSN2019-153	IARI - 19 - 43	3.2	20MS	1.6	5S	1.8	5S	50.6	80S	46	99
154	IPPSN2019-154	IARI - 19 - 44	15.8	40S	2.4	10S	1.0	5S	10.4	20S	46	89
155	IPPSN2019-155	IARI - 19 - 45	22.4	80S	14.9	80S*	3.2	10S	13.9	40S	45	78
156	IPPSN2019-156	IARI - 19 - 46	6.2	40MR	1.8	10S	3.0	10S	33.3	80S	46	89
157	IPPSN2019-157	IARI - 19 - 47	11.5	60S*	3.5	20S	0.0	0	9.5	20S	35	78
158	IPPSN2019-158	IARI - 19 - 48	12.9	60S*	1.5	5S	3.0	10S	22.4	60S	46	89
159	IPPSN2019-159	IARI - 19 - 49	2.1	5MS	24.0	80S	18.0	40S	49.0	80S	46	89
160	IPPSN2019-160	IARI - 19 - 50	5.5	30MR	4.1	20S	4.0	20S	43.8	80S	46	89
160A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**90.0**	**100S**	**76.0**	**80S**	**75.0**	**100S**	**68**	**99**
161	IPPSN2019-161	IARI - 19 - 51	5.4	20S	11.5	60S*	3.0	10S	38.8	60S	46	78
162	IPPSN2019-162	IARI - 19 - 52	30.0	80S	1.8	10S	5.0	20S	36.1	80S	46	89
163	IPPSN2019-163	IARI - 19 - 53	12.2	60S	13.8	60S	2.4	10S	42.5	80S	46	89
164	IPPSN2019-164	IARI - 19 - 54	0.8	20R	1.4	5MS	0.6	5MR	27.0	60S	46	89
165	IPPSN2019-165	IARI - 19 - 55	10.8	40S	3.1	10S	0.0	0	28.3	60S	46	89
166	IPPSN2019-166	IARI - 19 - 56	7.5	40MS	8.2	40MS	6.2	20S	3.6	20S	45	89
167	IPPSN2019-167	IARI - 19 - 57	44.7	80S	15.3	40S	3.2	10S	30.4	60S	36	78
168	IPPSN2019-168	IARI - 19 - 58	26.3	80S	11.7	30S	9.0	20S	24.8	40S	47	78
169	IPPSN2019-169	IARI - 19 - 59	51.4	100S	6.7	20S	3.2	10S	24.1	60S	36	78

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
170	IPPSN2019-170	IARI - 19 - 60	24.1	60S	17.7	80S	12.0	30S	19.9	60S	46	89
171	IPPSN2019-171	IARI - 19 - 61	51.4	100S	18.7	60S	2.0	10S	25.6	60S	46	78
172	IPPSN2019-172	IARI - 19 - 62	15.1	40S	13.4	60S	2.8	5S	19.6	60S	35	46
173	IPPSN2019-173	IARI - 19 - 63	12.2	40MS	6.0	40MS	0.2	TS	12.3	40S	35	46
174	IPPSN2019-174	IARI - 19 - 64	23.5	60S	10.0	30S	1.2	5S	4.0	20S	35	48
175	IPPSN2019-175	IARI - 19 - 65	28.0	60S	2.1	10MS	1.4	5S	8.1	40S	45	68
176	IPPSN2019-176	IARI - 19 - 66	14.7	40S	8.1	40S	0.2	TS	13.0	40S	35	89
177	IPPSN2019-177	IARI - 19 - 67	27.7	80S	6.0	20MS	7.2	20MS	18.3	60S	45	78
178	IPPSN2019-178	IARI - 19 - 68	21.0	60S	16.4	60S	1.0	5S	37.6	80S	46	68
179	IPPSN2019-179	IARI - 19 - 69	17.3	60S	27.0	80S	12.8	40S	11.8	20S	35	48
180	IPPSN2019-180	IARI - 19 - 70	2.0	20MR	2.4	10MS	0.4	5MR	48.8	80S	57	78
180A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**77.5**	**100S**	**78**	**99**
181	IPPSN2019-181	IARI - 19 - 71	8.0	20S	0.9	5S	6.4	20S	37.6	60S	46	99
182	IPPSN2019-182	IARI - 19 - 72	0.8	5MS	0.0	TR	0.6	5MR	38.8	80S	45	78
183	IPPSN2019-183	IARI - 19 - 73	2.3	5S	0.1	TR	1.0	5S	57.5	80S	46	89
184	IPPSN2019-184	IARI - 19 - 74	3.4	30MR	1.7	10S	2.2	10S	50.0	80S	46	99
185	IPPSN2019-185	IARI - 19 - 75	1.8	20MR	1.7	10MS	2.2	10S	57.5	80S	46	99
186	IPPSN2019-186	IARI - 19 - 76	4.2	20S	14.8	80S*	4.4	20S	48.1	80S	46	78
187	IPPSN2019-187	IARI - 19 - 77	20.0	60S	1.4	5MS	0.2	TS	13.0	40S	35	46
188	IPPSN2019-188	IARI - 19 - 78	52.3	100S	13.0	40S	4.0	10S	18.8	60S	35	46
189	IPPSN2019-189	IARI - 19 - 79	50.2	100S	18.7	80S	4.6	20S	24.9	60S	36	68
190	IPPSN2019-190	IARI - 19 - 80	20.8	80S	1.1	5MS	9.0	40S	13.6	40S	35	46
191	IPPSN2019-191	IARI - 19 - 81	12.7	40S	4.7	20S	10.0	40S	38.1	80S	35	58
192	IPPSN2019-192	IARI - 19 - 82	2.0	10S	0.4	5MR	0.0	0	4.2	20MS	46	68
193	IPPSN2019-193	IARI - 19 - 83	1.1	5S	0.6	5MR	0.4	5MR	11.4	40S	46	68
194	IPPSN2019-194	IARI - 19 - 84	4.1	20S	0.8	5MR	0.2	TS	2.9	20MS	47	58
195	IPPSN2019-195	IARI - 19 - 85	10.8	60S*	0.1	TR	0.2	TS	12.9	40S	56	78
196	IPPSN2019-196	IARI - 19 - 86	4.9	20MS	0.1	TR	0.6	5MR	12.4	40S	45	78
197	IPPSN2019-197	IARI - 19 - 87	1.7	5MS	2.0	10MS	5.0	20S	5.7	20S	46	68
198	IPPSN2019-198	IARI - 19 - 88	3.6	20S	1.4	5MS	5.4	20S	3.6	10MS	46	48
199	IPPSN2019-199	IARI - 19 - 89	8.1	20S	0.4	5MR	8.4	40S	3.5	20MS	45	68
200	IPPSN2019-200	IARI - 19 - 90	8.7	40S	0.1	TMR	8.2	40S	4.3	20S	46	78
200A	**INFECTOR**	**INFECTOR**	**80.0**	**100S**	**80.0**	**100S**	**80.0**	**100S**	**70.0**	**80S**	**78**	**99**
201	IPPSN2019-201	IARI - 19 - 91	12.5	40MS	2.1	10MS	2.0	10S	8.0	20S	46	78
202	IPPSN2019-202	IARI - 19 - 92	9.7	20S	19.0	80S	5.4	20MS	28.3	60S	35	46
203	IPPSN2019-203	IARI - 19 - 93	28.5	60S	14.4	60S	8.2	40S	10.4	40S	35	46
204	IPPSN2019-204	IARI - 19 - 94	6.6	10S	2.6	10MS	0.2	TS	45.0	60S	46	78
205	IPPSN2019-205	IARI - 19 - 95	16.8	40MS	13.5	40S	14.0	20S	26.0	60S	46	79
206	IPPSN2019-206	IARI - 19 - 96	6.4	20S	18.1	100S*	8.6	40S	32.1	80S	35	89
207	IPPSN2019-207	IARI - 19 - 97	13.6	40S	0.8	10MR	3.2	10S	11.0	40S	46	89
208	IPPSN2019-208	IARI - 19 - 98	24.7	40S	5.4	20S	3.2	10S	14.6	40S	45	78
209	IPPSN2019-209	IARI - 19 - 99	34.0	60S	8.0	30S	3.0	10S	22.8	60S	36	58
210	IPPSN2019-210	IARI - 19 - 100	37.3	80S	12.4	60S	13.0	60S*	23.8	60S	46	78
211	IPPSN2019-211	IARI - 19 - 101	6.9	20MS	1.1	10MR	4.2	20S	12.1	40S	46	78
212	IPPSN2019-212	IARI - 19 - 102	11.5	40MS	11.7	40S	4.2	10S	23.1	60S	35	46
213	IPPSN2019-213	IARI - 19 - 103	20.7	100S	12.7	40S	13.0	40S	18.8	60S	35	46
214	IPPSN2019-214	IARI - 19 - 104	27.0	80S	13.4	40S	11.0	40S	31.4	60S	35	46
215	IPPSN2019-215	IARI - 19 - 105	22.0	40S	4.8	20S	9.0	20S	18.5	40S	45	58
216	IPPSN2019-216	IARI - 19 - 106	15.0	40S	4.7	20MS	2.2	10S	11.9	40S	46	68
217	IPPSN2019-217	IARI - 19 - 107	11.7	40S	14.0	40S	16.2	40S	11.4	40S	35	46
218	IPPSN2019-218	IARI - 19 - 108	16.8	40S	7.4	20S	1.0	10MR	26.4	40S	35	58
219	IPPSN2019-219	IARI - 19 - 109	2.8	20MS	3.0	10S	4.0	20S	51.3	80S	35	68
220	IPPSN2019-220	IARI - 19 - 110	20.1	80MS	28.0	80S	28.4	40S	55.0	80S	45	68
220A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**93.3**	**100S**	**80.0**	**100S**	**77.5**	**100S**	**68**	**99**
221	IPPSN2019-221	IARI - 19 - 111	4.7	30MR	3.8	10MS	3.8	10S	56.3	80S	46	58
222	IPPSN2019-222	IARI - 19 - 112	1.4	10MR	0.1	TR	2.4	10S	45.0	80S	56	89
223	IPPSN2019-223	IARI - 19 - 113	1.8	10S	0.8	5MS	0.6	5MR	3.8	20S	46	89
224	IPPSN2019-224	IARI - 19 - 114	3.6	20S	0.7	10MR	4.8	10S	6.6	20S	46	78
225	IPPSN2019-225	IARI - 19 - 115	3.5	20S	1.7	10S	0.2	TS	11.2	40S	46	78
226	IPPSN2019-226	IARI - 19 - 116	5.7	20MS	0.1	TR	1.6	5S	6.3	20MS	46	78
227	IPPSN2019-227	IARI - 19 - 117	0.0	TR	0.0	TR	4.0	20S	42.6	80S	46	78

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
228	IPPSN2019-228	IARI - 19 - 118	2.4	10MR	1.0	5S	3.2	10S	18.3	60S	35	48
229	IPPSN2019-229	IARI - 19 - 119	44.2	80S	21.0	40S	3.2	10S	33.3	60S	46	68
230	IPPSN2019-230	IARI - 19 - 120	25.4	60S	4.2	20S	2.2	10S	16.4	60S	35	46
231	IPPSN2019-231	IARI - 19 - 121	7.2	20S	6.7	20MS	0.0	0	25.0	40S	35	46
232	IPPSN2019-232	IARI - 19 - 122	8.2	20S	36.0	100S	26.4	60S	6.4	20S	35	68
233	IPPSN2019-233	IARI - 19 - 123	11.0	40MS	6.7	10S	7.6	20S	4.9	20MS	35	45
234	IPPSN2019-234	IARI - 19 - 124	2.4	10S	5.1	20S	0.2	TS	28.1	60S	35	78
235	IPPSN2019-235	IARI - 19 - 125	0.3	5R	4.1	20S	0.2	TS	25.0	60S	45	78
236	IPPSN2019-236	IARI - 19 - 126	3.1	10MS	1.5	5S	2.2	10S	25.8	60S	35	78
237	IPPSN2019-237	IARI - 19 - 127	28.7	60S	26.7	80S	17.6	30S	32.5	60S	46	58
238	IPPSN2019-238	IARI - 19 - 128	0.1	TR	4.1	20S	1.0	5S	8.6	20S	46	78
239	IPPSN2019-239	IARI - 19 - 129	0.8	10MR	3.7	10S	1.0	5S	10.0	40S	46	78
240	IPPSN2019-240	IARI - 19 - 130	0.9	10MR	3.4	20S	1.0	5S	13.9	40S	35	57
240A	**INFECTOR**	**INFECTOR**	**80.0**	**100S**	**90.0**	**100S**	**76.0**	**80S**	**80.0**	**100S**	**78**	**99**
241	IPPSN2019-241	IARI - 19 - 131	34.0	80S	13.7	60S*	10.0	40S	10.9	40S	46	68
242	IPPSN2019-242	IARI - 19 - 132	1.6	10MS	14.0	60S*	6.4	20S	30.1	60S	35	46
243	IPPSN2019-243	IARI - 19 - 133	38.7	80S	11.6	60S*	8.2	20S	18.4	60S	35	46
244	IPPSN2019-244	IARI - 19 - 134	0.1	TR	0.1	TR	0.6	5MR	38.9	80S	34	45
245	IPPSN2019-245	IARI - 19 - 135	19.5	40S	13.5	40S	11.0	40S	5.5	20S	35	46
246	IPPSN2019-246	IARI - 19 - 136	25.3	80S	4.4	15MS	1.0	5MS	7.9	20S	36	58
247	IPPSN2019-247	IARI - 19 - 137	22.0	60S	7.7	20S	4.8	20S	9.9	20S	46	89
248	IPPSN2019-248	IARI - 19 - 138	11.9	30S	29.3	100S	6.4	20S	11.3	20S	25	48
249	IPPSN2019-249	IARI - 19 - 139	40.7	80S	31.3	80S	18.8	40S	31.1	60S	45	89
250	IPPSN2019-250	IARI - 19 - 140	4.4	10S	3.6	10S	5.0	20S	18.8	40S	36	89
251	IPPSN2019-251	IARI - 19 - 141	4.7	10S	0.9	5S	0.2	TS	20.1	60S	46	89
252	IPPSN2019-252	IARI - 19 - 142	30.4	80S	1.8	10S	2.2	10S	28.1	60S	35	48
253	IPPSN2019-253	IARI - 19 - 143	7.2	20S	22.4	80S	4.6	10S	16.9	40S	35	78
254	IPPSN2019-254	IARI - 19 - 144	8.4	20S	3.0	20MS	0.2	TS	20.9	60S	45	78
255	IPPSN2019-255	IARI - 19 - 145	15.4	40S	5.4	20MS	5.6	20MS	13.4	60S	46	89
256	IPPSN2019-256	IARI - 19 - 146	12.8	30MS	4.1	20MS	6.4	20S	13.0	40S	45	78
257	IPPSN2019-257	IARI - 19 - 147	0.9	5S	0.0	TR	2.0	10S	3.0	10S	25	36
258	IPPSN2019-258	IARI - 19 - 148	3.4	20MS	4.2	20MS	2.0	5S	16.8	60S	35	68
259	IPPSN2019-259	IARI - 19 - 149	4.0	10S	7.4	20S	1.4	5S	8.9	20S	35	57
260	IPPSN2019-260	IARI - 19 - 150	3.4	10MS	1.7	10S	0.2	TS	25.3	60S	35	46
260A	**INFECTOR**	**INFECTOR**	**80.0**	**100S**	**80.0**	**100S**	**80.0**	**100S**	**72.5**	**100S**	**68**	**99**
261	IPPSN2019-261	IARI - 19 - 151	0.7	10MR	1.8	10S	1.0	5MS	22.6	60S	45	56
262	IPPSN2019-262	IARI - 19 - 152	28.0	80S	7.2	20S	5.0	10S	18.9	40S	46	57
263	IPPSN2019-263	IARI - 19 - 153	28.0	80S	18.7	40S	3.0	10S	12.9	20S	46	78
264	IPPSN2019-264	IARI - 19 - 154	6.7	10S	8.0	40S	5.2	20S	21.9	60S	35	78
265	IPPSN2019-265	IARI - 19 - 155	3.7	10S	4.7	20S	0.2	TS	18.9	40S	35	78
266	IPPSN2019-266	IARI - 19 - 156	0.2	5R	0.9	5S	4.2	20S	13.8	40S	34	45
267	IPPSN2019-267	IARI - 19 - 157	0.2	5R	1.7	10S	4.2	20S	11.0	40S	36	48
268	IPPSN2019-268	IARI - 19 - 158	0.3	5R	0.0	TR	8.4	40S	3.1	20MR	36	48
269	IPPSN2019-269	IARI - 19 - 159	1.7	10S	0.0	TR	4.0	20S	10.5	80S*	23	45
270	IPPSN2019-270	IARI - 19 - 160	14.4	40S	20.7	80S	6.0	10S	41.4	80S	46	68
271	IPPSN2019-271	IARI - 19 - 161	1.8	10MS	10.4	40S	5.2	10S	29.5	60S	24	35
272	IPPSN2019-272	IARI - 19 - 162	6.2	20MS	5.4	20S	12.0	40S	42.5	60S	36	48
273	IPPSN2019-273	IARI - 19 - 163	1.7	10MS	1.4	10MS	4.4	20S	11.0	40S	46	78
274	IPPSN2019-274	IARI - 19 - 164	0.3	5R	0.7	10MR	9.0	40S	4.9	10S	46	68
275	IPPSN2019-275	IARI - 19 - 165	18.7	40S	7.0	20S	4.6	20S	33.8	60S	35	46
276	IPPSN2019-276	IARI - 19 - 166	37.3	80S	10.6	40S	17.4	60S	22.3	60S	36	47
277	IPPSN2019-277	IARI - 19 - 167	13.7	40MS	2.9	15MS	4.2	20S	33.8	60S	35	47
278	IPPSN2019-278	IARI - 19 - 168	12.7	40S	1.4	10MS	8.2	40S	23.8	40S	35	68
279	IPPSN2019-279	IARI - 19 - 169	11.0	40S	4.9	20MS	6.0	10S	15.5	40S	35	56
280	IPPSN2019-280	IARI - 19 - 170	25.4	80S	5.7	30S	0.2	TS	20.1	40S	35	56
280A	**INFECTOR**	**INFECTOR**	**76.7**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**77.5**	**100S**	**68**	**99**
ARS Niphad												
281	IPPSN2019-281	NIAW 3922	0.8	10MR	1.4	10MS	5.0	20S	41.9	80S	35	58
282	IPPSN2019-282	NIAW 3928	2.3	5S	1.0	5S	9.2	40S	56.3	80S	46	68
283	IPPSN2019-283	NIAW 3946	1.5	10MS	0.7	10MR	5.2	20S	45.0	80S	35	48
284	IPPSN2019-284	NIAW 3975	5.0	20S	7.2	20S	8.0	40S	31.9	60S	35	46

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
285	IPPSN2019-285	NIAW 3980	3.5	10MS	2.7	10MS	2.2	10S	31.9	80S	35	45
286	IPPSN2019-286	NIAW 4028	0.2	5R	0.0	TR	2.4	10S	37.3	60S	35	47
287	IPPSN2019-287	NIAW 3921	0.0	TR	1.7	10MS	4.4	20S	26.1	60S	46	68
288	IPPSN2019-288	NIAW 3924	0.7	5MS	0.7	5MS	4.2	20S	38.9	80S	36	58
289	IPPSN2019-289	NIAW 3950	1.1	5MS	1.7	10S	0.2	TS	33.3	60S	46	68
290	IPPSN2019-290	NIAW 3970	13.8	40S	7.5	20MS	0.0	0	23.5	60S	45	68
291	IPPSN2019-291	NIAW 3972	1.0	10MR	0.1	TR	0.6	5MR	39.5	80S	35	57
292	IPPSN2019-292	NIAW 3923	1.8	10S	0.1	TR	0.0	0	53.1	80S	46	78
293	IPPSN2019-293	NIAW 3927	3.4	10S	1.5	5S	4.0	20S	55.0	80S	45	78
294	IPPSN2019-294	NIAW 3931	7.3	30MR	45.3	100S	36.0	60S	47.5	80S	46	89
295	IPPSN2019-295	NIAW 3971	40.0	100S	1.7	5S	6.2	20S	22.8	60S	46	89
296	IPPSN2019-296	NIAW 3975	16.7	60S	3.3	10S	9.2	40S	29.4	60S	45	89
297	IPPSN2019-297	NIDW 1391	30.7	100S	0.8	5MS	3.4	10S	16.9	40S	45	78
298	IPPSN2019-298	NIDW 1396	35.7	100S	0.8	5MS	1.0	5MS	5.8	20S	45	78
299	IPPSN2019-299	NIDW 1417	32.0	100S	1.8	10S	2.2	10S	1.1	5S	35	46
300	IPPSN2019-300	NIDW 1422	38.3	100S	0.8	5MS	13.0	60S*	9.0	40S	46	68
300A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**77.5**	**80S**	**78**	**99**
301	IPPSN2019-301	NIDW 1440	13.1	60MS	0.2	TMR	6.0	20S	8.0	20S	46	68
302	IPPSN2019-302	NIDW 1399	10.3	40MS	0.8	5MS	5.8	20S	5.1	20MS	35	56
303	IPPSN2019-303	NIDW 1405	8.2	20S	1.4	10MS	9.2	40S	42.5	80S	34	57
304	IPPSN2019-304	NIDW 1410	29.0	80S	2.1	10MS	5.0	20S	13.5	40S	46	68
305	IPPSN2019-305	NIDW 1412	18.5	60S	5.4	20S	4.6	20S	10.8	40S	45	68
PDKV, Akola												
306	IPPSN2019-306	AKAW 4674	11.1	40S	13.3	40S	28.0	40S	55.0	80S	35	68
307	IPPSN2019-307	AKAW 5095	20.0	60S	6.9	20MS	10.0	20S	52.5	80S	34	45
308	IPPSN2019-308	AKAW 5096	22.2	60S	30.0	100S	34.0	40S	22.3	60S	46	68
309	IPPSN2019-309	AKAW 5100	4.7	40MR	16.0	80S	1.0	5S	42.3	80S	36	48
310	IPPSN2019-310	AKAW 5114	13.3	40S	9.7	20S	19.4	40S	55.0	80S	35	45
311	IPPSN2019-311	AKAW 5310	4.7	10S	4.0	10S	1.2	5S	52.5	80S	46	99
312	IPPSN2019-312	AKAW 5347	8.7	40MR	16.0	80S*	0.2	TS	31.9	60S	35	46
313	IPPSN2019-313	AKDW 5348	5.5	40MR	5.7	20MS	1.8	5MS	10.4	40S	46	78
314	IPPSN2019-314	AKAW 5349	4.7	40MR	11.4	60S*	6.4	20S	50.1	80S	45	78
315	IPPSN2019-315	AKAW 5350	4.4	20MS	7.0	20S	9.4	20S	36.9	60S	46	78
316	IPPSN2019-316	AKAW 5351	11.7	40S	6.7	30S	8.2	40S	35.8	60S	35	89
317	IPPSN2019-317	AKAW 5352	5.4	10MS	30.3	100S	15.2	20S	45.0	60S	35	46
318	IPPSN2019-318	WSM 109-4	2.2	5S	7.4	20MS	13.0	40S	50.0	80S	35	46
319	IPPSN2019-319	WSM 138	3.5	10MS	1.7	10S	5.2	20S	32.5	60S	46	68
320	IPPSN2019-320	WSM 253	14.0	30S	7.7	20S	4.0	10S	40.0	60S	46	78
320A	**INFECTOR**	**INFECTOR**	**76.7**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**72.5**	**100S**	**78**	**99**
NDUAT, Ayodhya												
321	IPPSN2019-321	NW 8003	6.7	20MS	16.7	80S	0.4	5MR	22.5	40S	25	56
322	IPPSN2019-322	NW 8004	23.3	60S	2.9	10MS	2.0	10S	17.5	40S	46	78
323	IPPSN2019-323	NW 8005	10.7	20MS	5.0	15MS	3.2	10S	20.9	40S	45	78
324	IPPSN2019-324	NW 8006	30.1	60S	24.0	60S	15.6	40S	40.0	60S	46	89
325	IPPSN2019-325	NW 8007	19.4	40S	11.2	40S	13.4	30S	40.0	60S	35	78
326	IPPSN2019-326	NW 8008	27.7	60S	39.3	80S	26.0	40S	41.3	80S	35	46
327	IPPSN2019-327	NW 8009	13.3	40S	8.8	40MS	9.0	20S	27.0	60S	35	46
328	IPPSN2019-328	NW 8010	38.1	60S	2.5	10S	2.0	10S	9.9	40S	46	78
329	IPPSN2019-329	NW 8011	33.0	80S	29.0	100S	20.0	40S	36.3	60S	35	46
330	IPPSN2019-330	NW 8012	16.8	60S	4.0	20MS	4.6	10S	16.2	60S	34	45
331	IPPSN2019-331	NW 8013	27.4	60S	1.5	10MS	1.4	5S	17.6	40S	35	45
332	IPPSN2019-332	NW 8014	20.0	40S	24.0	60S	9.0	40S	50.0	80S	35	46
333	IPPSN2019-333	NW 8015	34.3	60S	28.3	60S	17.2	40S	51.9	80S	46	56
334	IPPSN2019-334	NW 8016	44.3	80S	32.7	100S	4.0	10S	47.5	60S	46	78
335	IPPSN2019-335	NW 8017	34.7	60S	4.5	10MS	6.4	20S	18.4	60S	46	78
336	IPPSN2019-336	NW 8018	20.3	60MS	21.7	80S	9.2	20MS	48.8	80S	46	56
337	IPPSN2019-337	NW 8019	11.4	60S*	10.9	60S*	1.0	5S	12.1	40S	35	46
338	IPPSN2019-338	NW 8020	1.9	10MS	1.6	5S	1.4	5S	9.3	40S	35	46
339	IPPSN2019-339	NW 8021	11.4	60S*	0.8	5MS	0.2	TS	21.6	60S	35	56
340	IPPSN2019-340	NW 8022	23.4	60MS	2.1	10MS	1.2	5S	12.8	40S	35	57
340A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**86.7**	**100S**	**76.0**	**80S**	**77.5**	**100S**	**78**	**99**

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
341	IPPSN2019-341	NW 8023	13.7	40S	7.7	20S	0.2	TS	30.6	40S	46	68
342	IPPSN2019-342	NW 8024	24.7	60S	3.9	20S	4.0	10S	32.6	60S	35	36
343	IPPSN2019-343	NW 8025	0.8	5MS	0.1	TR	0.2	TS	3.9	10S	35	46
344	IPPSN2019-344	NW 8026	5.0	20MS	2.7	20MS	5.2	20S	26.3	40S	35	78
345	IPPSN2019-345	NW 8027	11.1	40MS	2.4	10MS	1.8	5S	35.0	60S	46	78
PAU, Ludhiana												
346	IPPSN2019-346	BWL 6886	12.8	40MS	4.0	20MS	2.2	10S	3.6	10S	45	78
347	IPPSN2019-347	BWL 6985	18.7	40S	18.3	100S*	2.2	10S	18.4	60S	46	89
348	IPPSN2019-348	BWL 6986	2.7	10MS	2.2	10MS	0.2	TS	2.4	10S	35	36
349	IPPSN2019-349	BWL 6987	1.4	10MS	3.0	10S	3.8	10S	3.8	10S	36	49
350	IPPSN2019-350	BWL 6988	36.0	80S	11.2	40MS	1.4	5S	6.9	20S	46	89
351	IPPSN2019-351	BWL 6997	6.7	20MS	3.7	10S	1.2	5S	12.3	40S	46	68
352	IPPSN2019-352	BWL 6998	6.8	20S	9.4	40S	1.0	5MS	11.5	40S	35	68
353	IPPSN2019-353	BWL 7115	2.7	10S	4.1	20S	5.0	20S	15.5	40S	35	46
354	IPPSN2019-354	BWL 7132	2.3	10MS	0.1	TMR	5.4	20S	9.8	40S	35	46
355	IPPSN2019-355	BWL 7402	2.1	10MR	0.9	TR	3.2	10S	4.6	10S	35	46
356	IPPSN2019-356	BWL 7411	3.8	10MS	1.4	10MS	2.2	10S	10.3	40S	35	46
357	IPPSN2019-357	BWL 7416	46.0	80S	21.5	100S	8.2	40S	2.8	10S	45	78
358	IPPSN2019-358	BWL 7423	37.3	60S	5.0	20S	4.0	20S	7.6	20MS	35	46
359	IPPSN2019-359	BWL 7443	45.0	100S	8.1	40S	1.8	5S	13.6	40S	35	47
360	IPPSN2019-360	BWL 7449	45.0	80S	7.4	40S	8.2	40S	12.3	60S	45	78
360A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**80.0**	**100S**	**80.0**	**100S**	**75.0**	**100S**	**68**	**99**
361	IPPSN2019-361	BWL 7464	41.7	80S	19.1	60S	3.2	10MS	7.0	40S	36	56
362	IPPSN2019-362	BWL 7466	13.5	40S	2.7	10MS	1.0	5S	11.9	40S	36	57
363	IPPSN2019-363	BWL 7468	42.0	80S	2.2	10S	0.0	TR	3.5	10MS	46	68
364	IPPSN2019-364	BWL 7478	7.0	20MS	3.4	10S	0.6	5MR	0.6	5MS	47	78
365	IPPSN2019-365	BWL 7495	5.3	10S	0.1	TMR	6.0	10S	3.9	20S	57	78
366	IPPSN2019-366	BWL 7499	3.7	10MS	0.7	5MS	0.2	TS	8.6	60S*	46	68
367	IPPSN2019-367	BWL 7500	2.2	5S	0.0	TR	2.6	10S	2.5	10S	47	78
368	IPPSN2019-368	BWL 7501	1.0	5MS	0.7	10MR	9.4	40S	3.0	10S	45	78
369	IPPSN2019-369	BWL 7519	4.7	20MS	19.4	80S	4.6	20S	1.3	5S	35	78
370	IPPSN2019-370	BWL 7566	9.4	20S	0.7	10MR	0.0	0	1.1	10MS	35	78
371	IPPSN2019-371	BWL 7567	7.7	20S	2.1	10MS	1.0	5S	8.5	60S*	35	68
372	IPPSN2019-372	BWL 7568	18.4	40S	1.4	10MS	2.0	5S	1.9	10S	35	68
373	IPPSN2019-373	BWL 7629	28.7	80S	3.4	20S	5.2	20S	3.0	20S	46	78
374	IPPSN2019-374	BWL 7630	30.0	60S	1.6	10MS	4.2	20S	8.9	20S	36	78
375	IPPSN2019-375	BWL 7631	29.5	60S	1.8	10MS	5.0	20S	11.5	40S	46	89
376	IPPSN2019-376	BWL 7632	9.5	20S	2.4	10S	0.6	5MR	3.0	10S	46	78
377	IPPSN2019-377	BWL 7633	8.3	40MR	4.4	20MS	6.2	20S	13.5	40S	46	78
378	IPPSN2019-378	BWL 7634	10.3	20MS	1.6	5S	1.0	5S	18.4	40S	46	78
379	IPPSN2019-379	BWL 7635	50.7	80S	9.4	20S	8.2	40S	10.1	40S	46	68
380	IPPSN2019-380	BWL 7636	50.7	80S	17.1	60S	0.2	TS	8.8	40S	47	68
380A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**83.3**	**100S**	**76.0**	**80S**	**77.5**	**100S**	**78**	**99**
381	IPPSN2019-381	BWL 7637	36.4	60S	0.0	TR	4.0	20S	5.6	40S	46	68
382	IPPSN2019-382	BWL 7638	18.0	60S	1.4	10MS	4.0	20S	6.5	40S	46	78
383	IPPSN2019-383	BWL 7639	28.4	60S	2.7	20MS	17.4	80S*	1.9	10S	46	68
384	IPPSN2019-384	BWL 7640	56.3	80S	4.5	20MS	0.4	5MR	22.4	60S	46	89
385	IPPSN2019-385	BWL 7641	20.0	80S	18.4	60S	13.2	40S	26.8	60S	35	78
386	IPPSN2019-386	BWL 7642	20.2	80S	14.1	60S*	3.8	10S	25.8	60S	36	78
387	IPPSN2019-387	BWL 7643	2.2	10MS	0.7	5MS	1.2	5S	7.8	40S	35	56
388	IPPSN2019-388	BWL 7644	5.5	10S	5.4	10S	8.4	40S	15.8	40S	46	78
389	IPPSN2019-389	BWL 7645	50.0	80S	24.4	80S	5.8	20S	9.9	40S	35	68
390	IPPSN2019-390	BWL 7834	17.8	40S	2.7	15MS	8.0	40S	9.0	40S	46	78
391	IPPSN2019-391	BWL 7838	17.8	40S	3.5	10MS	9.2	40S	2.8	10S	35	57
392	IPPSN2019-392	BWL 7854	4.2	20MS	3.9	10S	0.0	0	0.8	5S	36	68
393	IPPSN2019-393	BWL 7885	5.4	20MS	3.7	10S	8.2	40S	2.6	10S	46	78
394	IPPSN2019-394	BWL 7887	13.7	60MS	4.4	10S	4.2	20S	0.6	5S	46	78
395	IPPSN2019-395	BWL 7889	49.5	100S	8.4	20S	2.2	10S	1.1	5MS	36	67
396	IPPSN2019-396	BWL 7906	16.8	40S	13.8	40S	3.2	10S	3.4	10S	35	46
397	IPPSN2019-397	BWL 7936	8.9	30MS	30.7	100S	2.0	10S	3.3	10MS	46	78
398	IPPSN2019-398	BWL 7937	11.5	20S	13.7	30S	9.0	40S	5.6	10S	35	46

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
399	IPPSN2019-399	BWL 7976	16.8	40S	3.0	10S	2.2	10S	0.8	5MS	36	78
400	IPPSN2019-400	BWL 7981	22.5	60S	3.1	10S	5.0	10S	10.3	40S	46	68
400A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**83.3**	**100S**	**80.0**	**100S**	**72.5**	**100S**	**68**	**99**
401	IPPSN2019-401	BWL 8005	34.2	80S	1.4	10MS	0.2	TS	15.3	60S	46	78
402	IPPSN2019-402	BWL 8010	28.4	60S	1.4	10MS	0.0	0	30.0	60S	35	68
403	IPPSN2019-403	BWL 8151	12.1	40S	2.7	10MS	1.0	5MS	14.5	60S	35	78
404	IPPSN2019-404	BWL 8155	9.4	40MS	3.5	10MS	1.0	5MS	2.4	10S	36	78
405	IPPSN2019-405	BWL 8157	31.4	80S	9.7	20MS	0.2	TS	6.5	20S	47	89
406	IPPSN2019-406	BWL 8166	7.4	40MS	1.4	10MS	16.0	80S*	0.2	TS	35	68
407	IPPSN2019-407	BWL 8267	16.1	40S	4.7	20MS	8.0	40S	5.7	20S	46	78
408	IPPSN2019-408	BWL 8314	4.7	20MS	1.4	10MS	4.6	20S	4.4	10S	36	78
409	IPPSN2019-409	BWL 8354	19.0	40S	3.9	10S	4.0	20S	15.4	60S	46	78
410	IPPSN2019-410	BWL 8357	10.7	40MS	6.9	20S	15.2	60S	7.0	20MS	35	78
411	IPPSN2019-411	BWL 8447	17.0	40S	5.0	20MS	6.2	20S	5.3	20S	46	78
412	IPPSN2019-412	BWL 8458	14.7	40S	5.4	20MS	0.2	TS	5.4	20S	45	67
413	IPPSN2019-413	BWL 8459	14.7	40MS	1.4	10MS	0.6	5MR	8.9	40S	36	68
414	IPPSN2019-414	BWL 8515	10.5	20S	3.0	10S	2.2	5S	12.6	40S	46	89
415	IPPSN2019-415	BWL 8567	24.1	60S	2.1	10MS	0.2	TS	4.8	20S	46	89
416	IPPSN2019-416	BWL 8599	10.7	20S	12.2	60S*	3.2	10S	15.5	60S	46	78
417	IPPSN2019-417	BWL 8621	7.5	40MR	9.1	20S	4.0	10S	13.5	40S	46	89
418	IPPSN2019-418	BWL 8801	3.5	20MR	5.9	15MS	0.2	TS	2.2	10S	46	78
419	IPPSN2019-419	BWL 8802	6.7	20MS	11.7	40S	0.2	TS	12.0	40S	46	78
420	IPPSN2019-420	BWL 8803	24.2	60S	4.1	20MS	4.2	10S	22.8	60S	45	78
420A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**72.5**	**80S**	**78**	**99**
421	IPPSN2019-421	BWL 8804	17.5	40S	2.7	20MS	1.0	5S	10.4	20S	46	78
422	IPPSN2019-422	BWL 8805	15.3	40MS	2.7	10MS	1.4	5S	6.2	20S	36	68
423	IPPSN2019-423	BWL 8806	2.5	10MS	0.7	10MR	0.0	0	27.6	60S	46	78
424	IPPSN2019-424	BWL 8807	9.0	20MS	2.0	10MS	5.0	20S	7.8	40S	36	68
425	IPPSN2019-425	BWL 8808	6.3	15MS	8.4	40S	1.0	5S	11.1	40S	46	68
426	IPPSN2019-426	BWL 8809	24.7	40S	3.1	10S	0.2	TS	10.6	40S	45	78
427	IPPSN2019-427	BWL 8810	26.0	60S	5.8	10S	12.0	20S	11.6	40S	46	78
428	IPPSN2019-428	BWL 8811	21.4	40S	5.0	20S	2.2	10S	11.0	40S	47	78
429	IPPSN2019-429	BWL 8812	24.0	60S	4.8	20MS	6.0	20S	6.0	20MS	46	78
430	IPPSN2019-430	BWL 8813	8.4	20S	2.1	15MS	0.0	0	12.4	20S	36	68
431	IPPSN2019-431	BWL 8814	3.7	20MS	2.9	15MS	7.0	20S	18.1	60S	35	68
432	IPPSN2019-432	BWL 8815	10.7	20MS	17.4	100S*	2.2	10S	11.6	40S	46	78
433	IPPSN2019-433	BWL 8816	4.1	20S	2.5	10S	0.2	TS	4.0	10S	35	68
434	IPPSN2019-434	BWL 8817	2.7	10MS	1.7	10MS	0.0	0	2.9	10S	35	78
435	IPPSN2019-435	BWL 8818	10.5	20S	7.0	20MS	9.0	20S	9.8	40S	35	78
436	IPPSN2019-436	BWL 8819	8.0	20MS	0.9	5S	0.6	5MR	13.0	40S	35	89
437	IPPSN2019-437	BWL 8820	4.4	20MS	10.9	60S*	1.0	5S	1.3	5MS	45	78
438	IPPSN2019-438	BWL 8821	4.2	10MS	1.8	10S	3.2	10S	7.4	20S	45	78
439	IPPSN2019-439	BWL 8822	9.5	60MS*	19.1	100S	4.2	10S	9.5	40S	46	78
440	IPPSN2019-440	BWL 8823	20.1	60S	11.4	60S*	24.0	80S	9.4	20S	57	89
440A	**INFECTOR**	**INFECTOR**	**76.7**	**100S**	**90.0**	**100S**	**64.2**	**100S**	**72.5**	**80S**	**68**	**99**
441	IPPSN2019-441	BWL 8824	6.9	20MS	11.7	40S	4.8	20S	18.8	40S	45	78
442	IPPSN2019-442	BWL 8825	13.4	40S	1.4	10MS	2.2	10S	4.8	10S	46	89
443	IPPSN2019-443	BWL 8826	9.4	20S	2.2	10MS	1.2	5S	4.6	10S	45	78
444	IPPSN2019-444	BWL 8827	5.5	20MS	7.4	40S	10.0	40S	8.4	20S	45	68
445	IPPSN2019-445	BWL 8828	1.9	10MR	0.4	5MR	5.2	20S	11.0	60S	46	89
446	IPPSN2019-446	BWL 8829	17.0	40S	2.4	10MS	5.2	20S	12.9	60S	46	89
447	IPPSN2019-447	BWL 8830	10.0	30S	0.1	TMR	8.2	40S	8.6	20S	45	78
448	IPPSN2019-448	BWL 8831	20.7	40S	7.4	20S	2.8	10MS	8.4	40S	46	78
449	IPPSN2019-449	BWL 8832	22.3	40S	6.2	20S	6.2	30S	13.6	40S	46	78
450	IPPSN2019-450	BWL 8833	4.2	10MS	2.7	15MS	8.2	40S	6.2	20S	36	78
451	IPPSN2019-451	BWL 8834	6.1	20MS	3.4	20MS	5.8	20S	6.0	20S	45	89
452	IPPSN2019-452	BWL 8835	3.6	10MS	2.0	10MS	1.0	5MS	5.0	10S	45	89
453	IPPSN2019-453	BWL 8836	1.6	10MS	0.1	TR	0.2	TS	5.1	10S	45	89
454	IPPSN2019-454	BWL 8837	23.5	80S	5.6	20S	4.2	20S	4.8	10S	56	89
455	IPPSN2019-455	BWL 8838	7.5	40MS	3.9	10S	2.8	10MS	4.9	20MS	56	89
456	IPPSN2019-456	BWL 8839	4.8	20MS	0.9	5S	8.2	40S	7.4	20S	46	89

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
457	IPPSN2019-457	BWL 8840	15.5	40S	1.9	5S	8.6	40S	9.4	20S	46	78
458	IPPSN2019-458	BWL 8841	32.7	60S	3.0	10MS	4.6	20S	4.9	10S	46	78
459	IPPSN2019-459	BWL 8842	1.5	10MS	0.1	TMR	2.2	10S	6.8	20S	45	78
460	IPPSN2019-460	BWL 8843	1.8	5MS	0.7	10MR	2.2	10S	1.6	10S	46	68
460A	**INFECTOR**	**INFECTOR**	**80.0**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**72.5**	**100S**	**68**	**99**
461	IPPSN2019-461	BWL 8844	7.7	20S	1.5	10MS	4.4	10S	9.8	20S	35	36
462	IPPSN2019-462	BWL 8845	4.1	10MS	2.3	10MS	1.2	5S	12.3	40S	35	45
463	IPPSN2019-463	BWL 8846	2.2	5MS	0.1	TR	4.8	20S	3.8	10S	35	46
464	IPPSN2019-464	BWL 8847	3.3	20MR	0.1	TR	4.0	20S	4.5	20S	35	36
465	IPPSN2019-465	BWL 8848	1.7	10MR	0.1	TR	1.0	5MS	3.6	10MS	24	46
466	IPPSN2019-466	BWL 8849	3.9	20MS	0.1	TMR	12.8	40S	5.8	20S	35	45
467	IPPSN2019-467	BWL 8850	23.8	40S	2.1	10MS	4.2	20S	0.7	5S	35	68
468	IPPSN2019-468	BWL 8851	17.3	20S	4.7	20S	0.0	0	0.6	5MS	36	68
469	IPPSN2019-469	BWL 8852	2.7	5MS	12.4	40S	3.6	10S	0.8	5S	36	46
470	IPPSN2019-470	BWL 8853	7.4	20S	0.8	5MS	10.8	40S	1.9	10S	46	78
471	IPPSN2019-471	BWL 8854	27.7	60S	1.4	10MS	8.0	40S	3.9	20S	36	46
472	IPPSN2019-472	BWL 8855	5.7	10S	0.1	TR	9.8	40S	2.3	10S	36	78
473	IPPSN2019-473	BWL 8859	22.2	60MS	1.7	10S	5.0	20S	7.6	20S	46	78
474	IPPSN2019-474	BWL 8860	5.8	40MR	0.8	5MS	6.0	20S	4.1	20MS	45	68
475	IPPSN2019-475	BWL 8861	17.0	40S	22.0	80S	13.2	20S	10.6	40S	45	78
476	IPPSN2019-476	BWL 8862	10.2	30S	1.7	10S	4.2	20S	10.0	40S	46	78
477	IPPSN2019-477	BWL 8863	6.8	20MS	3.2	10S	2.0	10S	1.3	5S	45	78
478	IPPSN2019-478	BWL 8864	4.8	20MS	1.1	5S	1.0	5S	5.6	40S	46	78
479	IPPSN2019-479	BWL 8865	11.7	20S	1.4	10MS	8.2	40S	13.3	40S	46	78
480	IPPSN2019-480	BWL 8866	22.8	40S	2.3	10MS	4.0	20S	10.0	20S	56	89
480A	**INFECTOR**	**INFECTOR**	**80.0**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**75.0**	**100S**	**68**	**99**
481	IPPSN2019-481	BWL 8867	32.1	60S	6.0	20S	0.2	TS	5.7	10S	46	89
482	IPPSN2019-482	BWL 8868	15.7	40S	3.5	20MS	2.0	5S	6.8	20MS	46	89
483	IPPSN2019-483	BWL 8869	2.9	10MS	3.1	10S	3.0	10S	4.6	10S	35	56
484	IPPSN2019-484	BWL 8870	24.0	60MS	3.9	10S	2.2	10S	6.0	20S	45	79
485	IPPSN2019-485	BWL 8871	15.7	40S	1.5	10MS	2.0	5S	3.6	10S	57	89
486	IPPSN2019-486	BWL 8872	12.2	20S	0.1	TR	0.0	0	5.6	10S	45	89
487	IPPSN2019-487	DW 569	14.3	40MS	4.1	20MS	3.6	10S	4.4	10S	45	78
488	IPPSN2019-488	DW 570	11.7	40MS	0.1	TR	1.2	5S	2.5	10S	46	78
489	IPPSN2019-489	DW 571	13.0	40MS	0.9	10MR	1.0	5S	1.9	5S	46	78
490	IPPSN2019-490	DW 572	12.5	40MS	1.5	10MS	2.2	10S	2.2	5S	35	78
491	IPPSN2019-491	DW 573	25.7	40S	3.6	20MS	1.0	5S	2.8	5S	35	78
492	IPPSN2019-492	WG 1272	11.7	40S	5.7	10S	7.0	20S	3.4	10MS	35	78
493	IPPSN2019-493	WG 1720	14.0	40MS	15.4	80S*	5.0	20S	7.3	20S	35	78
494	IPPSN2019-494	WG 1728	25.5	60S	16.3	40S	12.2	60S*	7.9	20S	46	78
495	IPPSN2019-495	WG 1730	30.7	60S	16.7	60S	0.2	TS	7.4	20S	46	89
496	IPPSN2019-496	WG 1760	5.4	20MS	0.8	5MS	0.0	0	8.4	40S	45	89
497	IPPSN2019-497	WG 1771	3.5	10MS	2.4	10S	5.0	20S	1.5	5S	45	89
498	IPPSN2019-498	WG 1772	33.0	60S	18.4	60S	2.2	10MS	1.6	5S	45	89
499	IPPSN2019-499	WG 1786	6.8	20MS	15.5	80S	8.0	20S	10.3	40S	35	78
500	IPPSN2019-500	WG 1796	22.3	60S	1.1	5MS	8.2	40S	10.6	40S	46	89
500A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**86.7**	**100S**	**76.0**	**80S**	**72.5**	**80S**	**68**	**99**
501	IPPSN2019-501	WG 1808	15.7	40S	6.4	20S	3.6	10S	4.8	10S	45	78
502	IPPSN2019-502	WG 1825	32.3	60S	2.3	10MS	4.8	20S	2.5	10S	45	78
503	IPPSN2019-503	WG 1826	12.5	40S	2.9	10MS	1.2	5S	9.1	20S	35	78
504	IPPSN2019-504	WG 1833	17.8	40S	2.1	10MS	0.0	0	13.4	40S	35	78
505	IPPSN2019-505	WG 1875	28.0	60S	7.0	40MS	0.2	TS	2.9	10S	45	89
506	IPPSN2019-506	WG 1892	6.5	40MR	13.8	60S	3.8	10S	10.3	20S	35	89
507	IPPSN2019-507	WG 1899	5.7	20MS	1.4	10MS	1.0	5MS	8.8	20S	35	89
508	IPPSN2019-508	WG 1916	6.7	20MS	1.4	10MS	0.8	5MS	13.4	40S	35	47
509	IPPSN2019-509	WG 1921	21.0	60S	4.1	20S	2.0	10S	7.3	20S	45	78
510	IPPSN2019-510	WG 1929	7.0	20S	1.6	5S	2.8	10S	15.4	40S	35	57
511	IPPSN2019-511	WG 1996	8.4	20S	2.9	10MS	1.0	5MS	16.4	40S	46	89
512	IPPSN2019-512	WG 1999	25.2	60S	2.0	10MS	0.2	TS	18.9	40S	45	78
513	IPPSN2019-513	WG 2004	8.3	20S	3.5	10MS	2.0	10S	9.1	20S	46	89
514	IPPSN2019-514	DWG 2044	28.3	60S	6.1	20S	0.2	TS	3.6	10S	46	68

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
515	IPPSN2019-515	DWG 2052	16.9	60S	2.6	10S	2.0	10S	10.5	60S*	56	99
JNKVV, Powarkheda												
516	IPPSN2019-516	MP 20 - 01	4.8	30MR	18.2	60S	14.4	50S	48.8	80S	46	99
517	IPPSN2019-517	MP 20 - 02	6.1	20S	2.6	10S	0.2	TS	29.8	60S	46	89
518	IPPSN2019-518	MP 20 - 03	13.0	20S	3.1	10MS	0.0	0	25.8	40S	46	78
519	IPPSN2019-519	MP 20 - 04	29.0	100S	9.4	20S	2.0	10S	35.1	60S	46	78
520	IPPSN2019-520	MPO 20 - 05	21.0	100S	4.8	20S	6.0	30S	18.4	40S	45	89
520A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**90.0**	**100S**	**80.0**	**100S**	**75.0**	**100S**	**78**	**99**
521	IPPSN2019-521	MP 20 - 06	17.2	40S	7.0	20S	2.0	10S	6.9	10S	45	89
522	IPPSN2019-522	MP 20 - 07	17.5	40S	19.1	60S	7.2	20MS	12.1	40S	57	89
523	IPPSN2019-523	MPO 20 - 08	11.8	60S*	2.8	20MS	5.6	20S	0.1	TMS	46	89
524	IPPSN2019-524	MP 20 - 09	18.0	40S	13.3	20S	7.0	20S	18.7	60S	35	46
525	IPPSN2019-525	MP 20 - 10	6.4	20S	11.0	40S	3.6	10S	29.1	60S	46	89
526	IPPSN2019-526	MPO 20 - 11	5.9	20S	0.9	5S	0.0	0	5.5	20S	46	89
527	IPPSN2019-527	MP 20 - 12	17.4	80S	20.0	60S	8.2	20S	35.5	80S	47	89
528	IPPSN2019-528	MPO 20 - 13	15.1	80S*	5.6	20S	2.4	10S	10.6	60S	46	89
529	IPPSN2019-529	MP 20 - 14	3.9	10MS	2.4	5S	5.0	20S	8.1	40S	35	78
530	IPPSN2019-530	MP 20 - 15	4.4	20MS	16.0	80S*	12.4	30S	41.5	60S	45	78
531	IPPSN2019-531	MPO 20 - 16	4.0	10S	1.9	5S	0.2	TS	8.9	60S*	46	89
532	IPPSN2019-532	MPO 20 - 17	7.3	10S	0.4	5MR	0.0	0	2.5	10MS	46	78
533	IPPSN2019-533	MPO 20 - 18	4.0	10MS	8.4	40S	0.4	5MR	3.8	20MS	46	78
534	IPPSN2019-534	MP 20 - 19	13.3	40MS	29.3	60S	38.0	60S	40.0	60S	45	89
535	IPPSN2019-535	MPO 20 - 20	2.5	10S	0.1	TR	10.0	40S	7.3	40S	46	78
536	IPPSN2019-536	MP 20 - 21	1.9	5MS	1.0	5S	5.0	20S	22.4	40S	46	89
537	IPPSN2019-537	MP 20 - 22	9.0	20MS	1.6	5S	0.2	TS	28.8	60S	46	89
538	IPPSN2019-538	MP 20 - 23	1.0	10MR	0.1	TR	2.0	10S	39.5	80S	35	78
539	IPPSN2019-539	MP 20 - 24	3.0	10MS	15.4	60S	8.2	20S	36.5	60S	46	89
540	IPPSN2019-540	MP 20 - 25	1.4	10MS	6.0	20S	11.0	40S	33.3	60S	47	89
540A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**90.0**	**100S**	**80.0**	**100S**	**72.5**	**100S**	**78**	**99**
541	IPPSN2019-541	MP 20 - 26	31.7	60S	11.7	30S	14.0	40S	21.0	40S	46	89
542	IPPSN2019-542	MP 20 - 27	2.7	10S	38.3	100S	18.0	40S	15.6	40S	46	78
543	IPPSN2019-543	MP 20 - 28	8.3	20S	1.4	5MS	0.0	0	11.3	40S	46	89
544	IPPSN2019-544	MP 20 - 29	11.7	30S	13.7	40S	2.8	10MS	23.4	60S	45	89
545	IPPSN2019-545	MP 20 - 30	2.8	10MS	15.7	40S	4.6	10S	31.3	60S	46	78
Lokbharti												
546	IPPSN2019-546	LOK-2019-1	0.4	10R	0.9	5S	4.2	20S	25.6	60S	56	89
547	IPPSN2019-547	LOK-2019-2	0.2	TMR	3.4	20S	4.0	20S	28.6	60S	47	89
548	IPPSN2019-548	LOK-2019-3	9.1	20S	60.0	80S	52.0	60S	37.5	80S	46	89
549	IPPSN2019-549	LOK-2019-4	2.1	10MS	4.7	20MS	3.0	10S	29.5	60S	46	89
550	IPPSN2019-550	LOK-2019-5	0.7	5MR	0.0	TR	1.0	10MR	26.5	60S	45	99
551	IPPSN2019-551	LOK-2019-6	19.3	60S	0.1	TR	1.2	5S	33.8	60S	45	89
552	IPPSN2019-552	LOK-2019-7	0.9	10MR	1.4	10MS	0.8	5MS	26.8	60S	45	89
BHU, Varanasi												
553	IPPSN2019-553	HUWL 1901	2.0	5MS	19.4	80S	1.6	10MS	45.0	60S	35	48
554	IPPSN2019-554	HUWL 1902	2.0	10MS	1.7	5S	4.0	20S	43.8	60S	46	89
555	IPPSN2019-555	HUWL 1903	33.3	80S	58.3	80S	42.0	60S	40.0	60S	46	89
556	IPPSN2019-556	HUWL 1904	10.1	30S	20.4	40S	16.0	40S	26.4	60S	35	78
557	IPPSN2019-557	HUWL 1905	5.5	20MS	5.0	30S	7.0	20S	17.6	40S	45	78
558	IPPSN2019-558	HUWL 1906	6.2	20S	5.7	30S	0.4	5MR	19.5	40S	35	78
559	IPPSN2019-559	HUWL 1907	2.9	10MS	1.8	5S	0.2	TS	38.8	60S	45	89
560	IPPSN2019-560	HUWL 1908	10.2	20S	5.1	20S	20.2	60S	40.6	60S	46	89
560A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**80.0**	**100S**	**76.0**	**80S**	**75.0**	**100S**	**79**	**99**
561	IPPSN2019-561	HUWL 1909	21.9	60S	5.9	20S	4.0	10S	31.1	60S	46	89
562	IPPSN2019-562	HUWL 1910	21.0	40S	6.2	20MS	20.0	40S	47.5	60S	45	89
563	IPPSN2019-563	HUWL 1911	0.8	5MR	0.1	TR	0.2	TS	47.0	60S	46	89
564	IPPSN2019-564	HUWL 1912	0.9	10MR	0.2	TMS	0.0	TR	41.5	60S	36	89
565	IPPSN2019-565	HUWL 1913	44.0	100S	30.7	60S	30.0	60S	29.5	60S	45	89
566	IPPSN2019-566	HUWL 1914	2.1	10MR	0.1	TMR	1.0	5S	46.3	60S	46	89
567	IPPSN2019-567	HUWL 1915	7.5	20S	2.1	10MS	8.2	40S	51.3	80S	46	89
568	IPPSN2019-568	HUWL 1916	38.7	100S	51.3	80S	34.0	60S	37.5	60S	46	89
569	IPPSN2019-569	HUWL 1917	3.7	10MS	2.2	5S	0.0	0	55.0	80S	45	89

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
570	IPPSN2019-570	HUWL 1918	3.4	10MS	1.8	10S	0.2	TS	55.0	80S	46	89
571	IPPSN2019-571	HUWL 1919	37.7	80S	2.9	10MS	0.0	0	43.1	60S	46	99
572	IPPSN2019-572	HUWL 1920	6.4	10S	5.7	20S	6.2	20MS	37.9	80S	35	46
573	IPPSN2019-573	HUWL 1921	21.7	100S	6.4	20S	1.0	5S	46.3	60S	36	49
574	IPPSN2019-574	HUWL 1922	5.1	20MS	22.7	80S	5.8	10S	34.0	60S	46	89
575	IPPSN2019-575	HUWL 1923	4.7	20MS	2.2	10MS	0.4	5MR	23.1	40S	45	89
576	IPPSN2019-576	HUWL 1924	20.0	60S	2.2	10MS	1.0	5S	25.0	40S	46	89
577	IPPSN2019-577	HUWL 1925	9.7	20S	2.2	10MS	4.0	20S	19.5	40S	46	78
578	IPPSN2019-578	HUWL 1926	7.9	20MS	2.7	10MS	1.2	5S	17.4	40S	46	78
579	IPPSN2019-579	HUWL 1927	5.8	20S	2.9	15MS	0.2	TS	17.9	40S	46	78
580	IPPSN2019-580	HUWL 1928	5.7	20S	1.5	10MR	2.6	10MS	26.4	40S	46	89
580A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**90.0**	**100S**	**80.0**	**100S**	**70.0**	**100S**	**78**	**99**
581	IPPSN2019-581	HUWL 1929	29.7	80S	15.4	60S	11.2	40S	41.3	80S	45	89
582	IPPSN2019-582	HUWL 1930	19.7	40S	17.5	80S	0.2	TS	19.3	40S	46	89
583	IPPSN2019-583	HUWL 1931	28.0	40S	11.4	60S*	0.2	TS	23.1	40S	45	78
584	IPPSN2019-584	HUWL 1932	13.3	20S	10.4	40S	3.2	10S	12.0	40S	46	78
585	IPPSN2019-585	HUWL 1933	2.9	10MS	9.0	20S	12.0	20S	16.0	40S	36	78
586	IPPSN2019-586	HUWL 1934	27.5	100S	23.0	60S	28.0	60S	22.8	40S	36	78
587	IPPSN2019-587	HUWL 1935	17.3	60S	3.5	10S	5.0	10S	25.0	40S	45	78
588	IPPSN2019-588	HUWL 1936	24.0	40S	17.7	60S	7.0	20S	19.1	40S	46	67
589	IPPSN2019-589	HUWL 1937	44.7	80S	3.9	20MS	0.2	TS	20.6	60S	35	78
590	IPPSN2019-590	HUWL 1938	17.7	40S	13.0	40S	4.0	10S	26.6	40S	46	89
591	IPPSN2019-591	HUWL 1939	23.3	60S	13.0	20S	8.6	20MS	45.0	60S	46	89
592	IPPSN2019-592	HUWL 1940	21.0	40S	18.5	40S	14.2	30S	33.9	60S	35	78
SKUAST - Jammu												
593	IPPSN2019-593	JAUW 685	12.0	20S	20.9	80S	23.2	40S	23.4	60S	46	78
594	IPPSN2019-594	JAUW 686	8.2	40S	25.3	80S	11.4	20S	26.4	40S	46	89
595	IPPSN2019-595	JAUW 687	5.0	20MS	5.2	20MS	2.4	10S	16.4	40S	35	68
596	IPPSN2019-596	JAUW 688	10.0	40S	1.1	5S	1.0	5MR	32.3	60S	45	89
597	IPPSN2019-597	JAUW 689	4.4	10S	0.8	5MS	5.2	20MS	18.9	40S	46	89
598	IPPSN2019-598	JAUW 690	3.7	10MS	3.4	10S	4.0	10S	15.6	40S	46	89
599	IPPSN2019-599	JAUW 691	9.9	20S	3.1	10S	3.2	10S	8.7	20MS	35	35
600	IPPSN2019-600	JAUW 692	17.5	40S	1.4	10MS	2.0	10S	12.6	40S	46	89
600A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**72.5**	**80S**	**68**	**99**
601	IPPSN2019-601	JAUW 693	10.0	40MS	2.2	10MS	2.0	10S	14.3	40S	46	78
602	IPPSN2019-602	JAUW 694	6.9	20S	2.1	10MS	0.0	0	2.0	10S	46	89
SKUAST - Srinagar												
603	IPPSN2019-603	SKW 357	37.7	80S	38.0	80S	19.0	40S	21.1	40S	46	89
604	IPPSN2019-604	SKW 358	23.7	40S	19.1	60S	4.2	10S	19.3	60S	46	89
605	IPPSN2019-605	SKW 359	19.3	60S	23.0	40S	11.4	20S	51.3	80S	56	89
606	IPPSN2019-606	SKW 360	0.1	TR	18.1	60S	9.8	20S	21.4	60S	46	89
MPUAT, Udaipur												
607	IPPSN2019-607	PWU 10	2.0	20MR	1.8	10S	1.0	5S	2.6	10S	46	89
608	IPPSN2019-608	PWU 6	3.7	10MS	1.8	5S	1.0	5S	48.8	60S	46	89
609	IPPSN2019-609	PWU 8	8.5	30S	1.0	5S	1.6	10MS	8.6	40S	46	89
610	IPPSN2019-610	PWU 11	6.7	20S	0.9	5S	1.2	5S	3.3	10S	46	89
611	IPPSN2019-611	PWU 3	10.8	40S	2.3	10MS	2.2	10S	1.9	10MS	45	89
612	IPPSN2019-612	PWU 1	0.9	10MR	3.4	10S	0.4	5MR	55.0	80S	35	89
613	IPPSN2019-613	PWU 13	2.2	5MS	9.5	40S	3.8	10S	35.8	80S	46	89
614	IPPSN2019-614	PWU 4	2.4	10MS	0.1	TR	0.2	TS	5.3	20S	35	67
BARC, Mumbai												
615	IPPSN2019-615	TAW119	21.7	40S	5.7	20S	2.6	10MS	4.1	10S	46	78
616	IPPSN2019-616	TAW122	12.7	40S	30.3	100S	7.0	10S	10.3	40S	35	36
617	IPPSN2019-617	TAW123	29.8	80S	14.7	40S	2.2	10S	1.9	10S	36	89
618	IPPSN2019-618	TAW132	0.7	10MR	3.4	20MS	1.0	5S	16.1	40S	35	78
619	IPPSN2019-619	TAW134	2.0	10MS	3.4	20S	8.2	40S	15.3	60S	35	78
620	IPPSN2019-620	TAW135	7.4	20S	17.7	80S	7.2	20MS	12.4	40S	46	89
620A	**INFECTOR**	**INFECTOR**	**76.7**	**100S**	**86.7**	**100S**	**76.0**	**80S**	**72.5**	**80S**	**68**	**99**
621	IPPSN2019-621	TAW136	9.7	40S	3.6	20MS	8.2	40S	7.6	20S	45	78
622	IPPSN2019-622	TAW182	6.9	20MS	8.7	20S	7.4	20S	10.5	40S	46	89
623	IPPSN2019-623	TAW183	2.7	5MS	1.0	5S	0.2	TS	11.3	40S	46	89

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
624	IPPSN2019-624	TAW184	4.7	10MS	1.8	10S	0.2	TS	17.1	40S	45	89
BAU, Ranchi												
625	IPPSN2019-625	JKW 280	4.5	10S	7.2	40S	2.0	10S	28.6	60S	35	89
626	IPPSN2019-626	JKW 281	7.3	20MS	1.4	10MS	1.0	5MS	20.4	60S	34	68
627	IPPSN2019-627	JKW 282	12.0	20S	1.4	10MS	0.0	0	10.3	40S	35	68
628	IPPSN2019-628	JKW 283	8.4	20S	41.7	80S	33.0	60S	28.8	60S	45	89
629	IPPSN2019-629	JKW 284	26.3	40S	0.1	TR	1.6	10MS	7.5	40S	45	78
630	IPPSN2019-630	JKW 285	10.7	40MS	3.6	20S	1.0	5MS	6.1	20MS	46	89
631	IPPSN2019-631	JKW 286	18.7	40S	0.8	5MS	1.0	5S	16.3	40S	34	89
632	IPPSN2019-632	JKW 287	2.4	10S	2.1	10MS	4.0	10S	14.6	40S	46	89
633	IPPSN2019-633	JKW 288	0.3	5R	4.1	20S	0.0	0	12.0	40S	46	78
634	IPPSN2019-634	JKW 289	17.3	40S	27.7	100S	12.0	40S	2.6	10MS	46	89
RVSKVV, Gwalior												
635	IPPSN2019-635	RVW 4340	9.0	20MS	2.1	10MS	2.8	10MS	26.4	60S	36	89
636	IPPSN2019-636	RVW 4341	1.1	10MR	23.0	100S	0.6	5MR	28.3	60S	46	89
637	IPPSN2019-637	RVW 4342	0.4	10R	0.1	TR	0.4	5MR	35.0	60S	46	89
638	IPPSN2019-638	RVW 4343	2.8	20MR	15.4	80S*	4.6	10S	30.6	60S	45	89
639	IPPSN2019-639	RVW 4344	13.7	30S	29.3	80S	20.2	40S	40.0	60S	45	89
640	IPPSN2019-640	RVW 4345	14.5	40MS	28.0	100S	13.0	30S	40.0	60S	36	89
640A	**INFECTOR**	**INFECTOR**	**73.3**	**100S**	**83.3**	**100S**	**80.0**	**100S**	**72.5**	**80S**	**68**	**99**
641	IPPSN2019-641	RVW 4346	31.7	80S	16.0	20S	11.4	20S	27.6	60S	45	89
642	IPPSN2019-642	RVW 4347	11.7	40MS	47.3	100S	40.2	60S	40.0	60S	46	89
643	IPPSN2019-643	RVW 4348	1.3	10MR	9.4	40S	8.2	40S	33.1	60S	46	89
644	IPPSN2019-644	RVW 4349	14.4	40S	10.1	20S	12.2	20S	34.4	60S	46	89
Parbhani												
645	IPPSN2019-645	PBN 1544	3.7	10S	0.7	5MS	2.0	10S	48.1	80S	46	89
646	IPPSN2019-646	PBN 622	9.7	20S	26.3	80S	19.4	40S	48.8	80S	46	89
647	IPPSN2019-647	PBN 4871-1	19.0	40S	22.7	60S	19.4	40S	45.0	60S	35	89
648	IPPSN2019-648	PBND 5128	2.3	10S	1.4	10MS	1.8	5S	19.5	40S	46	78
649	IPPSN2019-649	PBND 1625-01	1.7	10S	1.4	10MS	1.8	10MS	8.9	40S	45	78
SDAU, Vijapur												
650	IPPSN2019-650	VA 2018-05	0.4	10R	0.1	TMR	1.0	5MS	29.3	60S	45	99
651	IPPSN2019-651	VA 2018-08	5.7	20MS	11.7	20S	4.2	20S	32.5	60S	46	99
652	IPPSN2019-652	VA 2018-10	1.5	10MS	0.1	TR	14.6	60S	31.9	60S	46	99
653	IPPSN2019-653	VA 2018-13	0.0	TR	0.0	TR	1.2	5S	32.3	60S	46	99
654	IPPSN2019-654	VA 2018-06	0.3	5R	0.1	TR	0.0	0	57.5	80S	46	99
655	IPPSN2019-655	VA 2018-12	1.2	10MR	1.4	10MS	0.0	0	48.8	60S	45	99
656	IPPSN2019-656	VA 2018-15	2.7	20MS	6.4	20S	3.4	10MS	24.4	60S	46	89
657	IPPSN2019-657	VA 2018-09	1.1	5MS	14.1	80S*	0.2	TS	34.1	60S	46	89
658	IPPSN2019-658	VA 2018-03	1.7	10S	0.4	5MR	0.2	TS	27.6	60S	46	99
659	IPPSN2019-659	VA 2018-14	3.1	20MS	0.1	TR	2.8	10MS	20.8	40S	46	89
660	IPPSN2019-660	VA 2018-04	6.0	30MS	10.0	40S	1.0	5S	43.8	80S	57	99
660A	**INFECTOR**	**INFECTOR**	**73.3**	**100S**	**80.0**	**100S**	**80.0**	**100S**	**75.0**	**80S**	**68**	**99**
661	IPPSN2019-661	VA 2018-11	3.7	20MR	0.3	TMS	2.0	10S	33.9	60S	56	99
662	IPPSN2019-662	VA 2018-28	1.6	5MS	1.7	10S	1.8	10MS	51.3	80S	46	99
663	IPPSN2019-663	VA 2018-17	1.9	5S	0.9	5S	5.2	20S	41.9	60S	56	99
664	IPPSN2019-664	VA 2018-21	2.0	10MR	0.1	TR	0.2	TS	40.0	60S	46	99
665	IPPSN2019-665	VA 2018-22	6.4	30MS	9.4	20S	0.2	TS	40.9	60S	56	99
666	IPPSN2019-666	VA 2018-30	6.3	30S	0.4	5MR	1.0	5S	50.0	60S	46	99
667	IPPSN2019-667	VA 2019-01	3.5	10S	1.6	5S	1.2	5S	26.0	40S	46	89
668	IPPSN2019-668	VD 2018-16	3.6	10MS	0.7	10MR	4.6	20S	9.0	40S	46	78
669	IPPSN2019-669	VD 2018-14	1.6	10MR	1.4	10MS	2.8	10MS	3.6	20S	47	89
670	IPPSN2019-670	VD 2018-09	3.7	10S	2.5	10MS	1.0	5MS	5.9	20S	46	89
671	IPPSN2019-671	VD 2018-07	2.0	20MR	0.2	TMS	1.0	5S	9.8	40S	46	89
672	IPPSN2019-672	VD 2018-13	1.4	10MS	0.1	TR	0.2	TS	22.8	60S	46	99
673	IPPSN2019-673	VD 2018-12	2.7	10MS	0.1	TR	1.0	5MS	8.1	20S	47	89
674	IPPSN2019-674	J 18-16	2.3	20MR	0.8	5MS	0.0	0	65.0	80S	46	89
675	IPPSN2019-675	J 18-02	6.3	20S	32.7	80S	15.2	40S	55.0	80S	46	89
676	IPPSN2019-676	J 18-11	18.7	40S	16.4	60S	4.0	20S	37.5	60S	46	89
677	IPPSN2019-677	J 18-21	18.5	30S	34.0	80S	20.2	40S	48.1	60S	47	89
678	IPPSN2019-678	J 18-13	7.1	30MS	19.2	80S	12.0	20S	36.3	60S	45	89

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
679	IPPSN2019-679	J 18-30	5.4	20S	15.1	60S	0.2	TS	30.0	60S	57	89
680	IPPSN2019-680	JD 18-12	9.4	40S	13.8	40S	3.4	20MS	6.9	20MS	47	89
680A	**INFECTOR**	**INFECTOR**	**76.7**	**100S**	**90.0**	**100S**	**80.0**	**100S**	**75.0**	**80S**	**68**	**99**
681	IPPSN2019-681	J 18-32	10.3	40S	3.7	20S	5.0	10S	57.5	80S	45	89
682	IPPSN2019-682	DR- 17-09	6.4	20MS	11.1	40MS	5.0	20S	45.5	80S	46	99
683	IPPSN2019-683	DR-19-01	8.0	20S	0.7	10MR	0.6	5MR	31.1	60S	47	99
684	IPPSN2019-684	DR-18-11	3.7	20MS	0.4	5MR	0.4	5MR	12.4	80S*	46	99
IGKV, Bilaspur												
685	IPPSN2019-685	CG 1901	2.7	10MS	4.1	20S	0.0	0	60.0	80S	45	99
686	IPPSN2019-686	CG 1902	4.3	20MS	4.8	20S	5.4	20MS	51.3	80S	46	89
687	IPPSN2019-687	CG 1903	26.3	40S	36.3	60S	34.0	60S	52.5	80S	35	59
688	IPPSN2019-688	CG 1904	7.5	20MS	9.4	40S	10.4	20S	51.3	80S	46	89
689	IPPSN2019-689	CG 1905	4.2	10S	9.6	40S	0.8	5MS	52.5	80S	46	78
690	IPPSN2019-690	CG 1906	2.0	10MR	0.4	5MR	0.6	5MR	55.0	80S	46	99
691	IPPSN2019-691	CG 1907	9.7	20S	2.4	10S	0.2	TS	20.5	40S	46	89
692	IPPSN2019-692	CG 1908	5.7	20MS	2.9	15MS	0.4	5MR	40.0	60S	46	89
693	IPPSN2019-693	CG 1909	20.7	40S	7.4	20S	8.0	20S	34.9	60S	46	89
694	IPPSN2019-694	CG 1910	5.4	30MS	0.1	TR	0.0	0	60.0	80S	46	89
695	IPPSN2019-695	CG 1911	5.6	20S	0.9	5S	4.8	20S	57.5	80S	46	99
696	IPPSN2019-696	CG 1912	7.7	20S	0.9	5MS	1.0	5MS	45.0	60S	46	89
697	IPPSN2019-697	CG 1913	10.7	30S	7.2	20MS	2.8	10S	41.3	60S	46	89
698	IPPSN2019-698	CG 1914	21.3	40S	2.8	10MS	0.8	5MS	52.5	80S	46	89
699	IPPSN2019-699	CG 1915	12.4	40MS	9.5	20MS	7.0	20MS	47.5	60S	46	89
CSSRI, Karnal												
700	IPPSN2019-700	KRL 1911	8.7	40MS	1.4	10MS	8.2	20S	32.5	60S	45	89
700A	**INFECTOR**	**INFECTOR**	**80.0**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**72.5**	**80S**	**68**	**99**
701	IPPSN2019-701	KRL 1912	0.9	10MR	1.7	10S	2.2	10S	6.5	20MS	46	89
702	IPPSN2019-702	KRL 1913	22.7	60S	2.0	10MS	1.2	5S	9.3	40S	46	89
703	IPPSN2019-703	KRL 1914	6.4	20S	12.2	60S*	1.8	10MS	7.5	20S	35	78
704	IPPSN2019-704	KRL 1915	7.7	20S	3.1	10S	0.4	5MR	24.3	60S	35	89
705	IPPSN2019-705	KRL 1916	3.1	10MS	2.0	10MS	5.6	20S	32.6	60S	46	89
706	IPPSN2019-706	KRL 1917	19.4	40S	4.2	10MS	8.0	40S	22.4	60S	45	89
707	IPPSN2019-707	KRL 1918	12.0	40S	6.7	10S	4.2	20S	22.3	40S	46	78
708	IPPSN2019-708	KRL 1919	6.1	20S	32.7	100S	8.0	40S	44.0	60S	46	89
709	IPPSN2019-709	KRL 1920	14.0	30S	41.7	100S	34.0	60S	37.6	60S	46	78
710	IPPSN2019-710	KRL 1921	16.7	40S	2.9	10MS	20.2	60S	20.8	60S	46	78
711	IPPSN2019-711	KRL 1922	6.3	20MS	25.7	60S	32.0	40S	38.8	60S	46	99
712	IPPSN2019-712	KRL 1923	8.0	20MS	25.3	60S	30.0	60S	39.4	60S	46	99
713	IPPSN2019-713	KRL 1924	4.0	20MR	31.0	60S	38.2	60S	34.4	60S	46	99
714	IPPSN2019-714	KRL 1925	2.2	10MS	3.4	20S	0.2	TS	36.9	60S	46	89
715	IPPSN2019-715	KRL 1926	23.1	80S	4.3	20S	8.2	40S	35.5	60S	35	49
716	IPPSN2019-716	KRL 1927	39.0	80S	21.3	60S	6.0	20S	33.8	60S	56	99
717	IPPSN2019-717	KRL 1928	30.5	80S	14.3	30S	10.2	20S	47.5	80S	46	89
718	IPPSN2019-718	KRL 1929	27.3	80S	14.2	40S	6.2	20S	35.6	60S	57	99
719	IPPSN2019-719	KRL 1930	16.0	30S	17.3	40S	4.0	10S	45.0	80S	57	99
720	IPPSN2019-720	KRL 1931	3.3	20MR	4.6	20S	16.2	40S	48.8	80S	46	89
720A	**INFECTOR**	**INFECTOR**	**76.7**	**100S**	**80.0**	**100S**	**80.0**	**100S**	**75.0**	**100S**	**78**	**99**
721	IPPSN2019-721	KRL 1932	13.7	40MS	11.5	40S	16.0	40S	48.8	60S	46	89
722	IPPSN2019-722	KRL 1933	7.2	20MS	8.1	40S	7.2	20MS	27.5	60S	57	89
723	IPPSN2019-723	KRL 1934	3.1	20MR	9.2	40S	8.3	20S	40.0	60S	46	89
724	IPPSN2019-724	KRL 1935	11.7	40MS	52.0	100S	30.2	50S	41.3	60S	45	78
UAS, Dharwad												
725	IPPSN2019-725	UASD1901	13.5	40S	8.8	40MS	1.2	5S	23.6	40S	46	89
726	IPPSN2019-726	UASD1902	20.7	40S	10.9	60S*	1.6	10MS	16.9	40S	45	89
727	IPPSN2019-727	UASD1903	18.2	40S	4.3	20S	1.0	5MS	16.3	40S	46	78
728	IPPSN2019-728	UASD1904	15.5	40S	6.8	20S	0.0	0	15.3	40S	46	89
729	IPPSN2019-729	UASD1905	10.0	20S	10.3	40S	1.2	5S	10.2	20S	45	78
730	IPPSN2019-730	UASD1906	10.7	20S	5.4	30MS	1.8	5S	38.5	60S	46	78
731	IPPSN2019-731	UASD1907	13.0	40S	22.7	60S	3.8	10S	41.3	60S	46	89
732	IPPSN2019-732	UASD1908	13.5	40MS	12.7	20S	3.6	10S	25.3	60S	36	89
733	IPPSN2019-733	UASD1909	16.0	40MS	8.7	20S	0.2	TS	33.4	60S	56	89

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
734	IPPSN2019-734	UASD1910	13.7	40S	9.4	20S	3.6	10MS	24.4	40S	46	78
735	IPPSN2019-735	UASD1911	10.3	20S	3.6	10MS	3.2	10S	32.5	60S	46	78
736	IPPSN2019-736	UASD1912	12.4	30MS	11.4	40MS	0.0	0	27.7	60S	46	78
737	IPPSN2019-737	UASD1913	12.5	40MS	4.1	15MS	1.2	5S	13.3	40S	46	78
738	IPPSN2019-738	UASD1914	19.7	80S	6.1	20S	1.6	10MS	37.8	60S	46	89
739	IPPSN2019-739	UASD1915	41.7	80S	6.8	20S	0.0	TR	16.4	40S	35	78
740	IPPSN2019-740	UASD1916	43.0	80S	11.6	60S*	0.2	TS	21.9	40S	46	78
740A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**72.5**	**80S**	**68**	**99**
741	IPPSN2019-741	UASD1917	12.7	40MS	5.4	20S	0.0	0	42.0	60S	56	89
742	IPPSN2019-742	UASD1918	22.7	80S	1.4	10MS	6.4	20S	5.0	20S	46	89
743	IPPSN2019-743	UASD1919	19.3	40S	4.8	20S	3.8	10S	5.8	20MS	46	78
744	IPPSN2019-744	UASD1920	8.4	40S	0.1	TR	1.2	5S	3.8	20MS	46	89
745	IPPSN2019-745	UASD1921	23.7	100S	0.1	TR	0.0	0	3.6	10MS	46	89
746	IPPSN2019-746	UASD1922	2.7	10S	0.1	TR	0.2	TS	3.9	10MS	46	89
747	IPPSN2019-747	UASD1923	8.0	20S	1.7	10S	0.2	TS	1.4	5MS	47	99
748	IPPSN2019-748	UASD1924	31.3	100S	2.4	10S	3.4	10S	1.8	5MS	46	89
749	IPPSN2019-749	UASD1925	13.7	60S	2.4	10S	2.6	5S	2.6	10MS	46	78
750	IPPSN2019-750	UASD1926	14.7	40MS	0.9	5S	1.0	5MS	9.6	40S	46	78
751	IPPSN2019-751	UASD1927	5.4	10S	0.1	TR	1.2	5S	21.4	40S	46	99
752	IPPSN2019-752	UASD1928	11.0	40MS	1.6	5S	1.6	5MS	16.1	40S	46	78
753	IPPSN2019-753	UASD1929	12.3	30S	1.4	20MR	2.2	10S	20.8	60S	46	78
754	IPPSN2019-754	UASD1930	8.0	30MS	0.1	TR	1.2	5S	19.6	40S	46	78
RARI, Durgapura												
755	IPPSN2019-755	WR 2015	2.2	20MR	0.1	TR	1.6	10MS	23.1	60S	46	89
756	IPPSN2019-756	WR 2016	5.4	10S	1.6	5S	0.2	TS	24.8	60S	45	78
757	IPPSN2019-757	WR 2017	4.0	30MR	2.6	10S	0.0	0	30.9	60S	45	78
758	IPPSN2019-758	WR 2018	4.0	30MS	11.0	40S	7.0	20MS	22.3	60S	46	78
759	IPPSN2019-759	WR 2019	2.4	10MS	2.0	10MS	3.0	10S	22.4	60S	46	89
760	IPPSN2019-760	WR 2020	1.9	10MR	0.9	5S	0.0	0	25.6	60S	46	89
760A	**INFECTOR**	**INFECTOR**	**76.7**	**100S**	**86.7**	**100S**	**76.0**	**80S**	**72.5**	**100S**	**78**	**99**
761	IPPSN2019-761	WR 2021	1.8	10MS	8.1	20S	16.0	40S	36.3	60S	45	78
762	IPPSN2019-762	WR 2022	5.5	20MS	21.4	60S	8.0	20S	29.6	80S	46	89
763	IPPSN2019-763	WR 2023	0.1	TR	0.7	5MS	1.2	5S	26.4	60S	36	89
764	IPPSN2019-764	WR 2024	0.3	5R	8.8	40S	1.0	10MR	32.3	60S	45	89
765	IPPSN2019-765	WR 2025	9.3	20MS	15.4	40S	17.0	40S	32.0	60S	46	89
766	IPPSN2019-766	WR 2026	3.8	10MS	28.7	80S	3.6	10S	46.3	60S	46	89
767	IPPSN2019-767	WR 2027	0.0	TR	0.0	TR	0.0	0	17.4	40S	35	46
768	IPPSN2019-768	WR 2028	0.2	5R	0.9	5S	2.0	5S	24.8	40S	35	89
769	IPPSN2019-769	WR 2029	9.2	20MS	2.6	10MS	5.4	20MS	20.1	40S	45	89
770	IPPSN2019-770	WR 2030	10.7	30S	5.2	15MS	5.0	10S	16.3	40S	46	89
771	IPPSN2019-771	WR 2031	11.4	40S	10.7	20S	4.6	10S	15.8	60S	45	89
772	IPPSN2019-772	WR 2032	1.5	20MR	0.0	TR	0.2	TS	20.8	60S	46	89
773	IPPSN2019-773	WR 2033	0.9	10MR	20.7	80S	11.4	20S	14.9	40S	46	89
774	IPPSN2019-774	WR 2034	4.5	10MS	15.2	80S*	0.2	TS	25.2	60S	46	89
775	IPPSN2019-775	WR 2035	4.7	20MS	5.4	20S	4.0	10S	28.0	60S	46	89
776	IPPSN2019-776	WR 2036	0.2	5R	3.0	10S	0.2	TS	16.4	60S	45	78
777	IPPSN2019-777	WR 2037	0.1	TR	3.5	20S	3.2	10S	24.5	60S	46	78
778	IPPSN2019-778	WR 2038	1.0	10MR	6.8	40S	3.2	10S	19.3	40S	46	78
779	IPPSN2019-779	WR 2039	21.3	40S	40.7	100S	20.8	40S	23.1	60S	46	78
780	IPPSN2019-780	WR 2040	9.4	40MS	2.8	20MS	2.0	10S	28.1	60S	56	89
780A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**75.0**	**100S**	**68**	**99**
781	IPPSN2019-781	WR 2041	2.7	10MS	4.8	20S	1.6	10MS	24.5	60S	46	89
782	IPPSN2019-782	WR 2042	1.7	5S	0.1	TR	0.0	0	16.1	40S	46	89
783	IPPSN2019-783	WR 2043	1.4	10MS	0.9	5S	4.8	20S	18.5	60S	46	68
784	IPPSN2019-784	WR 2044	4.7	20MS	0.1	TR	0.4	5MR	20.3	40S	46	89
785	IPPSN2019-785	WR 2045	6.4	20S	1.4	10MS	0.6	5MR	20.5	40S	46	78
786	IPPSN2019-786	WR 2046	12.7	30MS	9.5	20S	0.8	10MR	26.1	60S	46	78
787	IPPSN2019-787	WR 2047	4.7	10S	3.6	20MS	1.0	5S	17.9	40S	45	99
788	IPPSN2019-788	WR 2048	4.2	10S	6.4	20MS	10.2	30S	29.3	60S	56	99
789	IPPSN2019-789	WR 2049	7.2	30MS	0.1	TR	1.0	5S	30.1	60S	46	89
790	IPPSN2019-790	WR 2050	2.9	20MS	2.7	20MS	0.4	5MR	22.3	60S	46	99

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
791	IPPSN2019-791	WR 2051	0.0	TR	0.9	5S	4.2	20S	17.6	60S	46	58
792	IPPSN2019-792	WR 2052	1.7	10MS	27.3	60S	11.0	20S	25.1	60S	36	89
793	IPPSN2019-793	WR 2053	2.2	5S	0.1	TR	4.0	10S	40.0	60S	45	78
794	IPPSN2019-794	WR 2054	4.8	20MS	2.2	10MS	8.8	20S	46.0	80S	46	89
795	IPPSN2019-795	WR 2055	10.3	20S	3.0	10MS	2.8	10S	24.0	60S	45	89
796	IPPSN2019-796	WR 2056	4.7	20MR	1.8	10S	0.2	TS	29.5	60S	35	47
797	IPPSN2019-797	WR 2057	9.3	20MS	16.4	80S	10.0	20S	21.3	60S	46	89
798	IPPSN2019-798	WR 2058	22.7	60S	29.2	80S	17.0	40S	14.6	40S	46	89
799	IPPSN2019-799	WR 2059	3.5	10MS	2.6	10S	0.2	TS	13.8	40S	46	89
800	IPPSN2019-800	WR 2060	32.0	60S	23.6	80S	15.2	60S	3.6	10S	46	89
800A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**72.5**	**80S**	**78**	**99**
801	IPPSN2019-801	WR 2061	23.8	40S	4.1	40MR	0.4	5MR	16.5	40S	45	89
802	IPPSN2019-802	WR 2062	27.0	40S	5.1	20MS	0.2	TS	13.8	40S	35	78
803	IPPSN2019-803	WR 2063	9.7	20S	6.7	40S	0.2	TS	15.9	40MS	56	78
804	IPPSN2019-804	WR 2064	22.7	40S	9.1	40S	6.6	20S	27.5	60S	46	78
NIF												
805	IPPSN2019-805	BLK BALAGI	5.1	20MS	19.0	60S	17.0	40S	36.3	80S	47	89
806	IPPSN2019-806	KUDRAT 9	41.7	80S	17.8	40MS	1.8	20MR	42.3	60S	46	99
807	IPPSN2019-807	MOHIT GOLD	45.1	100S	39.0	80S	37.0	60S	47.5	60S	36	78
GBPUAT, Pantnagar												
808	IPPSN2019-808	UP1	15.2	60S	0.9	5S	4.0	20S	12.5	40S	45	78
809	IPPSN2019-809	UP2	8.1	30S	4.1	20S	5.0	10S	16.4	60S	35	67
810	IPPSN2019-810	UP3	18.9	40S	4.7	20S	9.2	20S	5.3	10S	35	57
811	IPPSN2019-811	UP4	42.0	80S	25.5	60S	12.8	50S	1.6	5S	46	89
812	IPPSN2019-812	UP5	6.1	20MS	2.2	10MS	2.4	10S	6.8	10S	46	78
813	IPPSN2019-813	UP6	30.0	80S	5.5	20S	0.2	TS	14.2	60S	46	89
814	IPPSN2019-814	UP7	15.4	40MS	17.0	80S*	0.0	0	14.5	40S	46	89
815	IPPSN2019-815	UP8	19.0	40S	18.0	80S	14.0	40S	19.8	60S	46	89
816	IPPSN2019-816	UP9	5.4	10MS	6.7	40S	0.0	0	16.2	60S	46	89
817	IPPSN2019-817	UP10	30.7	60S	5.6	20MS	4.8	10S	37.3	80S	35	89
818	IPPSN2019-818	UP11	12.4	40S	22.4	80S	13.2	40S	29.8	80S	46	78
819	IPPSN2019-819	UP12	18.3	40S	16.0	80S*	2.4	10S	22.0	60S	46	89
820	IPPSN2019-820	UP13	0.0	TR	0.1	TR	4.2	20S	13.5	30S	45	46
820A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**86.7**	**100S**	**76.0**	**100S**	**70.0**	**80S**	**68**	**99**
821	IPPSN2019-821	UP14	3.1	10MS	3.4	10S	2.8	10MS	17.4	40S	45	78
822	IPPSN2019-822	UP15	5.4	20S	0.1	TR	0.2	TS	8.4	20S	46	89
823	IPPSN2019-823	UP16	26.7	60S	0.2	TMR	1.0	5MS	18.8	60S	46	78
824	IPPSN2019-824	UP17	3.4	10MS	0.9	5S	5.4	20S	3.9	10MS	35	78
825	IPPSN2019-825	UP18	2.8	10MS	0.9	5S	2.0	10S	6.2	20S	46	89
826	IPPSN2019-826	UP19	1.0	5MR	0.9	5S	1.0	5MS	12.8	20S	46	89
827	IPPSN2019-827	UP20	21.2	60S	0.9	5MS	7.6	20S	11.7	40MS	36	78
828	IPPSN2019-828	UP21	21.2	40S	6.5	20S	1.2	5S	8.1	20S	46	78
829	IPPSN2019-829	UP22	10.5	20S	0.1	TR	10.2	40S	8.6	20S	45	78
830	IPPSN2019-830	UP23	4.1	20MS	0.1	TMR	1.2	5S	3.4	10S	45	78
831	IPPSN2019-831	UP24	9.4	20MS	2.1	10MS	0.0	0	4.9	10S	45	78
832	IPPSN2019-832	UP25	9.0	20MS	0.1	TR	0.2	TS	7.4	20MS	45	78
833	IPPSN2019-833	UP26	8.5	20MS	0.1	TR	9.2	20S	9.1	20S	45	89
834	IPPSN2019-834	UP27	9.0	40MS	0.2	TMS	0.0	0	6.9	20S	36	78
835	IPPSN2019-835	UP28	9.0	20S	1.6	5S	0.2	TS	7.1	20MS	46	89
836	IPPSN2019-836	UP29	2.2	10MS	12.3	60S*	1.0	5MS	7.1	20S	45	89
837	IPPSN2019-837	UP30	16.4	40MS	3.1	10S	1.6	10MS	11.3	20S	36	78
838	IPPSN2019-838	UP31	21.3	40MS	12.7	60S*	0.8	5MS	20.4	40S	46	78
839	IPPSN2019-839	UP32	27.5	60S	12.7	60S*	0.2	TS	12.6	40S	46	78
840	IPPSN2019-840	UP33	22.4	60S	3.7	20MS	8.2	40S	17.2	40S	47	78
840A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**83.3**	**100S**	**80.0**	**100S**	**75.0**	**100S**	**78**	**99**
841	IPPSN2019-841	UP34	30.7	60S	8.4	20S	0.2	TS	19.3	40S	46	89
842	IPPSN2019-842	UP35	4.1	10MS	0.1	TR	4.6	20S	24.3	60S	35	36
843	IPPSN2019-843	UP36	31.3	60S	7.2	20S	9.4	40S	22.0	60S	45	78
844	IPPSN2019-844	UP37	30.7	80S	6.7	40MS	0.2	TS	17.9	40S	36	78
845	IPPSN2019-845	UP38	5.1	20S	4.4	20MS	1.2	5S	25.1	60S	46	89
846	IPPSN2019-846	UP39	8.1	20S	0.1	TMR	0.2	TS	5.4	10S	46	89

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
847	IPPSN2019-847	UP40	16.0	40S	0.1	TR	0.0	0	10.4	40S	24	35
848	IPPSN2019-848	UP41	7.4	20MS	23.7	60S	21.0	40S	9.8	20S	45	78
849	IPPSN2019-849	UP42	18.3	40MS	30.0	100S	22.0	40S	20.4	40S	46	78
850	IPPSN2019-850	UP43	36.0	80S	6.2	40MS	21.0	40S	13.9	40S	45	89
851	IPPSN2019-851	UP44	5.4	20MS	8.5	30S	16.2	60S	20.0	40S	46	78
852	IPPSN2019-852	UP45	30.7	60S	13.4	20S	7.2	20MS	13.1	40S	45	78
853	IPPSN2019-853	UP46	10.4	20S	12.3	60S*	2.0	10S	23.4	60S	36	78
854	IPPSN2019-854	UP47	14.0	30S	3.4	10S	6.0	20S	24.5	60S	46	89
855	IPPSN2019-855	UP48	0.2	5R	0.1	TMR	4.8	20S	11.8	40S	46	89
856	IPPSN2019-856	UP49	16.4	60S	4.0	10MS	2.0	10S	13.7	40S	46	89
857	IPPSN2019-857	UP50	25.3	80S	0.1	TMR	2.8	10MS	6.2	20S	46	89
858	IPPSN2019-858	UP51	7.7	20S	2.1	10MS	0.4	5MR	3.7	20MS	46	89
859	IPPSN2019-859	UP52	10.7	40MS	2.3	10MS	0.0	0	5.5	10S	46	89
860	IPPSN2019-860	UP53	2.8	10MS	2.7	10MS	5.8	20S	21.5	40S	46	89
860A	**INFECTOR**	**INFECTOR**	**76.7**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**77.5**	**100S**	**68**	**99**
861	IPPSN2019-861	UP54	5.5	10S	2.2	10MS	0.2	TS	8.1	10S	45	78
862	IPPSN2019-862	UP55	14.7	40S	3.5	20MS	0.6	5MR	13.9	40S	46	78
863	IPPSN2019-863	UP56	22.0	60S	4.2	15MS	0.2	TS	22.1	60S	35	78
864	IPPSN2019-864	UP57	9.0	20MS	0.9	5S	1.0	5S	10.8	20S	35	89
865	IPPSN2019-865	UP58	9.4	40S	0.2	TMR	1.0	5S	14.5	40S	45	89
866	IPPSN2019-866	UP59	17.4	60S	0.1	TR	1.0	5S	11.3	40S	36	89
867	IPPSN2019-867	UP60	26.4	80S	0.1	TMR	1.2	5S	10.1	20S	45	89
SHUATs, Allahabad												
868	IPPSN2019-868	AAI-W28/MR-3014/10/4/11	18.0	40S	19.7	40S	16.2	40S	55.5	80S	45	99
869	IPPSN2019-869	AAI-W29/MR-3012-1/4/3	26.0	60S	53.3	100S	45.0	80S	60.0	80S	46	89
870	IPPSN2019-870	AAI-W34[MR 3012]	8.2	20S	3.4	10MS	6.6	20S	20.8	40S	36	78
871	IPPSN2019-871	SHUATS - W49	20.0	60S	22.2	80S	23.2	40S	21.9	60S	46	89
872	IPPSN2019-872	SHUATS - W50 [MR-3161/23]	11.5	20S	32.9	80S	38.0	60S	37.5	60S	46	99
873	IPPSN2019-873	SHUATS - W70 [MR-3144/13]	16.4	40S	0.1	TR	0.8	5MS	17.9	60S	46	99
874	IPPSN2019-874	AAI-W15 [94]	2.1	20MR	0.1	TR	1.0	5S	24.1	40S	45	78
875	IPPSN2019-875	AAI-W21 [MR-1003]	11.0	20S	15.7	40S	29.2	40S	31.8	80S	46	89
RPCAU, Pusa												
876	IPPSN2019-876	RAUW 4	3.1	10MS	10.0	20S	21.2	40S	38.8	80S	46	89
877	IPPSN2019-877	RAUW 6	10.7	20S	21.4	60S	27.4	40S	48.8	80S	45	99
878	IPPSN2019-878	RAUW 7	11.0	20S	20.0	60S	22.6	40S	40.0	80S	46	99
879	IPPSN2019-879	RAUW 104	15.2	40S	4.4	20MS	0.2	TS	18.1	60S	36	78
880	IPPSN2019-880	RAUW 105	24.5	60S	12.8	60S	1.0	5S	26.8	60S	35	78
880A	**INFECTOR**	**INFECTOR**	**90.0**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**67.5**	**80S**	**68**	**99**
BAU, Sabour												
881	IPPSN2019-881	BRW 3878	6.5	20S	55.3	100S	34.0	60S	37.6	80S	35	68
882	IPPSN2019-882	BRW 3879	15.3	60S	29.4	80S	21.2	60S	27.6	60S	35	68
883	IPPSN2019-883	BRW 3880	24.8	80S	20.7	60S	5.6	10S	35.0	60S	36	68
884	IPPSN2019-884	BRW 3881	31.7	60S	34.3	100S	14.0	20S	35.0	80S	46	89
885	IPPSN2019-885	BRW 3882	9.3	20S	11.1	40S	16.0	20S	23.6	60S	46	78
886	IPPSN2019-886	BRW 3883	19.0	40S	31.3	80S	8.8	20MS	32.5	60S	46	89
887	IPPSN2019-887	BRW 3884	13.7	40S	13.0	40S	9.8	20S	27.0	60S	36	68
888	IPPSN2019-888	BRW 3885	33.3	60S	28.7	80S	9.0	20S	35.0	60S	46	89
889	IPPSN2019-889	BRW 3886	20.0	40S	13.3	40S	8.2	20S	36.9	60S	46	89
890	IPPSN2019-890	BRW 3887	21.7	40S	33.3	60S	32.2	40S	36.8	80S	36	78
891	IPPSN2019-891	BRW 3888	20.3	40S	6.7	20S	4.0	10S	33.1	60S	46	89
892	IPPSN2019-892	BRW 3889	18.0	40S	26.3	60S	14.2	40S	31.3	60S	36	89
893	IPPSN2019-893	BRW 3890	8.0	20MS	19.4	60S	15.0	40S	37.5	60S	46	89
894	IPPSN2019-894	BRW 3891	19.3	40S	21.0	40S	24.2	60S	40.0	60S	35	78
895	IPPSN2019-895	BRW 3892	19.7	40S	7.4	40S	0.0	0	23.1	40S	46	78
896	IPPSN2019-896	BRW 3893	18.7	40S	16.0	40S	5.4	20S	28.1	60S	46	78
897	IPPSN2019-897	BRW 3894	37.0	80S	8.4	40S	0.2	TS	35.8	60S	46	89
898	IPPSN2019-898	BRW 3895	6.1	40MS	8.0	20S	5.6	20S	15.0	40S	46	89

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
899	IPPSN2019-899	BRW 3896	23.4	60S	16.4	40S	0.0	TR	12.1	40S	46	78
900	IPPSN2019-900	BRW 3897	18.1	60S	1.4	10MS	10.0	40S	19.5	40S	46	78
900A	**INFECTOR**	**INFECTOR**	**90.0**	**100S**	**86.7**	**100S**	**76.0**	**80S**	**77.5**	**100S**	**68**	**99**
901	IPPSN2019-901	BRW 3898	14.7	40S	3.4	10MS	0.2	TS	24.4	40S	46	78
902	IPPSN2019-902	BRW 3899	10.7	20S	2.0	10MS	1.2	5S	30.0	60S	46	89
903	IPPSN2019-903	BRW 3900	8.0	20MS	2.1	10MS	0.2	TS	25.3	40S	47	89
904	IPPSN2019-904	BRW 3901	8.7	20MS	3.4	10MS	1.0	5MS	20.7	40S	46	89
905	IPPSN2019-905	BRW 3902	8.0	20MS	1.5	10MS	4.2	20S	10.6	20MS	46	78
10th HYPT												
906	IPPSN2019-906	10TH HYPT-402	5.3	10S	2.8	10MS	6.0	20S	17.0	40S	46	89
907	IPPSN2019-907	10TH HYPT-403	16.7	40S	8.8	20MS	1.0	5S	22.4	60S	45	99
908	IPPSN2019-908	10TH HYPT-404	8.7	20S	3.1	20MS	4.0	20S	13.8	40S	46	89
909	IPPSN2019-909	10TH HYPT-405	16.7	40S	0.1	TR	0.2	TS	18.6	40S	46	89
910	IPPSN2019-910	10TH HYPT-406	17.7	40S	1.4	10MS	1.0	5MS	21.9	40S	46	89
911	IPPSN2019-911	10TH HYPT-407	27.5	60S	1.8	10MS	0.2	TS	14.8	40S	46	78
912	IPPSN2019-912	10TH HYPT-408	6.4	20S	0.1	TR	0.6	5MR	21.4	40S	46	78
913	IPPSN2019-913	10TH HYPT-409	4.9	20S	9.7	20S	9.0	40S	12.6	20S	46	78
914	IPPSN2019-914	10TH HYPT-410	7.0	10S	6.7	20S	11.4	40S	13.6	40S	36	78
915	IPPSN2019-915	10TH HYPT-411	2.9	10MS	0.4	5MR	4.4	20S	9.7	20S	45	89
916	IPPSN2019-916	10TH HYPT-412	6.8	30MS	3.4	10S	6.4	20S	7.1	20S	46	89
917	IPPSN2019-917	10TH HYPT-413	3.4	10MS	2.7	20MS	0.2	TS	7.9	20S	35	78
918	IPPSN2019-918	10TH HYPT-414	10.8	40S	2.0	10MS	5.0	20S	12.5	40S	46	89
919	IPPSN2019-919	10TH HYPT-415	12.0	40S	2.2	10MS	4.0	20S	11.1	20S	46	89
920	IPPSN2019-920	10TH HYPT-416	21.3	60S	4.9	20S	1.8	10MS	12.8	20S	46	89
920A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**75.0**	**100S**	**68**	**99**
921	IPPSN2019-921	10TH HYPT-417	30.0	60S	3.0	10MS	4.0	10S	19.5	60S	46	89
922	IPPSN2019-922	10TH HYPT-418	29.4	80S	1.5	10MS	1.0	5MS	30.6	60S	47	89
923	IPPSN2019-923	10TH HYPT-419	9.0	20MS	1.4	10MS	2.0	10S	9.7	20S	45	89
924	IPPSN2019-924	10TH HYPT-420	12.0	40S	6.1	20S	4.0	20S	10.4	20S	45	89
925	IPPSN2019-925	10TH HYPT-421	12.4	60S	2.1	10S	1.0	5S	23.8	60S	46	89
926	IPPSN2019-926	10TH HYPT-422	9.3	40S	4.7	20S	2.0	5S	14.0	40S	46	89
927	IPPSN2019-927	10TH HYPT-423	11.2	40S	1.2	5S	2.8	10MS	13.1	40S	46	89
928	IPPSN2019-928	10TH HYPT-424	6.5	20MS	9.3	30S	16.2	40S	16.3	40S	46	89
929	IPPSN2019-929	10TH HYPT-425	3.4	20MS	3.5	20S	0.2	TS	14.5	40S	46	89
930	IPPSN2019-930	10TH HYPT-426	18.0	60S	5.0	10S	3.6	10S	23.6	60S	35	78
931	IPPSN2019-931	10TH HYPT-427	18.0	60S	5.2	20MS	4.8	20S	21.4	40S	45	89
932	IPPSN2019-932	10TH HYPT-428	16.0	60S	1.5	10MS	0.2	TS	12.5	20S	46	89
933	IPPSN2019-933	10TH HYPT-429	7.7	20S	0.7	5MS	2.2	5S	12.8	40S	46	89
934	IPPSN2019-934	10TH HYPT-430	10.0	40S	3.1	10S	5.0	20S	14.4	20S	46	89
935	IPPSN2019-935	10TH HYPT-431	10.9	40	0.0	TR	1.0	5S	14.6	40S	46	89
936	IPPSN2019-936	10TH HYPT-432	13.3	40S	8.3	20S	3.8	10S	13.6	40S	46	78
937	IPPSN2019-937	10TH HYPT-433	24.0	60S	4.4	10MS	6.8	20S	11.4	20S	46	89
938	IPPSN2019-938	10TH HYPT-434	26.8	80S	1.5	5MS	2.8	10S	12.3	20S	46	89
939	IPPSN2019-939	10TH HYPT-435	23.3	60S	1.7	10MS	9.2	40S	15.6	40S	46	89
940	IPPSN2019-940	10TH HYPT-436	19.4	60S	1.4	10MS	0.2	TS	16.1	40S	46	89
940A	**INFECTOR**	**INFECTOR**	**76.7**	**100S**	**90.0**	**100S**	**80.0**	**100S**	**77.5**	**100S**	**78**	**99**
941	IPPSN2019-941	10TH HYPT-437	28.5	60S	30.7	80S	12.0	20S	38.3	60S	46	89
942	IPPSN2019-942	10TH HYPT-438	14.1	40S	2.7	10MS	1.0	5S	25.0	80S	45	78
943	IPPSN2019-943	10TH HYPT-439	20.7	60S	1.8	10MS	1.2	5S	25.6	80S	36	78
944	IPPSN2019-944	10TH HYPT-440	7.4	20S	0.1	TMR	0.8	5MS	14.5	40S	45	89
945	IPPSN2019-945	10TH HYPT-441	10.3	40S	1.3	5MS	0.6	5MR	8.0	20MS	35	89
946	IPPSN2019-946	10TH HYPT-442	9.8	20S	4.1	20S	2.6	10S	25.0	60S	45	89
947	IPPSN2019-947	10TH HYPT-443	7.4	20S	5.4	20S	2.4	5S	20.0	40S	45	78
948	IPPSN2019-948	10TH HYPT-444	15.0	40S	1.5	20MR	14.4	60S	10.7	20S	46	78
949	IPPSN2019-949	10TH HYPT-445	19.0	40S	0.2	TMS	10.8	40S	10.4	20S	46	89
950	IPPSN2019-950	10TH HYPT-446	17.0	40S	0.9	5S	1.4	5S	24.0	60S	46	89
951	IPPSN2019-951	10TH HYPT-447	3.8	10S	0.1	TMR	1.2	5S	11.0	40S	46	89
952	IPPSN2019-952	10TH HYPT-448	6.1	20S	0.7	10MR	0.4	5MR	23.9	60S	45	89
953	IPPSN2019-953	10TH HYPT-449	15.3	40S	1.7	10MS	0.0	0	17.8	40S	46	89
954	IPPSN2019-954	10TH HYPT-450	8.7	20S	0.5	5MR	4.0	20S	20.5	40S	45	89
CI - HYT 2019-20												

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
955	IPPSN2019-955	HYT 1	4.7	20S	0.7	10MR	14.2	40S	10.1	20S	45	78
956	IPPSN2019-956	HYT 2	16.7	60S	0.5	5MR	7.2	20S	16.7	40S	35	78
957	IPPSN2019-957	HYT 3	20.7	60S	2.9	20MS	0.2	TS	9.6	20S	35	78
958	IPPSN2019-958	HYT 4	28.7	60S	3.4	20S	2.0	5S	5.1	10S	46	89
959	IPPSN2019-959	HYT 5	26.0	60S	3.5	20MS	1.8	5S	6.1	10S	46	89
960	IPPSN2019-960	HYT 6	26.7	60S	4.1	20S	1.0	5S	19.4	40S	47	89
960A	**INFECTOR**	**INFECTOR**	**90.0**	**100S**	**90.0**	**100S**	**80.0**	**100S**	**75.0**	**100S**	**78**	**99**
961	IPPSN2019-961	HYT 7	19.3	40S	17.8	40S	0.2	TS	14.4	40S	45	89
962	IPPSN2019-962	HYT 8	29.2	60S	6.8	20S	0.4	5MR	12.2	40S	35	45
963	IPPSN2019-963	HYT 9	7.5	10S	3.4	10S	1.0	5S	4.8	10S	45	89
964	IPPSN2019-964	HYT 10	8.2	20MS	1.4	10MS	1.0	5MS	4.3	10S	46	89
965	IPPSN2019-965	HYT 11	7.7	20MS	0.7	10MR	4.2	20S	9.1	20MS	46	89
966	IPPSN2019-966	HYT 12	12.5	40S	8.7	20S	7.2	20S	14.5	40S	46	89
967	IPPSN2019-967	HYT 13	26.0	80S	4.4	20MS	1.4	5S	5.5	20MS	46	89
968	IPPSN2019-968	HYT 14	22.7	60S	14.0	60S	1.0	5S	6.3	20S	45	89
969	IPPSN2019-969	HYT 15	22.7	60S	1.5	10MS	0.2	TS	6.3	20MS	46	89
970	IPPSN2019-970	HYT 16	2.8	10MS	6.8	40S	1.0	5S	6.5	20S	46	89
971	IPPSN2019-971	HYT 17	32.0	80S	14.0	60S	7.4	20S	14.4	40S	46	89
972	IPPSN2019-972	HYT 18	9.5	20S	0.1	TR	0.2	TS	13.4	40S	46	89
973	IPPSN2019-973	HYT 19	3.5	10S	6.4	30S	8.2	40S	28.0	60S	24	46
974	IPPSN2019-974	HYT 20	10.1	40MS	0.1	TR	1.8	10MS	5.9	10S	46	89
975	IPPSN2019-975	HYT 21	4.3	10MS	1.4	10MS	1.8	10MS	14.7	40S	36	46
976	IPPSN2019-976	HYT 22	0.9	5MS	0.0	TR	4.0	20S	1.6	5S	46	78
977	IPPSN2019-977	HYT 23	5.5	20S	1.4	10MS	8.2	40S	18.0	60S	45	78
978	IPPSN2019-978	HYT 24	39.7	80S	8.0	20S	8.2	20S	24.6	60S	45	89
979	IPPSN2019-979	HYT 25	15.7	40S	11.7	20S	2.0	10S	26.3	60S	46	78
PI - Crop Improvement												
980	IPPSN2019-980	RWP2019-1	19.2	40S	10.9	40S	11.8	40S	23.1	40S	45	78
980A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**90.0**	**100S**	**80.0**	**100S**	**75.0**	**100S**	**68**	**99**
981	IPPSN2019-981	RWP2019-2	11.7	40S	5.4	20S	4.2	20S	18.6	40S	45	89
982	IPPSN2019-982	RWP2019-3	33.0	80S	2.2	10MS	0.2	TS	17.1	40S	46	89
983	IPPSN2019-983	RWP2019-4	28.7	60S	4.6	20MS	0.6	5MR	12.5	40S	46	78
984	IPPSN2019-984	RWP2019-5	4.1	10MS	9.4	40S	9.0	40S	24.9	60S	46	89
985	IPPSN2019-985	RWP2019-6	16.7	40S	3.4	15MS	12.6	60S*	18.6	40S	46	89
986	IPPSN2019-986	RWP2019-7	9.7	20S	3.4	20S	9.8	40S	9.3	20S	46	78
987	IPPSN2019-987	LBP2019-1	16.0	40S	0.2	TMR	0.2	TS	6.1	20S	46	78
988	IPPSN2019-988	LBP2019-2	7.7	20S	3.4	20MS	0.2	TS	16.0	40S	45	89
989	IPPSN2019-989	LBP2019-3	18.7	40S	2.2	10MS	1.0	5S	7.0	10S	46	89
990	IPPSN2019-990	LBP2019-4	14.0	30S	0.9	10MR	0.2	TS	14.5	40S	46	89
991	IPPSN2019-991	LBP2019-5	9.7	20S	24.7	80S	8.2	20S	13.6	40S	36	48
992	IPPSN2019-992	LBP2019-6	3.9	10S	1.4	10MS	4.2	20S	11.4	20S	46	78
993	IPPSN2019-993	LBP2019-7	17.2	40S	26.4	80S	15.0	40S	9.4	40S	46	68
994	IPPSN2019-994	LBP2019-8	12.0	40S	2.7	10MS	0.2	TS	9.7	20S	35	68
995	IPPSN2019-995	LBP2019-9	26.0	40S	17.1	80S	8.2	20S	8.9	20S	35	78
996	IPPSN2019-996	LBP2019-10	7.7	10S	2.7	20MS	1.0	5S	17.4	40S	46	89
997	IPPSN2019-997	LBP2019-11	25.3	60S	21.3	60S	6.6	10S	21.5	40S	46	89
998	IPPSN2019-998	DWAP1901	21.3	40S	20.7	40S	10.6	20S	21.0	40S	46	89
999	IPPSN2019-999	DWAP1902	6.9	20S	8.7	40S	0.2	TS	21.4	40S	46	89
1000	IPPSN2019-1000	DWAP1903	22.7	60S	30.0	100S	26.2	40S	21.1	60S	46	89
1000A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**93.3**	**100S**	**80.0**	**100S**	**75.0**	**80S**	**68**	**99**
1001	IPPSN2019-1001	DWAP1904	2.8	20MR	0.8	5MS	0.2	TS	23.0	60S	45	78
1002	IPPSN2019-1002	DWAP1905	11.0	20S	17.4	80S	1.2	5S	5.6	20MS	46	78
1003	IPPSN2019-1003	DWAP1906	14.1	40S	2.7	10MS	1.0	5S	12.9	40S	45	78
1004	IPPSN2019-1004	DWAP1907	35.7	80S	4.0	10S	1.0	5S	16.3	40S	46	68
1005	IPPSN2019-1005	DWAP1908	2.2	10MR	0.8	5MS	2.0	10S	4.3	10S	46	68
1006	IPPSN2019-1006	DWAP1909	7.7	20S	18.8	80S	5.0	10S	18.2	60S	46	78
1007	IPPSN2019-1007	BST1901	37.5	80S	13.5	40MS	5.0	10S	15.4	40S	35	78
1008	IPPSN2019-1008	QST1901	22.0	40S	2.7	20MS	1.0	5S	13.1	40S	36	68
1009	IPPSN2019-1009	QST1902	5.7	20MS	2.9	10MS	1.4	5S	10.0	40S	45	78
1010	IPPSN2019-1010	QST1903	8.7	20S	4.4	10S	1.0	5S	15.5	40S	46	89
1011	IPPSN2019-1011	DWM1822	27.3	80S	4.1	10MS	1.0	5S	10.9	40S	47	89

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
1012	IPPSN2019-1012	RWP2019-8	12.3	40MS	22.4	80S	5.4	10S	2.9	10S	46	89
1013	IPPSN2019-1013	RWP2019-9	29.7	60S	26.7	80S	9.8	20S	2.7	10S	46	89
1014	IPPSN2019-1014	RWP2019-10	22.1	60S	27.7	80S	9.2	20MS	19.6	60S	46	89
1015	IPPSN2019-1015	LBP2019-12	12.7	40S	2.2	10MS	2.8	5S	13.3	40S	46	78
1016	IPPSN2019-1016	LBP2019-13	5.0	10S	1.4	10MS	2.8	10MS	21.9	40S	45	68
1017	IPPSN2019-1017	LBP2019-14	5.7	10S	1.9	10S	4.0	10S	18.9	40S	46	78
1018	IPPSN2019-1018	LBP2019-15	10.5	40MS	23.0	80S	8.0	20S	19.0	60S	46	78
1019	IPPSN2019-1019	LBP2019-16	20.3	40S	7.0	20S	4.2	10S	12.6	40S	46	89
1020	IPPSN2019-1020	LBP2019-17	7.7	20MS	5.5	20MS	2.0	5S	20.2	40S	45	89
1020A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**90.0**	**100S**	**80.0**	**100S**	**72.5**	**100S**	**78**	**99**
1021	IPPSN2019-1021	LBP2019-18	6.7	20MS	3.4	10S	3.8	10S	23.3	40S	46	89
1022	IPPSN2019-1022	LBP2019-19	32.7	80S	8.5	40S	6.8	20S	24.4	60S	45	89
1023	IPPSN2019-1023	LBP2019-20	8.7	20S	23.4	100S	5.0	20S	29.4	60S	45	89
1024	IPPSN2019-1024	LBP2019-21	3.2	10S	5.5	20S	6.2	20MS	15.7	40S	35	78
1025	IPPSN2019-1025	DWAP1910	1.7	20MR	13.4	80S	0.2	TS	27.6	80S	45	78
1026	IPPSN2019-1026	DWAP1911	5.1	20S	0.4	5MR	0.0	0	30.0	60S	45	78
1027	IPPSN2019-1027	BST1902	5.7	20MS	3.3	20MS	1.8	5S	9.9	20S	35	89
1028	IPPSN2019-1028	BST1903	11.3	40S	0.7	5MS	2.0	5S	7.0	20S	35	89
1029	IPPSN2019-1029	BST1904	4.7	20MS	0.9	5S	2.0	5S	3.4	10S	45	78
1030	IPPSN2019-1030	BST1905	2.0	10S	0.1	TR	0.2	TS	3.2	20S	46	78
1031	IPPSN2019-1031	BST1906	7.0	20S	6.2	40MS	7.0	30S	3.0	10S	36	78
1032	IPPSN2019-1032	QST1904	36.7	80S	6.8	40S	0.2	TS	20.2	40S	35	89
1033	IPPSN2019-1033	PYTSR05	7.2	20MS	3.4	10MS	0.2	TS	21.9	40S	35	89
1034	IPPSN2019-1034	RWP2019-11	2.0	5MS	0.2	TMS	0.2	TS	4.3	10S	35	89
1035	IPPSN2019-1035	RWP2019-12	12.4	40S	8.5	40S	0.2	TS	11.6	40S	46	89
1036	IPPSN2019-1036	RWP2019-13	13.0	40S	3.5	15MS	3.6	10S	13.9	40S	46	89
1037	IPPSN2019-1037	RWP2019-14	4.0	10MS	1.4	20MR	0.0	0	9.6	40S	46	89
1038	IPPSN2019-1038	RWP2019-15	29.3	80S	20.7	60S	5.0	10S	12.1	40S	45	68
1039	IPPSN2019-1039	RWP2019-16	28.7	80S	0.1	TR	0.2	TS	8.0	20S	46	89
1040	IPPSN2019-1040	LBP2019-22	22.3	80S	0.1	TR	0.2	TS	34.8	80S	46	89
1040A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**86.7**	**100S**	**76.0**	**80S**	**72.5**	**100S**	**78**	**99**
1041	IPPSN2019-1041	LBP2019-23	2.1	10MR	6.7	40S	1.0	5S	21.4	60S	35	57
1042	IPPSN2019-1042	LBP2019-24	5.7	20MS	0.0	TR	0.2	TS	18.0	40S	45	78
1043	IPPSN2019-1043	LBP2019-25	3.3	10MS	11.7	60S*	2.8	10MS	6.0	20S	46	89
1044	IPPSN2019-1044	LBP2019-26	1.0	10MR	10.1	60S*	3.2	10S	9.9	40S	34	56
1045	IPPSN2019-1045	LBP2019-27	1.4	10MR	0.0	TR	4.0	10S	17.7	60S	45	89
1046	IPPSN2019-1046	DWAP1912	5.7	20MS	1.4	5S	4.0	10S	5.3	20MS	46	89
1047	IPPSN2019-1047	DWAP1913	2.0	5MS	1.6	5S	1.0	5S	8.5	40S	45	89
1048	IPPSN2019-1048	DWAP1914	1.5	10MS	0.0	TR	0.2	TS	12.6	20S	45	89
1049	IPPSN2019-1049	DWAP1915	3.4	20MS	0.0	TR	2.0	10S	11.5	20S	46	78
1050	IPPSN2019-1050	DWAP1916	0.8	10MR	10.3	40S	2.0	10S	16.5	60S	47	89
1051	IPPSN2019-1051	QST1905	8.9	20S	0.1	TMR	12.2	40S	8.0	20S	46	89
1052	IPPSN2019-1052	QST1906	40.7	100S	9.4	20S	0.6	5MR	33.4	60S	46	89
1053	IPPSN2019-1053	QST1907	5.7	10S	8.2	20S	21.0	40S	13.7	40S	46	89
1054	IPPSN2019-1054	QST1908	21.4	80S	2.4	10S	2.0	10S	11.9	40S	56	78
1055	IPPSN2019-1055	QST1909	5.4	20S	3.4	20S	2.2	10S	7.0	20S	46	89
1056	IPPSN2019-1056	RWP2019-17	16.2	40S	12.3	40S	5.0	20S	11.4	40S	46	78
1057	IPPSN2019-1057	RWP2019-18	18.7	40S	3.4	20S	0.2	TS	6.8	20S	46	89
1058	IPPSN2019-1058	RWP2019-19	20.0	40S	2.7	20MS	17.0	40S	12.6	40S	45	89
1059	IPPSN2019-1059	RWP2019-20	25.3	60S	17.8	60S	24.2	60S	19.4	60S	46	89
1060	IPPSN2019-1060	RWP2019-21	24.7	60S	0.1	TR	0.2	TS	16.0	40S	45	57
1060A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**75.0**	**100S**	**68**	**99**
1061	IPPSN2019-1061	RWP2019-22	0.8	10MR	0.1	TR	0.2	TS	20.5	40S	45	89
1062	IPPSN2019-1062	RWP2019-23	18.3	40S	3.4	20S	18.6	40S	10.1	20S	47	89
1063	IPPSN2019-1063	LBP2019-28	26.1	60S	22.3	80S	24.2	40S	24.8	60S	56	89
1064	IPPSN2019-1064	LBP2019-29	38.7	80S	20.1	80S	24.0	40S	10.4	40S	46	68
1065	IPPSN2019-1065	LBP2019-30	36.7	80S	22.1	80S	22.2	40S	11.4	40S	35	78
1066	IPPSN2019-1066	DWAP1917	8.7	20S	20.0	80S	21.0	40S	10.9	20S	35	68
1067	IPPSN2019-1067	DWAP1918	9.4	20MS	26.7	80S	17.6	40S	14.8	40S	46	89
1068	IPPSN2019-1068	DWAP1919	1.7	10MR	13.4	80S*	2.0	10S	15.1	20S	36	89
1069	IPPSN2019-1069	DWAP1920	3.9	10S	5.4	40MS	2.0	10S	16.1	40S	45	89

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
1070	IPPSN2019-1070	DWAP1921	20.3	40S	4.4	20S	14.0	40S	19.1	40S	45	89
1071	IPPSN2019-1071	DWAP1922	8.7	20S	0.1	TMR	0.2	TS	14.3	40S	45	89
1072	IPPSN2019-1072	BST1907	5.3	10S	1.4	10MS	1.8	5MS	15.7	40S	45	89
1073	IPPSN2019-1073	BST1908	24.3	60S	6.1	40MS	7.0	20S	7.5	20S	46	78
1074	IPPSN2019-1074	BST1909	9.1	20S	3.4	20MS	3.0	10S	8.8	40S	46	78
1075	IPPSN2019-1075	QST1910	13.0	40S	4.0	20S	1.0	5S	10.5	40S	46	89
1076	IPPSN2019-1076	QST1911	8.2	40MS	0.1	TMR	2.0	10S	6.5	20S	46	89
1077	IPPSN2019-1077	GRU/17-18/8	8.7	40MS	1.7	10MS	5.0	20S	5.3	20S	45	89
VPKAS, Almora												
1078	IPPSN2019-1078	VW1901	13.3	30S	1.7	10MS	0.2	TS	3.0	10S	36	89
1079	IPPSN2019-1079	VW1902	6.7	20MS	0.4	5MR	13.4	40S	15.8	40S	35	78
1080	IPPSN2019-1080	VW1903	4.3	10S	0.7	5MS	5.0	20S	23.9	60S	35	68
1080A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**90.0**	**100S**	**80.0**	**100S**	**70.0**	**80S**	**68**	**99**
1081	IPPSN2019-1081	VW1904	12.0	40S	3.4	20MS	28.2	60S	18.5	40S	46	78
1082	IPPSN2019-1082	VW1905	20.7	40S	43.4	100S	29.0	60S	9.1	20S	56	89
1083	IPPSN2019-1083	VW1906	1.7	10S	0.2	TMS	1.0	5S	6.0	20S	35	45
1084	IPPSN2019-1084	VW1907	18.0	40S	1.4	10MS	6.2	20MS	13.1	40S	35	78
1085	IPPSN2019-1085	VW1908	10.0	20S	8.0	40S	1.0	5S	19.4	60S	35	89
1086	IPPSN2019-1086	VW1909	3.5	10MS	1.5	10MS	2.8	5S	11.8	40S	35	89
1087	IPPSN2019-1087	VW1910	1.6	20MR	0.5	5MR	1.0	5S	22.3	60S	45	89
1088	IPPSN2019-1088	VW1911	3.7	10MS	6.8	40S	4.2	10S	14.4	40S	46	89
1089	IPPSN2019-1089	VW1912	17.3	40S	0.7	5MS	0.2	TS	11.8	40S	45	89
1090	IPPSN2019-1090	VW1913	9.3	40MS	13.5	60S	16.0	60S	15.5	40S	45	89
1091	IPPSN2019-1091	VW1914	2.8	20MS	1.0	5MS	0.6	5MR	20.9	60S	35	46
1092	IPPSN2019-1092	VW1915	1.7	10MS	1.4	10MS	1.0	5S	12.4	40S	35	78
1093	IPPSN2019-1093	VW1916	3.3	20MR	3.4	15MS	1.4	5S	9.6	20S	45	89
1094	IPPSN2019-1094	VW1917	4.7	10S	2.9	10MS	2.4	10S	15.5	60S	46	78
1095	IPPSN2019-1095	VW1918	5.4	10S	19.5	40S	13.0	40S	22.0	60S	46	78
1096	IPPSN2019-1096	VW1919	5.0	10S	10.1	60S*	0.2	TS	6.6	20S	46	89
1097	IPPSN2019-1097	VW1920	26.0	60S	5.3	15MS	3.2	10S	21.4	60S	45	89
1098	IPPSN2019-1098	VW1921	10.7	20S	4.0	20MS	2.6	5S	14.4	40S	46	89
1099	IPPSN2019-1099	VW1922	13.0	30S	5.7	15MS	8.6	40S	6.3	10S	46	99
1100	IPPSN2019-1100	VW1923	21.5	40S	2.2	10MS	0.2	TS	31.3	60S	45	56
1100A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**72.5**	**100S**	**68**	**99**
1101	IPPSN2019-1101	VW1924	11.7	20S	8.3	20S	10.0	40S	8.7	20S	56	89
1102	IPPSN2019-1102	VW1925	4.8	20S	4.0	20MS	11.4	20S	6.6	10S	34	55
1103	IPPSN2019-1103	VW1926	19.4	40S	2.8	10MS	4.2	20S	7.6	20MS	46	89
1104	IPPSN2019-1104	VW1927	28.7	40S	4.7	15MS	0.2	TS	14.3	40S	46	89
1105	IPPSN2019-1105	VW1928	0.7	5MR	2.1	10S	18.0	40S	15.0	60S	45	89
1106	IPPSN2019-1106	VW1929	17.5	40S	4.5	10S	0.2	TS	4.8	10S	46	78
1107	IPPSN2019-1107	VW1930	1.4	10MR	0.7	5MS	0.2	TS	6.7	20S	34	35
1108	IPPSN2019-1108	VW1931	0.2	TS	0.1	TMR	15.0	40S	12.4	40S	35	48
1109	IPPSN2019-1109	VW1932	8.8	20S	17.5	40S	21.2	60S	2.4	5S	46	68
1110	IPPSN2019-1110	VW1933	3.3	20S	0.1	TMR	0.2	TS	9.1	40S	46	78
1111	IPPSN2019-1111	VW1934	59.3	100S	24.4	80S	17.8	40S	6.0	20S	35	46
1112	IPPSN2019-1112	VW1935	1.3	10MR	5.1	20MS	11.4	20S	18.8	40S	45	78
1113	IPPSN2019-1113	VW1936	1.3	10MS	1.7	10S	0.0	TR	13.4	40S	24	46
1114	IPPSN2019-1114	VW1937	5.3	20MS	1.3	5S	1.0	5S	17.5	60S	46	89
1115	IPPSN2019-1115	VW1938	2.1	10MS	4.1	20S	2.0	10S	19.5	60S	46	89
1116	IPPSN2019-1116	VW1939	6.0	20MS	9.4	40S	15.6	60S	20.5	60S	46	89
1117	IPPSN2019-1117	VW1940	4.7	40MR	4.5	20MS	12.0	60S*	2.0	5S	56	89
1118	IPPSN2019-1118	VW1941	3.1	10S	6.9	40S	12.0	60S*	19.5	60S	56	78
1119	IPPSN2019-1119	VW1942	5.7	10S	19.1	80S	1.0	10MR	8.6	40S	45	89
1120	IPPSN2019-1120	VW1943	12.0	30S	6.7	40S	10.2	20S	28.8	60S	46	89
1120A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**93.3**	**100S**	**80.0**	**100S**	**72.5**	**100S**	**68**	**99**
1121	IPPSN2019-1121	VW1944	2.7	10MS	0.1	TR	2.2	10S	14.6	40MS	45	89
1122	IPPSN2019-1122	VW1945	8.7	20S	6.8	40S	7.8	20S	12.1	40S	25	36
1123	IPPSN2019-1123	VW1946	10.0	40S	1.4	10MS	9.0	40S	5.5	10S	46	89
1124	IPPSN2019-1124	VW1947	15.3	40S	1.5	10MS	9.0	40S	8.0	20S	45	89
1125	IPPSN2019-1125	VW1948	13.7	40S	6.9	20S	5.0	20S	13.6	40S	45	89
1126	IPPSN2019-1126	VW1949	3.7	20S	3.4	20S	8.6	40S	15.6	40S	46	89

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
1127	IPPSN2019-1127	VW1950	30.3	100S	9.6	30S	4.2	20S	8.8	20S	57	89
CCSHAU, Hisar												
1128	IPPSN2019-1128	P13031	42.0	100S	14.7	40S	6.2	20S	14.7	40S	46	89
1129	IPPSN2019-1129	P13294	23.7	40S	4.8	20S	0.2	TS	4.4	20S	45	89
1130	IPPSN2019-1130	P13343	19.3	40S	15.7	60S*	0.2	TS	13.4	40S	46	68
1131	IPPSN2019-1131	P13377	23.3	60S	13.4	60S*	3.0	10S	23.1	40S	45	89
1132	IPPSN2019-1132	P13517	11.8	20S	8.4	20S	3.0	10S	19.5	40S	45	78
1133	IPPSN2019-1133	P13559	18.3	40S	7.7	20MS	6.2	20S	18.1	40S	46	78
1134	IPPSN2019-1134	P13570	13.5	40MS	2.6	10S	3.2	10S	6.9	20S	45	89
1135	IPPSN2019-1135	P13580	21.5	60S	4.4	20S	3.2	10S	6.2	20S	45	78
1136	IPPSN2019-1136	P13633	20.7	60S	0.9	5MS	0.2	TS	13.3	40S	46	89
1137	IPPSN2019-1137	P13638	21.3	60S	8.7	40S	0.2	TS	13.6	40S	46	89
1138	IPPSN2019-1138	P13650	10.0	20S	3.4	20S	0.2	TS	14.9	40S	46	89
1139	IPPSN2019-1139	P13653	5.0	20MS	0.0	TR	1.0	5S	17.4	40S	46	89
1140	IPPSN2019-1140	P13666	11.5	40S	0.4	5MR	1.0	5S	7.1	20S	46	89
1140A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**83.3**	**100S**	**80.0**	**100S**	**72.5**	**80S**	**69**	**99**
1141	IPPSN2019-1141	P13673	8.0	20S	10.1	60S*	16.2	80S*	11.9	40S	46	78
1142	IPPSN2019-1142	P13704	9.3	40MS	0.7	5MS	6.2	20MS	12.3	40S	35	78
1143	IPPSN2019-1143	P13706	20.8	40S	6.5	20MS	3.6	10S	9.7	40S	45	89
1144	IPPSN2019-1144	P13720	14.3	40S	1.6	5S	4.0	20S	6.7	20S	46	89
1145	IPPSN2019-1145	P13723	20.7	80S	15.0	60S	15.0	40S	2.6	10S	45	89
1146	IPPSN2019-1146	P13726	5.8	20S	12.0	40S	8.0	20S	3.8	20MS	45	78
1147	IPPSN2019-1147	P13738	13.7	40S	0.0	TR	6.0	20S	8.4	40S	46	68
1148	IPPSN2019-1148	P13741	24.7	60S	3.1	20MS	7.2	20S	10.1	40S	46	68
1149	IPPSN2019-1149	P13767	19.7	60S	0.6	5MR	4.2	20S	6.9	20S	46	78
1150	IPPSN2019-1150	P13809	3.3	10S	0.1	TMR	1.0	5S	12.0	40S	46	78
1151	IPPSN2019-1151	P13813	7.3	20MS	4.1	20S	0.2	TS	9.0	20S	46	89
1152	IPPSN2019-1152	P13815	8.0	20S	5.3	20S	3.0	5S	13.3	60S	56	89
1153	IPPSN2019-1153	P13820	6.4	20S	26.0	100S	5.0	10S	5.5	20S	57	89
1154	IPPSN2019-1154	P13821	14.0	30MS	5.1	10S	12.0	40S	13.4	40S	46	89
1155	IPPSN2019-1155	P13828	17.0	40S	7.1	20S	2.6	5S	5.9	10S	56	89
1156	IPPSN2019-1156	P13832	13.3	40S	2.4	10S	4.0	10S	6.1	20S	45	89
1157	IPPSN2019-1157	P13833	14.0	40S	2.8	10MS	0.2	TS	17.5	40S	36	89
1158	IPPSN2019-1158	P13835	11.3	20S	0.1	TMR	6.2	20S	6.3	20S	36	89
1159	IPPSN2019-1159	P13841	4.3	10MS	4.7	20S	0.2	TS	8.6	20S	46	89
1160	IPPSN2019-1160	P13851	2.5	10MS	0.1	TMR	5.0	10S	16.4	40S	45	89
1160A	**INFECTOR**	**INFECTOR**	**90.0**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**70.0**	**80S**	**68**	**99**
1161	IPPSN2019-1161	P13854	15.7	40S	1.4	10MS	12.0	60S*	19.0	60S	45	89
1162	IPPSN2019-1162	P13855	3.8	10MS	0.1	TR	0.2	TS	26.3	40S	45	78
1163	IPPSN2019-1163	P13856	6.0	20S	2.5	10S	26.0	40S	9.1	20S	46	89
1164	IPPSN2019-1164	P13858	5.0	20MS	6.1	40MS	7.0	20S	10.5	20S	45	89
1165	IPPSN2019-1165	P13861	2.7	10MS	0.4	5MR	11.0	20S	13.1	40S	45	89
1166	IPPSN2019-1166	P13908	10.7	40S	1.8	10MS	4.2	20S	9.6	20S	46	89
1167	IPPSN2019-1167	P13348	14.0	60S	2.8	10MS	14.0	60S	15.8	40S	46	89
1168	IPPSN2019-1168	P13537	12.7	40S	4.7	10S	17.0	60S	14.4	60S	46	89
1169	IPPSN2019-1169	P13543	12.7	40S	1.1	10MR	0.2	TS	9.4	20S	46	89
1170	IPPSN2019-1170	P13582	13.0	40S	2.7	10MS	0.2	TS	19.4	40S	46	89
1171	IPPSN2019-1171	P13644	19.0	60S	2.4	10MS	18.0	40S	11.0	40S	45	89
1172	IPPSN2019-1172	P13686	13.3	40S	3.4	10MS	13.0	20S	14.5	40S	46	89
1173	IPPSN2019-1173	P13811	14.0	40S	4.9	20MS	2.0	10S	7.8	20S	45	89
1174	IPPSN2019-1174	P13816	11.0	40S	0.4	5MR	0.2	TS	9.8	20S	45	89
1175	IPPSN2019-1175	P12206	22.5	60S	22.7	60S	18.6	40S	16.5	60S	46	78
1176	IPPSN2019-1176	P12368	33.0	60S	19.4	80S	7.8	20S	14.4	40S	46	89
1177	IPPSN2019-1177	P13614	18.2	60S	8.7	40S	4.0	10S	14.0	40S	47	89
1178	IPPSN2019-1178	P13779	6.8	20MS	1.4	5MS	0.2	TS	9.1	40S	46	89
1179	IPPSN2019-1179	P13787	12.5	40S	2.0	10MS	0.0	TR	23.0	40S	46	78
1180	IPPSN2019-1180	P13789	13.0	30MS	17.0	80S	1.0	5S	34.8	60S	46	89
1180A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**83.3**	**100S**	**76.0**	**80S**	**72.5**	**80S**	**68**	**99**
1181	IPPSN2019-1181	P13834	6.3	20S	3.3	20S	0.2	TS	11.7	40S	46	78
1182	IPPSN2019-1182	P13839	20.4	60S	0.1	TR	4.2	20S	12.2	40S	45	89
1183	IPPSN2019-1183	P13965	2.4	20MR	0.7	10MR	1.8	5S	1.8	5S	45	89

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
1184	IPPSN2019-1184	P13966	6.7	20MS	0.0	TR	5.0	20S	10.5	40S	46	78
1185	IPPSN2019-1185	P8213	27.7	100S	3.1	10S	1.0	5MS	2.5	5S	45	68
1186	IPPSN2019-1186	P8217	25.4	100S	2.4	10S	0.2	TS	4.1	10MS	56	78
1187	IPPSN2019-1187	P8223	27.3	100S	3.4	20S	0.2	TS	3.4	10S	45	89
Nuziveedu Seeds												
1188	IPPSN2019-1188	NWS2128	47.7	100S	12.8	60S*	2.0	10S	27.0	60S	46	89
1189	IPPSN2019-1189	NWS2194	8.2	20MS	0.7	5MS	9.0	20S	28.8	60S	46	89
BMZ - Breeding 2019-20												
1190	IPPSN2019-1190	BISA-01	13.1	40S	2.1	10MS	0.2	TS	11.9	40S	46	89
1191	IPPSN2019-1191	BISA-02	11.3	20S	1.6	5S	0.0	0	7.2	20S	46	89
1192	IPPSN2019-1192	BISA-03	4.5	10S	2.7	20MS	2.8	10MS	12.4	40S	46	78
1193	IPPSN2019-1193	BISA-04	8.7	20S	0.1	TMR	0.2	TS	8.1	20MS	35	78
1194	IPPSN2019-1194	BISA-05	4.7	20S	4.2	20MS	1.8	5S	10.6	20S	46	89
1195	IPPSN2019-1195	BISA-06	7.7	20MS	0.8	10MR	2.8	10S	11.1	20S	45	89
1196	IPPSN2019-1196	BISA-07	17.0	40S	2.7	20MS	4.4	20S	6.5	10S	45	89
1197	IPPSN2019-1197	BISA-08	5.0	20MS	2.7	20MS	1.2	5S	2.9	10S	36	89
1198	IPPSN2019-1198	BISA-09	31.3	60S	1.7	10MS	0.0	0	11.5	40S	46	89
1199	IPPSN2019-1199	BISA-10	17.7	40S	1.4	10MS	0.0	0	15.9	40S	46	89
1200	IPPSN2019-1200	CSW217	1.4	5MS	0.1	TR	0.2	TS	6.7	20S	45	68
1200A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**90.0**	**100S**	**76.0**	**80S**	**72.5**	**100S**	**79**	**99**
1201	IPPSN2019-1201	CSW219	15.3	40MS	2.1	10MS	0.2	TS	17.6	40S	46	89
1202	IPPSN2019-1202	CSW220	14.0	40S	3.5	20MS	1.0	5S	5.6	20S	34	47
1203	IPPSN2019-1203	CSW221	12.3	40MS	13.2	20S	6.8	20S	3.1	10S	47	89
1204	IPPSN2019-1204	CSW222	11.8	40S	4.5	10S	2.8	10S	16.8	40S	46	78
1205	IPPSN2019-1205	CSW223	15.3	40S	4.1	20MS	2.8	10S	8.3	20S	46	89
1206	IPPSN2019-1206	HI 1636	1.5	10MS	0.0	TR	9.0	40S	50.5	80S	46	89
1207	IPPSN2019-1207	HI 1637	1.0	5MS	0.0	TR	0.2	TS	45.0	60S	46	89
1208	IPPSN2019-1208	HI 1641	3.7	20MS	0.1	TR	4.2	20S	53.1	80S	46	89
1209	IPPSN2019-1209	HI 1647	8.2	20MS	6.2	20MS	2.0	10S	23.1	60S	47	89
1210	IPPSN2019-1210	BWL 5373	9.6	20MS	16.0	60S	1.8	10MS	4.1	10S	45	89
1211	IPPSN2019-1211	BWL 6893	12.7	40S	3.8	20S	1.0	5MS	18.0	40S	46	78
1212	IPPSN2019-1212	BWL 7466	10.7	40S	2.1	10MS	2.8	10S	13.2	40S	45	78
1213	IPPSN2019-1213	BWL 8166	6.9	20MS	1.5	10MS	1.8	5S	2.5	20S	46	89
1214	IPPSN2019-1214	BWL 8173	31.3	60S	2.3	10MS	0.2	TS	2.3	10S	46	89
1215	IPPSN2019-1215	BWL 8226	5.8	20MS	4.5	20MS	2.0	10S	12.2	40S	47	89
1216	IPPSN2019-1216	BWL 8231	18.5	40MS	2.7	20MS	2.8	10S	7.1	40S	46	89
1217	IPPSN2019-1217	BWL 8234	22.0	40S	5.8	40MS	1.0	5MS	3.1	10S	46	89
1218	IPPSN2019-1218	BWL 8858	12.8	30S	4.1	20MS	1.0	5MS	13.8	40S	46	89
1219	IPPSN2019-1219	BWL 8856	31.1	60S	4.2	10MS	0.2	TS	11.5	20S	47	89
1220	IPPSN2019-1220	WH 1288	4.9	20S	1.5	10MS	4.2	20S	19.0	40S	46	89
1220A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**90.0**	**100S**	**76.0**	**80S**	**75.0**	**100S**	**78**	**99**
1221	IPPSN2019-1221	WH 1289	27.7	60S	2.1	10MS	1.0	5S	20.3	40S	46	89
1222	IPPSN2019-1222	WH 1290	6.8	20MS	4.4	10S	1.0	5S	16.7	40S	46	89
1223	IPPSN2019-1223	WH 1291	15.3	40MS	20.4	100S*	1.4	5S	17.6	40S	46	89
1224	IPPSN2019-1224	BMZ-K-1901	10.5	20MS	4.1	20S	1.0	5MS	21.9	60S	46	89
1225	IPPSN2019-1225	BMZ-K-1902	5.0	20MS	0.2	TMS	0.8	5MS	21.9	40S	46	89
1226	IPPSN2019-1226	BMZ-K-1903	4.1	10MS	0.2	TMR	0.2	TS	14.9	40S	45	89
1227	IPPSN2019-1227	BMZ-K-1904	11.2	40S	2.2	10MS	2.0	10S	11.8	30MS	46	89
1228	IPPSN2019-1228	BMZ-K-1905	6.0	20S	1.4	10MS	1.4	5S	8.7	20S	46	89
1229	IPPSN2019-1229	BMZ-K-1906	8.7	20MS	1.4	10MS	4.8	20S	12.3	40S	46	78
1230	IPPSN2019-1230	BMZ-K-1907	11.7	40S	10.2	60S*	4.8	20S	11.7	40S	45	89
1231	IPPSN2019-1231	UAS BW 11404	12.7	40MS	8.8	40S	6.0	20S	30.4	60S	45	89
1232	IPPSN2019-1232	UAS BW 11454	5.8	20MS	1.4	5MS	6.0	20S	11.4	40S	46	89
1233	IPPSN2019-1233	UAS428	5.4	20S	3.0	10MS	9.4	40S	4.8	10S	36	56
JNKVV, Jabalpur												
1234	IPPSN2019-1234	MP3538	19.5	60S	5.0	20S	14.0	60S	30.7	60S	46	89
1235	IPPSN2019-1235	MP3539	11.0	40MS	36.0	80S	34.0	40S	47.5	80S	56	89
1236	IPPSN2019-1236	MP3540	16.7	40S	11.4	40S	5.2	10S	39.4	60S	46	89
1237	IPPSN2019-1237	MP3541	2.3	20MR	0.7	5MS	0.2	TS	36.3	60S	46	89
1238	IPPSN2019-1238	MP3542	9.3	20S	4.9	20MS	9.0	20S	11.1	40S	46	78
1239	IPPSN2019-1239	MP3543	22.8	100S	11.8	60S*	9.2	20S	33.1	80S	57	89

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
1240	IPPSN2019-1240	MP3544	13.4	40S	14.4	60S	7.4	20S	35.5	80S	46	78
1240A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**90.0**	**100S**	**80.0**	**100S**	**75.0**	**100S**	**68**	**99**
1241	IPPSN2019-1241	MP3545	6.2	20S	9.9	40S	4.0	20S	6.5	20S	45	78
1242	IPPSN2019-1242	MP3546	10.7	40MS	1.8	10S	2.0	10S	10.9	40S	46	89
1243	IPPSN2019-1243	MP3547	13.7	40MS	29.0	60S	21.2	40S	55.6	80S	56	89
1244	IPPSN2019-1244	MP3536	2.0	20MR	1.4	10MS	0.2	TS	38.8	60S	46	89
1245	IPPSN2019-1245	MP3537	40.0	80S	4.8	20MS	6.0	20S	47.6	80S	46	89
1246	IPPSN2019-1246	MP3525	28.5	80S	15.4	60S	0.2	TS	15.1	40S	46	78
1247	IPPSN2019-1247	MP3551	19.3	60S	5.4	20MS	4.2	10S	31.3	60S	46	78
1248	IPPSN2019-1248	MP3552	3.6	10S	7.4	20S	4.0	10S	18.3	40S	46	78
Sal/Alk nursery												
1249	IPPSN2019-1249	RWP-2019-26	6.4	20MS	5.3	10S	8.8	20S	20.1	60S	47	89
1250	IPPSN2019-1250	RWP-2019-27	8.8	20S	8.8	40S	4.8	10S	28.6	80S	46	89
1251	IPPSN2019-1251	KRL-1901	18.3	60S	12.1	40S	15.0	20S	42.5	80S	46	89
1252	IPPSN2019-1252	KRL-1902	7.1	30S	24.0	40S	40.2	60S	40.1	80S	46	89
1253	IPPSN2019-1253	KRL-1903	16.7	40S	5.4	20S	14.2	40S	37.5	80S	45	78
1254	IPPSN2019-1254	KRL-1904	7.1	20MS	2.8	10MS	12.6	60S*	42.3	80S	46	89
1255	IPPSN2019-1255	KRL-1905	5.7	20MS	8.1	20S	18.0	40S	48.0	80S	46	89
1256	IPPSN2019-1256	KRL-1906	30.0	60S	0.1	TR	5.0	10S	45.5	80S	45	78
1257	IPPSN2019-1257	KRL-1907	4.5	10MS	11.7	15MS	4.2	20S	56.0	80S	46	89
1258	IPPSN2019-1258	KRL-1908	3.2	10S	4.0	20MS	6.2	20S	32.5	60S	46	89
1259	IPPSN2019-1259	KRL-1909	25.7	60S	1.4	5MS	8.0	20S	27.6	60S	45	89
1260	IPPSN2019-1260	KRL-1910	6.3	20MS	4.8	20S	6.0	20S	30.1	60S	46	89
1260A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**86.7**	**100S**	**80.0**	**100S**	**72.5**	**100S**	**68**	**99**
1261	IPPSN2019-1261	WH1352	16.2	40S	1.4	10MS	2.0	10S	11.2	40S	46	89
1262	IPPSN2019-1262	WH1351	9.7	20S	3.0	20MS	1.4	5S	3.4	10S	35	89
1263	IPPSN2019-1263	RWP-2019-24	3.8	10S	0.1	TMR	4.8	10S	7.5	20S	46	89
1264	IPPSN2019-1264	RWP-2019-25	4.1	20MS	0.4	5MR	1.0	5MS	3.1	10S	46	89
1265	IPPSN2019-1265	DWAP-1923	3.5	20MS	3.4	20MS	3.0	10S	6.7	10S	46	89
1266	IPPSN2019-1266	DWAP-1924	13.0	40S	0.9	5S	0.0	0	16.4	40S	35	68
1267	IPPSN2019-1267	BST-SAL-1910	2.8	20MS	0.1	TR	2.0	10S	40.0	80S	46	89
1268	IPPSN2019-1268	SANSR-6	6.5	20S	1.3	5MS	9.0	20S	30.1	60S	46	78
1269	IPPSN2019-1269	SANSR-7	6.0	20S	1.8	10S	16.0	40S	20.0	40S	46	78
1270	IPPSN2019-1270	NEPZ-18-51	12.0	40MS	19.7	60S	17.8	40S	22.4	60S	36	78
1271	IPPSN2019-1271	NEPZ-18-25	4.9	20S	0.1	TR	3.2	10S	14.3	40S	46	78
1272	IPPSN2019-1272	LBP-18-23	8.0	20S	18.0	40S	9.0	20S	18.4	60S	45	78
1273	IPPSN2019-1273	KRL210 (C)	33.0	60S	16.0	40S	6.0	10S	28.8	80S	46	89
1274	IPPSN2019-1274	KRL 19 (C)	17.3	40S	32.0	80S	9.0	20S	45.0	80S	46	89
1275	IPPSN2019-1275	NW-7081	10.3	40S	0.1	TMR	3.0	10S	27.8	60S	46	89
1276	IPPSN2019-1276	NW-7098	28.0	60S	4.8	20S	0.2	TS	13.0	40S	45	78
1277	IPPSN2019-1277	K-1809	11.7	20S	1.6	10MS	0.2	TS	22.6	60S	46	78
1278	IPPSN2019-1278	K-1805	4.3	10S	8.4	30S	4.2	10S	14.8	40S	36	78
WBN/QCSN												
1279	IPPSN2019-1279	HD3304	16.3	40MS	6.1	20S	3.2	10S	6.4	20S	46	78
1280	IPPSN2019-1280	QLD112	15.2	40S	22.3	80S	5.0	10S	6.6	20S	45	89
1280A	**INFECTOR**	**INFECTOR**	**76.7**	**100S**	**90.0**	**100S**	**76.0**	**80S**	**72.5**	**100S**	**78**	**99**
1281	IPPSN2019-1281	GW2017-825	8.7	20MS	2.7	10MS	0.6	5MR	52.5	80S	57	89
1282	IPPSN2019-1282	AR-15-15	29.0	80S	40.0	80S	12.8	60S*	31.3	80S	57	89
1283	IPPSN2019-1283	BWL5429	6.4	20S	11.4	60S*	4.8	20S	6.9	20S	46	89
1284	IPPSN2019-1284	QBP-18-14	6.2	20S	0.4	5MR	6.0	20S	15.9	60S	46	78
1285	IPPSN2019-1285	QBP-18-15	10.7	40S	1.4	10MS	2.0	10S	22.8	60S	46	68
1286	IPPSN2019-1286	MP3533	6.5	20S	25.0	60S	28.0	40S	47.5	80S	46	78
1287	IPPSN2019-1287	GW-2018-934 (d)	1.2	10MR	11.4	60S*	1.0	5S	14.7	80S	46	89
1288	IPPSN2019-1288	GW-2018-936 (d)	2.2	10MR	0.1	TR	0.2	TS	2.4	10S	47	89
1289	IPPSN2019-1289	KA1821	11.7	40S	2.7	10MS	10.2	20S	17.0	40S	35	78
1290	IPPSN2019-1290	BWL-8035	5.4	20MS	0.4	5MR	0.2	TS	19.6	60S	35	78
1291	IPPSN2019-1291	NIAW-3889	5.1	20MS	0.5	5MR	0.2	TS	26.5	60S	45	78
1292	IPPSN2019-1292	MP3520	14.2	40S	18.1	60S	12.2	40S	31.1	60S	45	89
1293	IPPSN2019-1293	MP3522	6.7	20MS	2.1	10MS	1.0	5MS	15.8	40S	45	78
1294	IPPSN2019-1294	QBI-19 - 11	7.3	20MS	2.8	20MS	0.2	TS	21.5	40S	46	89
1295	IPPSN2019-1295	QBI-19 - 22	8.7	30S	7.7	30S	2.8	10MS	23.8	60S	36	78

IPPSN No.	Entry code	Entry	Stem rust		Leaf rust (South)		Leaf rust (North)		Yellow rust		Foliar blight	
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg.	HS
1296	IPPSN2019-1296	QBI-19 - 08	14.3	40MS	12.0	40MS	5.4	20MS	25.1	60S	46	78
1297	IPPSN2019-1297	QBI-19 - 16	10.0	20S	14.0	60S	3.4	10S	28.8	80S	46	89
1298	IPPSN2019-1298	QBI-19 - 09	2.9	10MS	3.5	20S	3.0	10MS	20.2	40S	46	89
1299	IPPSN2019-1299	QBI-19 - 14	6.1	20MS	17.4	80S	1.4	5S	27.8	60S	45	99
1300	IPPSN2019-1300	QBI-19 - 13	8.0	20S	1.6	5S	8.2	40S	32.5	60S	46	89
1300A	**INFECTOR**	**INFECTOR**	**83.3**	**100S**	**90.0**	**100S**	**76.0**	**80S**	**75.0**	**100S**	**68**	**99**
1301	IPPSN2019-1301	QBI-19 - 23	4.8	20MS	16.8	60S	2.4	10S	31.4	60S	35	56
1302	IPPSN2019-1302	QBI-19 - 15	5.4	20MS	11.7	40S	1.3	5S	26.4	60S	46	89
1303	IPPSN2019-1303	QBI-19 - 10	4.7	10MS	1.4	5MS	3.8	10S	26.1	60S	45	89
1304	IPPSN2019-1304	BWL- 7827	7.0	20S	0.1	TR	2.0	10S	12.1	40S	46	89
1305	IPPSN2019-1305	BWL- 7829	6.7	10S	2.0	10MS	0.2	TS	5.0	10S	46	89
1306	IPPSN2019-1306	BWL- 8875	16.2	40S	3.7	10S	3.8	10S	16.1	60S	46	89
1307	IPPSN2019-1307	BWL- 8878	14.4	40S	11.4	60S*	0.6	5MR	15.6	60S	46	78
1308	IPPSN2019-1308	BWL- 8879	20.0	40S	2.8	20MS	1.0	5MS	7.8	20S	46	89
1309	IPPSN2019-1309	BWL- 8880	6.2	20MS	2.8	20MS	1.8	5S	2.3	5S	46	89
1310	IPPSN2019-1310	BWL- 8881	4.7	20MS	2.7	20MS	0.2	TS	1.4	10MS	46	89
1311	IPPSN2019-1311	BWL- 8884	4.6	10MS	3.5	20MS	0.0	0	1.3	5S	46	89
1312	IPPSN2019-1312	GW-A-2019-957	4.4	20MS	0.1	TR	1.0	5S	21.4	60S	56	99
1313	IPPSN2019-1313	GW-A-2019-958	4.0	20MR	0.1	TMR	4.2	20S	35.4	60S	45	99
1314	IPPSN2019-1314	KA-1916	35.5	80S	38.1	100S	36.0	60S	36.4	80S	56	99
1315	IPPSN2019-1315	KA-1917	43.3	80S	24.7	40S	40.0	60S	37.4	80S	46	89
1316	IPPSN2019-1316	KA-1935	13.4	40S	0.1	TR	13.0	60S*	29.3	60S	46	89
1317	IPPSN2019-1317	BNSR-4	8.3	20MS	9.0	20S	32.0	60S	12.8	40S	46	89
1318	IPPSN2019-1318	BST-2019-01	6.7	20S	7.7	20MS	2.0	10S	12.6	40S	46	99
1319	IPPSN2019-1319	BST-2019-02	6.7	20MS	16.0	40S	12.0	40S	28.4	80S	46	89
1320	IPPSN2019-1320	8th HPYT431	13.7	20S	4.7	20S	0.2	TS	17.5	40S	45	78
1320A	**INFECTOR**	**INFECTOR**	**86.7**	**100S**	**90.0**	**100S**	**80.0**	**100S**	**72.5**	**80S**	**68**	**99**
1321	IPPSN2019-1321	8th HPYT443	24.3	40S	6.0	20S	0.2	TS	9.5	20S	46	89
1322	IPPSN2019-1322	2nd HPYT429	39.0	80S	13.1	40S	16.2	40S	8.0	20S	46	89
1323	IPPSN2019-1323	QLD-116	1.7	5MS	2.7	20MS	0.2	TS	11.4	20S	46	89
1324	IPPSN2019-1324	UASDW30561	4.4	10S	0.1	TR	0.2	TS	3.0	10S	56	89

Abbreviations: ACI = Average Coefficient of Infection, HS = Highest Score, Avg. = Mean, *Indicates high rust score (more than 40S) at one location only.

150 YEARS OF CELEBRATING THE MAHATMA

बेटी बचाओ बेटी पढ़ाओ

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
Agrisearch with a human touch

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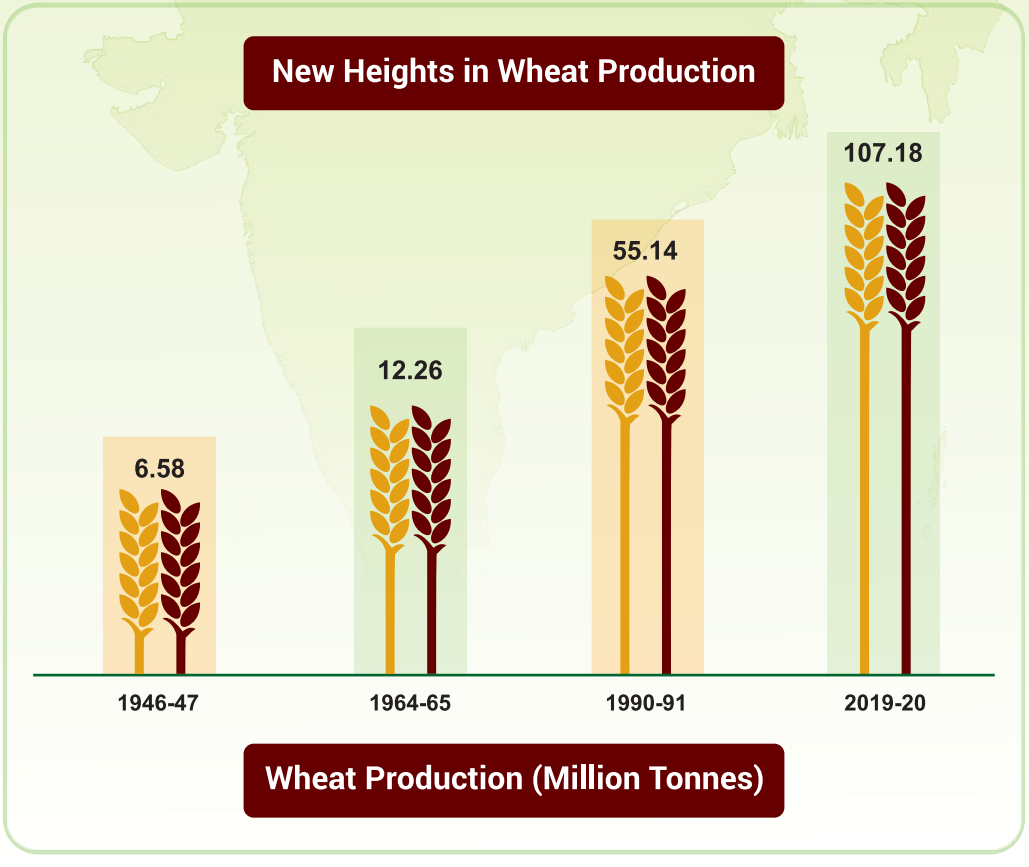

59th All India Wheat & Barley Research Workers' Meet
(August 24-25, 2020)

59वीं अखिल भारतीय गेहूँ एवं जौ अनुसंधान कार्यशाला में आयोजित गोष्ठी के दौरान जारी किया गया