प्रगति प्रतिवेदन
PROGRESS REPORT
2021-22

फसल सुरक्षा
CROP PROTECTION

Azadi Ka Amrit Mahotsav

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
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CROP PROTECTION

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(Sudheer Kumar)
Principal Investigator
(Crop Protection Programme)

ICAR-IIWBR, Karnal
Dated: 10rd August 2022

C O N T E N T S

ANNEXURES

PROGRAMME OF WORK, 2021-22

The programme for the crop year 2021-22 discussed in detail in work plan finalization meeting held on 5.8.2021 through virtual platform and finalized in the 60th All India Wheat and Barley Research Workers Meet during August 23-24, 2021. 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 Centres against rusts and foliar blights for promoting to coordinated multi-location trials. (Under artificial inoculated conditions)

(a) Rusts:

North:

Stripe rust: Malan, Dhaulakuan, Jammu, Gurdaspur, Ludhiana, Karnal, Hisar and Durgapura.

Leaf rust: Ludhiana, Karnal, Delhi, Durgapura, Ayodhya, Kanpur, Sabour and Coochbehar.

South:

Leaf rust + Stem rust: Vijapur, Indore, Powarkheda, Niphad, Pune, Mahabaleshwar, Dharwad and Wellington.

(b) **Leaf Blight:** Ayodhya, Varanasi, RPCAU Pusa, Sabour, Kalyani, Coochbehar, Pune and Dharwad.

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: Kudwani, Malan, Bajaura, Dhaulakuan, Almora, Jammu, Gurdaspur, Ludhiana, Karnal, Hisar, Delhi, Durgapura and Pantnagar.

Leaf rust: Jammu, Ludhiana, Karnal, Hisar, Delhi, Durgapura, Pantnagar, Kanpur, Ayodhya and Kalyani.

South:

Leaf rust and Stem rusts: Junagarh, Vijapur, Indore, Powarkheda, Niphad, Pune, Mahabaleshwar, Dharwad and Wellington.

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 to the Incharge, IIWBR Regional Station Flowerdale, Shimla for pathotype analysis, with information to P.I. (Crop Protection).

For screening against rusts the mixture of following races will be used and be provided by IIWBR, RS, Flowerdale, Shimla

Rust	Rust pathogen	Pathotypes
Stem/Black	*Puccinia graminis tritici*	11, 40A, 117-6, 21A-2, 122
Stripe/Yellow	*P. striiformis*	238S119, 46S119, 110S119, 110S84, T
Leaf/Brown	*P. triticina*	77-9, 77-5, 104-2, 12-5, 77-1

3. Monitoring of PPSN

The teams of plant pathologists and breeders will be constituted by PI, CP for effective monitoring and data recording in PPSN at various locations in different zones.

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

Stripe rust: Ludhiana, Karnal, Durgapura
Leaf rust: Ayodhya, Mahabaleshwar
Stem rust: Mahabaleshwar, Indore

PROGRAMME 2: Seedling rust resistance and rust gene postulation

1. Race specific adult plant resistance

AVT entries will be screened for adult plant resistance to specific predominant races

a) Stripe, leaf and stem rusts (under controlled conditions): Flowerdale, Shimla
b) Stripe rust – Ludhiana and New Delhi
c) Leaf rust – Powarkheda, New Delhi and Ludhiana
d) Black rust (under controlled conditions): Pune, Indore and Mahabaleshwar

Race inoculum to be supplied by RS, IIWBR, Flowerdale and races should be the same for all the respective Centres as follows.

Rust	**Rust pathogen**	**Pathotypes**	
		Flowerdale	**Other Centres**
Stem/Black	*P. graminis tritici*	11, 40A, 117-6	11, 40A
Stripe/Yellow	*P. striiformis*	238S119, 46S119, 110S119	238S119, 46S119
Leaf/Brown	*P. triticina*	77-9, 77-5, 104-2	77-9, 77-5

2. Seedling Resistance Tests (SRT) and postulation of rust resistance genes

(a) Stripe, leaf and stem 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.

(b) Leaf and stem rust: 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 AVT's entries as well as other resistant entries identified. It will have all the released varieties and material found resistant in preceding years.

Centres:
NWPZ: Ludhiana, Karnal, Hisar and Pantnagar.
NEPZ: Ayodhya, Varanasi, RPCAU Pusa, Sabour, Ranchi, Kalyani Coochbehar and Shillongani.
CZ: Indore and Powarkheda
PZ: Pune and Dharwad

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.

Centres: Malan, Jammu, Ludhiana, Karnal, Hisar, New Delhi, and Pantnagar.

PROGRAMME 5: Loose Smut

Loose Smut Screening Nursery (LSSN): It will contain resistant materials identified in the past released varieties and AVT entries.

Centres: Malan, Almora, Ludhiana, Hisar and Durgapura.

PROGRAMME 6: Powdery Mildew

Powdery Mildew Screening Nursery (PMSN): All entries of AVT, previously identified resistant material and released varieties (NHZ, NWPZ)

Centres: Malan, Dhaulakuan, Almora, Jammu, Pantnagar and Wellington

PROGRAMME 7: Region specific diseases

1. **Flag Smut Screening Nursery:** Ludhiana, Hisar, Delhi and Durgapura.
2. **Head scab:** Dhulakuan, Gurdaspur, Delhi and Wellington
3. **Foot rot:** Dharwad
4. **Hill bunt:** Malan, Bajaura and Almora (AVT entries NHZ only).

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 2021 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 teams are constituted to monitor wheat crop in West Bengal, Bihar 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 Centres are required to send the rust infected samples (natural infection) for pathotype analysis to the concerned centres according to recommended protocol.

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

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, Ayodhya, 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 all the cooperating centres by analysing samples from grain *mandies* of their respective states.

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:
   Stripe rust: Kudwani, Malan, Dhaulakuan, Almora, Jammu, Ludhiana, Karnal, Hisar, Delhi, Durgapura and Pantnagar.
   Leaf rust (N): Jammu, Ludhiana, Karnal, Hisar, Delhi, Durgapura, Pantnagar, Kanpur, Ayodhya and Kalyani.
   Leaf rust (S) and Stem rusts: Vijapur, Indore, Powarkheda, Niphad, Pune, Mahabaleshwar, Dharwad and Wellington.

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
   Stripe rust: Kudwani, Malan, Dhaulakuan, Almora, Jammu, Ludhiana, Karnal, Hisar, Delhi, Durgapura and Pantnagar.
   Leaf rust (N): Jammu, Ludhiana, Karnal, Delhi, Durgapura, Pantnagar, Kanpur, Ayodhya and Kalyani.
   Leaf rust (S) and Stem rusts: Vijapur, Indore, Powarkheda, Niphad, Pune, Mahabaleshwar, Dharwad and Wellington.
   Leaf blights: Ludhiana, Karnal, Pantnagar, Ayodhya, Varanasi, Sabour, Kalyani, Coochbehar, Indore, Powarkheda, Pune and Dharwad.
   Karnal Bunt: Malan, Jammu, Ludhiana, Karnal, Hisar, New Delhi, and Pantnagar.
   Loose smut: Malan, Almora, Ludhiana, Hisar and Durgapura**.**
   Powdery mildew: Malan, Dhaulakuan, Almora, Jammu, Pantnagar and Wellington
   Flag smut: Ludhiana, Hisar, Delhi and Durgapura
   Head scab: Dhulakuan, Gurdaspur, Delhi and Wellington
   Nematodes (CCN): Hisar and Durgapura.

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

3. **Management of diseases**

(a) Chemical management of powdery mildew:

Centres: Malan, Dhaulakuan, Almora, Jammu Pantnagar and Wellington.
The chemicals will be tested are:

S. No.	Treatments	Doses
1	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	@ 0.1%
2	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC	@ 0.1%
3	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	@ 0.1%
4	Propiconazole	@ 0.1%
5	Tebuconazole	@ 0.1%
6	Control	-

The chemical will be evaluated under artificial inoculated condition and spray will be done on initiation of diseases and repeated once after 15 days. Design – RBD, Plot size – 6 rows of 3 meters, replications - 3.

(b) Chemical management of head scab:

Centres: Gurdaspur, Ludhiana, Karnal and Wellington.
The chemicals will be tested are:

S. No.	Treatments	Doses
1	Picoxystrobin 7.05% + Propiconazole 11.7% SC,	@ 0.1%

2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE,	@ 0.1%
3	Tebuconazole 50% + Trifloxystrobin 25% WG,	@ 0.06%
4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	@ 0.1%
5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	@ 0.1%
6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	@ 0.1%
7	Propiconazole	@ 0.1%
8	Tebuconazole	@ 0.1%
9	Control	-

The chemical will be evaluated under artificial inoculated condition and spray will be done at heading stage. Design – RBD, Plot size – 6 rows of 3 meters, replications - 3.

(c) Chemical management of leaf rust:

Centres: Ludhiana, Karnal, Durgapura, Pantnagar, Kanpur, Ayodhya, Indore, Powarkheda, Niphad, Mahabaleshwar.

The chemicals will be tested are:

S. No.	Treatments	Doses
1	Picoxystrobin 7.05% + Propiconazole 11.7% SC,	@ 0.1%
2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE,	@ 0.1%
3	Tebuconazole 50% + Trifloxystrobin 25% WG,	@ 0.06%
4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	@ 0.1%
5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	@ 0.1%
6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	@ 0.1%
7	Propiconazole	@ 0.1%
8	Tebuconazole	@ 0.1%
9	Control	-

The chemical will be evaluated under artificial inoculated condition and spray will be done on initiation of diseases and repeated once after 15 days. Design – RBD, Plot size – 6 rows of 3 meters, replications - 3.

(d) Chemical management of stem rust:*

Centres: Vijapur, Indore, Niphad, Pune, Mahabaleshwar, Dharwad and Wellington.

The chemicals will be tested are:

S. No.	Treatments	Doses
1	Picoxystrobin 7.05% + Propiconazole 11.7% SC,	@ 0.1%
2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE,	@ 0.1%
3	Tebuconazole 50% + Trifloxystrobin 25% WG,	@ 0.06%
4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	@ 0.1%
5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	@ 0.1%
6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	@ 0.1%
7	Propiconazole	@ 0.1%
8	Tebuconazole	@ 0.1%
9	Control	-

The chemical will be evaluated under artificial inoculated condition and spray will be done on initiation of diseases and repeated once after 15 days. Design – RBD, Plot size – 6 rows of 3 meters, replications - 3.

(e) Chemical management of leaf blight

Centres: Karnal, Ayodhya, Sabour, Kalyani, Coochbehar, Pune and Dharwad.

The chemicals will be tested are:

S. No.	Treatments	Dosages
1	Tebuconazole 50% + Trifloxystrobin 25%,	0.1%
2	Propiconazole 13.9% + Difenconazole 13.9%	0.1%
3	Azoxystrobin 12.5% + Tebuconazole 12.5%	0.1%

4	Picoxystrobin 7.05% + Propiconazole 11.7%	0.1%
5	Kresoxim Methyl 44.3% SC	0.1%
6	Propiconazole 25%	0.1%
7	Tebuconazole 25.9%	0.1%
8	Mancozeb 75%	0.2%
9	Control	-

The chemical will be evaluated under artificial inoculated condition and spray will be done on initiation of diseases 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, Durgapura, Khudwani, Kalyani, RAU Pusa, 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, Durgapura, Khudwani, Kalyani, RAU Pusa, 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) Population dynamics of insect-pests and natural enemies under different residue management scenarios in rice-wheat cropping system (Centres: Karnal, Ludhiana-New trial)

Effect of different sowing methods (Happy seeder, Superseeder, Rotavator) under varied residue amounts will be tested to study the population dynamics of insect-pests and natural enemies in rice-wheat cropping system.

(d) Effect of silicon on the incidence of major insect-pests and natural enemies of wheat (Centres: Karnal and Ludhiana-New trial)
Different doses of Monosilicic acid (MSA) will be evaluated against major insect-pests and natural enemies of wheat.

(e) Evaluation of biodegradable insecticide loaded hydrogels for management of termites in wheat (Centres: Karnal and Ludhiana-New trial)
Soil application of polyacrylamide and alginate loaded insecticide hydrogel formulations will be tested for management of termites in wheat.

(f) 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.

(g) 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.

(h) Management of aphids through foliar application of new chemical molecules (Centres: Karnal, Ludhiana, Niphad, Vijapur, Kanpur, Durgapura)
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.

(h) Management of lepidoterous pests (pink stem borer, army worm & cutworms) of wheat: (Centres: Karnal and Ludhiana)
With increasing incidence of lepidopterous insect-pests in rice-wheat cropping system, an experiment will be conducted on the management of these pests through, chemicals, biopesticides etc.

(i) 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.

3. Stored Grain Pest Management

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

(b) To evaluate seed protectants for management of storage insect pests of wheat (**Centres**: Karnal, Ludhiana, Kharibari, Niphad)
Effect of seed protectants will be tested against infestation of major storage insect pests; *Sitophilus oryzae* or *Rhizopertha dominica* in wheat.

PROGRAMME 11. NEMATOLOGY

1. Monitoring of Nematodes: *Heterodera avenae, Anguina tritici, Meloidogyne graminicola* and other plant parasitic nematod*e*: All centres of Nematology

2. **Evaluation of resistance against nematodes parasitizing wheat**
   (a) *Heterodera avenae*: Hisar and Durgapura. (AVT and MDSN lines)

3. **Evaluation of new chemical against cereal cyst nematode, *Heterodera avenae***
   Centres: Hisar and Durgapura.
   Treatments:
   T1 = Fluensulfone 2% GR @0.5 Kg a.i./ha at sowing (25 Kg formulation/ha)
   T2 = Fluensulfone 2% GR @1.0 Kg a.i./ha at sowing (50 Kg formulation/ha)
   T3 = Fluensulfone 2% GR @1.5 Kg a.i./ha at sowing (75 Kg formulation/ha)
   T4 = Fluensulfone 2% GR @2.0 Kg a.i./ha at sowing (100 Kg formulation/ha)
   T5 = Carbofuran @2 kg a.i/ ha at sowing
   T6 = Untreated Check

4. **Differentiation of CCN Pathotype by using International differential**
   Centre: Durgapura

List of Cooperators

PLANT PATHOLOGY PROGRAMME

NHZ

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P. Nallathambi

ENTOMOLOGY PROGRAMME

ICAR-IIWBR, Karnal
Poonam Jasrotia

PAU, Ludhiana
Beant Singh

Wheat Research Station, Vijapur
Ronak Thakkar

SKNAU, RARI, Durgapura
A.S. Baloda & B. N.Sharma

CSAUA&T, Kanpur
J. K. Singh

UAS, Dharwad
Gurudatt M. Hegde

ARS, Niphad
Bhalchandra Mhaske

Kharibari, WB
Wasim Reza

SKUAST-K. Khudwani
Shabir Hussain Wani

RPCAU, Pusa Bihar
M. S. Sai Reddy

NEMATOLOGY PROGRAMME

SKNAU, RARI, Durgapura
S.P. Bishnoi

CCS HAU, Hisar
Priyanka Duggal

Summary of trials and nurseries allotted and conducted at different cooperating centres during 2021-22 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	9		
2	Bajaura	Dr Rakesh Devlash	2		1
3	Coochbehar	Dr. Satyajit Hembram	5		2
4	Delhi	Drs. V. K. Singh, M.S.Saharan	15	1	2
5	Dharwad	Dr. Gurudatt.M.Hegde	10		3
6	Dhaulakuan	Dr Shiwani Dhiman	9	1	1
7	Durgapura	Dr. P.S. Shekhawat	13		2
8	Ayodhya	Dr. Shiv Pratap Singh	9		3
9	Hisar	Dr Rajender Singh Beniwal	13		
10	RPCAU, Pusa	Dr. Dinesh Rai	2		
11	Indore	Mr. Prakasha T.L.	9	1	1
12	Jammu	DR.M.K. Panday	12		2
13	Junagarh	Dr. I. B. Kapadiya	1		
14	Kalyani(Nadia)	Dr. Sunita Mahapatra	7	1	3
15	Kanpur	Dr. Javed Bahar Khan	5		
16	Kudwani	Drs.Nazir A.Bhat, Fayaz Mohdin	3		
17	Karnal	Drs.Sudheer Kumar, Prem Lal Kashyap, Ravindra Kumar	15		
18	Ludhiana	DR.Jaspal Kaur, Ritu Bala	20		
19	Gurdaspur	DR. Jaspal Kaur,	5		1
20	Mahabaleshwar	M. A. Sushir, V. M. Sali	7		
21	Malan	Dr. Sachin Upmanyu	12	1	2
22	Niphad	Dr. B. M. Ilhe, B.C. Game	6		
23	Pantnagar	Dr. Deepshikha	14		1
24	Powerkheda	Dr. K. K. Mishra	8	1	3
25	Pune	Dr. Sudhir Navathe	10		2
26	Ranchi	Dr. H. C. Lal	1		
27	Sabour	Dr. C.S. Azad	5		2
28	Shillongani	Mrs. R. Chakravarty	1		
29	Shimla	Drs. S.C. Bhardwaj, O.P. Gangwar, Pramod Prasad	4		
30	Varanasi	Dr. S.S. Vaish	3		
31	Vijapur	Ms. Elangbam Premabati Devi, Ronak Thakkar	5		2
32	Wellington	Dr. P. Nallathambi	11	1	2
	Entomology				
1	Dharwad	Dr. Gurudatt M. Hegde	2		
2	Duragupra	Dr. A.S. Baloda	4		1
3	Kanpur	Dr. J.K.Singh	5		1
4	Karnal	Dr. Poonam Jasrotia	12		
5	Kharibari	Dr. Wasim Reza	5		
6	Ludhiana	Dr. Beant Singh	11		
7	Niphad	Dr. Bhalchandra Mhaske	11		
8	RPCAU, Pusa	Dr. M.S. Sai Reddy	1		1
9	Vijapur	Ronal Thakkar	6		1
10	Khudwani	Dr. Shabir Hussain Wani	2		
	Nematology				
1	Durgapura	Dr. S.P.Bishnoi	3		
2	Hisar	Dr. Priyanka Duggal	3		
	Total		**316**	**7**	**39**

SUMMARY

Biotic stresses are adversely affecting the wheat crop and causing significant yield losses. To avoid these losses crop protection programme continuously keeping strict surveillance, identification of new resistance sources, strategic deployment of resistant varieties and development of management strategies. The major aim of AICRPW&B is to develop high yielding, disease resistant and climate resilient varieties for all the wheat growing zones of India. Crop protection programme worked in collaboration to wheat breeders to evaluate breeding material against major diseases and insect pests. 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 2021-22 are summarised below:

PATHOLOGY

Survey and surveillance for diseases

Wheat and barley crop health was monitored by regular surveys conducted with major emphasis on occurrence of yellow rust in NWPZ and surveillance for wheat blast near Bangladesh boarder. The 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. 27 (Issues 1 to 5) which was issued during the crop season and also uploaded on ICAR-IIWBR website (www.iiwbr.icar.gov.in). The first appearance of yellow rust of wheat is reported from village Nikku Nangal at Sh Anandpur Sahib block of Rupnagar district of Punjab on 14.1.2022 on verities HD2967 and HD 3086. Leaf rust infection was first recorded at very low incidence in few farmers' fields in the Dharwad and Belagavi districts of Karnataka during the surveys conducted on 22.12.2021. No wheat blast like symptoms was noticed at farmer's field but incidence of leaf rust, Fusarium head blight and leaf blight in some varieties was noticed in farmer's field of Raiganj, Gangarampur, Hili, Gazole, Samsi, Ratua, Manikchak, Chopra, Kharibari and Cooch Behar of West Bengal. Infestation of aphids was low in the initial stages of crop growth which increased in the months of February and March in some areas. Infestation of stem borer was also observed in some fields in Karnataka. Besides these few instance of disease and pest occurrence, no major report of disease and insects infestation observed. Overall the wheat crop health is good in all the wheat growing areas.

Host resistance

Wheat germplasm and advance breeding materials were evaluated against disease and insect pests resistance at various hot spot locations under artificially inoculated conditions. The major plant pathological nurseries were: Initial Plant Pathological Nursery (IPPSN), Plant Pathological Nursery (PPSN), Elite PPSN (EPPSN), Multiple Disease Screening Nursery (MDSN), and disease specific nurseries like Leaf Blight Screening Nursery (LBSN), Karnal Bunt Screening Nursery (KBSN), Powdery Mildew Screening Nursery (PMSN), Loose Smut Screening Nursery (LSSN), Flag Smut Screening Nursery (FSSN), Head Scab Screening Nursery, Foot rot Screening Nursery and Hill Bunt Screening Nursery. The numbers of entries tested under different plant pathological nurseries are given in Figure 1.1.

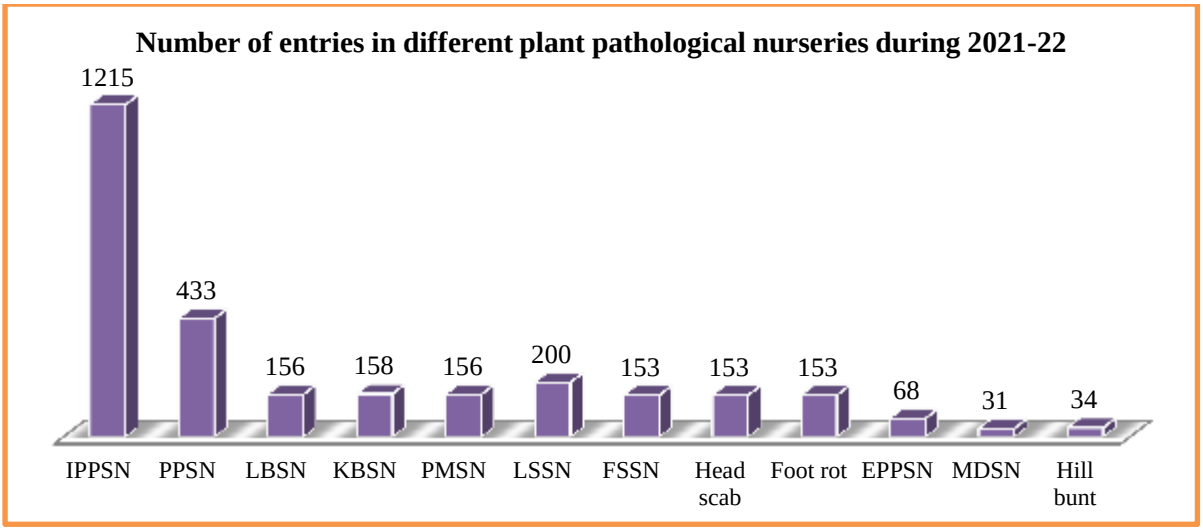

Fig. 1.1. Constitution of different plant pathological nurseries during 2021-22

Entries identified resistant against rusts in advance breeding lines:
Rust resistance materials in AVT entries (2021-22) with ACI upto 10.0 are given below:

Stem, Leaf and Stripe rusts
HD3402, HS692, HS693, VL3029, HS691, PBW870, DBW318, HI8840(d), PBW835^{Q}*, WH1402, WH1403, HI8759(C), HI8846, HD3437 and PBW902

Stem and leaf rusts
HD3402, HPW481, HS692, HS693, VL3029, HS691, UP3113, VL892(C), DBW377, PBW870, DBW318, HD3090(C), HI1633(C), MP1380#, HI8826(d)*, MP1378, HI8839(d), HI8840(d), MP1358(I)(C), NIAW3922, NIDW1149(d)(C), DBW352#, GW513(I)(C), GW547^{B}, HI1636(I)(C). HI1650*, NWS2194#, HI1665, NIAW4028 , CG1036*, GW532, HI1655^{Q}* , HI1666, HI8823(d)(I)(C), HI8830(d)*, MACS6795, PBW835^{Q}*, DBW353, PBW771(C), HD3386, NIAW3170(C), HD3397, HI1628(C), HI1654*, HUW838(I)(C), WH1402, WH1403, DBW402, KRL2021, RAJ4565, HD3438, HD3439, CG1029(C), HD3407*, HI1634(C), HI8759(C), HI8846, HI8847, HD3437, PBW677(C) and PBW902

Stem and Stripe rusts
VL2043, HD3402, HPW487, HS692, HS693, VL3029, HS690, HS691, HPW349(C), PBW870, DBW318, HI8840(d), HD3392, PBW835^{Q}*, DBW359, HD3369*, HD3400, WH1402, WH1403, HI8759(C), HI8846, HD3437 and PBW902

Leaf and Stripe rusts
VL2044, HD3402, HS692, HS693, VL3029, HPW484, HS691, VL2047, PBW870, DBW318, DDW48(d)(C), HI8840(d), UAS478(d), DDW47(d)(C), PBW833*, PBW835^{Q}*, HD3249(C), WH1402, WH1403, HI8759(C), HI8846, HD3440, HD3437 and PBW902

Identification of multiple diseases resistant entries:
The entries found resistant against rusts were again tested for other diseases also under Multiple Diseases Screening Nursery (MDSN) at multilocations. The following genotypes have been identified as conformed source of resistance for multiple diseases that may be used as resistant donor in breeding programme:

Resistant to all three rust: MPO 1357 (d)
Resistant to stem and leaf rust: HS 679,HS 681,DDK 1058 (dic.),HUW 838,RAJ 4541,HI 8823(d), DDK 1059 (dic.),GW 513,HD 2864,HI 1544,HI 1633,HI 8627(d),HI 8818(d),VL 3024

Resistant to stem and leaf rust +PM: HD 2733
Resistant to leaf and stripe rust +PM+FS: DDW 47(d)
Resistant to leaf & stripe rust +KB: UAS 466(d)
Moderately Resistant to Leaf Blight: HS 507, HI 1636

Utilization of resistance sources
The NGSN comprising 20 entries with confirmed sources of high level of disease resistance were shared with 20 breeding centers across different agro climatic zones of country for their utilization in breeding for resistance to biotic stresses. All the 20 entries were utilized in the range of 12.5 – 50.0% by different breeding centers. The most utilized entries at many centers were UP 3043, PBW 821, PBW 752 and WH 1270. Khudwani center, utilized maximum 15 entries in their breeding programme followed by Jabalpur and Durgapura.

Pathotype distribution of rust pathogens in India and Nepal during 2021-22
During 2021-22, 565 samples including three rusts of wheat, stripe of barley collected/received from thirteen states, and two Union Territories (UTs) and Nepal were analyzed.

Yellow or stripe rust of wheat and barley (*Puccinia striiformis*)
During current cropping season, 126 rust samples of wheat and barley were analyzed from five states and two UTs of Indian, and Nepal. Six pathotypes {238S119, 110S119, 46S119, 46S103 (P), 47S103 (T) and 79S68} of wheat rust pathogen (*Puccinia striiformis* f. sp. *tritici*, *Pst*) were identified. Only one pathotype 57 (0S0) of *Puccinia striiformis* f. sp. *hordei* (*Psh*) was identified in 8 barley yellow rust samples collected from barley disease screening nursery at Durgapura, Rajasthan. The *Pst* population was avirulent to *Yr5*, *Yr10*, *Yr15*, *Yr16*, *Yr32*, and *YrSP*. The frequency of *Pst* pathotype 110S119 was maximum (34.9%) followed by 238S119 (31.0%). The frequency of pathotype 238S119 was higher in Himachal Pradesh, Punjab and Nepal. The frequency of 46S119 (virulent on *Yr2*, *Yr3*, *Yr4*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr18*, *Yr19*, *Yr21*, *Yr22*, *Yr23*, *Yr25*, *Yr*A) increased to 20.6% from 15.12% previous cropping season.

Black rust of wheat (*Puccinia graminis* f. sp. *tritici*)
A total of 67 black rust samples received from Gujrat, Maharashtra, Madhya Pradesh and Tamil Nadu were pathotyped on wheat differentials. Five pathotypes 11, 21, 34-1, 40-2 and 40A of *Puccinia graminis* f. sp. *tritici* (*Pgt*) were identified. The *Pgt* population was avirulent to *Sr26*, *Sr27*, *Sr31*, *Sr32*, *Sr35*, *Sr39*, *Sr40*, *Sr43*, *SrTt3* and *SrTmp*. Pathotype 11 (79G31=RRTSF), virulent to *Sr2*, *Sr5*, *Sr6*, *Sr7b Sr9a*, *Sr9b*, *Sr9c*, *Sr9d*, *Sr9f*, *Sr9g*, *Sr10*, *Sr13*, *Sr14*, *Sr15*, *Sr16*, *Sr17*, *Sr18*, *Sr19*, *Sr20*, *Sr21*, *Sr28*, *Sr29*, *Sr30*, *Sr34*, *Sr36*, *Sr38* and *Sr*McN, was recorded in 69.4% of the samples.

Brown rust of wheat (*Puccinia triticina*)
A total of 377 samples of wheat leaf rust were pathotyped from 13 states and one UT of India and neighbouring country Nepal. Among the 18 pathotypes of *Puccinia triticina* that were identified in these samples, pathotype 77-9 (121R60-1) was the most widely distributed and occurred in 59.9% of the samples followed by 121R60-1,7 in 19.4% samples. Pathotype 77-5 (121R63-1), that remained the most predominant for more than 20 years was observed in 9.5% samples only. The remaining 15 pathotypes were identified in 11.1% samples only. In Nepal, four pathotypes were identified in 31 samples. Pathotype 77-9 was the most predominant in Nepal.

Rust resistance genes in AVT lines (Gene postulation)
***Sr*-genes**
Fourteen stem rust resistance genes (*Sr2*, *Sr5*, *Sr7a*, *Sr7b*, *Sr8a*, *Sr8b*, *Sr9b*, *Sr9e*, *Sr11*, *Sr13*, *Sr24*, *Sr28*, *Sr30* and *Sr31*) were characterized in 133 entries. The frequency of *Sr2* was maximum as it was postulated in 61 AVT entries followed by *Sr11*, *Sr7b*, and *Sr30*, which were characterized in 41, 38 and 27 entries, respectively. *Sr31* linked with *Lr26* and *Yr9* and conferring resistance to all the known *Pgt* pathotypes in Indian subcontinent was postulated in 16 AVT entries. Whereas, *Sr24* linked to *Lr24* was characterized in 3 entries CG1029(C), GW513(I)(C) and HI1636(I)(C). *Sr5* and *Sr9b* were

characterized in 18 entries while *Sr28* and *Sr8b* were postulated only in two entries. Other *Sr* genes i.e. *Sr8a, Sr13, Sr9e,* and *Sr7a* were postulated in 20, 15, 4 and 1 entries, respectively.

***Lr*-genes**

Eight *Lr* genes *Lr1, Lr3, Lr10, Lr13, Lr23, Lr24, Lr26,* and *Lr34* were characterized in 113 entries. *Lr13* was the most commonly postulated leaf rust resistance gene that was characterized, alone or in combination, in maximum number of lines (65) followed by *Lr10* (37 lines), and *Lr23* (31 lines). *Lr24* that is linked with *Sr24* was postulated in 03 entries CG1029, GW513, HI1636. *Lr26,* tightly linked with *Yr9* and *Sr31,* was characterized in 16 lines. *Lr34* was postulated in only HD2733. Resistance to leaf rust in nine entries was based on a combination of three different genes.

***Yr*-genes**

Among the 153 lines of AVT, *Yr* genes were characterized in 94 lines. *Yr* genes were postulated in lines where differential interactions were observed and some cases tight linkage of *Yr* genes to other *Lr* and *Sr* genes also implicated the presence of a resistance gene. Four *Yr* genes viz. *Yr2*, *Yr9*, *YrA* and *Yr18* contributed to yellow rust resistance in Indian wheat material. Among the postulated *Yr* genes, the frequency of *Yr2* was maximum and it was characterized, alone or in combination, in 74 lines. *Yr9*, alone or in combination, was postulated in 16 entries. *Yr18* along with *Yr2* was characterized in only PBW175(C).

Management of diseases through chemicals

Field experimental trials for the evaluation of efficiency of three chemical 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%), Azoxystrobin 11% + Tebuconazole 18.3% w/w SC (0.1%), along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] were performed in randomized block design with three replications for the management of powdery mildew of wheat during the crop season 2021-22 at four different locations i.e. Pantnagar, Malan, Dhaulakuan and Jammu. Multi-location evaluations of the efficacy of the tested fungicides clearly highlighted that Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1% (T2) is the best performing fungicide across the locations followed by Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC (0.1%) and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC (0.1%). No phytotoxicity was recorded with any of the tested concentrations of the fungicides on wheat plants.

Besides this, six different fungicides viz., Picoxystrobin 7.05% + Propiconazole 11.7% SC (0.1%), yraclostrobin 133g/l + Epoxiconaxole 50g/l SE (0.1%), Tebuconazole 50% + Trifloxystrobin 25% WG (0.06%), Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC (0.1%), Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC (0.1%) and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC (0.1%) along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] were evaluated for the management of head scab, stem rust and brown rust at multilocations.

Advisory for stripe rust management: During the current season 2021-22 the weather remained congenial in the month of Feburary for yellow rust in NWPZ however, disease severity remained low due to deployment of resistant cultivars. Need based advisories for stripe rust management and Karnal bunt were issued. Awareness among farmers for stripe rust management was created through mobile, internet, toll free number, newspapers, discussions and delivering lectures in farmers training programmes.

Preparedness to wheat blast

Survey were conducted during the cropping season 2021-22 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. Awareness was also created in farmers to take all preventive measures available against blast and to grow the

resistant varieties identified. For identification of wheat blast resistant sources advance breeding lines and potential germplasm were screened at Jashore, Bangladesh and Quirassallis through CIMMYT. A total 350 entries sent in 2020 screened against blast at Jashore, Bangladesh at two different dates of sowing during 2020-21 and out that 283 againg tested at Jashore, Bangladesh at two different dates of sowing during 2021-22. Out of these 283, across the years, 3 entries found free from infection and 100 are categorised resistant on the basis of average disease upto 10% infection. Besides that 350 entries again sent in 2021 to screen against blast during 2021-22 at Jashore, Bangladesh at two different dates of sowing, and 6 entries (NW8045, PBW879, UP3116, DWAP 2174, DWAP 2175 and GRU 25) found free from infection and 86 are categorised resistant on the basis of highest score upto 10% infection.

Post-harvest surveys for Karnal bunt

A total of 7759 grain samples collected from various mandies in different zones and were analyzed at cooperating centers. The overall 21.94% samples were found infected. The samples from Rajasthan showed maximum infection (37.10%). The average incidence of Karnal bunt infected gains was 0.227% ranging from 0 to 12.4%. The maximum grain infection of 12.4% was observed in a sample from Jammu. In general the samples fall in the category of less than 1% grains infected with Karnal bunt. In case of Madhya Pradesh in current year the samples collected from Seoni malwa, Harda mandi, Dolaria mandi, Itarsi mandi and Sagar having Karnal bunt infection in the range of 6.6 to 40.0 per cent but the average incidence level remained low (0.00079%) ranging from 0 to 1.1 percent grain infection. However, the samples collected from Ujjain, Indore, Dhar, Dewas and Sehore were found free from Karnal bunt infection. This year the sample collected from Uttarakhand, Karnataka and Maharashtra were also found free from Karnal bunt infection.

Training for human resource development

Under the coordinated programme the promising material is tested at multi-locations, therefore it becomes very important to follow the uniform disease recording and data reporting. Among coordinated centers, in some of centers new scientist joined either by direct recruitment or by transfer. to bring more uniformity in disease creation and data recording a training was organized on "Field trial conduction, data recording and reporting under wheat and barley crop protection programme" from 1st – 3rd February, 2022 through virtual mode at ICAR-IIWBR, Karnal for scientists working in crop protection under the coordinated system. The scientist and technical workers involved in disease and insect pest recording have been participated.

ENTOMOLOGY

Survey and surveillance for insect pests

- In Punjab, the aphid incidence was above economic threshold level in some places viz. village Tapa (Barnala) and Bhucho mandi (Bhatinda) during the second fortnight of March. The natural enemies viz. grubs and adults of coccinellid beetles, syrphid fly and chrysoperla were observed in most of the fields infested with aphids. Surveys were also carried out in the months of November-December to monitor the pest prevalence in residue managed wheat fields. No serious infestation of pink stem borer or armyworm was recorded during 2021-22 crop year except few minor infestations.
- In Maharashtra state, survey was carried out in the villages of Nashik and adjoining district Ahemednagar and Aurangabad at different crop stages on farmers field during the season (Dec 2021 to March 2022). Medium to Heavy incidence of aphids was recorded during the survey. The Coccinellid & Crysoparla predator grubs and beetles feeding on the aphid were also observed. The incidence of jassids was recorded in low intensity.
- In Gujarat state, the termite damage during the Rabi 2021-22 crop season in wheat fields was very low in the fields across the area surveyed. The incidence of aphid was observed to be low to moderate during ear head stage of the crop. The population of *H. armigera*, pink stem borer and surface grasshopper were not observed. Besides, in barley fields the aphid population was

moderate to high. Among natural enemies, predators like coccinellid beetles, chrysoperla and syrphid fly were noticed predating on wheat and barley aphids.

- In Kanpur, survey was conducted in villages viz., Araul, Kannauj, Hardoi and Unnao during 2021-22. Incidence of shootfly was recorded to be 2 per cent aat all three locations. The incidence of termite was observed 10 per cent wheat variety HD2967 of wheat in Hardoi.However, it was 8% in locations Unnao and Araul on variety HD2967. Moderate infestation (25-30 aphid/tiller) of foliar aphid was on barley variety namely, 'Barley Local' while the shootfly infestation was observed 1.66% at the village Araul (Kanpur). The moderate incidence of pink stem of 2% borer was observed in irrigated crop one per cent in variety HD-2967.
- In Haryana, survey was conducted field season from December -March in Ladwa, Yamunanagar, Kunjpura, Subhari, Racina and Hajwana, Karnal etc. This year incidence of aphids, termites, pink stem borer and army worm was reported to be low (1-3%). Termites and root aphid was reported to be around 2-4% during November and December. Aphid infestation started appearing in the month of January and the population in the beginning was around 4-5 aphids/tiller but in February, higher infestation of aphids (27-39 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.

Screening against major insect-pests

Shoot fly: Based on the average infestation of shoot fly at three locations viz., Ludhiana, Dharwad and Kanpur, the lowest infestation index (2.91 %) of shoot fly entry was reported in RAJ4083(C) had highest index of 12.64 % in DBW371. At Ludhiana centre, maximum infestation index of 7.95 per cent was reported on HI8759(C) and minimum (3.60 per cent) on KRL19(C). Nine entries viz., SKW362, UP3113, RAJ4083(C), HI1665, HI8830(d)*, MACS6795, HI1621(C), HD3249(C) and HD3386 at Dharwad had zero infestation of shootfly while highest infestation (19.61 %) was observed on PBW175(C). At Kanpur location, lowest infestation 2.85 % was observed on HD3400 and highest infestation of 20% was recorded on entry PBW835Q*.

Brown wheat mite: At Ludhiana, three entries HD3418, DBW365 and VL2044 recorded the minimum mite population of 7.7/10 cm^2 area while maximum mite population of 24.0 /10 cm^2 in entry PBW902. This seasonal incidence of mite was very low at Durgapura and Kanpur locations; therefore data of insect incidence was not included.

Foliar aphid: Based on the average score of aphids at five locations; Ludhiana, Karnal, Niphad, Khudwani and Kharibari six entries; VL2041,VL2043,VL2044, HD3402, HPW481 and HPW487 scored in moderately resistance category (grade 3) and rest of entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category. The infestation of aphids at Vijapur, Durgapura and Pusa Bihar was recorded to very low and therefore data was rejected.
Out of 280 tested NIVT entries, none of the entry showed the moderately resistance (grade 3) or resistance (grade 2) reaction based average score of three locations i.e. Ludhiana, Niphad and Karnal. All entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category.

Root aphid: Out of total 153 entries, all entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category. None of the entry showed the moderately resistance (grade 3) or resistance (grade 2) reaction at Ludhiana.

Screening against multiple pests

The average infestation index of shootfly recorded at three locations (Ludhiana, Dhardwad & Kanpur) was to be lowest (3.97%) in entry HI8823 (d) and the maximum score of 11.55% was recorded for GW513. The lowest population of 5.67 brown wheat mites/10 cm^2 was recorded in entry HUW 838 while entry HS 681 had highest population of 15.67 mites/10 cm^2 at Ludhiana.Based on average score of five locations (Ludhiana, Karnal, Khudwani, Kharibari and Niphad), 8 entries HS507, HS679, HD3334, VL2036, HI8823 (d), HD2864, NIAW3170 and VL3024 showed moderately resistance (grade 3) response to foliar aphid. At Ludhiana, all entries

were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category to root aphid.

Integrated pest management studies

- Influence of sowing time on the incidence and population build-up of major insect pests of wheat was studied. The termite damage recorded at seedling stage in different dates of sowing indicated that early sown crop (first fortnight of Nov 2021) suffered more termite damage as compared to timely, late and very late sown crop. At earing stage, again termite damage was highest in early sown crop followed by timely and late sown and very late sown crop. The root aphid appeared in the early growing season and its attack was observed on 3-5 week old crop. Foliar aphid incidence first appeared in first week of February in early, timely, late sowing dates and second week of February in very late sowing time. 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 2022 in early sowing date. However, peak of aphid population was recorded in10th SMW for II sowing time and it was in 11th SMW for III & IV sowing time.

- The effect of different sowing methods viz. Happy-Seeder, Super-Seeder, Rotavator along with conventional sowing in wheat was tested to study the population dynamics of major insect-pests and natural enemies in rice-wheat cropping system. Pink Stem borer incidence was highest in Rotavator sown wheat crop followed by Super seeder and Happy-Seeder sown crop at different observation time. However, there was no difference observed in foliar aphid incidence among all tillage conditions. All residue management conditions recorded significantly lower number of root aphids/tillers as compared to conventional tillage. Coccinellid population was higher in all residue managed wheat fields as compared to conventionally sown wheat crop.

- Effect of silicon application in the form sodium meta-silicate was tested to determine its effect on aphid abundance and their coccinellid predators in wheat. The observations indicated that one or two foliar applications of sodium meta-silicate have little effect on aphid population. Although some reduction in aphid control was recorded in foliar application of sodium meta-silicate but it remained above economic threshold level of 5 aphids/earhead. However, application of thiamethoxam 25WG significantly reduced the aphid population. Coccinellid population was statistically at par with each other in all sodium meta-silicate application and it was significantly lower than foliar application of thiamethoxam 25WG. The grain yield recorded in all silicon treatment was also significantly lower than foliar application of thiamethoxam 25WG.

- Evaluation of biodegradable insecticide loaded hydrogels for management of termites in wheat was done during 2021-22. Insecticides recommended for termites control viz. thiamethoxam 70WS @ 1 g/kg of seed, chlorpyriphos @ 4 ml/kg of seed and Neonix @ 2 ml/kg of seed, were loaded with commonly available Hydrogel (Goond Katira along with Jaggery) and tested for their efficacy along with seed treatments without hydrogels and untreated control. Fipronil 0.3 G @ 7 kg/ac and chlorpyriphos 20 EC @ 1.2 litres/ac alone or in combination with hydrogels were also applied before first irrigation and tested for their efficacy. 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 & 6 weeks of germination indicated that all seed treatments recorded significantly lower per cent damaged effective tillers/m row as compared to plots treated with soil application of insecticides before first irrigation and untreated check. There was no difference in insecticides applied alone or in combination goond katira for termite control. Among the different insecticide seed treatments, termites damage was lowest in goond Katira (5kg/ha) + neonix @ 2 ml/kg of seed whereas among the soil application, it was minimum in goond Katira (5kg/ha) + fipronil 0.6% GR applied before Ist irrigation. However, all the insecticide treated plots recorded significantly lower termite damage as compared to untreated check except.

- 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.

- Evaluation of insecticides was carried out against lepidopterous pests (pink stem borer, army worm & cutworms) of wheat. Fipronil 0.6% GR @10 kg/ha (0.71%) followed by chlorantraniliprole 18.5 SC @ 150 (0.73%) was found effective and it was at par with of fipronil 0.6% GR @7.5 kg/ha and flubendiamide 480 SC @ 60 ml/ha. However, the biopesticide, *Bacillus thuringiensis* @ 1 & 1.5 lt/ha and lower dosage of flubendiamide 480 SC, chlorantraniliprole 18.5 SC were significantly inferior and were at par with untreated control (2.52%).

- 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.

- For management of termites, in pre-mixed insecticide imidacloprid 18.5%+ hexaconazole 1.5% FS recorded lowest termite damage followed by Imidacloprid 600FS + Tebuconazole.

- 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 fifty three entries of AVT were screened for resistance against *H. avenae* (CCN) under sick plot conditions or pot condition at Hisar and Durgapura centers. No entry found resistant or moderately resistant across all the centers however only one entry VL3028 shown moderate level of resistance at Hisar center.

Management of cereal cyst nematode

A new nematicide *viz* Fluensulfone 2% GR at different doses was evaluated for nematicidal properties against CCN at two locations namely Hisar and Durgapura. Minimum CCN infection and maximum yield was observed in Fluensulfone 2% GR @ 2.0 kg a.i./ha, however, it was statistically at par with all the dose of Fluensulfone 2% GR but significant over Carbofuran @2 kg a.i/ ha and untreated control.

PROGRAMME 1. HOST RESISTANCE: IPPSN AND PPSN

Constitution of different plant pathological nurseries during 2021-22

Wheat germplasm and advance breeding materials were evaluated against disease and insect pests resistance at various hot spot locations under artificially inoculated conditions. The major plant pathological nurseries were: Initial Plant Pathological Nursery (IPPSN), Plant Pathological Nursery (PPSN), Elite PPSN (EPPSN), Multiple Disease Screening Nursery (MDSN), and disease specific nurseries like Leaf Blight Screening Nursery (LBSN), Karnal Bunt Screening Nursery (KBSN), Powdery Mildew Screening Nursery (PMSN), Loose Smut Screening Nursery (LSSN), Flag Smut Screening Nursery (FSSN), Head Scab Screening Nursery, Foot rot Screening Nursery and Hill Bunt Screening Nursery. The numbers of entries tested under different plant pathological nurseries are given in Figure 1.1.

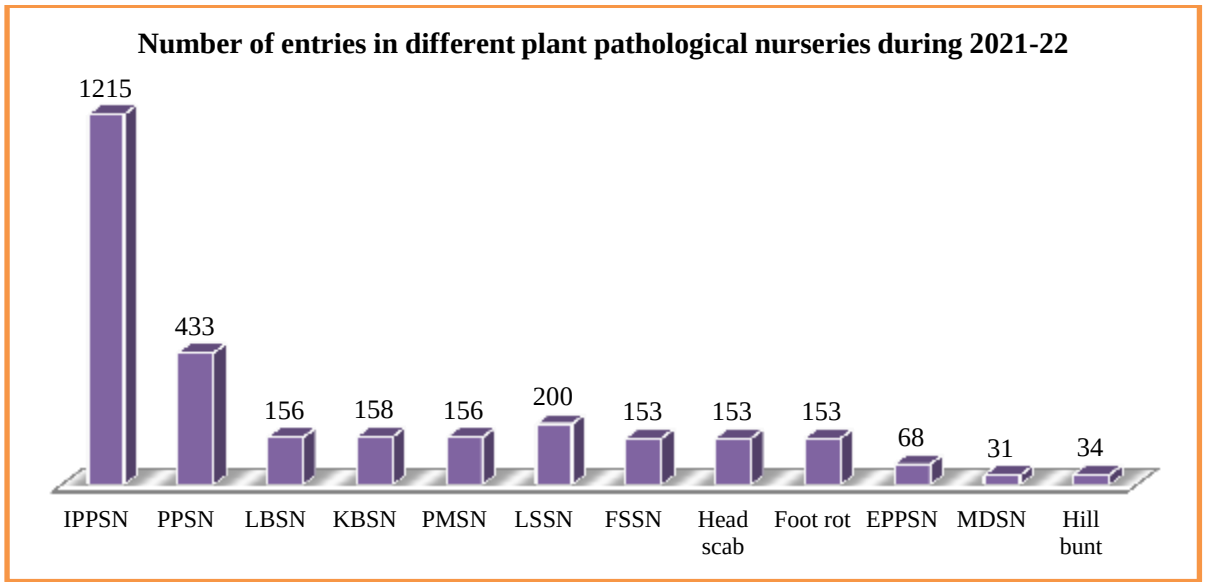

Fig. 1.1. Constitution of different plant pathological nurseries during 2021-22

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: 1215
No. of breeding centers: 41

Test Locations

Yellow Rust: Malan, Dhaulakuan, Jammu, Gurdaspur, Ludhiana, Karnal, Hisar and Durgapura.
Leaf Rust (North): Ludhiana, Karnal, Delhi, Durgapura, Ayodhya, Kanpur, Sabour and Coochbehar.
Leaf Rust and Stem Rust (South): Vijapur, Indore, Powarkheda, Niphad, Pune, Mahabaleshwar, Dharwad and Wellington (6)
Leaf Blight: Ayodhya, Varanasi, RPCAU Pusa, Sabour, Kalyani, Coochbehar, Pune and Dharwad.

Stem rust data of Dharwad, Leaf rust (S) data of Vijapur, Powarkheda and Dharwad, Leaf rust (N) data of Durgapura, Ayodhaya, Coochbehar and Sabour, Yellow rust data of Malan and foliar blight of Kalyani and Dharwad were not considered due to erratic/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 of all three rust and Mahabaleshwar centers of leaf and stem rusts. Following pathotypes were supplied for inoculation:

Rust	Rust pathogen	Pathotypes
Stem/Black	*Puccinia graminis tritici*	11, 40A, 117-6, 21A-2, 122
Stripe/Yellow	*P. striiformis*	238S119, 46S119, 110S119, 110S84, T
Leaf/Brown	*P. triticina*	77-9, 77-5, 104-2, 12-5, 77-1

The entriest found resistant (ACI<10) and qualify for promotion (ACI<20) to three rusts are given in Table 1.1. A total 1215 entries were screened for rusts at multilocation under artificially inoculated condition. Out of these, 797, 1053, 990 and 384 entries found resistant against stem rust, leaf rust (S), leaf rust (N) and stripe rust, respectively (Fig. 1.2). The center wise per cent entries in each zone found resistant were represented by Fig. 1.3 to 1.9. The disease data of IPPSN entries were also uploaded on IIWBR website.

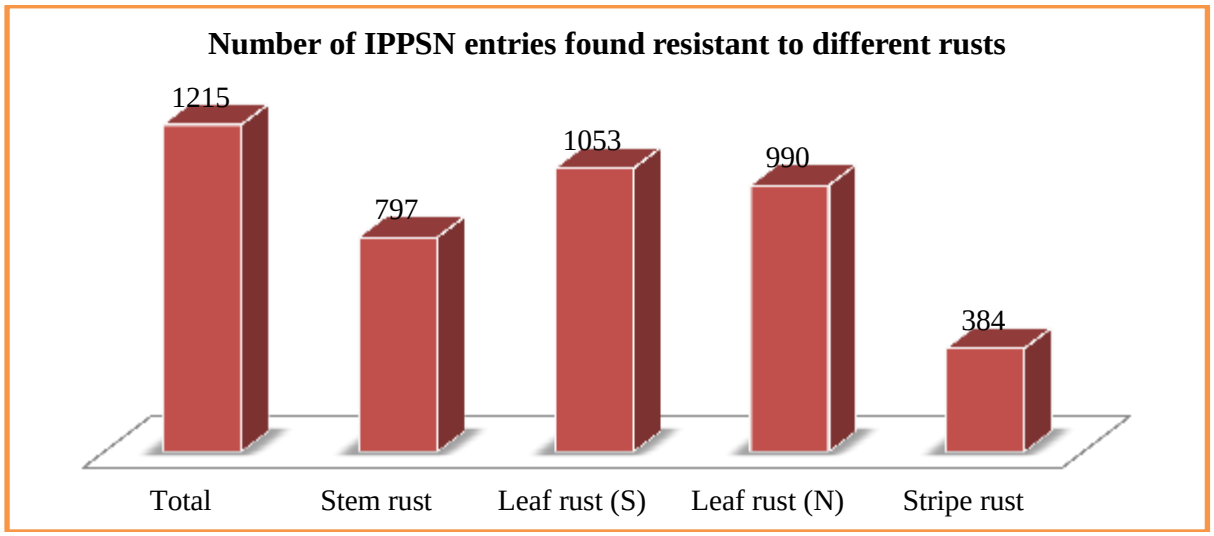

Fig. 1.2 Number of IPPSN entries found resistant to different rusts.

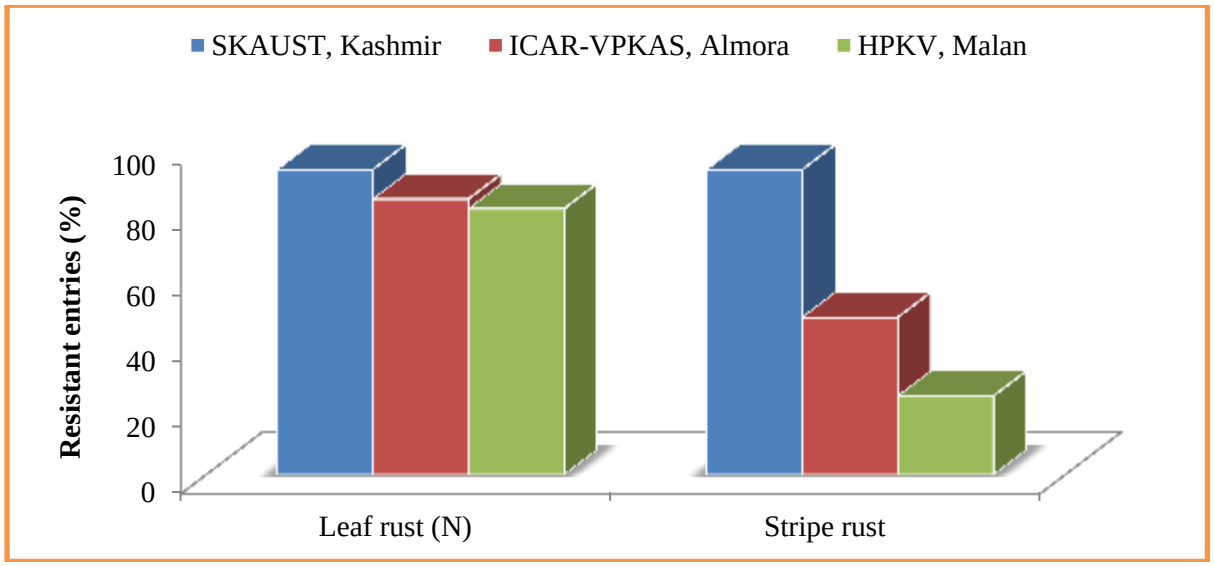

Fig. 1.3. Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of NHZ (Leaf (N) and Stripe rust)

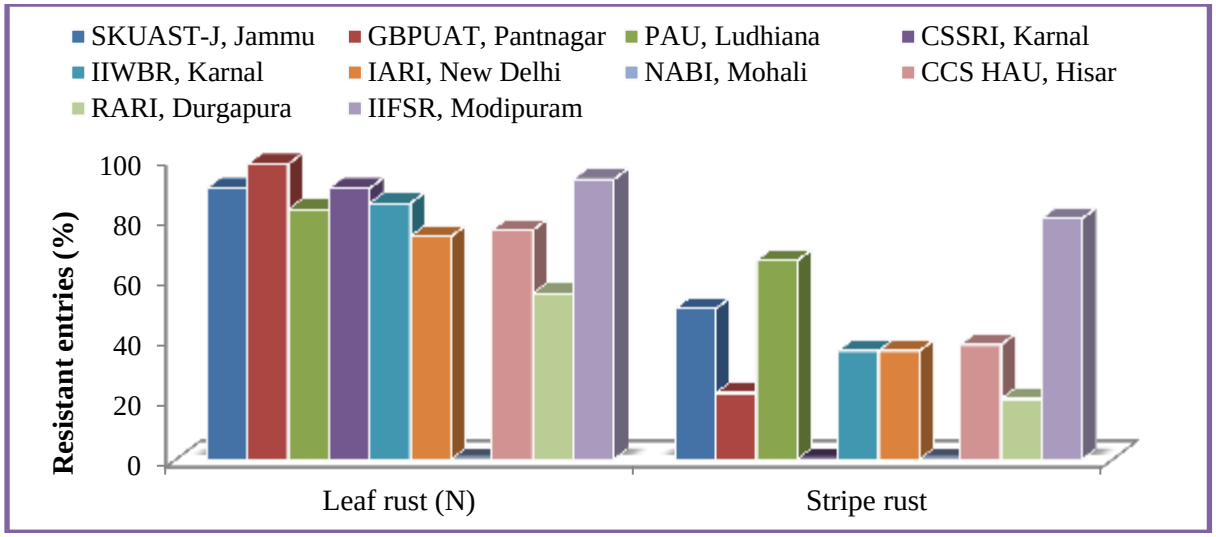

Fig. 1.4 Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of NWPZ (Leaf (N) and Stripe rust)

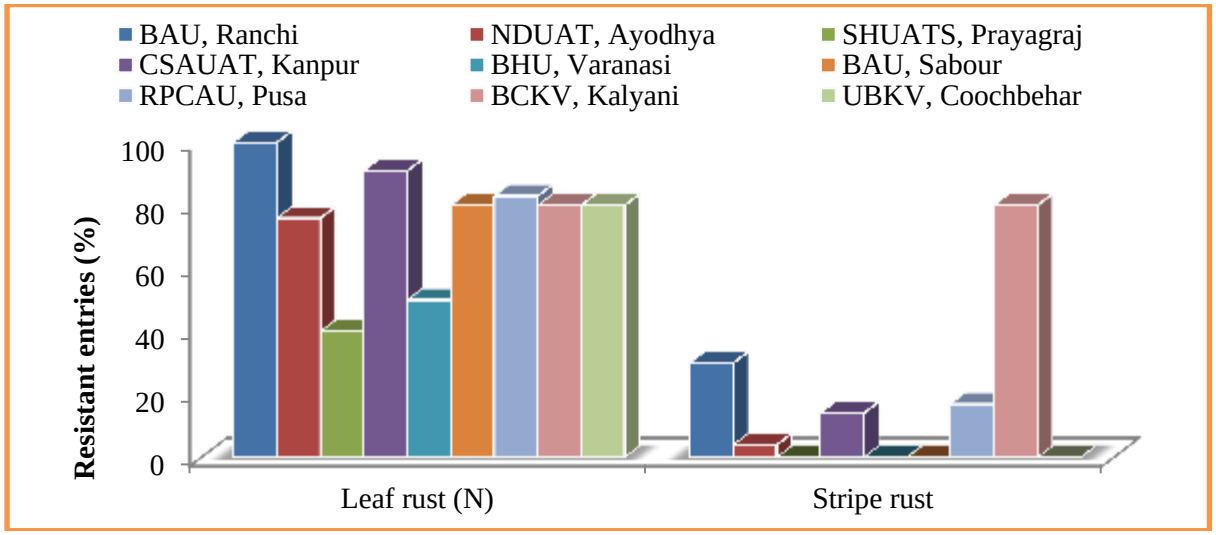

Fig. 1.5 Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of NEPZ (Leaf (N) and Stripe rust)

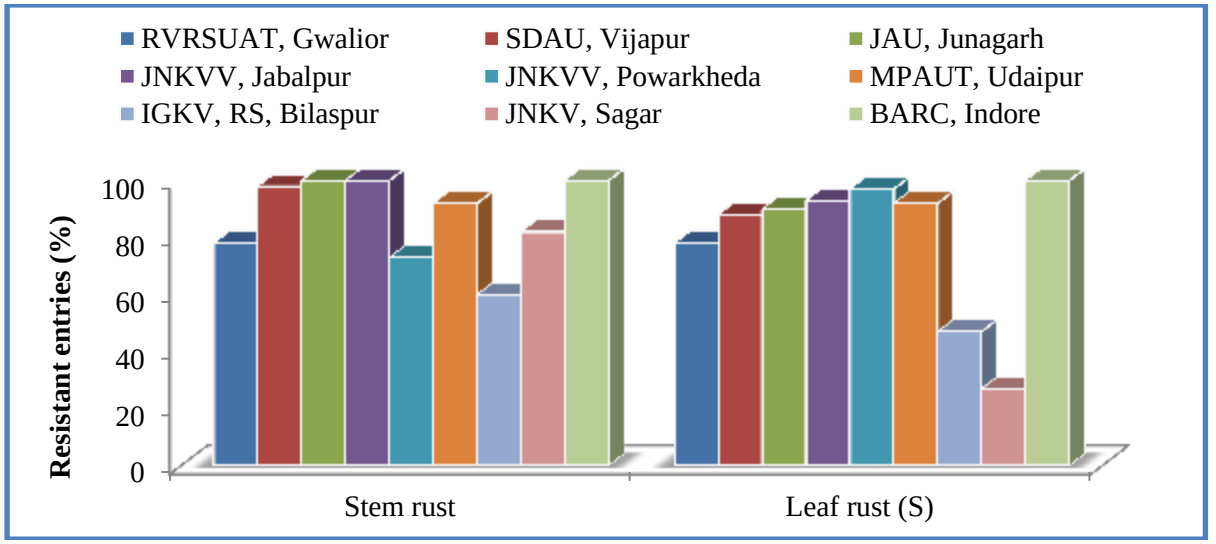

Fig. 1.6. Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of CZ (Stem and Leaf rust)

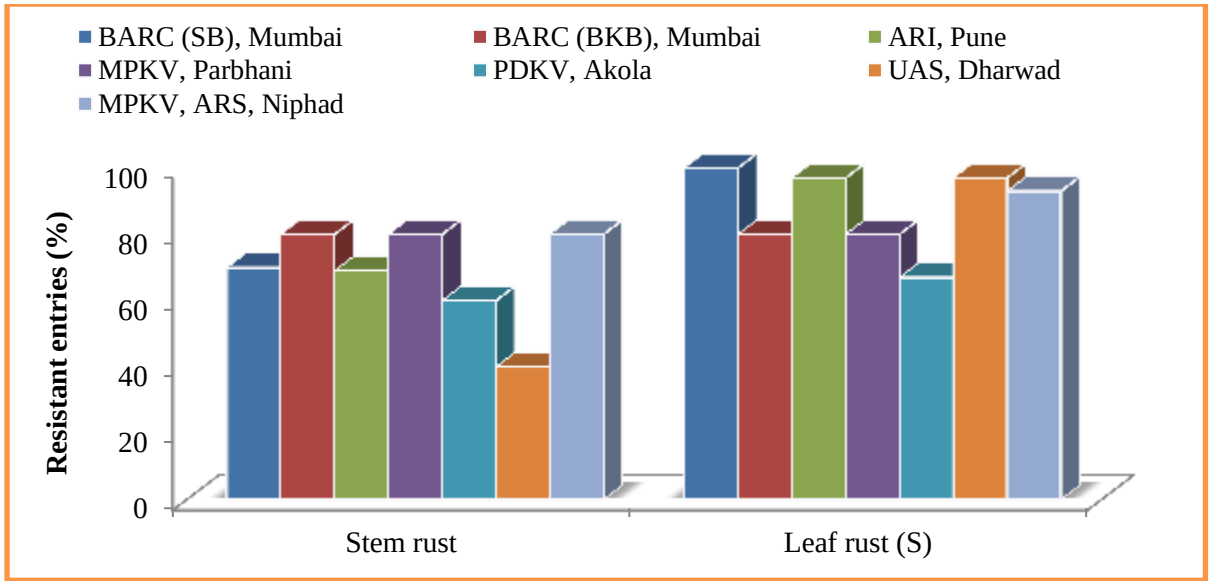

Fig. 1.7. Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of PZ (Stem and Leaf rust)

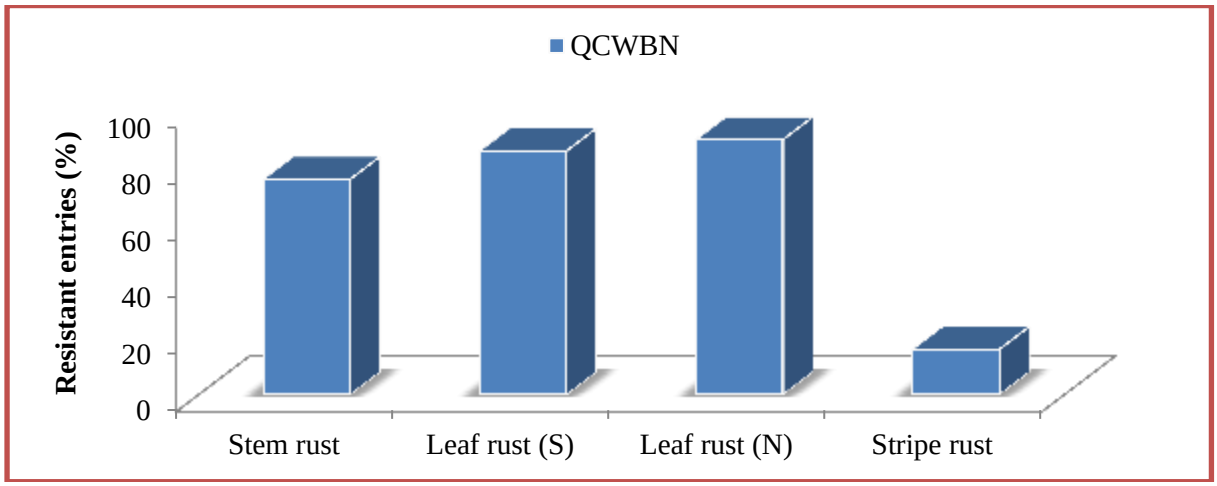

Fig. 1.8. Per cent of rust resistant entries in IPPSN slots belonging to different special trials (Stem, Leaf and stripe rust)

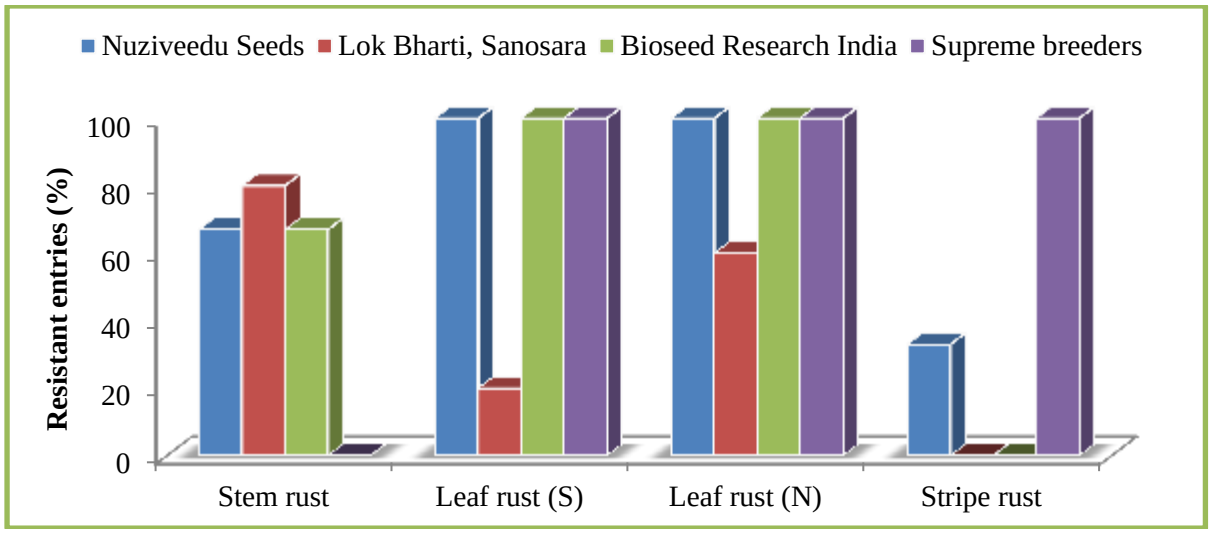

Fig. 1.9. Per cent of rust resistant entries in IPPSN slots belonging to different private seed companies (Stem, Leaf and stripe rust)

Table 1.1: Number to resistant entries (ACI<10) and entries qualify for promotion (ACI <20) in IPPSN slots of different centres during 2021-22.

Centers	Total Entries	Resistant entries (ACI<10)				Promotional entries (ACI<20)			
		Stem rust	Leaf rust		Stripe rust	Stem rust	Leaf rust		Stripe rust
			South	North			South	North	
NHZ									
SKAUST, Kashmir	15	14	14	14	14	15	15	15	15
ICAR-VPKAS, Almora	25	14	22	21	12	22	24	25	20
HPKVV Malan	21	17	19	17	5	21	21	20	12
NWPZ									
SKUAST-J, Jammu	10	2	10	9	5	8	10	10	9
GBPUAT, Pantnagar	50	25	49	49	11	42	50	50	33
PAU, Ludhiana	130	88	114	108	86	118	127	125	101
CSSRI, Karnal	20	16	18	18	0	20	20	20	5
IIWBR, Karnal	176	100	158	149	63	165	169	171	122
IARI, New Delhi	167	108	138	124	60	154	159	150	87
NABI, Mohali	2	2	2	0	0	2	2	2	0
CCS HAU, Hisar	50	22	48	38	19	42	50	47	44
RARI, Durgapura	40	23	24	22	8	34	35	34	23
IIFSR, Modipuram	15	9	14	14	12	15	15	15	15
NEPZ									
BAU, Ranchi	10	6	9	10	3	9	10	10	5
NDUAT, Ayodhya	25	18	21	19	1	22	23	22	6
SHUATS, Prayagraj	5	1	2	2	0	2	3	2	1
CSAUAT, Kanpur	35	24	33	32	5	34	35	35	10
BHU, Varanasi	20	9	12	10	0	16	16	13	2
BAU, Sabour	20	14	19	16	0	19	20	20	8
RPCAU, Pusa	6	3	6	5	1	5	6	6	1
BCKV, Kalyani	5	4	5	4	4	5	5	5	5
UBKV, Coochbehar	5	2	5	4	0	5	5	5	3
CZ									
RVSKVV, Gwalior	18	14	14	11	0	16	16	16	1
SDAU, Vijapur	40	39	35	33	6	40	40	37	13
JAU, Junagarh	20	20	18	20	2	20	20	20	3
JNKVV, Jabalpur	15	15	14	12	4	15	15	15	6
JNKVV, Powarkheda	30	22	29	30	9	28	30	30	12
MPUAT, Udaipur	12	11	11	8	4	12	12	11	9
IGKVV, RS, Bilaspur	15	9	7	8	1	14	15	14	3
JNKVV, Sagar	11	9	3	2	1	11	11	5	1
BARC, Indore	5	5	5	5	0	5	5	5	0
PZ									
BARC (SB), Mumbai	10	7	10	7	0	10	10	9	5
BARC (BKB), Mumbai	5	4	4	4	0	5	5	4	1
ARI, Pune	35	24	34	33	14	30	35	35	22
MPKV, Parbhani	5	4	4	4	0	5	5	4	0
PDKV, Akola	15	9	10	9	2	13	11	12	3
UAS, Dharwad	35	14	34	35	17	29	35	35	22
MPKV, ARS, Niphad	30	24	28	29	5	29	30	30	7
Special trials									
QCWBN	50	38	43	45	8	49	46	48	17
Private companies									
Nuziveedu Seeds	3	2	3	3	1	3	3	3	2
Lok Bharti, Sanosara	5	4	1	3	0	5	5	5	0
Bioseed Research India	3	2	3	3	0	3	3	3	0
Supreme breeders	1	0	1	1	1	1	1	1	1
Total	**1215**	**797**	**1053**	**990**	**384**	**1118**	**1173**	**1144**	**655**

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 433 entries that comprise AVT, NIVT and special trials including checks during 2021-22. 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.

Test Locations

North:
Yellow Rust: Khudwani, Malan, Bajaura, Dhaulakuan, Almora, Jammu, Gurdaspur, Ludhiana, Karnal, Hisar, Delhi, Durgapura and Pantnagar (13)
Leaf Rust: Jammu, Ludhiana, Karnal, Hisar, Delhi, Durgapura, Pantnagar, Kanpur, Ayodhya and Kalyani (10)
South:
Leaf and Stem Rusts: Junagarh, Vijapur, Indore, Powarkheda, Niphad, Pune, Mahabaleshwar, Dharwad and Wellington (9)

Data were not considered due to poor/erratic disease development from the following centres:
Stripe rust: Bajaura
Leaf rust (N): Durgapura, Kalyani and Ayodhaya
Leaf rust (S): Junagarh, Vijapur, Indore and Dharwad
Stem rust: Dharwad and Pune

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 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 (2021-22) with ACI upto 10.0 are given below:

Stem, Leaf and Stripe rusts

HD3402, HS692, HS693, VL3029, HS691, PBW870, DBW318, HI8840(d), PBW835^{Q}*, WH1402, WH1403, HI8759(C), HI8846, HD3437 and PBW902

Stem and leaf rusts

HD3402, HPW481, HS692, HS693, VL3029, HS691, UP3113, VL892(C), DBW377, PBW870, DBW318, HD3090(C), HI1633(C), MP1380#, HI8826(d)*, MP1378, HI8839(d), HI8840(d), MP1358(I)(C), NIAW3922, NIDW1149(d)(C), DBW352#, GW513(I)(C), GW547^{B}, HI1636(I)(C). HI1650*, NWS2194#, HI1665, NIAW4028 , CG1036*, GW532, HI1655^{Q}* , HI1666, HI8823(d)(I)(C), HI8830(d)*, MACS6795, PBW835^{Q}*, DBW353, PBW771(C), HD3386, NIAW3170(C), HD3397, HI1628(C), HI1654*, HUW838(I)(C), WH1402, WH1403, DBW402, KRL2021, RAJ4565, HD3438, HD3439, CG1029(C), HD3407*, HI1634(C), HI8759(C), HI8846, HI8847, HD3437, PBW677(C) and PBW902

Stem and Stripe rusts

VL2043, HD3402, HPW487, HS692, HS693, VL3029, HS690, HS691, HPW349(C), PBW870, DBW318, HI8840(d), HD3392, PBW835^{Q}*, DBW359, HD3369*, HD3400, WH1402, WH1403, HI8759(C), HI8846, HD3437 and PBW902

Leaf and Stripe rusts

VL2044, HD3402, HS692, HS693, VL3029, HPW484, HS691, VL2047, PBW870, DBW318, DDW48(d)(C), HI8840(d), UAS478(d), DDW47(d)(C), PBW833*, PBW835^{Q}*, HD3249(C), WH1402, WH1403, HI8759(C), HI8846, HD3440, HD3437 and PBW902

Table 1.2. Adult plant response of AVT entries against three rusts under epiphytotic conditions at hot spot locations in field during 2021-22

AVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Gene Postulation		
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	*Sr*	*Lr*	*Yr*
1	VL2041*	3.1	10MS	6.4	20MS	17.9	60S	22.3	40S	*Sr 30+5+11+*	*Lr13+*	*Yr2+*
2	VL2043	5.3	20MS	10.8	30MS	22.9	60S	3.4	20MR	*R*	*Lr13+*	*Yr2+*
3	VL2044	10.6	40S	3.6	10MS	8.6	20S	3.7	20MS	*Sr30+11+*	*Lr13+3+*	*Yr2+*
4	HD3402	8.9	20MS	6.0	20MS	7.9	20S	2.5	20MS	*Sr9b+11+*	*Lr13+*	*R*
5	HPW481	3.8	40MR	6.4	30S	4.0	10S	11.0	60S	*R*	*Lr13+3+*	*Yr2+*
6	HPW487	4.3	10MS	10.0	30S	10.9	30S	5.8	20S	*Sr31+*	*Lr26+23+1+*	*Yr9+*
7	HPW488	7.9	20S	12.8	40S	22.3	60S	11.7	20S	*Sr8a+9b+7b+*	*Lr13+3+*	-
8	HS692	6.3	20MS	8.9	40S	2.7	10S	5.5	40MS	*Sr31+2+*	*Lr26+R*	*Yr9+*
9	HS693	9.6	20S	6.0	10S	8.4	20MS	3.9	40MS	*Sr9b+11+7b+*	*Lr13+*	-
10	HS694	18.6	40S	10.4	40MS	12.1	30S	1.9	10S	*Sr11+7b+*	*Lr13+3+*	*R*
11	UP3114	20.0	40S	13.2	20S	18.7	40S	30.0	60S	*Sr8a+9b+7b+*	*Lr3+*	-
12	VL3028	30.0	60S	12.4	30S	2.0	10MS	5.3	20MS	*Sr30+5+11+*	*Lr13+1+*	*Yr2+*
13	VL3029	3.5	20S	2.9	10S	6.9	20S	7.2	40S	*Sr8a+5+9e+*	*Lr13+*	-
14	VL3030	22.3	40S	9.2	30S	6.9	20S	15.5	60S	*Sr30+8a+2+*	*Lr13+1+*	*Yr2+*
15	HPW483	0.4	5MR	13.2	40S	5.0	15S	20.4	60S	*Sr31+*	*Lr26+10+*	*Yr9+*
16	HPW484	36.6	80S	6.9	20MS	2.2	15S	5.9	20S	*Sr30+5+11+*	*Lr13+1+*	*Yr2+*
17	HPW485	13.1	40S	13.6	30S	11.3	20S	18.2	60S	*Sr8a+9b+7b+2+*	*Lr13+*	*YrA+*
18	HPW486	1.8	10MS	10.8	30S	20.3	40S	26.5	60S	*Sr31+*	*Lr26+10+*	*Yr9+*
19	HS688	9.6	40S	10.1	20MS	6.9	15S	17.2	60S	*Sr8a+9b+*	*Lr23+10+*	*Yr2+*
20	HS689	3.7	10MS	7.6	30S	21.3	70S	16.5	40S	*Sr5+9b+7b+*	*Lr13+1+*	-
20A	Infector	82.9	100S	84.0	100S	77.1	100S	77.5	100S	-	-	-
21	HS690	9.6	20S	8.8	20S	22.0	60S	4.9	20S	*Sr5+9b+11+*	-	*YrA+*
22	HS691	0.3	5MR	4.1	20S	1.9	10MS	6.9	40S	*Sr2+R*	*R*	-
23	SKW362	33.1	60S	3.2	20MR	7.9	40S	27.5	60S	*Sr30+11+*	*Lr13+1+*	*Yr2+*
24	UP3113	9.5	20S	7.0	20MS	7.1	40S	18.7	60S	*Sr13+11+7b+2+*	*Lr13+1+*	-
25	VL2047	26.0	40S	7.6	30S	6.6	20S	9.0	20S	*Sr13+11+9e+*	*Lr13+10+*	*Yr2+*
26	VL2048	13.9	40S	14.4	40S	5.7	10S	28.5	80S	*Sr30+8a+5+*	*Lr13+10+*	*Yr2+*
27	VL2049	7.8	20S	18.8	60S	27.1	70S	10.7	60S	*Sr30+8a+5+*	*Lr13+1+*	*Yr2+*
28	VL2050	11.1	20S	13.2	30S	13.4	60S	18.9	80S	*Sr9e+7b+*	*Lr13+10+*	*Yr2+*
29	HS507(C)	2.3	15MS	10.8	20S	23.6	60S	11.2	20S	*Sr31+5+*	*Lr26+1+*	*Yr9+*
30	HS562(C)	21.1	40S	12.8	30S	22.2	60S	13.4	40S	*Sr8a+9b+11+*	*Lr23+10+3+*	*YrA+*

AVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Gene Postulation		
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	*Sr*	*Lr*	*Yr*
31	HS490(C)	9.3	30S	13.2	40S	10.7	20S	20.2	60S	*Sr8a+9b+*	*Lr23+*	*Yr2+*
32	HPW349(C)	7.5	20S	7.6	20S	15.0	40S	9.3	40S	*Sr7b+2+*	*Lr13+10+*	*Yr2+*
33	VL907(C)	0.4	5MR	21.2	80S	5.6	20S	16.0	60S	*Sr31+2+*	*Lr26+10+*	*Yr9+*
34	VL892(C)	3.8	10MS	5.7	20S	6.4	20S	40.1	80S	*Sr30+11+*	*Lr13+10+*	*Yr2+*
35	DBW377	3.8	20MS	6.8	20MS	2.2	10S	12.5	40S	*R*	*Lr23+1+*	*Yr2+*
36	PBW870	2.9	10MS	5.4	10S	4.3	20S	6.6	20MS	*R*	*R*	*Yr2+*
37	DBW372	11.3	40S	8.4	15MS	6.6	20MS	28.0	60S	*Sr28+*	*Lr23+1+*	*Yr2+*
38	DBW318	0.7	10MR	1.7	10MS	4.6	20S	9.8	60S	*R*	*Lr* 23+	*Yr2+*
39	DBW327 (C)	7.4	20S	5.6	20S	16.6	40S	19.9	60S	*Sr5+13+*	*Lr23+1+*	*Yr2+*
40	DBW332(C)	12.6	20S	4.9	20MS	4.9	20S	21.5	60S	*Sr30+8a+*	*Lr13+1+*	*Yr2+*
40A	Infector	80.0	100S	80.0	100S	74.3	100S	77.5	100S	-	-	-
41	DBW370	41.1	80S	15.3	60S	5.3	20S	29.3	70S	*Sr7b+*	*Lr13+1+*	*Yr2+*
42	DBW371	34.3	80S	4.9	20MS	2.3	15S	20.7	60S	*Sr8a+5+*	*Lr23+1+*	*Yr2+*
43	DBW373	22.9	40S	19.2	40S	11.5	40S	23.5	60S	*Sr11+*	*Lr13+1+*	*Yr2+*
44	PBW868	3.6	20MS	14.8	30S	14.1	30S	28.8	80S	*R*	*Lr13+10+*	*Yr2+*
45	PBW871	13.6	40S	6.8	30S	13.4	60S	22.9	60S	*Sr9b+11+2+*	*Lr13+1+*	*Yr2+*
46	PBW872	9.5	20MS	6.8	30S	14.9	40S	22.3	40S	*	*Lr23+10+*	*Yr2+*
47	HD3090(C)	4.0	15MS	1.7	20MR	7.2	30S	60.5	90S	*Sr31+2+*	*Lr26+R*	*Yr9+*
48	HI1633(C)	1.6	10MR	3.3	20MS	2.0	10S	58.5	90S	*Sr31+*	*Lr26+R*	*Yr9+*
49	RAJ4083(C)	3.3	15MS	11.6	30S	13.9	40S	45.0	90S	*Sr11+*	*Lr13+*	*Yr2+*
50	DBW320#*	8.9	20MS	20.9	80S	21.5	60S	14.7	40S	*Sr30+8a+*	*Lr10+1+*	*Yr2+*
51	MP1380#	1.3	5S	6.0	30S	8.3	40S	27.1	60S	*Sr2+*R	*Lr13+*	-
52	DBW407[B]	12.1	20S	15.2	40S	19.3	70S	25.8	60S	*Sr13+7b+*	*Lr13+*	*Yr2+*
53	DDW48(d)(C)	14.3	60S	2.0	15MR	3.1	20S	5.2	20MS	*Sr7b+2+*	*Lr23+*	-
54	HI8826(d)*	6.6	40S	4.9	30MS	6.3	20S	12.6	40S	*Sr7b+2+*	-	-
55	MACS4100(d)*	16.8	100S	12.1	60S*	1.7	10S	16.2	40S	-	-	-
56	MP1378	1.5	20MR	8.0	30S	2.5	15S	55.0	80S	*Sr31+*	*Lr26+10+*	*Yr9+*
57	MP3552	18.6	40MS	20.8	80S*	20.0	50S	23.9	60S	*Sr30+5+11+*	*Lr13+1+*	*Yr2+*
58	UAS3015	32.6	60S	11.2	20S	2.9	10S	24.6	60S	*Sr7b+*	*Lr23+10+*	*Yr2+*
59	HI8839(d)	2.0	10MR	4.6	15S	4.5	15S	10.4	40S	*Sr13+7b+*	-	-
60	HI8840(d)	5.8	40MS	4.1	20S	1.9	5S	9.3	20S	*Sr13+7b+*	-	*Yr2+*
60A	Infector	80.0	100S	80.0	100S	75.7	100S	77.5	100S	-	-	-

AVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Gene Postulation		
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	*Sr*	*Lr*	*Yr*
61	MP1358(I)(C)	6.0	20MS	4.8	20S	8.0	20S	13.8	40S	*Sr11+*	*Lr23+10+*	*Yr2+*
62	NIAW3922	4.3	20MS	3.3	20MS	4.0	15S	30.3	60S	*Sr31+2+*	*Lr26+R*	*Yr9+*
63	NIDW1149(d)(C)	9.7	20MS	3.3	20MS	1.6	5S	13.1	50S	*Sr11+2+*	*Lr23+10+*	*Yr2+*
64	UAS478(d)	16.9	80S	4.9	30MS	7.4	40S	6.2	40MS	*Sr7b+2+*	*Lr23+*	-
65	DBW352#	1.3	10MR	3.6	20MS	6.5	40S	39.7	70S	*Sr2+*R	*R*	*Yr2+*
66	GW513(I)(C)	1.5	10MR	3.3	20MS	5.2	30S	61.3	100S	*Sr24+2+*	*Lr24+R*	*Yr2+*
67	GW547^{B}	1.9	10MR	1.3	15MR	3.2	10S	42.8	90S	*Sr2+*R	*R*	*Yr2+*
68	HI1636(I)(C)	0.1	TMR	0.4	5MR	1.4	10S	65.5	100S	*Sr24+2+*	*Lr24+R*	-
69	HI1650*	0.4	5MR	4.0	20S	5.3	40MS	55.7	80S	*Sr31+*	*Lr26+R*	*Yr9+*
70	MACS6768*	3.0	20MR	12.1	60S*	6.0	20S	73.0	100S	*Sr31+2+*	*Lr26+R*	*Yr9+*
71	MP3535*	28.7	40S	24.8	80S	29.3	80S	22.3	60S	*	*Lr13+10+3+**	*Yr2+*
72	NWS2194#	8.6	20MS	9.7	30S	3.6	15S	47.2	90S	*Sr30+11+*	*Lr13+1+*	-
73	HI1665	0.6	5MR	3.2	20MS	1.5	10S	64.0	100S	*Sr2+R*	*R*	-
74	NIAW4028	1.2	10MS	3.2	20MS	7.3	20MS	60.3	100S	*Sr30+5+2+*	-	-
75	CG1036*	1.2	5MS	8.1	40S	4.3	30S	66.7	100S	*Sr7b+2+*	-	-
76	CG1040	17.1	40MS	15.6	40S	15.4	60S	54.2	80S	R	*Lr13+*	-
77	DDW47(d)(C)	19.4	60S	2.5	20MR	3.6	20S	4.4	20S	*Sr11+7b+2+*	*Lr13+10+**	*Yr2+*
78	DDW55(d)^{Q}*	14.4	80S*	2.5	15MS	7.6	40S	24.3	70S	*Sr7b+2+*	*R*	-
79	GW532	1.3	20MR	1.3	15MR	0.7	5S	36.9	80S	*Sr2+R*	*R*	-
80	HD3401	14.1	80S	1.3	15MR	3.7	10S	22.5	60S	-	*Lr23+10+*	-
80A	Infector	80.0	100S	76.0	100S	77.1	100S	79.2	100S	-	-	-
81	HI1655^{Q}*	0.9	10MR	0.4	5MR	2.6	10S	39.5	90S	*Sr2+R*	-*	-
82	HI1666	0.4	5MR	0.8	10MR	4.3	20S	49.5	80S	*Sr2+R*	*R*	-
83	HI8823(d)(I)(C)	1.0	10MR	0.9	10MR	1.0	5S	17.0	40S	*Sr11+2+*	-	-
84	HI8830(d)*	2.5	40MR	4.1	20S	3.5	15MS	10.8	40S	*Sr7b+2+*	-	-
85	MACS6795	2.9	20MR	2.0	15MR	1.0	5S	64.8	100S	*Sr2+R*	*R*	-
86	MP1377	14.3	40MS	4.4	10S	8.7	40S	42.5	80S	*Sr13+11+7b+*	-	-
87	MP3288(C)	7.2	20S	4.8	20MS	10.3	20S	47.0	80S	*	-*	-
88	UAS3019	9.1	20MS	9.2	30S	11.3	50S	25.2	60S	*Sr9b+7b+*	*Lr13+*	*Yr2+*
89	DBW316#*	36.0	80S	22.4	60S	34.3	70S	19.0	60S	*	*Lr13+10+3+**	*
90	HD3118(C)	21.7	40S	21.2	30S	28.9	90S	11.4	40S	*Sr9b+11+*	-	*Yr2+*
91	HD3392	7.6	20MS	8.9	20S	20.7	50S	2.2	10S	*Sr13+11+7b+*	*Lr13+*	*R*

AVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Gene Postulation		
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	*Sr*	*Lr*	*Yr*
92	HI1621(C)	15.0	60S	10.8	30S	22.5	70S	5.8	20S	*Sr28+*	*Lr13+*	*Yr2+*
93	PBW833*	35.7	60S	5.6	20MS	7.3	30S	5.9	20S	*Sr7b+2+*	*R*	*Yr2+*
94	PBW835^{Q}*	9.4	20MS	3.3	20MS	2.7	10S	2.2	20S	*Sr2+R*	*R*	*R*
95	HD3249(C)	13.7	60S	4.0	10S	3.5	10S	4.1	15MS	*Sr11+2+*	*R**	-
96	PBW826#*	6.3	20MS	6.9	30S	11.7	60S	11.5	40S	*Sr30+8a+2+*	*Lr23+*	*Yr2+*
97	HD3388	14.4	30S	4.9	20MS	5.9	20S	14.9	40S	*Sr13+7b+*	*Lr23+1+*	*YrA+*
98	PBW852	5.4	20MS	8.2	30S	20.0	60S	20.3	50S	*Sr30+11+2+*	*Lr23+1+*	-
99	DBW252(C)	5.5	20S	6.8	30S	10.6	30S	21.0	40S	*Sr8a+5+11+2+*	*Lr13+10+*	*Yr2+*
100	HD3171(C)	27.4	40S	32.0	80S	31.3	100S	29.8	60S	*Sr11+7b+2+*	*Lr23+13+10+*	*Yr2+*
100A	Infector	80.0	100S	76.0	100S	74.3	100S	77.5	100S	-	-	-
101	HD3293(C)	14.6	30S	15.6	30S	28.6	100S	17.5	40S	*Sr13+2+*	*Lr13+10+*	*Yr2+*
102	DBW353	6.9	20MS	4.8	20S	6.9	20S	15.6	40S	*Sr13+7b+*	*Lr13+*	-
103	JKW261(I)(C)	31.4	40S	7.2	20MS	3.6	20S	18.8	60S	*Sr11+*	*Lr23+13+*	-
104	PBW771(C)	4.9	20MS	3.3	20MS	7.7	40S	12.0	40S	*Sr31+2+*	*Lr26+23+1+*	*Yr9+*
105	WH1124(C)	26.6	60S	16.8	60S	26.0	70S	21.0	60S	*Sr7b+2+*	*Lr13+10+3+*	*Yr2+*
106	HD2967(C)	7.7	40S	16.8	80S*	5.8	20S	42.8	80S	*Sr8a+11+2+*	*Lr23+*	*Yr2+*
107	HD3386	7.0	20S	2.0	15MR	9.7	40S	13.4	40S	*Sr30+5+2+*	*Lr13+10+*	*Yr2+*
108	DBW359	5.0	10S	8.1	20MS	10.1	40S	7.7	20S	*Sr9b+7b+*	-	*Yr2+*
109	DBW358	6.4	20MS	20.8	40S	16.4	40S	17.3	40S	*Sr30+5+*	-	*Yr2+*
110	NIAW3170(C)	3.5	20MS	9.6	40S	0.7	5S	40.5	80S	*Sr8a+2+*	*Lr13+10+*	-
111	HD3043(C)	1.2	10MR	29.6	40S	24.3	100S	23.9	60S	*Sr31+2+*	*Lr26+10+*	*Yr9+A+*
112	HD3369*	6.0	40S	5.6	20MS	11.5	40S	5.9	20S	*Sr13+*	*Lr13+*	-
113	HD3397	2.6	10MS	5.6	20MS	6.1	40S	27.4	80S	-	*Lr13+*	*Yr2+*
114	HD3400	8.9	20S	6.4	20S	15.0	40S	8.7	40S	*R*	*Lr23+10+*	-
115	HD3418	18.0	40S	3.3	20MS	1.5	10MS	10.1	40S	*Sr30+*	*Lr13+1+*	*Yr2+*
116	HI1628(C)	5.2	15MS	4.0	20MR	3.1	10S	15.2	40S	*Sr2+*R	*Lr13+10*	*Yr2+*
117	HI1653*	11.4	20MS	3.3	20MS	2.9	20S	14.4	40S	*Sr7b+*	*Lr13+3+*	*Yr2+*
118	HI1654*	2.6	20MS	4.8	30MS	0.2	TR	14.8	40S	*Sr13+*	*Lr13+*	*Yr2+*
119	HUW838(I)(C)	5.7	15MS	2.4	10MS	1.9	10S	20.8	40S	*Sr8a+5+11+*	*Lr13+10+3+*	*Yr2+*
120	UP3090	23.3	40S	4.8	20MS	0.0	0	29.8	80S	*Sr30+11+*	*Lr23+10+*	-
120A	Infector	80.0	100S	84.0	100S	72.9	100S	77.5	100S	-	-	-
121	WH1402	5.4	40MR	4.9	20MS	2.9	10S	2.9	20MS	*R*	*Lr13+*	*R*

AVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Gene Postulation		
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	*Sr*	*Lr*	*Yr*
122	WH1403	4.2	10S	6.8	20MS	1.0	5S	4.1	40S	*Sr2*+R	*Lr13+*	*R*
123	DBW365	20.1	60S	10.8	30S	9.3	30S	20.3	60S	*Sr8a+2+*	*Lr13+10+*	*Yr2+*
124	DBW366	22.0	40S	4.8	20MS	4.0	10S	21.5	60S	*Sr30+8a+*	-*	*Yr2+*
125	DBW402	9.6	40S	2.9	10MS	1.2	5S	11.4	40S	*Sr11+7b+2+*	*Lr13+1+*	*Yr2+*
126	HD3415	11.4	20S	2.5	10S	16.0	40S	29.9	60S	*Sr30+11+*	*Lr13+10+*	*Yr2+*
127	Kharchia65(C)	42.4	80S	64.0	80S	48.5	80S	75.0	100S	*Sr7b+*	-	-
128	KRL19(C)	8.9	40S	36.0	60S	26.2	90S	66.3	100S	*Sr8b+9b+11+2+*	*Lr13+*	-
129	KRL2006	30.9	60S	4.8	20S	5.7	20S	36.3	80S	*Sr30+*	-	-
130	UAS310	30.0	60MS	4.8	20S	3.1	10S	20.3	40S	*Sr13+7b+*	*Lr13+10+*	-
131	KRL2021	3.3	10S	4.1	20S	6.0	20S	27.8	60S	*Sr30+5+*	*Lr13+1+*	*Yr2+*
132	KRL210(C)	30.6	40S	11.6	30S	40.1	80S	20.8	60S	*Sr7b+2+*	*Lr23+*	*Yr2+*
133	RAJ4565	9.7	20S	2.1	15MR	3.1	15S	37.1	90S	*Sr30+11+2+*	-	-
134	HD3438	0.5	5MR	3.2	20MS	3.8	20MS	66.7	100S	*R*	*R*	-
135	HD3439	9.3	40MS	4.8	20MS	0.7	5S	15.0	70S	*R*	*R*	*R*
136	CG1029(C)	2.4	20MR	3.2	20MS	0.7	5S	66.7	100S	*Sr24+2+*	*Lr24+R*	*Yr2+*
137	HD3407*	0.9	5MS	1.7	20MR	0.0	0	11.2	60S	*R*	*R*	*R*
138	HI1634(C)	1.1	10MR	0.3	TS	1.5	10S	51.8	90S	*Sr31+*	*Lr26+R*	*Yr9+*
139	MP3336(C)	12.0	40MS	12.8	30S	15.0	40S	54.1	100S	*Sr11+2+*	*Lr13+*	*Yr2+*
140	HI8498(C)	14.3	30MS	4.5	20MS	2.7	10S	12.8	60S	*Sr11+2+*	*Lr23+*	-
140A	Infector	80.0	100S	80.0	100S	74.3	100S	77.5	100S	-	-	-
141	HI8759(C)	4.9	10MS	1.3	15MR	0.7	5S	8.7	40S	*Sr11+2+*	-	-
142	HI8846	1.3	10MS	3.2	20MS	1.7	10MS	3.9	20MS	*Sr30+*	-	-
143	HI8847	1.2	10MS	3.2	20MS	0.6	5MS	14.7	40S	*Sr2*+R	-	-
144	HD2733(C)	3.0	10MS	7.6	20S	11.6	40MS	53.8	90S	*Sr31+2+*	*Lr26+34+*	*Yr9+18+*
145	HD3411*	33.3	60S	8.8	20S	16.3	40S	27.7	60S	*Sr7b+*	*Lr13+*	*Yr2+*
146	HD3440	35.7	60S	6.4	20MS	0.6	5MS	1.6	20MR	*Sr7b+*	-	*R*
147	HD3406*	30.0	40S	4.1	20S	6.7	20S	18.0	60S	*Sr13+*	*Lr23+10+1+*	*Yr2+*
148	HD3436	10.7	40S	10.0	30S	32.9	80S	3.6	20S	*Sr8b+9b+9e+*	*Lr23+*	*R*
149	HD3437	2.0	10S	4.4	15MS	8.4	20S	1.7	5MS	*Sr30+*	*Lr13+10+*	*R*
150	PBW175(C)	4.4	10MS	25.2	80S	21.7	40S	56.2	100S	*Sr7a+2+*	*Lr23+34+*	*Yr2+18+*
151	PBW677(C)	4.1	20MS	5.6	20S	8.8	20S	20.5	60S	*Sr9b+11+2+*	*Lr23+1+*	*Yr2+*
152	PBW901	42.3	60S	4.9	20MS	2.5	10MS	24.6	60S	*Sr9b+7b+2+*	*R*	*Yr2+*

AVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Gene Postulation		
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	*Sr*	*Lr*	*Yr*
153	PBW902	6.3	20S	4.1	20S	2.9	20S	2.2	10S	*Sr2+R*	*R*	*Yr2+*
153A	Infector	80.0	100S	80.0	100S	70.0	80S	77.5	100S			

Abbreviations: ACI = Average Coefficient of Infection, HS = Highest Score, Avg. = Mean, Leaf rust (S) = Leaf rust (South), Leaf rust (N) = Leaf rust (North), *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 2021-22

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
1	VL2041*	24	46	4.0	9.3	3	5	3.5	6.6	3	25.0	11.1	18.6	13.5	20.2
2	VL2043	35	57	7.5	19.7	5	7	3.6	8.3	4	15.0			16.2	25.4
3	VL2044	46	67	3.1	8.3	3	5	4.5	9.1	4	33.3			16.9	30.0
4	HD3402	46	78	11.3	26.9	5	7	3.8	10.0	4	11.1			15.9	31.0
5	HPW481	45	78	7.9	15.0	6	9	3.9	6.2	4	25.0			3.2	6.7
6	HPW487	57	89	9.1	29.1	3	4	2.8	5.0	5	30.0			16.6	25.5
7	HPW488	46	89	8.7	28.1	6	9	4.1	9.1	4	27.8			5.8	10.5
8	HS692	57	89	5.9	12.5	5	7	7.4	14.0	4	7.1			20.4	32.3
9	HS693	35	79	4.9	11.1	7	9	4.6	11.2	2	27.8			16.2	27.7
10	HS694	46	79	13.4	44.4	6	8	8.0	14.7	4	33.3			16.3	23.3
11	UP3114	36	67	7.0	14.6	5	7	4.4	6.3	3	18.8			17.5	38.2
12	VL3028	46	78	8.7	27.4	3	5	2.8	5.0	4	31.3			12.8	23.2
13	VL3029	46	89	9.8	34.1	3	7	4.1	8.2	4	16.7			9.5	16.9
14	VL3030	46	89	9.8	27.3	4	7	4.7	9.3	5	25.0			10.5	22.6
15	HPW483	46	89	5.3	8.3	3	6	4.7	8.1	4	25.0			4.4	6.1
16	HPW484	46	78	6.5	13.5	3	7	4.6	10.0	4	35.0			3.9	8.2
17	HPW485	35	67	1.9	5.8	4	9	4.3	8.6	3	22.2			5.5	8.6
18	HPW486	46	69	6.1	11.7	3	4	4.6	9.1	3	30.0			12.9	24.2
19	HS688	46	89	7.3	23.7	3	6	5.0	10.0	4	35.0			24.4	37.3
20	HS689	46	89	8.8	28.0	5	7	6.6	11.2	3	5.6			7.2	8.6
20A	Infector	78	99	25.6	50.5	8	9	20.3	23.3	4	-			-	-
21	HS690	35	97	4.2	11.2	6	9	7.1	11.6	3	18.8			19.9	28.9
22	HS691	35	79	2.6	6.3	6	9	6.1	10.3	3	30.0			21.2	28.5
23	SKW362	46	77	12.8	46.2	6	9	4.6	9.3	5	30.0			16.2	32.5
24	UP3113	46	78	7.6	23.2	3	7	4.9	10.0	5	22.2			7.7	8.6
25	VL2047	46	79	7.9	25.9	4	7	4.6	9.2	4	6.3			3.6	7.3
26	VL2048	46	89	11.7	37.0	5	9	5.5	8.3	4	25.0			9.2	16.7
27	VL2049	46	77	9.6	29.5	3	4	8.0	12.5	5	25.0			16.2	37.5
28	VL2050	35	68	13.8	28.0	5	9	4.8	11.1	3	30.0			26.7	55.4
29	HS507(C)	35	77	8.3	26.7	5	7	4.2	8.3	1	27.8	20.8	28.6	13.8	29.1
30	HS562(C)	45	99	8.1	27.1	6	9	4.1	9.1	3	11.1	13.6	21.7	5.4	7.7

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
31	HS490(C)	46	79	2.1	5.0	4	5	5.8	13.3	3	27.8			5.9	9.8
32	HPW349(C)	46	79	8.1	24.7	4	6	5.6	11.1	4	31.3	15.1	23.3	12.0	27.9
33	VL907(C)	35	78	11.1	30.8	3	7	5.7	10.0	4	7.1	15.4	17.5	6.3	7.5
34	VL892(C)	57	89	10.7	27.2	4	7	6.3	12.5	4	7.1			23.5	34.7
35	DBW377	47	89	9.6	23.6	5	7	5.2	8.3	4	31.3				
36	PBW870	35	68	8.1	15.4	6	9	4.2	6.3	4	25.0				
37	DBW372	46	78	6.3	24.6	4	7	7.0	11.1	4	22.2				
38	DBW318	56	89	8.5	21.0	5	9	4.7	9.4	2	30.0				
39	DBW327 (C)	46	89	11.2	39.6	5	7	3.7	7.3	4	27.8	16.5	23.4		
40	DBW332(C)	46	78	13.1	37.8	5	9	4.7	8.6	4	22.2	23.6	43.1		
40A	Infector	78	99	22.9	37.5	7	9	20.9	28.2	5	-				
41	DBW370	46	79	7.2	19.6	5	9	7.7	11.3	4	27.8				
42	DBW371	46	89	2.8	8.6	5	7	6.3	12.5	4	35.0				
43	DBW373	56	77	14.8	32.6	5	9	5.7	9.3	4	20.0				
44	PBW868	57	79	8.2	14.7	7	9	1.7	3.3	4	25.0				
45	PBW871	46	78	14.9	41.2	5	9	6.5	12.5	5	25.0				
46	PBW872	45	78	10.2	31.4	6	9	8.1	9.6	5	20.0				
47	HD3090(C)	67	98	15.3	45.7	5	9	5.7	8.3	4	27.8	15.3	30.0		
48	HI1633(C)	56	89	11.2	40.2	5	9	5.6	8.6	4	27.8	8.9	25.0		
49	RAJ4083(C)	46	89	11.1	37.5	6	9	5.7	9.0	5	25.0	25.0	43.0		
50	DBW320#*	45	68	10.2	35.4	5	9	5.4	10.0	5	22.2	5.4	11.1		
51	MP1380#	46	69	12.1	48.8	5	9	4.6	9.1	5	30.0				
52	DBW407[B]	35	77	5.3	16.2	5	9	3.8	7.3	3	21.4				
53	DDW48(d)(C)	46	78	1.8	5.6	6	9	3.3	6.6	4	18.8				
54	HI8826(d)*	46	89	9.4	21.4	6	9	0.8	1.5	3	14.3	2.1	8.3		
55	MACS4100(d)*	46	79	2.5	8.3	4	9	2.2	3.9	4	33.3	5.5	10.0		
56	MP1378	46	68	4.6	13.6	5	9	3.2	5.0	5	30.0				
57	MP3552	46	79	13.9	41.2	3	5	3.8	5.6	5	25.0				
58	UAS3015	46	79	8.5	28.0	4	9	3.3	4.1	4	30.0				
59	HI8839(d)	46	89	4.2	11.1	5	7	4.5	5.8	5	33.3				
60	HI8840(d)	46	88	2.4	4.5	6	9	5.1	8.3	3	27.8				
60A	Infector	78	89	25.3	40.2	8	9	21.5	29.4	4	-				

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
61	MP1358(I)(C)	35	79	6.5	19.6	4	9	2.8	4.2	4	25.0	24.2	36.3		
62	NIAW3922	46	89	4.7	6.2	2	5	4.5	5.6	4	25.0				
63	NIDW1149(d)(C)	47	79	5.1	9.1	3	7	2.5	5.0	3	27.8	8.7	18.3		
64	UAS478(d)	56	89	3.6	11.1	2	7	1.8	3.5	3	18.8				
65	DBW352#	57	88	6.3	26.4	3	5	1.3	2.6	4	20.0				
66	GW513(I)(C)	67	89	9.7	31.0	5	9	5.0	8.5	5	8.3	10.1	30.0		
67	GW547^{B}	57	89	4.5	15.9	4	7	4.3	9.6	4	15.0				
68	HI1636(I)(C)	67	99	10.6	38.8	5	9	8.7	11.5	5	25.0	16.3	25.0		
69	HI1650*	57	79	4.9	13.0	3	5	5.4	12.2	5	27.8	22.7	27.7		
70	MACS6768*	57	89	12.8	36.0	4	7	3.7	7.3	4	27.8	14.8	36.6		
71	MP3535*	57	89	6.3	17.0	4	7	3.0	6.2	4	16.7	20.8	26.6		
72	NWS2194#	57	89	5.9	19.3	4	7	3.3	6.5	4	11.1				
73	HI1665	57	89	9.9	23.9	3	7	2.3	4.5	4	25.0				
74	NIAW4028	57	89	8.4	25.6	3	5	3.1	4.5	5	33.3				
75	CG1036*	56	99	4.4	10.5	4	7	3.1	5.0	5	27.8	20.6	46.6		
76	CG1040	46	89	4.2	9.7	3	6	2.5	4.3	4	31.3				
77	DDW47(d)(C)	46	78	6.5	20.5	4	7	3.1	5.0	3	25.0	7.5	18.3		
78	DDW55(d)^{Q}*	57	89	5.7	15.6	3	7	2.1	4.2	5	27.8	5.1	10.9		
79	GW532	57	99	4.0	8.3	5	9	3.1	4.3	4	20.0				
80	HD3401	57	99	10.2	45.8	4	7	4.2	7.1	5	20.0				
80A	Infector	78	99	22.4	37.5	8	9	21.8	24.0	5	-				
81	HI1655^{Q}*	57	79	10.6	41.2	3	6	4.5	6.7	5	30.0	25.2	46.6		
82	HI1666	57	89	12.7	29.3	3	5	6.4	10.5	4	25.0				
83	HI8823(d)(I)(C)	57	89	4.3	8.3	4	7	1.8	3.5	4	22.2	22.4	76.2		
84	HI8830(d)*	57	89	8.1	11.1	5	9	1.3	2.5	4	11.1				
85	MACS6795	57	99	3.4	9.6	3	6	3.2	5.0	3	35.0				
86	MP1377	57	79	9.8	38.8	3	7	4.2	7.1	5	25.0				
87	MP3288(C)	57	89	9.8	28.1	5	9	4.3	8.2	4	22.2	31.6	47.8		
88	UAS3019	57	89	6.3	12.5	3	5	5.3	6.6	4	6.3				
89	DBW316#*	47	78	7.3	24.0	4	9	3.9	5.0	4	35.0				
90	HD3118(C)	57	79	7.9	13.9	3	5	2.6	4.5	5	20.0	16.6	25.0		
91	HD3392	46	68	4.5	14.1	2	5	5.2	7.2	5	22.2				

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
92	HI1621(C)	46	78	9.4	36.7	4	6	4.2	8.3	4	33.3	8.7	26.6		
93	PBW833*	36	69	16.2	48.5	3	7	4.6	9.1	4	35.0	27.6	41.8		
94	PBW835^{Q}*	57	79	14.6	38.8	4	9	5.4	11.1	5	16.7	12.6	22.2		
95	HD3249(C)	46	79	3.4	10.0	3	7	1.3	2.5	5	33.3	24.2	36.2		
96	PBW826#*	46	78	14.2	54.2	3	5	4.4	7.3	5	16.7	8.7	15.0		
97	HD3388	46	78	6.8	16.3	3	6	5.2	6.6	3	25.0	21.2	28.6		
98	PBW852	46	89	16.0	53.6	3	7	2.9	5.0	5	16.7	16.0	36.0		
99	DBW252(C)	46	68	5.5	14.5	2	5	5.4	8.1	5	0.0				
100	HD3171(C)	47	68	11.3	43.3	3	7	3.2	5.0	5	25.0				
100A	Infector	78	89	26.9	45.5	7	9	17.8	25.0	5	-				
101	HD3293(C)	46	68	13.7	56.0	3	7	3.4	5.5	5	20.0	21.1	46.6		
102	DBW353	46	79	17.2	51.7	2	5	5.4	7.5	5	22.2				
103	JKW261(I)(C)	46	79	9.9	30.0	2	7	5.2	8.6	5	33.3	28.4	37.6		
104	PBW771(C)	46	89	4.9	11.1	4	9	13.7	31.6	5	22.2	15.4	19.5		
105	WH1124(C)	46	89	4.7	8.3	2	5	3.7	9.1	5	25.0	26.6	42.5		
106	HD2967(C)	35	67	4.5	13.0	3	5	6.6	12.5	4	33.3	28.3	71.1		
107	HD3386	36	68	13.1	42.1	5	9	7.9	11.5	5	27.8				
108	DBW359	46	68	14.7	52.9	2	5	5.7	9.6	5	30.0				
109	DBW358	36	79	11.6	38.8	4	9	4.7	8.7	5	11.1				
110	NIAW3170(C)	57	69	6.9	13.3	3	9	4.1	6.3	4	30.0	37.2	47.1		
111	HD3043(C)	46	68	5.9	12.5	2	5	2.7	5.3	5	16.7	20.1	30.0		
112	HD3369*	47	89	6.2	15.6	4	7	3.4	6.8	5	35.0	19.4	35.0		
113	HD3397	46	78	10.3	34.5	5	7	5.2	7.3	5	6.3				
114	HD3400	46	89	7.6	20.5	6	9	5.2	8.5	5	25.0				
115	HD3418	46	68	7.7	29.7	5	9	6.0	9.5	5	30.0				
116	HI1628(C)	56	89	11.6	34.9	6	9	6.1	11.6	3	0.0	31.6	47.5		
117	HI1653*	46	89	14.5	41.5	5	9	5.7	10.0	5	25.0	20.7	31.7		
118	HI1654*	46	89	7.3	22.1	4	9	4.3	8.5	5	30.0	28.0	45.0		
119	HUW838(I)(C)	46	89	8.6	31.3	5	9	4.7	9.3	5	25.0	33.1	57.6		
120	UP3090	46	89	5.3	9.1	6	9	6.2	11.7	5	27.8				
120A	Infector	78	79	25.9	33.5	8	9	23.2	26.6	4	-				
121	WH1402	35	69	7.5	20.3	6	9	4.3	6.6	4	16.7				

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
122	WH1403	35	67	5.5	13.3	5	9	4.2	8.3	4	27.8				
123	DBW365	35	77	12.4	27.6	6	9	4.6	9.1	5	16.7				
124	DBW366	35	77	6.4	17.9	5	9	4.3	7.2	5	20.0				
125	DBW402	46	79	5.6	19.6	5	9	4.5	8.3	4	25.0				
126	HD3415	46	79	7.0	21.2	4	7	5.8	9.1	4	25.0				
127	Kharchia65(C)	56	89	7.9	15.5	4	9	8.9	14.2	4	31.3	26.9	83.0		
128	KRL19(C)	46	89	5.7	25.2	4	9	5.3	10.0	4	25.0	24.1	80.0		
129	KRL2006	46	78	7.5	23.3	4	6	4.6	9.1	5	27.8				
130	UAS310	46	77	11.2	38.8	3	6	4.7	8.3	4	30.0				
131	KRL2021	56	99	5.4	18.9	2	5	8.0	15.6	4	25.0				
132	KRL210(C)	57	89	8.5	22.5	3	5	4.5	6.5	5	30.0	22.9	76.0		
133	RAJ4565	46	89	3.1	4.5	4	7	2.4	5.0	5	20.0				
134	HD3438	67	99	9.7	43.0	5	9	2.5	5.0	5	27.8				
135	HD3439	57	89	10.7	36.4	4	9	8.6	19.5	4	35.0				
136	CG1029(C)	67	99	13.1	34.8	5	9	7.5	12.5	4	6.3	16.8	28.0		
137	HD3407*	57	99	12.1	33.3	4	9	3.6	6.6	4	30.0	19.0	26.0		
138	HI1634(C)	57	89	10.4	24.4	5	7	4.9	8.3	4	33.3	20.2	32.0		
139	MP3336(C)	57	99	5.8	13.6	3	7	4.8	7.4	4	25.0	17.7	33.0		
140	HI8498(C)	46	79	5.3	11.3	3	7	1.8	3.5	5	27.8	5.5	16.6		
140A	Infector	78	89	25.3	41.2	5	8	22.4	26.6	5	-				
141	HI8759(C)	56	99	5.4	12.5	3	7	2.3	4.5	5	33.3				
142	HI8846	46	89	6.1	15.0	3	7	1.7	3.3	5	30.0				
143	HI8847	56	89	3.1	6.6	3	6	1.8	3.5	5	25.0				
144	HD2733(C)	46	89	2.3	8.6	4	7	3.0	5.0	3	0.0	19.8	25.0		
145	HD3411*	46	59	9.0	30.8	4	9	4.6	6.6	5	25.0	30.4	52.4		
146	HD3440	35	59	6.8	18.9	5	9	3.7	6.7	5	33.3				
147	HD3406*	25	59	9.3	20.8	4	7	3.2	5.0	5	28.6	31.3	61.3		
148	HD3436	35	99	13.8	34.4	5	9	5.0	7.2	5	30.0				
149	HD3437	35	59	6.2	13.7	3	9	3.7	6.8	3	30.0				
150	PBW175(C)	56	79	11.7	41.6	4	9	4.7	6.7	5	33.3				
151	PBW677(C)	36	79	6.5	22.4	3	5	2.9	5.0	3	30.0				
152	PBW901	46	89	12.1	41.2	3	7	5.9	10.5	3	16.7				

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
153	PBW902	36	69	10.7	35.7	3	5	2.7	6.6	4	30.0				

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 2019-20, 2020-21and 2021-22

S. No.	Entry / Year	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		LB (dd)		KB (%)		PM (0-9)		FS (%)		FHB (0-5)	FR (%)	LS (%)		HB (%)	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	HS	HS	AV	HS	AV	HS
1	**VL2041***																						
	2019-20	11.5	60S	2.6	10MS	2.5	20S	14.5	40S	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2020-21	5.8	20S	5.6	30S	9.3	30S	10.7	40S	23	57	8.3	19.4	3	7	2.1	6.3	4	35	-	-	11.1	20
	2021-22	3.1	10MS	6.4	20MS	17.9	60S	22.3	40S	24	46	4	9.3	3	5	3.5	6.6	3	25	11.1	18.6	13.5	20.2
2	**HS507(C)**																						
	2019-20	0.8	10MR	3.7	20MS	7.5	30S	5	10S	35	78	2.9	8.3	3	5	7.1	8.7	5	20	24.7	46.7	11.1	18.4
	2020-21	3.5	10MS	5.1	30S	15	60S	7	40S	35	79	4.7	8.6	4	9	5.5	7.5	3	75	26.7	46.7	8.5	15.6
	2021-22	2.3	15MS	10.8	20S	23.6	60S	11.2	20S	35	77	8.3	26.7	5	7	4.2	8.3	1	27.8	20.8	28.6	13.8	29.1
3	**HS562(C)**																						
	2019-20	29.1	80S	4.5	20S	7.4	30S	15.5	60S	45	89	4.2	11.6	3	5	4.1	9.3	4	5	34.4	58.7	16.2	36
	2020-21	14.5	40S	10.5	60MS	23.6	60S	11.4	60S	24	47	11.1	32.3	4	9	1.8	5.5	4	55	26.5	35	11.4	16.4
	2021-22	21.1	40S	12.8	30S	22.2	60S	13.4	40S	45	99	8.1	27.1	6	9	4.1	9.1	3	11.1	13.6	21.7	5.4	7.7
4	**HPW349(C)**																						
	2019-20	24.1	60S	7.4	40MS	5.2	30S	11.8	40S	35	68	9.2	31.3	3	7	4.7	8.3	5	29.4	22.1	45.8	21.3	57.3
	2020-21	8.5	30MS	10.6	40S	11.1	20S	8.2	60S	35	79	14.2	58.5	4	9	4.5	5.7	4	0	25.2	41.2	10.8	13.8
	2021-22	7.5	20S	7.6	20S	15	40S	9.3	40S	46	79	8.1	24.7	4	6	5.6	11.1	4	31.3	15.1	23.3	12	27.9
5	**VL907(C)**																						
	2019-20	0.6	5MR	4.8	20S	8.2	20S	22.4	60S	45	79	5	8.6	4	6	4.2	12.5	4	20	21.3	26.9	6.3	12.5
	2020-21	3.4	15MS	4.8	20S	6.4	20S	8	20S	24	58	13.2	34.4	4	9	2.2	6.6	3	0	31.1	35	6.1	12.3
	2021-22	0.4	5MR	21.2	80S	5.6	20S	16	60S	35	78	11.1	30.8	3	7	5.7	10	4	7.1	15.4	17.5	6.3	7.5
6	**PBW826#***																						
	2019-20	4	10S	8.6	40S	6.3	20MS	8.2	30S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	6.9	40MS	2	10S	12.3	40S	4.6	10MS	45	68	6.8	8.2	4	7	2.5	7.5	4	80	-	-		
	2021-22	6.3	20MS	6.9	30S	11.7	60S	11.5	40S	46	78	14.2	54.2	3	5	4.4	7.3	5	16.7	8.7	15		
7	**HD3406***																						
	2019-20																						
	2020-21	27.3	80S	9	40S	3.9	20S	16	60S	35	57	5.4	10	3	7	3.3	10	3	35	-	-		
	2021-22	30	40S	4.1	20S	6.7	20S	18	60S	25	59	9.3	20.8	4	7	3.2	5	5	28.6	31.3	61.3		
8	**HD3369***																						
	2019-20	13.7	60S	2.5	10MS	3.8	20S	8.1	20S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	6.3	20S	1.8	5S	3.6	20S	8.2	30S	36	89	2.8	6.6	4	9	8.4	18.3	4	50	-	-		
	2021-22	6	40S	5.6	20MS	11.5	40S	5.9	20S	47	89	6.2	15.6	4	7	3.4	6.8	5	35	19.4	35		
9	**HI1653***																						
	2019-20	7.9	40MS	7.1	40S	4	30S	11.2	40S														
	2020-21	13.5	60S	13.2	60S	5.9	20S	5.6	20S	46	89	22.6	90	4	7	4.6	9.6	4	50	-	-		
	2021-22	11.4	20MS	3.3	20MS	2.9	20S	14.4	40S	46	89	14.5	41.5	5	9	5.7	10	5	25	20.7	31.7		
10	**HI1654***																						
	2019-20	1.2	5S	2	10MS	1.4	10S	3.7	10MS	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	5.3	20MS	3.1	15MS	2.9	15S	3.6	20S	36	89	3.5	6.6	5	9	3.1	9.3	5	12.5	-	-		
	2021-22	2.6	20MS	4.8	30MS	0.2	TR	14.8	40S	46	89	7.3	22.1	4	9	4.3	8.5	5	30	28	45		
11	**DBW 187(C)**																						
	2019-20	10.8	40S	3.9	15MS	1.5	10S	12.9	60S*	45	89	5.5	12.5	2	6	3.1	5.6	4	45.0	13.0	21.3		

	2020-21	8	20S	1	15MR	1.6	10S	5.9	40S	46	78	6.1	13.5	4	9	2.4	7.2	4	0.0	-	-		
	2021-22	5.3	10S	5.6	20MS	3.3	10S	20.2	50S	-	-	-	-	-	-	-	-	-	-	-	-		
12	**DBW222(C)**																						
	2019-20	22.9	60S	4	20S	3.9	15S	14.2	60S	45	89	6.6	13.6	3	6	6.6	13.3	4	78.6	6.5	15.0		
	2020-21	23.9	60S	5.8	40S	5.1	30S	20.2	60S	35	58	5.3	9.5	4	9	6.0	9.6	4	60.0	19.0	76.0		
	2021-22	16	20S	5.6	20S	5.7	20S	25.8	60S	-	-	-	-	-	-	-	-	-	-	-	-		
13	**HD 3086(C)**																						
	2019-20	31	60S	19.5	80S	22.5	50S	14.3	60S	46	89	3.2	8.3	4	5	5.6	14.2	5	20.0	3.6	12.5		
	2020-21	31.6	80S	19.6	60S	13.6	40S	8.7	40S	46	79	7.6	18.8	4	7	17.5	25.0	4	50.0	18.3	73.3		
	2021-22	19.9	40S	10.4	20S	27.9	60S	18.8	60S	-	-	-	-	-	-	-	-	-	-	-	-		
14	**HD2967(C)**																						
	2019-20	7.6	40S	4.1	20MS	13.9	40S	37.6	80S	35	78	3.7	10	4	6	8.0	8.3	5	0.0	32.8	86.7		
	2020-21	9	30S	5.8	40S	2.1	10S	35.6	60S	24	57	19.6	84.8	4	9	1.8	5.5	5	50.0	29.6	46.6		
	2021-22	7.7	40S	16.8	80S*	5.8	20S	42.8	80S	35	67	4.5	13	3	5	6.6	12.5	4	33.3	28.3	71.1		
15	**PBW 644 (C)**																						
	2019-20	18	40S	17.8	60S	17.6	60S	33.2	60S	46	89	6	12.5	3	6	11.3	15.3	4	30.0	21.7	43.8		
	2020-21	18.3	60S	23.1	80S	12.9	30S	8.9	20S	34	57	5	10	5	9	6.9	8.3	4	0.0	20.7	33.5		
	2021-22	5.1	20S	4.8	20S	8.6	40S	28.5	60S	-	-	-	-	-	-	-	-	-	-	-	-		
16	**HD3043(C)**																						
	2019-20	5.6	20MS	39.5	80S	41.9	80S	18.2	60S	45	89	4	13.3	3	6	2.7	6.6	5	10.0	38.0	87.1		
	2020-21	5.8	20S	24	60S	22.6	60S	10.1	40S	35	55	4.7	6.6	4	7	3.7	11.1	4	0.0	23.6	31.5		
	2021-22	1.2	10MR	29.6	40S	24.3	100S	23.9	60S	46	68	5.9	12.5	2	5	2.7	5.3	5	16.7	20.1	30		
17	**NIAW3170(C)**																						
	2019-20	7	20MS	6	30S	1.5	5S	28.6	60S	46	89	1.8	8.3	4	5	2.2	6.6	5	42.1	40.8	72.0		
	2020-21	3.6	10MS	3.5	10S	4.3	20S	19.5	40S	45	77	4.4	9.3	5	7	5.4	8.3	5	40.0	44.5	70.0		
	2021-22	3.5	20MS	9.6	40S	0.7	5S	40.5	80S	57	69	6.9	13.3	3	9	4.1	6.3	4	30	37.2	47.1		
18	**HI1628(C)**																						
	2019-20	6	20MS	8.5	40S	3.8	15S	18.4	40S	46	89	4.7	16.7	2	4	5.7	13.3	5	0.0	52.0	71.2		
	2020-21	8	30MS	6.7	20S	2.9	20S	7.3	20S	46	78	8.7	22.9	5	7	4.2	12.5	5	50.0	40.1	85.4		
	2021-22	5.2	15MS	4	20MR	3.1	10S	15.2	40S	56	89	11.6	34.9	6	9	6.1	11.6	3	0	31.6	47.5		
19	**DBW 296(I)**																						
	2019-20	4.4	10MS	5.4	20S	5.8	15S	10.3	40S	46	89	6.2	18.3	2	7	7.0	11.1	5	66.7	-	-		
	2020-21	3.8	20S	1.2	15MR	2.9	10S	2.4	20MR	35	78	3.6	6.2	4	6	5.5	16.6	4	60.0	33.7	50.0		
	2021-22	10	60MS	1.7	10MS	0.7	5S	7	40S	-	-	-	-	-	-	-	-	-	-	-	-		
20	**HUW838(I)(C)**																						
	2019-20	2.4	10MS	2.6	15MS	8.1	50S	11.1	40S	46	89	4.6	14.3	3	5	2.5	7.5	5	79.0	-	-		
	2020-21	9.1	40S	5.8	40S	1.6	5S	5.9	20S	46	89	4.1	7.1	4	7	2.2	6.6	4	31.3	19.4	28.0		
	2021-22	5.7	15MS	2.4	10MS	1.9	10S	20.8	40S	46	89	8.6	31.3	5	9	4.7	9.3	5	25	33.1	57.6		
21	**PBW826#***																						
	2019-20	4	10S	8.6	40S	6.3	20MS	8.2	30S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	6.9	40MS	2	10S	12.3	40S	4.6	10MS	45	68	6.8	8.2	4	7	2.5	7.5	4	80	-	-		
	2021-22	6.3	20MS	6.9	30S	11.7	60S	11.5	40S	46	78	14.2	54.2	3	5	4.4	7.3	5	16.7	8.7	15		
22	**HD3406***																						
	2019-20																						
	2020-21	27.3	80S	9	40S	3.9	20S	16	60S	35	57	5.4	10	3	7	3.3	10	3	35	-	-		
	2021-22	30	40S	4.1	20S	6.7	20S	18	60S	25	59	9.3	20.8	4	7	3.2	5	5	28.6	31.3	61.3		

23	**HD3411***																						
	2019-20																						
	2020-21	33.3	60S	14.5	30S	12.9	30S	11.6	40S	46	89	5.8	12.5	5	9	12	15	4	90	-	-		
	2021-22	33.3	60S	8.8	20S	16.3	40S	27.7	60S	46	59	9	30.8	4	9	4.6	6.6	5	25	30.4	52.4		
24	**DBW316#***																						
	2019-20	2	10MS	1.1	5MS	1.5	10S	3.4	10S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	5.1	20MS	3.5	20S	5.1	20S	1.6	10MS	35	89	13.1	40.7	3	7	2.9	5	5	0	-	-		
	2021-22	36	80S	22.4	60S	34.3	70S	19	60S	47	78	7.3	24	4	9	3.9	5	4	35	-	-		
25	**PBW833***																						
	2019-20	33	80S	1.3	5S	1.4	10S	15.4	60S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	28.5	60S	6.2	20S	2.3	10S	6.4	40S	35	78	3.1	11.1	4	7	14.7	36.5	5	95	-	-		
	2021-22	35.7	60S	5.6	20MS	7.3	30S	5.9	20S	36	69	16.2	48.5	3	7	4.6	9.1	4	35	27.6	41.8		
26	**PBW835^{Q}***																						
	2019-20	13.1	40S	8.3	60S	1.3	10S	1.7	10S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	10.5	40MS	10	40S	3.4	15S	1	10S	56	99	10.4	28.7	5	9	11.6	14.2	4	50	-	-		
	2021-22	9.4	20MS	3.3	20MS	2.7	10S	2.2	20S	57	79	14.6	38.8	4	9	5.4	11.1	5	16.7	12.6	22.2		
27	**HD3249(C)**																						
	2019-20	3.3	10MS	9.4	60S	3.1	10S	8	20MS	46	99	4.2	11.3	3	7	7.8	14.6	5	5	20.5	35		
	2020-21	9.1	40S	9.5	60S	2.7	10S	7.3	30S	46	79	10.7	20	4	9	4.5	7	3	40	17.2	28.2		
	2021-22	13.7	60S	4	10S	3.5	10S	4.1	15MS	46	79	3.4	10	3	7	1.3	2.5	5	33.3	24.2	36.2		
28	**HD 3086(C)**																						
	2019-20	31	60S	19.5	80S	22.5	50S	14.3	60S	46	89	3.2	8.3	4	5	5.6	14.2	5	20.0	3.6	12.5		
	2020-21	31.6	80S	19.6	60S	13.6	40S	8.7	40S	46	79	7.6	18.8	4	7	17.5	25.0	4	50.0	18.3	73.3		
	2021-22	19.9	40S	10.4	20S	27.9	60S	18.8	60S	-	-	-	-	-	-	-	-	-	-	-	-		
29	**HD2967(C)**																						
	2019-20	7.6	40S	4.1	20MS	13.9	40S	37.6	80S	35	78	3.7	10	4	6	8.0	8.3	-	-	-	-		
	2020-21	9	30S	5.8	40S	2.1	10S	35.6	60S	24	57	19.6	84.8	4	9	1.8	5.5	-	-	-	-		
	2021-22	7.7	40S	16.8	80S*	5.8	20S	42.8	80S	35	67	4.5	13	3	5	6.6	12.5	4	33.3	28.3	71.1		
30	**DBW 187 (C)**																						
	2019-20	10.8	40S	3.9	15MS	1.5	10S	12.9	60S*	45	89	5.5	12.5	2	6	3.1	5.6	4	45.0	13.0	21.3		
	2020-21	8	20S	1	15MR	1.6	10S	5.9	40S	46	78	6.1	13.5	4	9	2.4	7.2	4	0.0	-	-		
	2021-22	5.3	10S	5.6	20MS	3.3	10S	20.2	50S	-	-	-	-	-	-	-	-	-	-	-	-		
31	**HD2733(C)**																						
	2019-20	2.2	10S	11.6	40S	22.5	50S	49.1	80S	46	89	3.8	14.4	4	7	5.4	16.3	4	0.0	16.3	37.5		
	2020-21	4.8	10MS	16.9	30S	13.7	40S	40.6	60S	46	89	2.8	9.3	5	9	3.8	8.2	11	55.0	42.7	75.0		
	2021-22	3	10MS	7.6	20S	11.6	40MS	53.8	90S	46	89	2.3	8.6	4	7	3	5	3	0	19.8	25		
32	**HI 1563(C)**																						
	2019-20	1.5	10MS	2.1	20MS	1.3	5S	46.4	80S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	2.1	20MR	2.4	20MS	4.3	20S	39.8	80S	57	99	12.2	32.1	6	9	18.6	28.6	5	75	-	-		
	2021-22	0.7	10MR	4.1	20S	8	40S	45.1	80S	-	-	-	-	-	-	-	-	-	-	-	-		
33	**HI1621(C)**																						
	2019-20																						
	2020-21	14.6	40S	17.7	60S	12.3	40S	2.9	20S	35	77	4.9	11.1	5	9	2.2	6.6	5	0	-	-		
	2021-22	15	60S	10.8	30S	22.5	70S	5.8	20S	46	78	9.4	36.7	4	6	4.2	8.3	4	33.3	8.7	26.6		
34	**DBW 107 (C)**																						
	2019-20	2.6	10MS	4.8	20S	2.4	5S	14.7	40S	-	-	-	-	-	-	-	-	-	-	-	-		

	2020-21	2.1	10MS	10.6	60S	2.7	15S	13.4	60S	46	89	14.5	58.6	6	9	4.1	8.3	4	55	-	-		
	2021-22	19.4	40S	12.6	30S	12.4	40S	26.5	60S	-	-	-	-	-	-	-	-	-	-	-	-		
35	**HD3118(C)**																						
	2019-20																						
	2020-21	24.9	60S	27.1	80S	24.3	60S	2.6	20S	46	78	3.2	10	5	9	2.8	8.3	4	45	-	-		
	2021-22	21.7	40S	21.2	30S	28.9	90S	11.4	40S	57	79	7.9	13.9	3	5	2.6	4.5	5	20	16.6	25		
36	**HI1650***																						
	2019-20	1.9	10MS	1.1	20MR	4.4	20MS	31.3	80S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	2.8	10S	1	15MR	1.1	10MS	27.4	60S	57	89	7.8	23.7	5	9	10.9	16.6	4	65	-	-		
	2021-22	0.4	5MR	4	20S	5.3	40MS	55.7	80S	57	79	4.9	13	3	5	5.4	12.2	5	27.8	22.7	27.7		
37	**MP3535***																						
	2019-20	13.5	40S	6.4	20S	2.5	20S	41.4	60S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	3.1	20MS	4.9	20S	4.5	20S	44.7	60S	46	68	6.2	8.3	6	9	4	9.3	5	40	-	-		
	2021-22	28.7	40S	24.8	80S	29.3	80S	22.3	60S	57	89	6.3	17	4	7	3	6.2	4	16.7	20.8	26.6		
38	**MACS6768***																						
	2019-20	11.3	40S	5.7	40S	3	10S	68.2	100S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	3.8	20MS	6.4	30S	4.1	20S	56	80S	56	99	11.5	36	7	9	2.8	8.3	4	65	-	-		
	2021-22	3	20MR	12.1	60S*	6	20S	73	100S	57	89	12.8	36	4	7	3.7	7.3	4	27.8	14.8	36.6		
39	**HD3407***																						
	2019-20																						
	2020-21	6	20MS	2.2	10MS	4	20S	1.6	10MS	47	89	11.7	24.4	6	9	6.6	10.3	3	60	-	-		
	2021-22	0.9	5MS	1.7	20MR	0	0	11.2	60S	57	99	12.1	33.3	4	9	3.6	6.6	4	30	19	26		
40	**HI8830(d)***																						
	2019-20	7	40S	3.1	10MS	4.5	30S	13.9	40S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	2.5	10MS	2.4	10S	2.3	10S	8.7	40MS	46	79	50.6	11.7	6	9	0.4	1.1	4	18.8	-	-		
	2021-22	2.5	40MR	4.1	20S	3.5	15MS	10.8	40S	57	89	8.1	11.1	5	9	1.3	2.5	4	11.1	-	-		
41	**CG1036***																						
	2019-20	3.3	10S	10.1	80S	4.5	20S	55.5	80S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	1.8	10MS	1.5	15MR	4.1	15S	51.5	60S	46	89	4.9	8.7	5	9	5.2	12.5	5	25	-	-		
	2021-22	1.2	5MS	8.1	40S	4.3	30S	66.7	100S	56	99	4.4	10.5	4	7	3.1	5	5	27.8	20.6	46.6		
42	**HI1655^{Q}***																						
	2019-20	1.1	5S	8.5	60S	1.4	10S	26.5	60S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	1.3	10MS	1	10MR	0	0	25.3	60S	46	79	7.2	17.7	5	9	11.4	16.1	3	55	-	-		
	2021-22	0.9	10MR	0.4	5MR	2.6	10S	39.5	90S	57	79	10.6	41.2	3	6	4.5	6.7	5	30	25.2	46.6		
43	**DDW55(d)^{Q}***																						
	2019-20	12.8	40S	4.8	20MS	2.6	20S	16.5	60S	-	-	-	-	-	-	-	-	-	-	-	-		
	2020-21	7.8	20S	1.8	20MR	0.4	5MR	17.4	60S	46	78	1	5	4	9	0	0	4	40	-	-		
	2021-22	14.4	80S*	2.5	15MS	7.6	40S	24.3	70S	57	89	5.7	15.6	3	7	2.1	4.2	5	27.8	5.1	10.9		
44	**GW 322 (C)**																						
	2019-20	15.8	40S	14.6	80S	22.4	50S	45.5	80S	47	89	5	15	4	9	4.6	7.5	4	0.0	43.9	66.5		
	2020-21	8.3	30S	7.3	20MS	8.6	20S	36	60S	46	79	4.8	8.5	6	9	8.6	9.7	5	35.0	14.3	22.2		
	2021-22	8	20S	14.4	30S	8.9	40S	54.5	90S	-	-	-	-	-	-	-	-	-	-	-	-		
45	**HI 1544 (C)**																						
	2019-20	2.8	10S	5.1	40S	3.6	10S	54.1	80S	57	89	11.6	42.9	4	9	12.2	23.1	4	18.8	17.9	45.0		
	2020-21	5.3	30S	5.8	40MS	1.4	10S	53	80S	56	99	21.8	64.5	5	9	21.4	33.9	4	70.0	40.2	54.8		
	2021-22	0.7	10MR	6.1	30S	3.9	10S	59.7	100S	-	-	-	-	-	-	-	-	-	-	-	-		

46	**HI1636(I)(C)**																						
	2019-20	0.3	5MR	3.1	20S	5.6	20S	49.5	80S	46	99	4.5	10	5	9	4.6	10.5	5	0.0	-	-		
	2020-21	3.3	10S	4	20MS	5.7	40S	40.8	60S	46	89	14.7	29.2	6	9	9.1	12.5	4	33.3	-	-		
	2021-22	0.1	TMR	0.4	5MR	1.4	10S	65.5	100S	67	99	10.6	38.8	5	9	8.7	11.5	5	25	16.3	25		
47	**GW513(I)(C)**																						
	2019-20	2.3	5MS	8.8	60S	5.8	20S	61.8	80S	56	89	5.6	14.3	5	9	3.7	11.1	5	10.0	-	-		
	2020-21	3.3	10MS	3.2	20S	7.3	20S	52.5	80S	57	99	6.5	12.5	5	9	12.4	20.0	5	68.8	-	-		
	2021-22	1.5	10MR	3.3	20MS	5.2	30S	61.3	100S	67	89	9.7	31	5	9	5	8.5	5	8.3	10.1	30		
48	**HD 2932 (C)**																						
	2019-20	11.3	20S	38.8	80S	35	70S	51.4	80S	46	89	3.6	10	4	9	2.5	7.5	5	47.4	-	-		
	2020-21	8	20MS	24.9	40S	24.9	60S	40.8	60S	36	79	3.1	9.3	5	9	2.8	8.3	5	70.0	7.4	24.0		
	2021-22	3.2	20MR	22.4	60S	19.3	60S	63.2	90S	-	-	-	-	-	-	-	-	-	-	-	-		
49	**HD 2864 (C)**																						
	2019-20	2.5	10S	7.6	60S*	5.6	20MS	57.7	80S	56	89	4	8.6	4	6	2.5	7.5	5	27.8	12.6	37.4		
	2020-21	5.8	30MS	4.1	20MS	5	20S	43.6	60S	56	79	9.7	22	6	9	3.1	9.3	4	75.0	-	-		
	2021-22	1.2	10MR	2.1	10S	1.1	10MS	64.3	100S	-	-	-	-	-	-	-	-	-	-	-	-		
50	**MP3336(C)**																						
	2019-20	9.4	30MS	26.5	80S	28.8	50S	51.8	80S	56	89	4.1	13.3	5	9	2.1	6.3	5	17.7	18.3	46.6		
	2020-21	5.8	20S	11.7	40S	12.6	40S	39	60S	56	99	6.1	15.2	6	9	12.7	17.7	5	50.0	26.3	52.2		
	2021-22	12	40MS	12.8	30S	15	40S	54.1	100S	57	99	5.8	13.6	3	7	4.8	7.4	4	25	17.7	33		
51	**CG1029(C)**																						
	2019-20	4.2	10MS	2.7	20MS	5	20S	62.7	80S	56	99	4.4	12.5	5	9	3.7	8.3	5	84.2	28.5	44.6		
	2020-21	2.8	10MS	0.5	5MR	16.7	60S	51.2	80S	46	89	4.6	12.5	6	9	4.1	7.8	3	80.0	19.3	45.0		
	2021-22	2.4	20MR	3.2	20MS	0.7	5S	66.7	100S	56	99	4.4	10.5	4	7	3.1	5	5	27.8	20.6	46.6		
52	**HI1634(C)**																						
	2019-20	0.3	5MR	3.1	20S	5.6	20S	49.5	80S	46	89	4.4	12.5	3	6	4.6	6.8	5	5.3	22.3	42.2		
	2020-21	10.1	60S*	13.3	80S*	4	20S	35.6	60S	46	79	8.9	21.3	6	9	4.2	12.5	5	80.0	24.9	35.0		
	2021-22	1.1	10MR	0.3	TS	1.5	10S	51.8	90S	57	89	10.4	24.4	5	7	4.9	8.3	4	33.3	20.2	32		
53	**HI 8627(C)**																						
	2019-20	2.2	40MR	1.6	5MS	2.6	10S	5.3	20MS	46	99	2.9	10	2	4	0.0	0.0	5	87.5	7.0	26.6		
	2020-21	3.1	10MS	4.3	20S	0.5	5MR	9.1	60S	46	79	2.1	5	3	7	1.5	4.5	5	50.0	28.7	46.6		
	2021-22	2.9	20MS	2.5	15MS	1.9	10MS	11.7	80S	-	-	-	-	-	-	-	-	-	-	-	-		
54	**MP3288(C)**																						
	2019-20	5.9	20S	7.7	40S	8.4	40S	29.6	80S	46	89	3.7	6.3	4	7	2.7	8.1	4	20.0	20.5	48.0		
	2020-21	2.8	20MR	2.7	20MS	2.1	10S	26	60S	46	78	6.5	10.8	4	7	7.3	9.1	4	10.0	7.2	26.6		
	2021-22	7.2	20S	4.8	20MS	10.3	20S	47	80S	-	-	-	-	-	-	-	-	-	-	-	-		
55	**DDW47(d)(C)**																						
	2019-20	1.9	5MS	1.2	10MR	5.8	20S	2.1	20MS	36	79	2.7	5.2	2	6	0.0	0.0	5	5.3	3.9	12.5		
	2020-21	3.5	10S	7.7	30S	3.4	20S	3.8	15S	46	99	3.2	8	4	7	1.4	4.3	4	58.3	11.0	22.2		
	2021-22	19.4	60S	2.5	20MR	3.6	20S	4.4	20S	-	-	-	-	-	-	-	-	-	-	-	-		
56	**DBW 110 (C)**																						
	2019-20	10	20S	10.3	40S	9.1	20S	34.5	80S	46	68	2.4	5	3	5	1.9	5.6	5	15.0	16.6	27.3		
	2020-21	8.3	40MS	2.9	20MS	11.7	40S	24.8	60S	46	79	4	10	4	9	3.9	7.3	3	65.0	18.0	43.8		
	2021-22																						
57	**HI8823(d)(I)(C)**																						
	2019-20	1.2	5MS	2.3	10S	6.6	30S	7.1	20MS	46	89	2.1	8.3	4	7	0.0	0.0	4	0.0	-	-		

	2020-21	3.5	15MS	0.9	10MR	2.1	5S	11.4	60S	46	89	3.4	7.5	5	9	5.7	11.1	5	60.0	-	-		
	2021-22	1	10MR	0.9	10MR	1	5S	17	40S	-	-	-	-	-	-	-	-	-	-	-	-		
58	**HI8826(d)***																						
	2019-20	6.8	40S	1.2	20MR	10.8	60S	9.8	40S														
	2020-21	2.1	10MS	6	20S	0.8	5S	11.6	60S	46	89	1.3	4.2	6	9	0	0	4	70	-	-		
	2021-22	6.6	40S	4.9	30MS	6.3	20S	12.6	40S	46	89	9.4	21.4	6	9	0.8	1.5	3	14.3	2.1	8.3		
59	**MACS4100(d)***																						
	2019-20	16.5	60S	5.9	40S	0.8	5S	12.8	40S														
	2020-21	6.5	20S	5.7	30MS	0.2	TS	8.8	60S	46	78	2.3	8	4	7	0	0	3	70	-	-		
	2021-22	16.8	100S	12.1	60S*	1.7	10S	16.2	40S	46	79	2.5	8.3	4	9	2.2	3.9	4	33.3	5.5	10		
60	**DBW320#***																						
	2019-20	11	20S	10.1	60S	10	30S	7.3	30S														
	2020-21	13.8	60S	15.7	80S	13.1	40S	8.9	40S	45	89	8.1	19.2	6	9	2.8	8.3	4	66.7	-	-		
	2021-22	8.9	20MS	20.9	80S	21.5	60S	14.7	40S	45	68	10.2	35.4	5	9	5.4	10	5	22.2	5.4	11.1		
61	**MACS 3949 (C)**																						
	2019-20	9.8	40S	6.1	20MS	1.8	10MS	2.5	20S	56	99	1.4	5	4	9	0.0	0.0	4	16.7	10.4	16.6		
	2020-21	7	20S	4.9	20S	0.5	5MR	2.7	20MR	46	69	3.2	12.5	5	7	1.4	4.3	3	0.0	3.8	15.0		
	2021-22	8.2	60MS*	2.1	10S	2.3	20MS	4.3	20S														
62	**DDW48(d)(C)**																						
	2019-20	18.1	100S*	5.6	20MS	6.6	40S	8.7	40S	45	99	1.5	6.7	3	5	0.0	0.0	3	57.9	4.5	12.5		
	2020-21	13	40MS	3.9	10MS	3.1	15S	3.2	10S	35	78	3	7.5	6	9	0.0	0.0	5	83.3	15.1	34.1		
	2021-22	14.3	60S	2	15MR	3.1	20S	5.2	20MS														
63	**GW 322 (C)**																						
	2019-20	15.8	40S	14.6	80S	22.4	50S	45.5	80S	47	89	5	15	4	9	4.6	7.5	4	0.0	43.9	66.5		
	2020-21	8.3	30S	7.3	20MS	8.6	20S	36	60S	46	79	4.8	8.5	6	9	8.6	9.7	5	35.0	14.3	22.2		
	2021-22	8	20S	14.4	30S	8.9	40S	54.5	90S														
64	**RAJ4083(C)**																						
	2019-20	4.4	20S	16.6	80S	10.8	40S	35.5	80S	57	89	5.1	11.6	4	9	5.5	13.2	4	5.0	22.4	35.4		
	2020-21	6.3	30S	7.3	20MS	10.1	40S	20.8	60S	46	89	16.7	54.5	5	9	2.2	6.6	5	20.0	6.3	12.5		
	2021-22	3.3	15MS	11.6	30S	13.9	40S	45	90S	46	89	11.1	37.5	6	9	5.7	9	5	25	25	43		
65	**HD 2932 (C)**																						
	2019-20	11.3	20S	38.8	80S	35	70S	51.4	80S	46	89	3.6	10	4	9	2.5	7.5	5	47.4	-	-		
	2020-21	8	20MS	24.9	40S	24.9	60S	40.8	60S	36	79	3.1	9.3	5	9	2.8	8.3	5	70.0	7.4	24.0		
	2021-22	3.2	20MR	22.4	60S	19.3	60S	63.2	90S														
66	**HD3090(C)**																						
	2019-20	3.8	20MR	3.1	30MS	5.8	15S	47.7	80S	46	99	4.5	12.3	4	6	4.9	14.7	5	10.0	44.7	73.3		
	2020-21	4.8	10S	5.1	20S	3.3	15S	37.4	60S	46	79	20.6	94.4	5	9	5.9	8.3	5	33.3	3.7	11.1		
	2021-22	4	15MS	1.7	20MR	7.2	30S	60.5	90S	67	98	15.3	45.7	5	9	5.7	8.3	4	27.8	15.3	30		
67	**HI1633(C)**																						
	2019-20	2	10S	10	80S*	7	20S	48.6	80S	56	89	3.2	11.2	5	9	2.9	8.7	5	0.0	24.8	40.9		
	2020-21	1.9	10MS	1	15MR	0.2	TS	32.3	60S	46	78	9.1	25.1	5	9	3.4	7.5	5	16.7	18.4	42.7		
	2021-22	1.6	10MR	3.3	20MS	2	10S	58.5	90S	56	89	11.2	40.2	5	9	5.6	8.6	4	27.8	8.9	25		
68	**DBW 370**																						
	2019-20																						
	2020-21	36	80S	9.6	60S	8.6	40S	6.3	20MS	46	79	6	11.9	3	7	1.1	3.3	3	58.3	-	-		
	2021-22	41.1	80S	15.3	60S	5.3	20S	29.3	70S														

69	**DBW 371**																						
	2019-20																						
	2020-21	26.5	80S	11.5	60S	0.7	5S	8.2	60S	46	78	4.2	6.7	3	7	0	0	5	18.8	-	-		
	2021-22	34.3	80S	4.9	20MS	2.3	15S	20.7	60S														
70	**DBW 372**																						
	2019-20																						
	2020-21	19.8	60S	11.7	60S	2.9	10S	13.3	40S	35	79	4.9	9.5	3	7	4.6	5	4	85	-	-		
	2021-22	11.3	40S	8.4	15MS	6.6	20MS	28	60S														
71	**PBW 872**																						
	2019-20																						
	2020-21	9.7	40MS	4	30MS	5.1	20S	14.7	60S	36	89	6.3	13.5	5	9	1.2	3.5	4	95	-	-		
	2021-22	9.5	20MS	6.8	30S	14.9	40S	22.3	40S														
72	**DBW 187 (C)**																						
	2019-20	10.8	40S	3.9	15MS	1.5	10S	12.9	60S*	45	89	5.5	12.5	2	6	3.1	5.6	4	45.0	13.0	21.3		
	2020-21	8	20S	1	15MR	1.6	10S	5.9	40S	46	78	6.1	13.5	4	9	2.4	7.2	4	0.0	-	-		
	2021-22	5.3	10S	5.6	20MS	3.3	10S	20.2	50S														
73	**DBW 303(C)**																						
	2019-20	7	20MS	1.6	10MS	0.6	10MR	6.7	20S	46	89	2.6	8.7	3	7	4.2	12.5	5	26.3	23.8	45.5		
	2020-21	5.6	20MS	2.3	15MS	1.6	10S	4	20MS	35	78	10.7	34.2	4	9	0.8	2.5	4	85.0	-	-		
	2021-22	4.6	10S	1.7	15MR	2.9	15S	14.3	40S														
74	**HD 3086 (C)**																						
	2019-20	31	60S	19.5	80S	22.5	50S	14.3	60S	46	89	3.2	8.3	4	5	5.6	14.2	5	20.0	3.6	12.5		
	2020-21	31.6	80S	19.6	60S	13.6	40S	8.7	40S	46	79	7.6	18.8	4	7	17.5	25.0	4	50.0	18.3	73.3		
	2021-22	19.9	40S	10.4	20S	27.9	60S	18.8	60S														
75	**DBW327 (C)**																						
	2019-20	15.3	40S	11	60S	11.3	50S	6.1	20MS	46	89	4.4	12.5	3	6	4.7	9.1	4	27.8	-	-		
	2020-21	5.3	20MS	6	20MS	5.7	20S	10	60S	35	78	4.5	9.3	4	9	1.2	2.5	4	60.0	-	-		
	2021-22	7.4	20S	5.6	20S	16.6	40S	19.9	60S	46	89	11.2	39.6	5	7	3.7	7.3	4	27.8	16.5	23.4		
76	**DBW332(C)**																						
	2019-20	16	40S	6.3	40S	10	30S	6.9	20S	45	89	4.7	13.3	4	6	3.3	10.0	5	36.8	-	-		
	2020-21	20	60S	7.4	40S	1.6	10S	7.1	20S	36	78	6.1	12.7	4	9	1.7	5.0	4	50.0	-	-		
	2021-22	12.6	20S	4.9	20MS	4.9	20S	21.5	60S	46	78	13.1	37.8	5	9	4.7	8.6	4	22.2	23.6	43.1		
77	**MP1358(I)(C)**																						
	2019-20	4.1	15MS	3.3	20MS	2.4	10MS	5.7	15S	46	89	4.7	10.1	3	5	1.7	5.0	5	42.1	-	-		
	2020-21	8.5	30MS	6.1	40S	1.7	10S	9.5	40S	46	89	10.4	26.2	4	7	6.2	12.5	4	0.0	-	-		
	2021-22	6	20MS	4.8	20S	8	20S	13.8	40S	35	79	6.5	19.6	4	9	2.8	4.2	4	25	24.2	36.3		
78	**NIDW1149(d)(C)**																						
	2019-20	2.9	10MS	2.3	20MS	2.6	10S	4.6	10S	56	89	1.9	6.5	5	9	0.0	0.0	4	10.0	3.3	13.3		
	2020-21	4.8	20MS	3.2	20MS	0.7	5S	0.7	10MR	57	89	4.1	13.3	5	9	0.0	0.0	5	31.3	25.4	45.1		
	2021-22	9.7	20MS	3.3	20MS	1.6	5S	13.1	50S	47	79	5.1	9.1	3	7	2.5	5	3	27.8	8.7	18.3		

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 2021-22

NIVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
NIVT-1A									
1	DBW187(C)	5.3	10S	5.6	20MS	3.3	10S	20.2	50S
2	HD3086(C)	19.9	40S	10.4	20S	27.9	60S	18.8	60S
3	DBW222(C)	16.0	20S	5.6	20S	5.7	20S	25.8	60S
4	DBW379	1.8	10MS	11.6	20MS	10.4	20S	16.2	40S
5	DBW380	18.3	40MS	4.9	20MS	2.9	10S	14.3	40S
6	DBW381	2.2	10S	3.2	20MS	2.1	10S	7.3	20S
7	DBW382	20.3	40S	19.2	40S	37.3	90S	8.0	40S
8	DBW383	14.3	40S	12.4	40S	22.2	40S	14.6	60S
9	BRW3921	11.4	20S	13.6	20S	6.4	30S	16.3	40S
10	BW17R6045	22.3	40S	9.6	20MS	7.5	40S	25.3	60S
11	HD3419	5.6	20S	4.1	20S	11.5	40S	10.4	40S
12	HD3420	8.4	20MS	7.2	20S	4.3	20S	4.1	20MS
13	HD3421	24.3	40S	1.1	10MR	1.5	10S	27.9	60S
14	HP1974	11.7	40S	8.0	20S	8.9	40S	2.1	10S
15	HUW849	16.6	40S	4.6	10S	8.6	40S	14.0	40S
16	JAUW695	7.9	20MS	13.2	40MS	20.9	40S	1.9	20S
17	K2101	1.7	10MS	12.8	30S	13.3	20S	13.4	40S
18	KRL2002	5.6	60MR	4.8	20S	7.1	10S	20.3	40S
19	NW8046	3.2	20MS	6.4	20MS	3.0	10S	18.1	40S
20	PBW882	12.9	40S	4.8	20MS	4.0	15S	5.8	20MS
20A	Infector	80.0	100S	72.0	100S	74.3	100S	74.2	90S
21	PBW883	10.9	20S	1.6	10MR	5.0	15S	0.2	TS
22	PBW884	6.6	20S	1.2	15MR	10.6	60S	3.6	10S
23	PBW885	4.3	20MR	1.2	15MR	1.7	10MS	2.3	20S
24	PBW886	16.7	40MS	1.3	15MR	12.1	40S	5.0	20S
25	RAJ4566	0.6	5MR	3.3	20MS	5.0	15S	34.8	80S
26	RAJ4567	9.7	20S	9.7	40S	18.3	60S	19.6	60S
27	RAJ4568	0.3	5MR	4.1	20MS	3.7	10S	8.4	40MS
28	RVW4350	6.9	40MS	7.2	10S	10.0	30S	53.5	80S
29	UBW16	16.1	40S	6.1	30S	4.6	10S	13.3	40S
30	UP3101	5.9	20MS	9.2	30S	11.4	40S	18.9	60S
31	UP3102	18.9	40S	4.8	10MS	3.6	10S	13.2	40S
32	UP3103	4.7	20MS	0.9	10MR	2.7	10S	12.3	40S
33	UP3104	5.7	20MS	3.3	20MS	4.4	20S	13.8	50S
34	WH1301	19.7	40S	0.8	10MR	8.0	40S	30.8	80S
35	WH1302	14.3	40S	4.0	10S	1.4	5S	10.0	30S
36	WH1303	5.3	20MS	7.3	20S	3.1	15S	14.3	40S
NIVT-1B									
37	AAI-W49	26.0	40S	21.6	40S	13.1	40S	24.5	60S
38	BRW3910	8.5	40S	3.2	10MS	5.0	20S	26.0	60S
39	BRW3926	3.2	20S	1.3	15MR	5.9	20S	29.5	60S
40	DBW384	14.1	40MS	1.7	10MS	6.6	20S	25.3	70S
40A	Infector	80.0	100S	76.0	100S	67.1	80S	73.3	90S
41	DBW385	0.8	10MR	12.0	20S	17.8	40S	25.3	60S
42	DBW386	2.7	10S	1.6	10MS	6.7	20S	12.9	40S
43	HD3422	5.3	20MS	8.0	20S	18.6	40S	1.8	5S
44	HD3423	27.9	60S	2.0	15MR	2.0	10S	16.3	40S

45	HI1668	11.4	20S	11.3	40S	7.6	40S	15.9	40S
46	HP1975	14.9	40S	2.1	10S	3.2	15MS	11.2	40MS
47	HUW850	30.3	60S	8.0	20MS	0.7	5S	35.7	60S
48	HUW851	17.1	40S	3.7	10S	11.1	40S	22.8	60S
49	JKW297	2.2	10S	4.0	20S	4.0	10S	21.6	50S
50	K2103	4.2	20MS	0.8	10MR	5.4	30S	51.7	80S
51	K2104	15.9	20S	4.1	10MS	6.1	30S	40.7	80S
52	K2105	19.4	40S	7.3	20	5.0	10S	33.4	60S
53	KRL2020	19.4	40S	8.8	20S	3.6	10S	25.2	60S
54	NW8044	5.4	20S	4.8	20MS	1.5	10S	5.8	20MS
55	NW8049	14.9	60MS	1.3	15MR	1.9	10MS	9.2	40S
56	NWS2214	8.6	20S	2.1	10S	1.7	15MS	9.9	40S
57	PBW887	4.7	20MS	5.6	20S	8.9	20S	13.1	40S
58	PBW888	25.7	40S	3.2	20MS	0.3	5MR	2.1	10S
59	PBW889	18.6	40S	6.8	30S	5.8	30S	8.8	30S
60	PBW890	15.3	40S	7.3	20S	8.6	30S	8.3	40S
60A	Infector	82.9	100S	76.0	100S	68.6	80S	72.5	90S
61	RAJ4569	9.0	40MS	7.4	20MS	4.9	10S	15.2	40S
62	RAJ4570	3.4	10S	10.5	20S	1.7	10S	8.8	20S
63	RVW4353	14.6	40MS	16.8	50S	20.7	40S	49.0	80S
64	TAW142	11.9	20S	13.6	30S	18.6	40S	26.3	60S
65	UP3105	12.9	20S	3.1	15S	4.3	10S	13.5	40S
66	UP3106	4.9	20MS	3.3	20MS	1.7	15MS	15.7	40S
67	WH1304	6.1	20MS	9.2	30S	2.1	15S	7.4	20S
68	WH1305	10.0	20MS	7.7	30S	9.4	30S	27.0	60S
NIVT-2									
69	GW322(C)	8.0	20S	14.4	30S	8.9	40S	54.5	90S
70	HI1544(C)	0.7	10MR	6.1	30S	3.9	10S	59.7	100S
71	MACS6222(C)	4.6	20MS	5.6	20S	5.0	20S	37.2	80S
72	RVW4355	4.1	10MS	5.7	20MS	3.3	10S	48.4	60S
73	AKAW5314	14.9	60MS	9.3	30S	4.7	15S	67.5	80S
74	AKAW5100	7.0	40S	8.8	20S	5.3	20S	57.3	80S
75	BLK-Balaji	6.0	30S	16.8	60S	10.4	40S	62.3	100S
76	CG1043	13.7	60MS	16.0	60S	16.0	40S	68.2	90S
77	DBW387	7.9	20S	4.4	10S	2.9	10S	34.4	90S
78	DBW388	9.1	20MS	2.1	10MS	2.3	10S	26.1	60S
79	GW536	7.6	20S	2.5	10MS	6.9	40S	70.8	90S
80	GW537	2.6	20MR	14.8	30S	7.3	20MS	49.7	90S
80A	Infector	77.1	100S	72.0	100S	67.1	100S	79.2	100S
81	GW540	1.8	10MR	10.0	40MS	20.9	40S	49.7	80S
82	GW541	4.2	10S	9.6	20MS	9.7	40S	49.3	80S
83	HD3424	4.4	20MS	1.1	5S	8.6	30S	34.0	70S
84	HI1669	2.3	20MR	3.3	20MS	3.1	10S	61.5	80S
85	HI1670	1.0	10MR	2.0	10S	3.0	10S	69.2	90S
86	HI1671	0.5	5MR	1.7	10MS	1.7	10S	75.0	100S
87	MACS6808	3.9	20MS	4.8	20MS	2.9	15S	57.2	90S
88	MACS6809	5.3	20MS	6.4	20MS	1.4	10S	51.7	100S
89	MACS6811	20.0	60MS	4.0	10MS	4.9	30S	42.5	90S
90	MACS6815	4.4	20MS	1.6	5MS	7.9	40S	60.5	90S
91	MP1386	0.9	10MR	1.2	15MR	8.7	40S	49.7	80S
92	MP1387	1.3	5MR	1.7	10MS	1.3	5S	42.4	80S
93	MP3558	10.3	60S*	35.2	80S	0.0	0	69.2	100S

94	MP3559	1.5	10S	4.8	30MS	4.9	20S	56.7	80S
95	NIAW4153	0.7	10MR	2.5	15MS	6.6	40S	67.7	80S
96	NIAW4183	0.5	5MR	1.7	10MS	5.7	40S	62.5	80S
97	NWS2222	5.0	20MS	8.0	20S	7.1	40S	41.6	80S
98	PBW891	9.2	20S	2.5	10MS	11.5	40S	22.1	60S
99	PWU15	2.2	10MS	2.0	10S	7.2	40S	51.0	80S
100	RAJ4575	1.7	10MS	12.0	40S	7.9	40S	29.6	80S
100A	Infector	82.9	100S	72.0	100S	77.1	100S	78.3	90S
101	RVW4358	1.4	10MR	6.4	20MS	3.9	20S	33.3	60S
102	UAS3020	7.3	20S	2.0	10S	2.7	15S	32.4	60S
103	UAS3021	16.9	40MS	5.9	20S	2.9	20S	23.8	80S
104	WH1306	4.1	10S	12.4	30S	13.3	40S	12.0	40S
NIVT-3A									
105	DBW107(C)	19.4	40S	12.6	30S	12.4	40S	26.5	60S
106	DBW173(C)	0.7	5MS	6.1	30S	2.6	5S	15.3	40S
107	HD3059(C)	6.3	20MS	6.0	30S	3.4	10S	28.2	60S
108	HI1563(C)	0.7	10MR	4.1	20S	8.0	40S	45.1	80S
109	AAI-W42	16.0	40S	9.6	20S	5.7	20S	13.8	60S
110	BRW3923	12.3	20S	4.1	20S	10.7	40S	25.4	60S
111	DBW389	1.2	10MS	12.8	40S	5.0	20S	21.7	60S
112	DBW390	29.4	60S	4.0	20MS	2.1	10S	22.6	60S
113	DBW391	9.1	20S	8.8	20S	5.8	20S	24.8	60S
114	DBW392	7.1	20S	1.6	10MS	4.0	20S	20.9	60S
115	DBW393	0.5	5MR	11.6	20S	2.6	10MS	24.9	60S
116	HD3425	15.7	60MS	8.8	20S	3.6	15S	23.3	60S
117	HD3426	20.6	40S	4.9	20MS	5.6	15S	3.0	20S
118	HD3427	9.7	20S	2.8	10S	4.4	20S	29.7	60S
119	HD3428	3.6	20MR	3.2	20MS	0.7	5S	15.3	40S
120	HUW852	13.7	40MS	5.6	20S	7.0	15S	42.6	60S
120A	Infector	77.1	100S	76.0	100S	71.4	80S	76.7	100S
121	JKW298	13.7	40MS	6.4	20MS	1.5	10S	31.4	70S
122	K2107	4.7	20MS	10.4	20MS	5.7	20S	25.7	60S
123	K2108	0.9	5MS	1.6	20MR	5.7	15S	17.3	40S
124	K2109	5.0	20MS	9.8	20MS	3.9	10S	51.7	80S
125	NW8040	4.3	20MS	5.0	20MS	4.9	20S	19.9	60S
126	NW8045	5.3	20MS	0.8	5MS	4.3	15S	25.7	60S
127	PBW892	3.0	20MS	3.3	20MS	1.9	5S	22.0	60S
128	PBW893	23.7	60S	6.4	20MS	1.4	10S	1.8	10MS
129	PBW894	23.8	40S	4.1	20S	3.6	15S	5.7	20S
130	PBW895	3.9	20MS	10.4	20S	12.9	40S	4.6	20S
131	PBW896	1.6	10MS	8.0	30MS	5.9	20S	11.3	40S
132	RAJ4572	0.2	5R	9.6	20MS	8.1	20S	22.4	60S
133	RAJ4573	1.6	20MR	13.2	30MS	4.6	20S	17.4	40S
134	RAJ4574	0.3	5MR	13.6	40S	4.0	10S	21.2	60S
135	UP3108	30.4	60S	4.5	15MS	0.7	5S	13.1	40S
136	UP3109	12.9	20S	2.8	10S	3.6	15S	8.6	20S
137	UP3110	31.4	40S	8.0	15MS	7.9	40S	12.3	40S
138	WH1307	7.0	20MS	2.5	15MS	0.7	5S	7.8	20S
139	WH1308	19.5	60MS	2.0	10MR	1.9	10MS	20.8	40S
140	WH1309	8.6	40MS	7.6	20MS	4.7	15S	29.3	60S
140A	Infector	80.0	100S	80.0	100S	72.9	80S	76.7	90S
NIVT-3B									

141	HD2932(C)	3.2	20MR	22.4	60S	19.3	60S	63.2	90S
142	HD2864(C)	1.2	10MR	2.1	10S	1.1	10MS	64.3	100S
143	AKAW5104	1.1	10MR	2.5	15MS	1.0	15MR	66.0	100S
144	CG1042	1.3	10MR	26.0	60S	8.6	40S	60.0	80S
145	DBW394	3.2	10MS	3.1	15S	1.6	10S	45.5	80S
146	DBW395	2.1	10MS	4.0	10MS	7.3	15S	23.1	60S
147	GW538	2.0	20MR	3.2	20MS	4.3	20MS	41.7	80S
148	GW542	0.2	5R	12.4	30S	15.0	40S	60.4	100S
149	HI1672	0.8	5MR	1.2	15MR	7.1	20S	65.0	100S
150	HI1673	1.5	10MR	2.5	15MS	2.9	10S	61.7	100S
151	HI1674	0.5	5MR	2.4	15MS	3.0	15S	55.0	80S
152	HI1675	0.2	5R	1.6	10MS	0.6	10MR	54.5	100S
153	LOK79	0.3	5MR	0.8	10MR	0.6	5MS	46.5	80S
154	MACS6805	3.0	20MS	4.0	20S	2.2	15S	40.5	90S
155	MACS6814	1.3	10MR	3.2	20MS	1.5	5S	37.1	80S
156	MP1388	2.7	10MS	3.3	20MS	0.0	0	54.8	100S
157	MP3556	3.3	20MS	9.2	20S	4.0	15S	14.1	40S
158	MP3557	6.9	20S	9.6	20S	2.5	15MS	47.7	80S
159	NIAW4114	3.7	40MR	6.4	20MS	3.1	10S	61.5	90S
160	NIAW4120	0.7	5MR	2.5	10MS	2.7	15S	69.2	90S
160A	Infector	77.1	100S	72.0	100S	70.0	100S	79.2	100S
161	PBW897	0.9	10MR	6.4	30MS	3.3	10S	7.4	40S
162	UAS3022	11.3	40MS	4.9	30MS	2.6	10MS	13.3	40S
163	UAS3023	9.1	20S	9.6	20S	3.0	10S	27.4	60S
164	WH1310	4.9	20MS	2.1	10S	0.3	5MR	6.6	20MS
NIVT-4									
165	HI8713(C)	1.7	20MR	3.3	20MS	3.1	10MS	16.4	40S
166	HI8737(C)	5.5	20MS	4.1	20S	1.8	10MS	8.7	30S
167	MACS3949(C)	8.2	60MS*	2.1	10S	2.3	20MS	4.3	20S
168	UAS428(C)	3.3	20MS	2.4	15MS	3.7	10S	5.8	30S
169	DDW59	6.0	40MS	3.2	20MS	4.3	20S	37.7	80S
170	DDW60	2.9	20MR	3.3	20MS	1.3	5S	5.7	40S
171	GW1360	1.8	20MR	3.3	20MS	1.7	15MS	2.8	10S
172	GW1361	3.2	20MS	0.9	10MR	2.7	15S	0.7	5MS
173	GW1363	6.6	20MS	6.5	20MS	0.9	5MS	7.8	20S
174	GW1364	2.0	20MR	0.4	5MR	2.9	10S	5.6	20S
175	HI8841	1.2	5MS	0.9	10MR	1.1	15MR	10.6	40S
176	HI8842	5.2	20S	4.5	20MS	2.0	10S	2.7	10S
177	HI8843	4.2	20MS	0.9	10MR	2.3	15MS	6.3	20S
178	MACS4120	3.6	20S	0.9	10MR	0.6	5MR	2.2	5S
179	MACS4121	5.8	40S	1.3	15MR	0.0	TR	2.7	10S
180	MACS4122	9.3	60MS	0.9	10MR	1.1	10MS	10.6	30S
180A	Infector	80.0	100S	74.0	100S	71.4	80S	74.2	100S
181	MPO1389	0.7	10MR	0.5	5MR	7.7	50S*	5.3	40S
182	MPO1390	3.3	20MS	0.1	R	1.4	10S	2.4	10S
183	NIDW1485	8.2	60MS*	0.9	10MR	2.9	15S	8.6	20S
184	PDW362	9.4	60MS*	1.2	10MR	1.4	10MS	6.4	20S
185	PDW363	8.9	60MS*	0.9	10MR	4.6	15S	7.5	40S
186	PWU18	1.6	10MS	2.5	15MS	2.5	15S	8.3	30S
187	PWU19	6.2	20MS	0.9	10MR	0.0	0	9.3	30S
188	UAS479	10.5	60S*	0.9	10MR	1.9	10MS	6.3	30S
189	UAS480	13.1	80MS	0.5	5MR	1.9	10MS	0.7	5S

190	AKDW4773	11.3	80MS	1.3	15MR	3.6	15S	4.5	40S
NIVT-5A									
191	DBW397	7.5	40MS	5.6	20S	0.3	5MR	12.6	60S
192	HI1612(C)	38.6	80S	2.0	10S	1.0	5S	18.8	60S
193	K1317(C)	12.6	60MS	2.8	10MS	3.4	10S	21.8	60S
194	PBW644(C)	5.1	20S	4.8	20S	8.6	40S	28.5	60S
195	BRW3924	17.9	40S	3.3	20MS	1.5	10S	13.8	40S
196	DBW396	42.9	80S	15.2	40S	8.6	20S	17.0	60S
197	DBW398	29.7	60S	4.8	20MS	3.7	20S	12.3	40S
198	DBW399	45.1	80S	15.6	30S	11.6	40S	13.8	40S
199	HD3429	10.7	20S	6.5	20MS	9.3	40S	36.4	60S
200	HD3430	6.3	20MS	3.3	15MS	3.0	10S	37.2	60S
200A	Infector	77.1	100S	76.0	100S	74.3	100S	75.8	100S
201	HI1676	12.6	40MS	4.8	20S	3.6	15S	31.1	80S
202	HP1976	17.1	40S	8.2	20MS	5.0	20S	11.6	40S
203	HUW853	11.2	30S	13.2	30S	20.0	40S	20.4	40S
204	JAUW704	17.6	60S	4.8	20MS	12.4	40S	4.5	20MS
205	JKW292	9.3	40S	20.0	60S	8.6	20S	60.2	80S
206	K2121	9.7	40S	6.4	20MS	6.0	10S	57.7	80S
207	NW8048	8.6	60S*	0.8	10MR	1.0	5S	31.7	80S
208	PBW898	36.6	60S	1.3	15MR	4.1	15S	22.8	70S
209	PBW899	19.1	60S	2.4	10MS	4.6	20S	4.5	20MS
210	PBW900	6.2	10S	1.8	10MS	4.3	20S	6.8	20S
211	TAW133	16.3	40MS	10.4	20S	20.9	40S	23.4	60S
212	UP3111	14.7	60S	6.4	20MS	3.6	10S	9.9	40S
213	UP3112	14.0	20S	10.4	20S	3.7	10S	16.4	60S
214	WH1311	7.5	30MS	0.1	TR	2.6	10S	13.3	40S
215	WH1312	7.2	20MS	0.9	10MR	3.9	15S	25.2	60S
NIVT-5B									
216	DBW110(C)	7.6	20MS	4.8	15MS	1.5	10S	37.8	80S
217	HI1605(C)	3.7	20MS	14.4	40S	6.3	20S	38.8	60S
218	HI8627(d)(C)	2.9	20MS	2.5	15MS	1.9	10MS	11.7	80S
219	UAS446(d)(C)	2.0	10MS	1.7	10MS	0.7	5S	4.9	40S
220	CG1041	6.3	20MS	32.4	70S	22.1	60S	47.9	100S
220A	Infector	80.0	100S	80.0	100S	72.9	100S	77.5	100S
221	DBW400	3.5	10S	0.1	TR	2.9	10S	23.9	60S
222	DDW61(d)	2.6	20MR	4.4	15MR	2.1	10S	1.8	10S
223	GW1362(d)	1.2	10MS	3.3	20MS	5.3	15MS	54.2	80S
224	GW539	0.9	10MR	18.0	30S	14.3	40S	58.8	80S
225	HI1677	1.5	10MR	2.5	15MS	2.3	10S	65.5	90S
226	HI1678	0.4	5R	2.5	15MS	3.0	10S	57.5	90S
227	HI1679	2.7	20MS	1.7	10MS	3.3	10S	55.5	90S
228	HI8844(d)	3.5	20MS	0.9	10MR	2.4	10S	8.2	20S
229	HI8845(d)	2.3	5MS	3.2	10MS	1.4	10S	11.6	40S
230	MACS6797	3.2	40MR	3.2	20MS	1.4	10S	35.7	90S
231	MACS6801	9.3	20MS	10.0	30S	3.9	15MS	43.8	80S
232	MP1384	2.0	10MS	10.0	20S	2.1	10S	19.3	60S
233	MP1385	3.5	20MR	12.6	20MS	13.6	60S	21.9	40S
234	MP3562	4.4	10S	4.2	20MS	4.3	20S	21.3	90S
235	NIAW4172	0.5	5MR	1.6	10MS	0.7	5S	60.5	100S
236	NIAW4178	3.7	20MS	3.2	20MS	3.7	20MS	65.3	80S
237	UAS3024	14.0	60MS	7.7	30S	5.3	15S	46.9	80S

238	UAS481(d)	8.4	40MS	1.3	15MR	9.3	40S	6.7	20S
239	WSM253	20.9	40S	19.6	30S	31.4	80S	59.0	100S
NIVT-6A									
240	DBW303(C)	4.6	10S	1.7	15MR	2.9	15S	14.3	40S
240A	Infector	80.0	100S	84.0	100S	71.4	80S	79.2	100S
241	DBW296	10.0	60MS	1.7	10MS	0.7	5S	7.0	40S
242	BRW3922	22.9	40S	4.0	15MS	3.1	15S	34.3	60S
243	DBW403	3.3	10MS	1.2	15MR	2.9	10S	6.0	20MS
244	DBW404	0.6	10MR	2.5	15MS	2.5	15MS	8.4	40S
245	HD3431	24.6	40S	4.8	20S	2.4	5S	15.5	40S
246	HD3432	17.7	40S	0.8	5MS	1.5	10S	24.6	60S
247	HD3433	5.9	20S	1.6	10MS	2.1	15S	9.0	20S
248	HI1682	13.1	30MS	6.4	20S	2.1	10S	29.3	60S
249	K2001	2.9	10MS	4.0	20S	1.4	5S	28.0	60S
250	PBW877	16.5	40S	3.2	20MS	7.0	20S	6.0	40S
251	PBW878	4.1	10MS	5.6	20MS	2.6	5S	12.3	40S
252	PBW879	12.9	20S	3.3	20MS	7.9	40S	22.1	60S
253	PBW880	12.1	40MS	1.6	10MS	7.9	40S	18.8	60S
254	RAJ4571	1.3	10MR	1.6	10MS	1.4	5S	25.6	60S
255	UP3115	12.3	30S	3.2	20MS	9.3	40S	25.3	60S
256	UP3116	5.7	20MS	2.4	15MS	3.0	15S	5.3	20MS
257	WH1313	2.9	10MS	6.4	20MS	5.0	20S	9.1	40S
258	WH1314	2.6	10S	1.7	10MS	5.0	10S	9.2	40S
NIVT-6B									
259	CG1044	10.9	40MS	18.4	40S	13.1	40S	48.7	80S
260	DBW401	5.8	20MS	11.3	40S	4.3	20S	9.5	40S
260A	Infector	82.9	100S	80.0	100S	70.0	80S	70.8	90S
261	DBW405	21.4	40S	5.6	20MS	6.5	15S	22.7	90S
262	DBW406	4.0	15MS	1.6	20MR	10.6	20S	28.5	90S
263	GW543	9.4	20S	0.9	10MR	6.5	20S	47.0	80S
264	GW544	1.4	10MR	2.4	15MS	4.4	15S	45.7	80S
265	GW545	3.1	20MS	7.6	20S	11.7	20S	47.5	90S
266	GW546	0.5	5MR	4.9	30MS	2.9	20S	51.6	80S
267	HD3435	5.5	20S	4.9	20MS	2.1	15S	12.1	50S
268	HI1680	0.5	5MR	4.1	20S	4.2	20S	51.8	80S
269	HI1681	2.3	20MR	1.7	10MS	0.8	5S	51.5	80S
270	HP1977	22.1	40S	7.6	30S	9.9	20S	19.4	70S
271	MACS6802	4.6	20MS	2.0	10S	2.1	15MR	25.2	60S
272	MACS6803	2.9	20MR	4.0	20S	1.4	10S	26.2	80S
273	MP1391	8.0	20S	4.1	20S	5.0	20S	29.2	90S
274	MP3564	0.2	5R	6.0	30S	0.0	0	44.7	80S
275	MP3567	0.3	10R	1.6	10MS	6.4	40S	43.3	80S
276	NIAW4040	1.2	10MR	9.2	20MS	3.4	15S	44.8	80S
277	NIAW4174	0.7	5MR	3.2	20MS	6.4	40S	53.0	80S
278	PBW881	7.2	20S	3.3	20MS	3.6	15S	18.8	70S
279	UAS3025	41.7	60S	4.0	10MS	2.0	10S	32.7	80S
280	UAS3026	32.9	60S	6.8	30S	2.1	10S	38.7	80S
280A	Infector	80.0	100S	84.0	100S	74.3	100S	77.5	90S

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

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PROGRAMME 2. RUSTS: BLACK, BROWN AND YELLOW

2.1 RACE SPECIFIC APR

AVT entries were evaluated at specific locations for Race Specific Adult Plant Resistance (APR) to three rusts (black, brown and yellow).

Locations:
Stem rust, leaf rust and yellow rust (under controlled conditions): Flowerdale, Shimla (Table 2.1, 2.2, 2.3, 2.4)
Brown rust and y**ellow rust** – Ludhiana and New Delhi (Table 2.5)
Black rust (under controlled conditions): Pune, Indore and Mahabaleshwar (Table 2.5)

Race specific Adult Plant Resistance (APR) in AVT entries (2021-22) at IIWBR, RS, Shimla

To search for race specific adult plant resistance, 153 AVT lines of wheat for 2021-22 were screened against the most predominant and virulent pathotypes of *P. graminis tritici. Puccinia triticina,* and *P. striiformis*. Two pathotypes of *P. graminis* (11 and 40A) three pathotype of *P. triticina* (77-5, 77-9 and 104-2), two pathotypes each of *P. striiformis* (46S119 and 238S119) were used to evaluate APR. These evaluations were conducted under polyhouses equipped with temperature and light adjustments. Proper checks including differentials, resistance genes and seedlings of AVT lines were also. The diseases reaction to different races is given in Table 2.1.

Table 2.1: Race specific adult plant rust resistance of AVT entries at ICAR-IIWBR, RS, Shimla during 2021-22

S. No.	Variety/ line	Stem rust		Leaf rust			Yellow rust		
		11	40A	77-5	77-9	104-2	46S119	110S119	238S119
1	VL2041	30MS	TMS	0	0	0	20S	10S	40S
2	VL2043	30S	TMS	0	10R	0	0	5R	40MS
3	VL2044	30S	0	0	10MR	0	0	0	TMR
4	HD3402	10MS	20MS	0	60S	60S	0	0	0
5	HPW481	5MS	TMS	0	80S	0	10S	5MR	40MS
6	HPW487	TS	0	0	0	0	0	0	10S
7	HPW488	0	10S	0	5MS	0	10S	5MR	10S
8	HS692	0	10MS	0	0	0	0	0	0
9	HS693	10S	20MS	0	20R	TR	0	0	0
10	HS694	5S	0	0	10MS	0	0	0	0
11	UP3114	5MS	5MS	0	10R	0	5S	0	60MS
12	VL3028	40S	TMS	0	0	0	TMR	0	5MR
13	VL3029	10MS	0	0	TR	0	0	0	10S
14	VL3030	30MS	TMS	0	0	0	0	0	20MS
15	HPW483	10S	0	40S	20S	5R	5MS	0	40MS
16	HPW484	20S	20MS	0	0	0	10S	5S	40MS
17	HPW485	30MS	30MS	20MR	10MS	10R	5S	20S	20S
18	HPW486	0	0	10S	5R	0	40S	20S	30S
19	HS688	30S	TMR	0	TR	0	10S	10S	20MS
20	HS689	30S	10MS	0	10R	0	5R	10S	60S
21	HS690	40S	40MS	10MR	5MS	20S	0	0	0
22	HS691	0	0	0	0	0	0	0	0
23	SKW362	40S	0	0	0	0	10MS	10MS	60MS
24	UP3113	20S	5MS	0	0	0	0	5MS	40S
25	VL2047	20S	0	0	0	0	10S	0	40MS
26	VL2048	20S	0	60S	80S	40S	0	0	80S
27	VL2049	30S	0	5R	20MS	0	0	0	40MR
28	VL2050	30MS	5MS	0	10MR	0	5S	5S	80S
29	HS507(C)	NG	0	0	0	0	0	10R	TMR
30	HS562(C)	40MS	20MS	0	60S	0	0	0	5S

31	HS490(C)	30MS	5MS	0	0	0	5S	5MR	60S
32	HPW349(C)	20MS	10MS	10MS	0	40S	0	TS	10S
33	VL907(C)	20MS	10MS	0	0	0	10S	5S	5MS
34	VL892(C)	30MS	30MS	5R	0	TR	20S	5MR	40S
35	DBW377	30S	20MS	0	0	0	5R	5MR	40MS
36	PBW870	10MR	10MR	0	0	10MR	0	5MR	5S
37	DBW372	40MS	10MS	0	0	0	40S	20S	40S
38	DBW318	0	TMR	0	0	0	5S	5MR	10S
39	DBW327 (C)	0	TMR	0	0	0	5MS	5S	10S
40	DBW332(C)	20S	0	0	NG	0	5MS	5MR	5S
41	DBW370	30S	5MS	0	0	0	5S	5MS	20MS
42	DBW371	40MS	5MS	0	0	0	10S	5MR	NG
43	DBW373	40MS	TMR	0	0	0	0	0	40MS
44	PBW868	20MS	0	TR	20	10	10S	5S	80S
45	PBW871	TS	TMR	0	0	NG	0	TS	10S
46	PBW872	5MS	10MS	0	0	0	5S	10MS	20S
47	HD3090(C)	20MS	10MS	0	0	0	30S	30S	80S
48	HI1633(C)	0	0	NG	0	0	20MS	10MS	60S
49	RAJ4083(C)	20MS	80MS	0	10MS	0	10S	30S	40MS
50	DBW320#*	10MS	10MS	0	10R	NG	0	5S	60MS
51	MP1380#	0	0	NG	0	0	0	40S	80S
52	DBW407[B]	30S	10MS	20MS	0	0	5R	10S	40MS
53	DDW48(d)(C)	20MS	10MS	0	0	TR	0	0	40S
54	HI8826(d)*	5MR	0	0	0	20MS	20S	10MS	60S
55	MACS4100(d)*	TR	TR	0	0	0	0	10MR	40MS
56	MP1378	20MS	10S	NG	0	0	40S	60S	80S
57	MP3552	30MS	5MS	NG	0	0	TMR	10MR	5S
58	UAS3015	40S	30MS	0	40MS	0	5MS	20MR	5MS
59	HI8839(d)	0	0	0	0	10R	0	5MR	20MR
60	HI8840(d)	0	TMS	NG	0	0	0	0	20MR
61	MP1358(I)(C)	5S	5MS	NG	0	0	5MR	5MR	10S
62	NIAW3922	0	0	0	0	0	10S	20MS	60S
63	NIDW1149(d)(C)	NG	0	0	0	0	0	NG	10R
64	UAS478(d)	5MR	TR	0	0	0	5S	60S	60S
65	DBW352#	10MR	0	0	0	0	5MS	40S	30S
66	GW513(I)(C)	5MR	TMS	NG	0	0	0	80S	80S
67	GW547[B]	0	TR	NG	0	0	10S	60MS	40MR
68	HI1636(I)(C)	0	TR	NG	0	0	60S	80S	80S
69	HI1650*	10MS	0	0	0	0	40S	80S	60S
70	MACS6768*	5MS	TS	0	0	0	60S	100S	80S
71	MP3535*	40S	20S	5MR	10	0	30MS	20S	5R
72	NWS2194#	40S	20MS	0	0	0	60S	60S	80S
73	HI1665	10MR	5MR	0	0	0	60S	80S	80S
74	NIAW4028	10S	0	0	0	0	60S	80S	80S
75	CG1036*	20MS	5MR	0	0	NG	40S	80S	80S
76	CG1040	20MS	10MS	NG	0	0	60S	30S	80S
77	DDW47(d)(C)	20MS	10MS	0	0	NG	5R	10MS	40MR
78	DDW55(d)[Q]*	10MR	5S	0	0	0	20MS	0	40MR
79	GW532	5MR	0	NG	0	0	10S	30S	40MS
80	HD3401	NG	5MR	0	0	0	0	10S	60S
81	HI1655[Q]*	0	0	0	0	0	10S	40S	40MS
82	HI1666	0	0	0	0	0	30S	40S	60MS
83	HI8823(d)(I)(C)	10MR	0	0	0	0	0	20S	60S
84	HI8830(d)*	5MR	0	0	0	0	20MS	10MR	40S
85	MACS6795	20MS	0	0	0	0	60S	80S	80S
86	MP1377	30MS	5MR	0	0	0	30S	30S	60S
87	MP3288(C)	20MS	10MS	0	0	0	30S	30MS	60S
88	UAS3019	30MS	10S	0	0	0	30S	0	10R

89	DBW316#*	60S	30S	0	5MS	0	20S	10S	TR
90	HD3118(C)	60S	30MS	0	40MS	0	20MR	10MR	5R
91	HD3392	30S	10MR	0	0	0	0	NG	0
92	HI1621(C)	40S	30MS	80S	20MS	NG	20MS	5MR	5MS
93	PBW833*	30S	30MS	0	0	NG	10MS	10S	10MS
94	PBW835^{Q}*	30MS	0	0	0	0	NG	5MR	0
95	HD3249(C)	10MS	0	0	0	0	30S	5MS	20MR
96	PBW826#*	10S	0	0	NG	0	10MS	10MS	20S
97	HD3388	40MS	10MS	NG	0	0	10S	TS	5S
98	PBW852	20S	5MS	0	20S	0	5S	10S	20S
99	DBW252(C)	20S	0	0	0	0	10S	5MS	20S
100	HD3171(C)	20S	0	0	0	0	0	20S	80S
101	HD3293(C)	20MS	0	0	0	0	0	5MS	10MS
102	DBW353	20MS	0	0	10MR	0	10MS	5MS	40MS
103	JKW261(I)(C)	40S	20MS	NG	0	0	20S	20S	30S
104	PBW771(C)	10MS	10MS	0	0	NG	0	5MR	10MS
105	WH1124(C)	40S	30S	0	5R	0	10MS	20S	TR
106	HD2967(C)	20MS	10S	0	NG	0	60S	80S	60S
107	HD3386	TS	30MS	0	0	0	30S	40MS	60S
108	DBW359	30MS	10MS	0	10R	0	5MR	10MS	5MS
109	DBW358	5S	10MS	0	NG	0	40S	40S	40S
110	NIAW3170(C)	30MS	30S	NG	0	0	30S	20S	10MS
111	HD3043(C)	5MS	0	5R	0	0	5R	10MS	40S
112	HD3369*	5MS	30MS	NG	NG	0	20S	30MR	5MS
113	HD3397	10MS	10MS	NG	0	0	20S	30MS	0
114	HD3400	10MS	10S	NG	NG	0	5MR	5MR	10S
115	HD3418	20S	5MS	0	0	0	5S	TR	5S
116	HI1628(C)	30MS	30S	0	10MS	0	20S	20S	TR
117	HI1653*	20MS	0	0	10R	0	0	20MR	5MR
118	HI1654*	TS	0	TR	0	0	10S	20S	20S
119	HUW838(I)(C)	10S	5MS	20R	0	0	10MS	10S	20MS
120	UP3090	40S	5MS	0	0	0	10S	40S	5S
121	WH1402	0	20MS	NG	0	0	0	0	0
122	WH1403	20MS	20MS	0	0	0	0	0	0
123	DBW365	20MS	20MS	NG	0	0	20MS	20S	20S
124	DBW366	40S	10MS	NG	0	0	30S	20S	20S
125	DBW402	40S	0	0	0	0	0	0	0
126	HD3415	30MS	30MS	0	0	0	20MS	40S	5MR
127	Kharchia65(C)	60S	60S	0	NG	80S	80S	80S	100S
128	KRL19(C)	30S	5MS	10R	NG	0	40S	60S	80S
129	KRL2006	40S	5MS	NG	0	0	30MS	40MS	20MS
130	UAS310	30S	30S	0	0	0	30MS	20MS	10R
131	KRL2021	20MS	30S	10R	NG	0	40S	30S	60S
132	KRL210(C)	40S	30S	NG	0	5MS	5MS	20S	5MR
133	RAJ4565	30MS	40S	TR	0	0	20S	20S	20S
134	HD3438	10MR	30MS	0	0	0	60S	80S	NG
135	HD3439	20MS	5MR	0	0	0	0	0	5R
136	CG1029(C)	20MR	10MR	0	0	0	40	80S	80S
137	HD3407*	10MR	10MR	0	0	0	0	0	TMR
138	HI1634(C)	10MS	0	0	0	0	40MS	40S	20S
139	MP3336(C)	30S	5MS	0	0	0	60MS	80S	80S
140	HI8498(C)	10MS	0	0	0	NG	30MS	5MR	40MR
141	HI8759(C)	20S	0	0	0	10MS	30MS	20MR	40MS
142	HI8846	5MR	0	0	0	0	10MS	30MR	60MS
143	HI8847	10MR	0	0	0	0	20MS	20MR	40MS
144	HD2733(C)	30MS	0	NG	NG	5MR	60S	60S	100S
145	HD3411*	80S	5MR	0	NG	0	40S	30MS	80S
146	HD3440	40S	60S	0	0	0	20MR	0	TR

147	HD3406*	40S	0	NG	0	0	0	40S	40MS
148	HD3436	20MS	5MS	0	0	NG	0	0	0
149	HD3437	10MS	0	0	NG	0	0	0	0
150	PBW175(C)	20MS	5MS	0	0	0	40S	80S	80S
151	PBW677(C)	30S	0	NG	0	0	30S	10MS	20S
152	PBW901	40S	20MS	10R	0	0	30S	40MS	40MS
153	PBW902	5MR	0	0	0	0	0	0	0

None of the entry possessed APR to all tested pathotypes of three rust pathogens. Total 28 lines showed APR to both brown and yellow rusts. Lines DBW349, HD3171, UP3114, and WH1124 that had APR to all tested pathotypes of *Puccinia triticina*, also showed APR to one or other pathotypes of *P. striiformis* f. sp *tritici*. Conversely, lines DBW402, HD3118, HI1653, HI8840, VL2044, and VL3028 that possessed APR to all tested pathotypes of *P. striiformis* f. sp *tritici*, also showed APR to one or two pathotypes of *Puccinia triticina* (Table 2.3 and 2.4). DDW55, HD3401 and MACS4100 showed APR to pathotypes of both black and yellow rust pathogens (Table 2.2 and 2.4). HD3411 and UAS478 that showed APR to pathotype 40A of black rust pathogen, also had APR to two pathotypes of brown rust pathogen (Table 2.2 and 2.3).

Stem rust

None of the AVT lines showed APR to both pathotypes of *P. graminis* f. sp. *tritici* combinedly and pathotype 11 individually. Only six entries DDW55 (d), HD3401, HD3411, HS694, MACS4100, and UAS478 (d) had APR to pathotype 40A (Table 2.2).

Table 2.2. Race specific adult plant resistance to the predominant and virulent pathotypes *Puccinia graminis tritici* in wheat lines of AVT during 2021-22

APR to Pathotype	No. of lines	Wheat Lines
11 and 40A	-	None
11	-	None
40A	06	DDW55(d), HD3401, HD3411, HS694, MACS4100, UAS478(d)
Total	**06**	

Leaf rust

Eighty-three entries of AVT showed APR to one or the other pathotypes of *P. triticina*. APR to all the pathotypes (77-5, 77-9 and 104-2) of leaf rust pathogen was observed in 08 lines (DBW359, HD3171, HPW485, MP3535, PBW175, UP3114, VL2041, and WH1124). Fourteen entries had APR combinedly to 77-5 and 77-9. APR to individual pathotypes 77-5, 77-9 and 104-2 was observed in 07, 31 and 11 lines, respectively (Table 2.3).

Table 2.3. Race specific adult plant resistance (APR) response in AVT lines to virulent pathotypes of *Puccinia triticina* during 2021-22

APR to pathotype	No. of lines	Detail
77-5, 77-9, 104-2	8	DBW359, HD3171, HPW485, MP3535, PBW175, UP3114, VL2041, WH1124
77-5 and 77-9	14	DBW373, DBW402, HD3386, HD3392, HD3415, HI1654, HS689, HUW838, NWS2194, PBW868, UAS3019, VL2050, VL3029, VL3030
77-5 and 104-2	5	DBW316, HD3043, HD3118, HD3411, HPW481
77-9 and 104-2	7	DBW318, DBW365, DDW48, HI8840, VL2044, UAS310, UAS478
77-5	7	DBW358, HD3402, HI1628, KRL2021, MP3336, VL907, VL3028
77-9	31	CG1040, DBW252, DBW320, DBW327, DBW353, DBW366, DBW370, DBW371, DBW372, DBW407, DDW47, HD3293, HD3397, HD3406, HD3436, HI1653, HPW349, HS490, HS688,

		JKW261, KRL210, KRL2006, MP1380, MP3552, NIAW3170, PBW871, SKW362, UP3090, UP3113, VL892, VL2043,
104-2	11	HD2733, HD3369, HD3437, HI8823, HI8830, HPW487, HS562, KRL19, RAJ4083, UAS3015, WH1402
Total	**83**	

Stripe rust

Fifty-three lines showed APR to different tested pathotypes of stripe rust pathogen. Among these, 8 lines DBW402, HD3118(C), HI1653, HI8839(d), HI8840(d), HS690, VL2044, and VL3028 possessed APR to three major pathotypes of *P. striiformis* in India. Seventeen lines had APR to 110S119. Four entries HS692, PBW902, VL2049, and PBW771(C) possessed APR to both 110S119 and 238S119 (Table 2.4).

Table 2.4. Race specific adult plant resistance (APR) response in AVT lines to virulent pathotypes of *Puccinia striiformis* f. sp. *tritici* during 2021-22

APR to pathotype	No. of lines	Detail
238S119, 110S119 and 46S119	08	DBW402, HD3118(C), HI1653, HI8839(d), HI8840(d), HS690, VL2044, VL3028
238S119 and 110S119	04	HS692, PBW902, VL2049, PBW771(C)
110S119 and 46S119	11	DDW48(d)(C), HD3400, HS562(C), MACS4100(d), MP1358(I)(C), MP3552, PBW871, VL2043, VL2047, VL2048, VL3030
238S119 and 46S119	02	DDW47(d)(C), NIDW1149(d)(C)
238S119	03	DBW316, HS507(C), WH1124(C),
10S119	17	DBW318, DBW332(C), DBW371, DBW377, DDW55(d), HD3369, HD3418, HI1621(C), HI8759(C), HI8830(d), HI8846, HPW483, HPW488, PBW870, UAS3019, UP3114, VL892(C)
46S119	08	DBW320, DBW359, GW513(I)(C), HD3171(C), HD3293(C), HD3401, HI8823(d)(I)(C), HPW349(C)
Total	**53**	

Table 2.5: Race Specific APR in AVT entries against selective pathotypes of stem, leaf and yellow at Ludhiana, Delhi, Pune, Indore and Mahabaleshwar centers during 2021-22.

S. No.	Entries	Stem rust						Leaf rust			Yellow rust				
		Pune		Indore		Mahabaleshwar		Ludhiana		Delhi	Delhi			Ludhiana	
		40A	117-6	11	40A	11	40A	77-9	77-5	77-5	238S119	46S119	110S119	238S119	46S119
1	VL2041	0	5MR	40S	10S	10MS	R	20S	0	0	60S	40S	40S	10S	0
2	VL2043	5MR	10MS	40S	20MR	20MS	R	40S	10S	0	0	0	0	5MS	0
3	VL2044	5MR	10S	40S	10MS	20MS	10MR	20S	5S	0	0	0	0	0	0
4	HD3402	10MR	10MR	40S	40MR	20MS	5MS	5S	0	5MR	0	0	0	5MS	0
5	HPW481	5MR	0	20MR	20MR	10MS	10MR	10S	0	0	0	5R	5R	10S	5MS
6	HPW487	0	0	20MR	10MR	R	R	TS	0	0	0	5MS	5S	0	0
7	HPW488	10MS	10MR	40S	10MS	5MS	R	40S	20S	0	0	5MR	5MS	5MS	TS
8	HS692	0	0	40MR	10MR	R	R	0	0	0	0	TR	0	0	TS
9	HS693	5MS	10MR	60S	40S	10S	10MR	10S	10S	TR	0	0	0	TS	0
10	HS694	20S	40S	60S	40S	20S	20MS	20S	10S	0	0	0	0	0	0
11	UP3114	20MS	20MR	40S	20MS	20MS	10MR	40S	40S	10S	10S	20S	20S	10S	40S
12	VL3028	10MS	40S	60S	40S	5S	10MR	5S	0	0	0	5R	0	0	TR
13	VL3029	0	5MR	20MS	10MR	R	R	20S	20S	0	5S	5MS	5MS	0	0
14	VL3030	10S	20S	60S	40MS	10S	20MR	20S	0	TS	5S	5S	5MR	5S	0
15	HPW483	0	5MR	5MR	5R	10MS	R	5S	10S	0	0	0	0	10S	5MS
16	HPW484	40S	80S	60S	40S	20MS	R	5S	0	0	5S	5S	0	0	0
17	HPW485	50S	60MS	20MS	10MR	10S	5MR	20S	0	0	0	0	0	5S	20MS
18	HPW486	10MS	5MR	10MR	10R	R	R	20S	10S	TR	10S	5S	0	40S	20MS
19	HS688	40S	80S	40S	20MS	10S	10MR	10S	0	0	TS	TR	0	0	5MS
20	HS689	10S	80S	40S	20MS	20S	10MS	10S	5S	0	5S	20S	20S	10MS	5S
21	HS690	0	20S	60S	40S	20MS	R	20S	0	5MR	0	0	0	5S	5S
22	HS691	0	0	5R	TR	R	R	0	0	0	0	0	0	10S	5S
23	SKW362	20S	80S	40S	30S	10S	20MR	40S	0	0	0	5S	0	10MS	10MS
24	UP3113	20S	40MS	40S	20S	20S	10MR	40S	10S	0	0	5S	0	40S	20S
25	VL2047	20S	60S	40S	20S	10MS	10MR	10S	0	0	5S	5S	0	10S	5S
26	VL2048	5MR	0	20MS	10MS	R	R	5S	0	10S	5MR	5S	5S	40S	20S
27	VL2049	10MS	10S	40S	10MS	20S	20MR	20S	0	10S	0	0	0	10S	10MS

28	VL2050	0	5MS	40S	30S	R	10S	20S	0	0	5R	5S	5S	20MS	10MS
29	HS507(C)	0	0	20MR	5MR	R	R	20S	0	0	0	5S	0	10MS	10S
30	HS562(C)	20S	20S	40S	20S	20S	10MR	20S	40S	0	0	0	0	0	0
31	HS490(C)	5MR	10MS	40S	10S	R	TMR	10MS	0	5MR	0	20S	10S	10S	10MS
32	HPW349(C)	20S	10MR	40S	10MS	20S	10MS	20S	0	0	5R	5MS	5MS	5MS	TS
33	VL907(C)	0	0	10MR	TR	10S	5MR	20S	0	0	0	5MS	0	10S	10MS
34	VL892(C)	0	5MR	30S	10MS	5MR	R	TS	0	0	10S	5S	5S	40S	20S
35	DBW377	5MS	10MS	40S	10MS	20S	20MR	5S	0	0	0	0	0	TS	10S
36	PBW870	5MS	20S	40MR	10MR	TMR	R	0	0	0	0	0	0	TR	0
37	DBW372	10S	20S	60S	20S	R	R	10S	0	0	10S	10S	10S	20MS	5S
38	DBW318	5MR	0	5MR	TMR	20MS	10MR	5S	0	0	0	0	0	0	0
39	DBW327 (C)	30S	30MS	40S	20MS	20MS	R	20S	5S	0	0	0	0	10S	10S
40	DBW332(C)	10S	80S	40S	40S	10S	10MR	10S	10S	0	5R	5MR	5MR	10S	5S
41	DBW370	40S	80S	40S	40S	20MS	R	0	0	5MR	10MS	10S	10MS	10S	5MS
42	DBW371	20S	80S	40S	40S	TMS	R	5S	0	0	0	5MS	5MS	TS	5MR
43	DBW373	10S	60S	40S	10S	20S	10MS	20S	10S	0	TR	5MS	TR	10S	5S
44	PBW868	5MR	10MR	40MR	10MR	20MR	R	20S	0	0	20S	20S	20S	40S	40S
45	PBW871	5MR	20S	40S	20MR	20S	10MS	20S	5S	0	5R	TR	TR	10S	10S
46	PBW872	5MR	10S	20S	10MR	TMS	R	20S	10S	0	TR	5MR	TR	5MS	0
47	HD3090(C)	0	10S	40MR	10MR	20S	10MR	0	0	0	5R	10S	10S	40MS	40S
48	HI1633(C)	0	20S	10MS	10MR	TMR	R	0	0	0	60S	10S	20S	40MS	40MS
49	RAJ4083(C)	20S	20S	20MS	10MR	TMR	R	10S	5S	5MS	20S	10S	10S	20S	20MS
50	DBW320#*	30S	60S	40MS	20MS	20MS	R	10S	TS	0	0	5S	5S	5S	TR
51	MP1380#	0	40MS	10R	10MR	20MS	10MS	0	0	0	20S	10S	20S	40S	20S
52	DBW407[B]	15MS	80S	40S	40MS	20S	10MS	40S	40S	5MS	5MR	5MS	TR	10S	5MS
53	DDW48(d)(C)	0	10MS	40MS	20MS	20MS	R	0	0	5MR	0	5S	5S	5S	0
54	HI8826(d)*	0	0	20MR	5MR	10MR	R	0	0	5MR	5MR	10S	10S	5S	5S
55	MACS4100(d)*	30S	10S	20MR	10MS	20S	20MS	0	0	0	10S	20S	20S	20MS	10MS
56	MP1378	0	0	40MR	10MR	R	R	0	0	0	60S	20S	40S	60S	40S
57	MP3552	20MS	20MS	40S	20MS	20S	20MS	20S	10S	0	10S	10MS	10MS	10S	5S
58	UAS3015	20S	40MS	60S	40S	20S	10MR	10S	0	0	0	0	0	5S	0
59	HI8839(d)	0	0	20MS	10MR	10MR	10MS	0	0	0	0	5R	0	5S	0

60	HI8840(d)	0	0	40MR	20MR	TMR	R	0	0	5MS	5MR	5S	5MR	10S	5S
61	MP1358(I)(C)	10S	10MR	10MR	20MS	20S	10MR	10S	0	0	0	5S	5S	TR	5S
62	NIAW3922	5MS	0	20MR	10MR	R	R	0	0	0	40S	20S	30S	10MS	10S
63	NIDW1149(d)(C)	0	0	10MR	NG	R	R	0	0	TR	0	0	0	0	TS
64	UAS478(d)	10S	5MS	20MS	5MR	20S	20MS	0	0	5MR	20S	10S	20S	5S	5S
65	DBW352#	0	0	20MR	10MR	R	R	0	0	0	20S	20S	20S	10MS	5MS
66	GW513(I)(C)	0	0	20MR	10R	TMR	R	0	0	0	80S	60S	60S	60S	40S
67	GW547[B]	0	0	20MR	10R	R	R	0	0	5MR	10MR	40S	20MR	10S	20S
68	HI1636(I)(C)	0	0	TMR	10R	R	R	0	0	0	10MS	40S	20MS	40MS	20S
69	HI1650*	0	5MR	20MR	10MR	10MR	R	0	0	0	20MS	20S	20MS	20MS	20MS
70	MACS6768*	0	20MS	10MS	10MR	R	R	0	0	0	60S	40S	40S	60S	40-60S
71	MP3535*	40S	80S	60S	40S	R	R	60S	40S	0	0	0	0	0	0
72	NWS2194#	20S	60S	40S	20MS	20MS	R	0	0	0	80S	40S	40S	40S	40S
73	HI1665	0	0	10MR	5MR	TMR	R	0	0	0	80S	40S	60S	60S	40-60S
74	NIAW4028	0	0	40S	10MR	R	R	0	0	0	60S	40S	40S	60S	40S
75	CG1036*	0	20MS	40MR	5MR	R	R	0	0	0	80S	40S	40S	60S	40S
76	CG1040	10MS	30S	40S	20MS	R	R	10S	0	0	80S	40S	60S	40S	20S
77	DDW47(d)(C)	10S	20MS	20S	10MS	20MS	R	0	0	0	0	0	0	5MS	TS
78	DDW55(d)[Q]*	20S	20MS	20MS	10MS	20S	20MS	0	0	0	20MS	40S	40S	40MS	20S
79	GW532	0	0	40MR	TMR	R	R	0	0	0	20MS	40S	40S	20s	20S
80	HD3401	80S	40MS	20MS	40S	20S	10MS	0	0	5MR	40S	40S	40S	5MS	10MS
81	HI1655[Q]*	0	0	20MR	5MR	R	R	0	0	0	60S	40S	60S	40S	20MS
82	HI1666	0	0	20MR	5MR	R	R	0	0	0	80S	40S	40S	40MS	20S
83	HI8823(d)(I)(C)	0	0	20MR	5MR	20MR	R	0	0	5S	20S	40S	30S	20MS	10S
84	HI8830(d)*	0	0	20MR	5MR	20MR	R	0	0	0	10S	40S	40S	10S	10MS
85	MACS6795	0	0	20MR	10R	20MR	R	0	0	5MR	60S	60S	60S	40S	60S
86	MP1377	0	10MS	40S	20MS	10MR	TMS	10S	0	0	20S	40S	40S	20MS	40S
87	MP3288(C)	5MR	0	40MR	20MS	5MS	R	20S	0	0	60S	40S	60S	40S	40S
88	UAS3019	0	20S	40S	20S	10S	10MS	10S	10S	0	40S	0	0	10S	10S
89	DBW316#*	20MS	60S	60S	40S	20S	10MS	40S	40S	0	0	0	0	0	5MS
90	HD3118(C)	10S	60MS	40S	40S	20S	10MR	40S	40S	0	0	TR	0	0	5S
91	HD3392	10S	20S	20MS	20MS	20MS	R	20S	40S	0	0	0	0	5MS	5MR

92	HI1621(C)	5MR	40S	40S	40MR	20S	20MS	40S	10S	0	5S	5S	0	5S	10MS
93	PBW833*	5MR	60S	40S	40S	20MS	R	40S	5S	0	TR	5MR	0	5MS	10S
94	PBW835^{Q}*	0	30S	40S	40MS	20MR	20MR	0	0	0	0	0	0	0	0
95	HD3249(C)	20S	10MS	40MR	20MR	20MS	R	10S	0	0	5MR	20S	20S	5MS	5MS
96	PBW826#*	0	20MS	10MR	5R	10S	10MR	20S	0	5MS	10MS	20S	10MS	0	10MS
97	HD3388	0	40S	40S	40MS	R	R	0	0	0	0	0	0	0	0
98	PBW852	10MR	40S	40S	20S	5S	R	40S	20S	0	5R	10S	0	5MS	0
99	DBW252(C)	5MR	20S	40S	40S	20S	10MR	20S	10S	0	5MS	20S	20S	10S	5MS
100	HD3171(C)	20S	40S	60S	40S	10S	10MR	40S	20S	5MS	40S	40S	40S	40S	20S
101	HD3293(C)	20S	80S	60S	40S	R	R	40S	20S	0	10S	40S	40S	10S	5MS
102	DBW353	20S	80S	40S	40MR	10S	10MR	40S	10S	0	0	5S	0	5MS	0
103	JKW261(I)(C)	20S	80S	60S	40S	5S	R	10S	5S	0	5S	10S	0	5MS	5MS
104	PBW771(C)	0	10S	40MS	40MR	20MS	R	0	0	0	TR	0	0	5MS	5S
105	WH1124(C)	30S	30S	60S	40S	10S	10MR	40S	40S	0	0	0	0	0	5S
106	HD2967(C)	0	0	20MS	10MS	10S	10MR	0	0	0	60S	60S	60S	40S	60S
107	HD3386	0	5MR	10S	5R	R	R	10S	0	0	10S	10S	10S	0	5S
108	DBW359	5MS	0	40S	20MS	20MS	R	40MS	5S	0	5MS	5MS	5MS	0	5S
109	DBW358	5MS	0	20S	10S	R	R	40S	40S	5MS	5MS	10S	10MS	5S	0
110	NIAW3170(C)	0	0	40MR	20MR	20MR	R	0	5S	0	20S	10S	10S	10S	10MS
111	HD3043(C)	5MR	0	20MS	5MS	20MR	R	40S	40S	0	5MS	20S	10MS	10S	10MS
112	HD3369*	0	0	5R	20MS	R	R	10S	10S	0	TR	0	0	0	0
113	HD3397	0	0	10S	20S	R	R	10S	5S	0	0	5S	0	10S	40S
114	HD3400	10S	10S	40S	40S	R	10MR	10S	10S	0	0	5S	0	5S	0
115	HD3418	0	20MS	40S	20MS	R	R	0	0	0	0	0	0	0	TR
116	HI1628(C)	5MR	20MS	40MS	20MS	R	R	10S	0	0	0	5S	0	10S	5S
117	HI1653*	0	40S	40S	5R	10MS	R	40S	10S	0	0	5S	0	5MS	0
118	HI1654*	5MR	5MR	5R	40MS	10S	10MR	0	0	0	TR	5S	0	0	0
119	HUW838(I)(C)	10S	20MS	40S	20S	10S	20MS	20S	TS	TR	5R	10S	0	5S	5S
120	UP3090	20S	80S	60S	40S	10S	10MR	0	0	0	0	5S	0	TS	20S
121	WH1402	0	40S	40MR	40MR	TMR	R	0	0	0	0	0	0	0	0
122	WH1403	0	20S	40MR	40MR	10S	5S	0	0	0	0	0	0	0	0
123	DBW365	30S	40S	40MS	40MS	TMR	20MS	10S	0	0	0	40S	0	0	5S

124	DBW366	30S	60S	40S	40S	R	R	10S	0	0	5R	40S	0	0	10S
125	DBW402	10S	10S	40S	40MS	R	10MR	5S	0	0	0	0	0	0	0
126	HD3415	10S	20MS	40S	40MS	10S	10MR	10S	0	0	0	5S	0	10S	10S
127	Kharchia65(C)	80S	80S	80S	60S	10S	10MR	40S	20S	40S	90S	80S	80S	80S	80S
128	KRL19(C)	30S	10S	20MS	40S	TMR	10MR	10S	5S	10S	90S	80S	80S	60S	80S
129	KRL2006	20S	60S	60S	40S	20MS	20MS	20S	5S	0	10S	10S	0	10S	5MS
130	UAS310	10MS	40S	40S	40S	10S	10MR	10S	TS	0	0	5MS	0	0	0
131	KRL2021	0	10MS	20MR	10MR	20MS	R	20S	5S	0	5S	10S	0	20S	40S
132	KRL210(C)	40S	60S	60S	40S	5MR	TMR	60S	40S	0	0	0	0	10MS	10S
133	RAJ4565	10S	10S	20MS	40S	TMR	R	0	0	0	5MS	5MS	5MS	10MS	10S
134	HD3438	0	5MR	40MR	20MR	TMR	R	0	0	5MS	60S	40S	40S	40S	60S
135	HD3439	0	0	20MS	40MR	10S	5MR	0	0	0	0	0	0	0	0
136	CG1029(C)	0	0	40MR	20MR	R	R	0	0	0	40S	40S	40S	40MS	60S
137	HD3407*	5MR	0	40MR	20MR	TMR	R	0	0	0	0	0	0	0	0
138	HI1634(C)	0	0	40MR	20MR	R	R	0	0	0	60S	30S	40S	40MS	40S
139	MP3336(C)	10S	60S	40MS	20MS	R	R	10S	5S	0	60S	40S	40S	40MS	40S
140	HI8498(C)	30S	40S	40MS	40MR	5S	10MR	0	0	0	TR	0	0	5MS	10MS
141	HI8759(C)	0	10MR	40MS	40MS	R	R	0	0	5S	5MR	5S	TR	5MS	5MS
142	HI8846	0	0	20MR	20MR	R	R	0	0	TMS	0	5S	0	5MS	5MS
143	HI8847	0	10MR	20MR	20MR	R	R	0	0	0	TR	5R	0	0	TR
144	HD2733(C)	0	10MR	40MR	10MR	R	R	5S	0	10S	80S	40S	40S	60S	60S
145	HD3411*	30S	60S	40S	40S	R	R	20S	5S	5MR	5S	10S	10S	20S	20S
146	HD3440	20S	80S	20S	40S	R	R	0	0	0	0	5S	0	5MS	0
147	HD3406*	5MR	40S	40S	40S	R	R	5S	0	TR	5S	5S	0	20MS	10S
148	HD3436	5MR	5MR	20MS	20MS	R	10MR	20S	10S	10S	5MS	0	0	0	0
149	HD3437	0	5MR	10MR	5MR	R	10MR	20S	10S	0	0	0	0	0	0
150	PBW175(C)	20S	60S	40MS	20MR	R	10MR	40S	5S	10S	20S	20S	20S	40MS	40MS
151	PBW677(C)	0	60S	40MS	20S	R	20MS	20S	5S	TR	5R	5S	0	10MS	10MS
152	PBW901	20S	80S	40S	40S	R	5MS	0	0	0	TR	5MR	0	20MS	10MS
153	PBW902	0	20MS	40MR	20MR	R	R	0	TR	TR	0	0	0	0	TS

2.2 Identification of slow ruster lines in AVT Material 2021-22

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	HD3402, HS693, HS694, DDW48(d)(C), NIDW1149(d)(C), PBW835^{Q}*, WH1402, WH1403, HD3440, HD3436, HD3437, PBW902
0.1 – 10	Nil
10.1 – 100	VL2044, HPW487, HS692, PBW870, DBW318, HI8839(d), HI8840(d), MP1358(I)(C), UAS478(d), DDW47(d)(C), HD3392, PBW833*, HD3369*, HD3400, HD3418, HI1654*, DBW402, HD3439, HD3407*, HI8759(C), HI8846, HI8847
100.1 - 200	VL2043, VL3028, HS690, HS691, VL2049, DBW327 (C) , DBW332(C), HI8830(d)*, DBW316#*, HD3118(C), HI1621(C), PBW826#*, HD3388, PBW852, HD3293(C), PBW771(C), WH1124(C), HD3386, DBW359, HD3397, HI1628(C), HUW838(I)(C)

B. Ludhiana

AUDPC	Entries
0	HD3402, NIDW1149(d)(C), UAS478(d), PBW835^{Q}*, WH1403, HD3439, HD3407*, HD3437
0.1 – 10	DDW48(d)(C), WH1402
10.1 – 100	HI8839(d), DDW47(d)(C), HD3392, HD3249(C), HD3440, PBW902
100.1 - 200	VL2043, VL2044, HPW487, HS692, HS693, HS694, VL3028, VL3029, DBW318, HI8840(d), MP3535*, PBW771(C), WH1124(C), HI8498(C), HI8759(C), HI8846, HI8847, HD3436

C. Gurdaspur

AUDPC	Entries
0	HS694, WH1403
0.1 – 10	HPW487, HD3392, HD3439, HD3407*

10.1 – 100	HS692, HS693, VL3028, DBW318, HI8826(d)*, HI8839(d), HI8840(d), NIDW1149(d)(C), UAS478(d), HD3118(C), PBW835^{Q}*, HD3249(C), WH1124(C), HD3369*, WH1402, HI8498(C), HI8846, HI8847, HD3440, HD3437, PBW902
100.1 - 200	VL2043, VL2044, HD3402, HPW488, VL3029, VL3030, HPW485, L2047, HS562(C),PBW870, PBW872, DDW48(d)(C), MP1358(I)(C), P3535*, DDW47(d)(C), HI8830(d)*, DBW316#*, HI1621(C), PBW826#*, PBW771(C), HD3400, HD3418, HI1654*, DBW402, HI8759(C), HD3436

D. Durgapura

AUDPC	Entries
0	HS694, PBW835^{Q}*, HD3407*, PBW902
0.1 – 10	HD3402, HS693, HD3392, PBW833*, WH1402, WH1403, DBW402, HI8846, HD3440, HD3437
10.1 – 100	VL2043, VL2044, HPW481, HS692, VL3029, HS690, VL2049, PBW870, DBW318, DDW48(d)(C), HI8826(d)*, NIDW1149(d)(C), UAS478(d), MP3535*, DDW47(d)(C), HI1621(C), HD3249(C), HD3388, HD3293(C), HD3400, HD3418, HI1654*, HD3439, HI8498(C), HI8847, HD3436
100.1 - 200	VL3030, HS691, DBW320#*, MACS4100(d)*, HI8840(d), DBW316#*, HD3118(C), PBW826#*, JKW261(I)(C), WH1124(C), DBW359, HD3369*, HI1653*, DBW365, KRL210(C), HI8759(C), HD3406*

Leaf Rust

A. Mahabaleshwar

AUDPC	Entries
0	Nil
0.1 – 10	HD3402, HPW481, VL3028, VL3030, HPW484, HS691, UP3113, VL2047, DBW377, DBW318, DBW332(C), DBW370, DBW371, HD3090(C), HI1633(C), DBW320#*, MP1380#, HI8826(d)*, MACS4100(d)*, HI8840(d), NIAW3922, NIDW1149(d)(C), UAS478(d), DBW352#, GW513(I)(C), GW547^{B}, HI1636(I)(C), HI1650*, MACS6768*, NWS2194#, HI1665, NIAW4028, CG1036*, DDW55(d)^{Q}*, GW532, HD3401, HI1655^{Q}*, HI1666, HI8823(d)(I)(C), HI8830(d)*, PBW835^{Q}*, HD3388, PBW771(C), HD3418, HI1653*, HI1654*, UP3090, DBW366, DBW402, HD3415, KRL2021, HD3438, CG1029(C), HD3407*, HI1634(C), HI8498(C), HI8759(C), HI8846, HI8847, HD3440, HD3406*, HD3437, PBW901, PBW902
10.1 – 100	VL2044, HS692, HS693, HS694, VL3029, HS689, SKW362, PBW870, PBW871, PBW872, DDW48(d)(C), UAS3015, HI8839(d), MP1358(I)(C), DDW47(d)(C), MACS6795, MP1377, MP3288(C), UAS3019, PBW833*, PBW826#*, PBW852, DBW252(C), DBW353, JKW261(I)(C), HD2967(C), HD3386, NIAW3170(C), HD3397, HUW838(I)(C), KRL2006, UAS310, RAJ4565, HD3439, HD3411*, HD3436
100.1 - 200	VL2041*, VL2043, HPW487, HPW488, HPW483, HS688, HS690, VL2049, VL2050, HS507(C), HS562(C), HS490(C), HPW349(C), VL907(C), VL892(C), DBW372, DBW327 (C), MP1378, MP3552, HD3392, HI1621(C), HD3249(C), HD3369*, HD3400, HI1628(C), WH1403, PBW677(C)

Stem Rust

A. Indore

AUDPC	Entries
0	Nil
0.1 – 10	HPW483, HS691, VL907(C), DBW318, HI1633(C), HI8826(d)*, HI1636(I)(C), MACS6768*, HI1665, HI1655^{Q}*, HI8823(d)(I)(C), HI8830(d)*, HD3369*, HD3397, HI1654*, HD3438, HD3407*, HI1634(C)
10.1 – 100	VL2041*, VL2043, VL2044, HD3402, HPW481, HPW487, HS692, HS693, UP3114, VL3029, HPW485, HPW486, HS688, HS689, UP3113, VL2048, VL2050, HS507(C), VL892(C), PBW870, PBW868, PBW872, HD3090(C), RAJ4083(C), MP1380#, DDW48(d)(C), MACS4100(d)*, MP1378, HI8839(d), HI8840(d), MP1358(I)(C), NIAW3922, NIDW1149(d)(C), UAS478(d), DBW352#, GW513(I)(C), GW547^{B,} HI1650*, NIAW4028, CG1036*, DDW55(d)^{Q}*, GW532, HD3401, HI1666, MACS6795, MP3288(C), UAS3019,

	HD3392, HI1621(C), PBW835[Q]*, HD3249(C), PBW826#*, PBW852, DBW353, PBW771(C), HD2967(C), DBW359, DBW358, NIAW3170(C), HD3043(C), HI1628(C), HI1653*, HUW838(I)(C), WH1402, WH1403, DBW365, DBW402, HD3415, KRL19(C), KRL2021, RAJ4565, HD3439, CG1029(C), MP3336(C), HI8759(C), HI8846, HI8847, HD2733(C), HD3437, PBW175(C), PBW677(C)
100.1 - 200	HPW488, HS694, VL3030, HS690, SKW362, VL2047, VL2049, HS562(C), HS490(C), HPW349(C), DBW377, DBW327 (C) , DBW332(C), DBW373, PBW871, DBW320#*, DBW407[B,] MP3552, UAS3015, NWS2194#, CG1040, DDW47(d)(C), MP1377, HD3118(C), HD3388, DBW252(C), HD3293(C), HD3386, HD3400, UP3090, DBW366, UAS310, HI8498(C), HD3406*, HD3436, PBW902

B. Mahabaleshwar

AUDPC	
0	Nil
0.1 – 10	HPW481, VL3029, HPW483, HPW486, HS691, VL2049, HS507(C), VL907(C), DBW377, DBW318, PBW868, MP1380#, MACS4100(d)*, MP1378, GW513(I)(C), HI1636(I)(C), HI1650*, HI1665, NIAW4028, CG1036*, GW532, HD3401, HI1655[Q]*, HI1666, HI8823(d)(I)(C), HI8830(d)*, DBW252(C), PBW771(C), HD3043(C), HD3369*, HI1654*, HD3438, CG1029(C), HD3407*, HI1634(C), HI8846, HI8847, HD3437, PBW677(C)
10.1 – 100	VL2041*, VL2043, VL2044, HPW487, HS692, HS688, HS689, VL892(C), PBW870, DBW372, DBW332(C), HD3090(C), HI1633(C), RAJ4083(C), DBW320#*, DDW48(d)(C), HI8826(d)*, HI8839(d), HI8840(d), DBW352#, GW547[B,] MACS6768*, DDW55(d)[Q]* , HD3392, PBW852, HD3293(C), DBW353, HD2967(C), NIAW3170(C), HD3397, DBW366, DBW402, KRL19(C), KRL2006, KRL2021, HD2733(C), HD3436
100.1 - 200	HPW488, HS693, HS694, VL3028, VL3030, HS690, UP3113, HS490(C), DBW327 (C) , UAS3015, MP1358(I)(C), NIAW3922, NIDW1149(d)(C), NWS2194#, DDW47(d)(C), MACS6795, MP1377, HD3118(C), PBW826#*, HD3386, DBW359, HD3400, HI1628(C), HI1653*, HUW838(I)(C), WH1402, WH1403, RAJ4565, HD3439, MP3336(C), HI8498(C), HI8759(C), HD3440, HD3406*, PBW175(C), PBW902

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2.3 Seedling Resistance Test (SRT) against pathotypes of wheat rusts

A. Flowerdale, Shimla

a) Rust resistance

For identifying rust resistance sources in advance breeding material 153 AVT lines were subjected to multiple pathotypes screening under controlled light and temperature conditions during 2021-22. Seedling (all-stage) rust resistance remains effective throughout the life of wheat plants. Advanced wheat lines (153) were evaluated at seedling stage against 59 pathotypes of three *Puccinia spp.* on wheat. Fifteen pathotypes of stripe, 21 of stem and 23 of leaf rust pathogens, that 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

Three AVT entries HD3407, HD3439, and PBW835 possessed resistance to all pathotypes of three rust pathogens. Resistance to black and brown rusts was observed in 10 entries. Entries WH1402 and WH1403 were resistant to black and yellow rusts. Fourteen lines were found resistant to leaf rust, whereas 11 to stem rust pathotypes. Only six entries HD3392, HD3402, HD3436, HD3437, HD3440, and HS694 conferred resistance to yellow rust pathotypes (Table 2.6).

Table 2.6: Rust resistance in advanced wheat material (AVT: 2021-22)

Rusts	No. of lines	Variety/line
Black, Brown and Yellow	03	HD3407, HD3439, PBW835
Black and Brown	10	DBW352, GW532, GW547, HD3438, HI1665, HI1666, HS691, MACS6795, PBW870, PBW902
Black and Yellow	02	WH1402, WH1403
Brown only	14	CG1029, DDW55, GW513, HD3090, HD3249*, HI1633, HI1634, HI1636, HI1650, HS692, MACS6768, NIAW3922, PBW833, PBW901
Black only	11	CG1040, DBW318, DBW377, HD3400, HI1628(C), HI1655, HI8847, HPW481, MP1380, PBW868, VL2043
Yellow only	06	HD3392, HD3402, HD3436, HD3437, HD3440, HS694

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

Wheat rust resistance genes (*Sr, Lr, 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.

***Sr*-genes**

Fourteen stem rust resistance genes (*Sr2, Sr5, Sr7a, Sr7b, Sr8a, Sr8b, Sr9b, Sr9e, Sr11, Sr13, Sr24, Sr28, Sr30* and *Sr31*) were characterized in 133 entries. The frequency of *Sr2* was maximum as it was postulated in 61 AVT entries followed by *Sr11, Sr7b*, and *Sr30*, which were characterized in 41, 38 and 27 entries, respectively. *Sr31* linked with *Lr26* and *Yr9* and conferring resistance to all the known *Pgt* pathotypes in Indian subcontinent was postulated in 16 AVT entries. Whereas, *Sr24* linked to *Lr24* was characterized in 3 entries CG1029(C), GW513(I)(C) and HI1636(I)(C). *Sr5* and *Sr9b* were characterized in 18 entries while *Sr28* and *Sr8b* were postulated only in two entries. Other *Sr* genes i.e. *Sr8a, Sr13, Sr9e,* and *Sr7a* were postulated in 20, 15, 4 and 1 entries, respectively (Table 2.7).

Table 2.7: *Sr genes* in AVT entries during 2021-22

***Sr*-gene**	**No. of lines**	**Variety/line**
Sr31+5+	01	HS507(C)
Sr31+2+	08	HD2733(C), HD3043(C), HD3090(C), HS692, MACS6768, NIAW3922,

		PBW771(C), VL907(C)
Sr31+	07	HI1633(C), HI1634(C), HI1650, HPW483, HPW486, HPW487, MP1378
Sr24+2+	03	CG1029(C), GW513(I)(C), HI1636(I)(C)
Sr30+8a+5+	02	VL2048, VL2049
Sr30+8a+2+	02	PBW826, VL3030
Sr30+8a+	03	DBW320, DBW332(C), DBW366
Sr30+5+11+	04	HPW484, MP3552, VL2041, VL3028
Sr30+5+2+	02	HD3386, NIAW4028
Sr30+5+	02	DBW358, KRL2021
Sr30+11+2+	02	PBW852, RAJ4565
Sr30+11+	06	HD3415, NWS2194, SKW362, UP3090, VL892(C), VL2044
Sr30+	04	HD3418, HD3437, HI8846, KRL2006
Sr28+	02	DBW372, HI1621(C)
Sr8a+5+9e+	01	VL3029
Sr8a+5+11+2+	01	DBW252(C)
Sr8a+5+11+	01	HUW838(I)(C)
Sr8a+5+	01	DBW371
Sr8a+9b+7b+2+	01	HPW485
Sr8a+9b+11+	01	HS562(C)
Sr8a+9b+7b+	02	HPW488, UP3114
Sr8a+9b+	02	HS490(C), HS688
Sr8a+11+2+	01	HD2967(C)
Sr8a+2+	02	DBW365, NIAW3170(C)
Sr8b+9b+9e+	01	HD3436
Sr8b+9b+11+2+	01	KRL19(C)
Sr5+9b+11+	01	HS690
Sr5+9b+7b+	01	HS689
Sr5+13+	01	DBW327 (C)
Sr9e+7b+	01	VL2050
Sr9b+11+7b+	01	HS693
Sr9b+11+2+	02	PBW677(C), PBW871
Sr9b+11+	02	HD3118(C), HD3402
Sr9b+7b+2+	01	PBW901
Sr9b+7b+	02	DBW359, UAS3019
Sr13+11+9e+	01	VL2047
Sr13+11+7b+2+	01	UP3113
Sr13+11+7b+	02	HD3392, MP1377
Sr13+7b+	06	DBW353, DBW407, HD3388, HI8839(d), HI8840(d), UAS310
Sr13+2+	01	HD3293(C)
Sr13+	03	HD3369, HD3406, HI1654
Sr11+7b+2+	03	DBW402, DDW47(d)(C), HD3171(C)
Sr11+7b+	01	HS694
Sr11+2+	06	HD3249(C), HI8498(C), HI8759(C), HI8823(d)(I)(C), MP3336(C), NIDW1149(d)(C)
Sr11+	04	DBW373, JKW261(I)(C), MP1358(I)(C), RAJ4083(C)
Sr7a+2+	01	PBW175(C)
Sr7b+2+	10	CG1036, DDW48(d)(C), DDW55(d), HI8826(d), HI8830(d), HPW349(C), KRL210(C), PBW833, UAS478(d), WH1124(C)
Sr7b+	06	DBW370, HD3411, HD3440, HI1653, Kharchia65(C), UAS3015
Sr2+	13	DBW352, GW532, GW547, HI1628(C), HI1655, HI1665, HI1666, HI8847, HS691, MACS6795, PBW835, PBW902, WH1403
Total	**133**	

***Lr*-genes**

Eight *Lr* genes *Lr1*, *Lr3*, *Lr10*, *Lr13*, *Lr23*, *Lr24*, *Lr26*, and *Lr34* were characterized in 113 entries. *Lr13* was the most commonly postulated leaf rust resistance gene that was characterized, alone or in combination, in maximum number of lines (65) followed by *Lr10* (37 lines), and *Lr23* (31 lines). *Lr24*

that is linked with *Sr24* was postulated in 03 entries CG1029, GW513, HI1636. *Lr26,* tightly linked with *Yr9* and *Sr31*, was characterized in 16 lines. *Lr34* was postulated in only HD2733. Resistance to leaf rust in nine entries was based on a combination of three different genes (Table 2.8).

Table 2.8: *Lr-genes* in AVT entries during 2021-22

***Lr*-gene**	**No. of lines**	**Line/Variety**
Lr3+	1	UP3114,
*Lr*10+1+	1	DBW320
*Lr*13+	22	CG1040, DBW353, DBW407, HD3369, HD3392, HD3397, HD3402, HD3411, HI1621, HI1654, HPW485, HS693, KRL19, MP1380, MP3336, RAJ4083, UAS3019, VL2041, VL2043, VL3029, WH1402, WH1403
*Lr*13+1+	16	DBW332, DBW370, DBW373, DBW402, HD3418, HPW484, HS689, KRL2021, MP3552, NWS2194, PBW871, SKW362, UP3113, VL2049, VL3028, VL3030,
*Lr*13+3+	5	HI1653, HPW481, HPW488, HS694, VL2044,
*Lr*13+10+	16	DBW252, DBW365, DDW47*, HD3293, HD3386, HD3415, HD3437, HI1628, HPW349, NIAW3170, PBW868, UAS310, VL892, VL2047, VL2048, VL2050,
*Lr*13+10+3+	4	DBW316*, HUW838, MP3535*, WH1124
*Lr*23+	9	DDW48, DBW318, HD2967, HD3436, HI8498, HS490, KRL210, PBW826, UAS478
*Lr*23+1+	7	DBW327, DBW371, DBW372, DBW377, HD3388, PBW677, PBW852,
*Lr*23+10+	8	HD3400, HD3401, HS688, MP1358, NIDW1149, PBW872, UAS3015, UP3090
*Lr*23+10+1+	1	HD3406
*Lr*23+10+3+	1	HS562,
*Lr*23+13+	1	JKW261,
*Lr*23+13+10+	1	HD3171
*Lr*23+34+	1	PBW175
*Lr*24+	3	CG1029, GW513, HI1636
*Lr*26+	7	HD3090, HI1633, HI1634, HI1650, HS692, MACS6768, NIAW3922
*Lr*26+1+	1	HS507,
*Lr*26+10+	5	HD3043, HPW483, HPW486, MP1378, VL907
*Lr*26+23+1+	2	HPW487, PBW771
*Lr*26+34+	1	HD2733
Total	**113**	

***Yr*-genes**

Among the 153 lines of AVT, *Yr* genes were characterized in 94 lines. *Yr* genes were postulated in lines where differential interactions were observed and some cases tight linkage of *Yr* genes to other *Lr* and *Sr* genes also implicated the presence of a resistance gene. Four *Yr* genes viz. *Yr2*, *Yr9*, *YrA* and *Yr18* contributed to yellow rust resistance in Indian wheat material. Among the postulated *Yr* genes, the frequency of *Yr2* was maximum and it was characterized, alone or in combination, in 74 lines. *Yr9*, alone or in combination, was postulated in 16 entries. *Yr18* along with *Yr2* was characterized in only PBW175(C) (Table 2.9).

Table 2.9: *Yr-genes* in AVT entries during 2021-22

***Yr*-gene**	**No. of lines**	**Variety/ line**
Yr2+	73	CG1029(C), DBW252(C), DBW318, DBW320, DBW327 (C) , DBW332(C), DBW352, DBW358, DBW359, DBW365, DBW366, DBW370, DBW371, DBW372, DBW373, DBW377, DBW402, DBW407, DDW47(d)(C), GW513(I)(C), GW547, HD2967(C), HD3118(C), HD3171(C), HD3293(C), HD3386, HD3397, HD3406, HD3411, HD3415, HD3418, HI1621(C), HI1628(C), HI1653, HI1654, HI8840(d), HPW349(C), HPW481, HPW484, HS490(C), HS688, HUW838(I)(C), KRL2021, KRL210(C), MP1358(I)(C), MP3336(C), MP3535, MP3552, NIDW1149(d)(C), PBW677(C), PBW826, PBW833, PBW868, PBW870, PBW871, PBW872, PBW901, PBW902, RAJ4083(C), SKW362, UAS3015, UAS3019,

		VL2041, VL2043, VL2044, VL2047, VL2048, VL2049, VL2050, VL3028, VL3030, VL892(C), WH1124(C),
Yr9+	14	HD3090(C), HI1633(C), HI1634(C), HI1650, HPW483, HPW486, HPW487, HS507(C), HS692, MACS6768, MP1378, NIAW3922, PBW771(C), VL907(C),
Yr9+18+	01	HD2733(C)
Yr9+A+	01	HD3043(C)
Yr2+18+	01	PBW175(C)
YrA+	04	HD3388, HPW485, HS562(C), HS690
Total	**94**	

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AVT entries of CZ & PZ were tested against selective pathotypes of stem and leaf rusts under glass house condition. These were tested at seedling stage against 15 pathotypes of stem rust and 15 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: 117-6, 122, 21A-2, 117-5, 117-4, 117-2, 42B, 295, 11A, 21A-1, 11, 40A, 34, 117 , 4A
Leaf Rust: 77-5, 77-9, 77-1, 104-2, 12-5, 77-8, 11, 77-2, 162A, 77-3, 12-2, 104, 12-3, 77-4, 104-1

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

Stem rust	PBW870, HD3090(C), HI1633(C), HI8839(d), HI8840(d), NIAW3922, NIDW1149(d)(C), DBW352#, GW513(I)(C), GW547B, HI1636(I)(C), HI1650*, MACS6768*, HI1665, NIAW4028, HI1655Q*, HI1666, HI8823(d)(I)(C), HI8830(d)*, MACS6795, MP3288(C), HD3438, HD3439, CG1029(C), HD3407*, HI1634(C), HI8759(C), HI8713(C), HI8841, NIDW1485, PDW362, PDW363, PWU18, PWU19
Leaf rust	HD3090(C), HI1633(C), DDW48(d)(C), MACS4100(d)*, MP1378, HI8839(d), NIAW3922, NIDW1149(d)(C), DBW352#, GW513(I)(C), $GW547^{B}$, HI1636(I)(C), HI1650*, MACS6768*, NIAW4028, CG1036*, $DDW55(d)^{Q}$*, GW532, HD3401, $HI1655^{Q}$*, HI1666, MACS6795, MP3288(C), HD3438, HD3439, CG1029(C), HD3407*, HI1634(C), MACS3949(C), UAS428(C), GW1363, HI8842, HI8843, MACS4120, MACS4121, MACS4122, MPO1389, PDW363, PWU18, PWU19, AKDW4773

PROGRAMME 3. LEAF BLIGHT

3.1. LEAF BLIGHT SCREENING NURSERY (LBSN), 2021-22

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 16 centres listed below:

Zone	Test locations
NWPZ	Ludhiana, Karnal, Hisar and Pantnagar (4)
NEPZ	Ayodhya, Varanasi, RPCAU Pusa, Sabour, Ranchi, Kalyani Coochbehar and Shillongani (8)
CZ	Indore and Powarkheda (2)
PZ	Pune and Dharwad (2)

The nursery was planted at 16 centers cited as above, the data from Dharwad, Coochbehar and Powarkheda was not considered due to poor/ erratic disease development and data from Indore were not received.

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 demonstrated the moderate level of resistance within average score below 35 and HS below 57 are VL 2041 and VL 2043. Besides these, the entries showed moderate level of resistance with average score below 35 are HS 693, HPW 485, HS 690, VL 2050, HS 507(C), VL 907(C), HD 2967(C), WH 1402, WH 1403, DBW 365, DBW 366, HD 3440, HD 3406*, HD 3437 and DBW 313 but the highest score exceeded 57 due to high disease at one location.

Table 3.1 Center wise leaf blight score of different entries at hard dough growth stage 2021-22

S. No.	Entries	Leaf Blight Score (00-99, dd) IIIrd (Hard dough) stage													
		Ludhiana	Hisar	Karnal	Pantnagar	Ayodhya	Sabour	Shillongani	Varanasi	Kalyani	RPCAU, Pusa	Ranchi	Pune	Avg.	HS
1	VL2041	12	34	25	12	46	36	02	24	34	12	13	39	24	46
2	VL2043	25	37	15	23	57	46	12	35	14	56	25	49	35	57
3	VL2044	47	46	14	13	67	46	12	35	45	67	36	59	46	67
4	HD3402	23	58	25	24	68	57	02	35	68	78	24	59	46	78
5	HPW481	11	45	16	23	46	46	24	47	56	78	14	77	45	78
6	HPW487	23	67	27	13	47	56	35	89	68	89	36	79	57	89
7	HPW488	11	58	25	24	56	57	24	46	68	89	14	79	46	89
8	HS692	68	45	58	35	78	57	35	68	89	89	24	57	57	89
9	HS693	11	24	15	13	46	36	12	46	36	45	13	79	35	79
10	HS694	45	23	25	25	56	46	35	46	68	78	26	79	46	79
11	UP3114	47	67	25	25	45	36	12	46	26	56	26	57	36	67
12	VL3028	57	45	16	13	78	36	12	57	68	67	26	39	46	78
13	VL3029	45	34	36	24	57	56	24	68	89	78	14	59	46	89
14	VL3030	24	35	14	14	46	56	12	57	89	78	13	79	46	89
15	HPW483	24	24	36	34	67	46	24	57	89	67	13	79	46	89
16	HPW484	11	67	15	25	67	46	03	57	26	56	35	78	46	78
17	HPW485	11	23	49	24	57	36	12	57	24	56	34	67	35	67
18	HPW486	35	57	35	25	68	36	12	68	69	67	36	57	46	69
19	HS688	35	45	46	25	57	36	24	68	89	67	24	78	46	89
20	HS689	35	56	27	24	46	36	12	78	89	67	35	79	46	89
20A	Infector	NG	78	89	67	NG	67	-	89	89	78	57	99	78	99
21	HS690	25	45	27	13	46	36	12	35	24	12	26	97	35	97
22	HS691	68	34	03	12	46	36	12	35	24	12	15	79	35	79
23	SKW362	68	24	35	23	57	46	12	58	68	56	36	77	46	77
24	UP3113	47	47	26	12	57	47	24	57	57	56	37	78	46	78
25	VL2047	11	36	37	23	56	46	35	79	68	56	35	77	46	79
26	VL2048	35	45	26	14	56	46	12	78	89	67	24	78	46	89
27	VL2049	24	46	37	25	68	57	12	57	68	67	15	77	46	77
28	VL2050	11	56	35	13	68	57	12	35	56	45	26	57	35	68
29	HS507(C)	11	35	37	23	57	46	12	46	56	34	23	77	35	77
30	HS562(C)	11	46	15	14	67	46	12	57	57	34	36	99	45	99
31	HS490(C)	22	57	68	24	56	46	13	68	79	45	36	79	46	79
32	HPW349(C)	11	78	27	24	56	47	12	57	59	45	24	79	46	79
33	VL907(C)	11	35	14	13	57	46	24	57	35	45	25	78	35	78
34	VL892(C)	47	36	47	34	57	36	57	79	89	78	24	67	57	89
35	DBW377	68	68	15	14	46	46	24	79	89	56	26	67	47	89
36	PBW870	37	35	14	23	67	35	12	35	68	45	24	59	35	68
37	DBW372	57	34	38	25	46	36	24	78	68	45	12	58	46	78
38	DBW318	67	45	24	24	57	47	68	89	89	56	13	57	56	89
39	DBW327 (C)	78	57	37	15	46	36	12	89	89	45	02	57	46	89
40	DBW332(C)	78	35	37	25	68	36	24	68	24	56	25	59	46	78
40A	Infector		89	79	57	NG	67	-	79	89	78	57	99	78	99
41	DBW370	58	67	25	24	57	56	35	79	25	56	25	79	46	79
42	DBW371	37	56	26	13	46	56	24	57	89	67	36	79	46	89
43	DBW373	57	68	48	12	47	56	35	68	36	67	46	77	56	77
44	PBW868	68	58	59	24	67	47	35	57	79	56	25	79	57	79
45	PBW871	22	78	16	23	46	57	35	68	48	45	15	78	46	78
46	PBW872	22	78	24	12	46	46	24	68	35	34	35	77	45	78
47	HD3090(C)	57	79	89	12	68	47	35	79	89	45	46	98	67	98

48	HI1633(C)	11	25	57	23	67	57	68	78	89	56	35	57	56	89
49	RAJ4083(C)	11	36	48	24	46	57	68	89	25	56	25	67	46	89
50	DBW320#*	57	23	16	13	46	45	35	68	45	45	23	68	45	68
51	MP1380#	35	12	58	23	47	46	35	68	25	56	14	69	46	69
52	DBW407[B]	35	24	26	12	47	36	24	68	24	34	14	77	35	77
53	DDW48(d)(C)	45	35	49	23	46	36	24	78	68	34	13	56	46	78
54	HI8826(d)*	67	45	57	13	68	36	12	89	68	34	35	59	46	89
55	MACS4100(d)*	78	37	69	24	47	47	35	79	34	45	13	57	46	79
56	MP1378	24	56	58	13	56	56	24	57	68	12	36	49	46	68
57	MP3552	22	45	47	12	56	57	24	78	79	56	24	68	46	79
58	UAS3015	57	23	14	23	57	47	35	79	69	45	24	66	46	79
59	HI8839(d)	22	13	26	23	57	57	24	68	58	78	35	89	46	89
60	HI8840(d)	11	45	48	13	68	57	35	68	79	56	35	88	46	88
60A	Infector	-	89	79	67	NG	67	-	78	79	78	57	89	78	89
61	MP1358(I)(C)	11	23	15	24	47	36	24	57	69	34	13	79	35	79
62	NIAW3922	12	12	49	34	57	46	68	89	38	45	13	89	46	89
63	NIDW1149(d)(C)	67	47	38	23	68	46	68	79	58	45	13	NA	47	79
64	UAS478(d)	35	58	36	13	47	57	57	89	89	45	12	87	56	89
65	DBW352#	35	78	69	23	67	47	46	79	68	34	25	88	57	88
66	GW513(I)(C)	78	56	-	13	68	57	68	89	89	56	24	89	67	89
67	GW547[B]	68	68	49	23	57	46	46	68	79	34	36	89	57	89
68	HI1636(I)(C)	57	56	99	13	67	57	57	78	89	78	25	99	67	99
69	HI1650*	57	68	58	23	78	46	68	79	58	78	25	47	57	79
70	MACS6768*	68	69	89	23	68	46	57	78	58	56	35	69	57	89
71	MP3535*	57	56	57	23	67	46	57	78	37	56	25	89	57	89
72	NWS2194#	67	67	58	13	46	47	68	89	58	56	36	46	57	89
73	HI1665	89	56	89	13	46	35	35	89	68	56	35	67	57	89
74	NIAW4028	68	23	89	23	57	35	68	68	89	56	46	88	57	89
75	CG1036*	67	12	99	13	47	36	68	68	36	45	36	88	56	99
76	CG1040	57	45	89	23	46	36	24	58	59	45	36	88	46	89
77	DDW47(d)(C)	47	23	57	23	57	47	35	78	68	45	36	67	46	78
78	DDW55(d)[Q]*	68	56	68	22	57	57	46	89	57	78	46	59	57	89
79	GW532	47	78	68	25	68	46	35	89	89	34	35	99	57	99
80	HD3401	78	15	48	35	57	57	35	99	68	45	36	58	57	99
80A	Infector	-	89	79	68	NG	67	-	79	69	89	57	99	78	99
81	HI1655[Q]*	57	56	79	23	68	56	35	78	38	67	35	66	57	79
82	HI1666	78	67	89	23	57	57	35	89	58	78	24	77	57	89
83	HI8823(d)(I)(C)	68	46	57	13	78	46	24	89	58	78	36	89	57	89
84	HI8830(d)*	68	35	69	24	68	46	24	89	69	67	23	88	57	89
85	MACS6795	37	56	79	14	46	46	68	78	57	56	23	99	57	99
86	MP1377	68	45	47	13	58	57	68	79	68	67	26	78	57	79
87	MP3288(C)	68	46	79	23	57	57	68	68	57	56	26	89	57	89
88	UAS3019	89	35	25	24	68	47	68	67	89	67	13	69	57	89
89	DBW316#*	57	36	37	13	78	56	68	68	25	67	36	68	47	78
90	HD3118(C)	68	34	26	24	78	46	68	79	58	56	35	66	57	79
91	HD3392	47	35	27	13	46	46	68	57	57	56	36	66	46	68
92	HI1621(C)	46	24	36	23	68	56	68	68	47	78	25	67	46	78
93	PBW833*	35	35	27	24	46	46	24	69	45	34	13	68	36	69
94	PBW835[Q]*	57	45	16	23	67	57	68	57	68	67	25	79	57	79
95	HD3249(C)	68	35	17	34	79	46	35	78	58	34	36	67	46	79
96	PBW826#*	78	45	15	24	56	46	24	57	45	23	26	69	46	78
97	HD3388	78	45	15	23	56	47	57	68	68	34	36	57	46	78
98	PBW852	89	46	16	23	47	47	24	57	35	34	47	58	46	89
99	DBW252(C)	68	67	27	14	67	46	46	58	58	34	24	58	46	68
100	HD3171(C)	47	45	58	24	58	57	68	68	25	56	36	57	47	68
100A	Infector	-	89	79	67	NG	67	-	79	68	78	57	79	78	89
101	HD3293(C)	68	45	46	13	46	36	35	68	56	34	24	57	46	68

102	DBW353	68	35	34	13	46	47	35	79	48	45	36	57	46	79
103	JKW261(I)(C)	68	24	57	24	57	36	35	79	35	34	24	77	46	79
104	PBW771(C)	68	34	49	25	68	36	24	89	46	34	13	79	46	89
105	WH1124(C)	37	35	57	24	47	57	24	89	23	56	12	69	46	89
106	HD2967(C)	12	67	39	13	46	36	24	35	46	12	24	34	35	67
107	HD3386	68	56	16	24	68	35	24	58	25	23	13	68	36	68
108	DBW359	35	35	38	23	58	35	35	57	45	34	36	68	46	68
109	DBW358	37	12	26	14	57	36	24	57	68	34	24	79	36	79
110	NIAW3170(C)	57	56	69	34	45	47	57	68	25	56	47	67	57	69
111	HD3043(C)	35	46	59	25	36	47	24	68	47	34	24	68	46	68
112	HD3369*	89	35	38	23	68	47	24	58	58	34	25	69	47	89
113	HD3397	58	24	48	14	57	47	35	78	58	34	36	46	46	78
114	HD3400	58	12	16	24	68	47	46	89	26	34	36	58	46	89
115	HD3418	57	13	17	13	67	46	46	57	68	34	13	67	46	68
116	HI1628(C)	89	12	57	23	67	47	35	89	68	45	46	45	56	89
117	HI1653*	89	23	36	13	68	47	24	78	56	45	03	79	46	89
118	HI1654*	89	23	25	23	67	37	24	79	56	34	46	89	46	89
119	HUW838(I)(C)	89	24	36	24	57	46	12	89	46	45	26	46	46	89
120	UP3090	68	46	36	14	68	47	35	89	56	34	24	77	46	89
120A	Infector	-	78	79	78	NG	67	-	79	79	78	57	79	78	79
121	WH1402	57	12	05	24	46	36	24	46	69	23	24	47	35	69
122	WH1403	47	23	15	13	56	36	24	46	46	23	36	67	35	67
123	DBW365	35	35	37	23	36	36	12	57	25	34	35	77	35	77
124	DBW366	35	34	26	12	46	46	12	57	25	34	37	77	35	77
125	DBW402	68	45	26	13	56	46	24	57	26	34	25	79	46	79
126	HD3415	78	56	16	24	57	46	24	58	68	12	36	79	46	79
127	Kharchia65(C)	78	45	-	23	67	56	24	89	89	23	46	79	56	89
128	KRL19(C)	57	23	-	14	68	47	35	89	46	56	36	79	46	89
129	KRL2006	68	56	05	24	46	37	35	46	78	34	35	47	46	78
130	UAS310	57	45	36	23	67	37	35	57	67	34	03	77	46	77
131	KRL2021	68	56	27	13	67	56	35	57	78	34	24	99	56	99
132	KRL210(C)	89	45	48	23	68	56	57	79	56	45	35	68	57	89
133	RAJ4565	89	23	48	24	57	47	24	78	68	34	13	69	46	89
134	HD3438	89	67	89	25	57	47	57	57	68	67	46	99	67	99
135	HD3439	25	35	58	14	67	47	57	89	56	67	36	89	57	89
136	CG1029(C)	78	67	99	24	78	56	57	78	57	56	35	99	67	99
137	HD3407*	68	45	58	13	47	56	68	89	68	67	25	99	57	99
138	HI1634(C)	35	67	89	24	68	47	57	89	68	67	37	79	57	89
139	MP3336(C)	48	68	99	35	47	47	57	89	57	56	26	79	57	99
140	HI8498(C)	57	23	37	14	47	46	24	79	35	67	25	69	46	79
140A	Infector	-	79	79	57	NG	67	-	89	78	89	57	89	78	89
141	HI8759(C)	68	24	58	25	57	47	12	99	68	56	36	67	56	99
142	HI8846	67	57	47	24	67	47	12	89	23	67	24	59	46	89
143	HI8847	78	56	58	24	46	56	24	89	24	67	35	59	56	89
144	HD2733(C)	68	67	69	13	36	47	24	57	36	23	23	89	46	89
145	HD3411*	57	56	47	24	46	46	24	57	14	34	23	59	46	59
146	HD3440	57	23	04	13	46	46	12	46	14	12	26	59	35	59
147	HD3406*	25	23	05	23	45	46	12	35	13	23	26	59	25	59
148	HD3436	68	34	15	12	46	47	12	46	68	12	13	99	35	99
149	HD3437	11	35	26	14	57	56	12	57	45	23	36	59	35	59
150	PBW175(C)	79	57	79	23	57	56	24	58	67	45	24	48	56	79
151	PBW677(C)	78	23	37	35	46	47	24	46	25	23	13	79	36	79
152	PBW901	89	36	39	12	57	47	24	58	34	56	13	79	46	89
153	PBW902	57	35	26	24	57	47	12	57	56	23	13	69	36	69
154	VL 2041	25	56	48	12	47	36	12	46	56	12	25	34	35	56
155	HS 562	25	45	16	13	67	36	12	57	34	34	36	79	35	79
156	DBW 313	35	13	25	24	46	47	24	57	56	34	26	79	36	79
156A	Infector	-	79	-	56	NG	67	-	79	68	78	68	89	78	89

Area Under Disease progress Curve (AUDPC) of leaf blight for LBSN entries:

The disease progress may account for different resistance components like latent period, size of spots, number of spore per unit area etc. which are under the influence of prevailing weather conditions. A convenient option of identifying lines that allow slow disease development is the estimation of the Area Under Disease Progress Curve (AUDPC) which takes into account all the factors collectively leading to manifestation of disease progress in a genotype. The AUDPC was calculated and on the basis of mean, the entries score less than 100 may categories as resistant and from 101 to 500 may categories as moderately resistant. The entries are categories as follows:

AUDPC	Entries
Upto 100	Nil
101 - 500	VL2041, VL2043, HD3402, HPW481, HPW488, HS693, UP3114, VL3028, VL3030, HPW485, HS690, HS691, VL2049, VL2050, HS507(C), HPW349(C), VL907(C), PBW870, DBW372, PBW872, DBW407^{B}, DDW48(d)(C), MP1378, MP1358(I)(C), HD2967(C), WH1402, DBW366, HD3440, HD3406*, HD3436, VL 2041

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PROGRAMME 4. KARNAL BUNT

4.1 KARNAL BUNT SCREENING NURSERY (KBSN) 2021-22

Wheat entries along with checks were evaluated for resistance to Karnal bunt at multilocations (Ludhiana, New Delhi, Hisar, Pantnagar, Karnal, Jammu and Malan) during 2021-22 crop season under artificially inoculated conditions. Data from Pantnagar has not been included because of low disease, whereas data from Malan was not received. 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 2021-22
Free from infection: Nil

Resistant (average incidence upto 5%):
VL 2041, VL 2044, HS 693, HPW 485, HS 690, HS 691, HS 490(C), DBW 371, DDW 48(d)(C), MACS 4100(d)*, MP 1378, HI 8839(d), HI 8840(d), NIAW 3922, UAS 478(d), GW 547^{B}, HI 1650*, CG 1036*, CG 1040, GW 532, HI 8823(d)(I)(C), MACS 6795, HD 3392, HD 3249(C), PBW 771(C), WH 1124(C), HD 2967(C), RAJ 4565, HI 8847, HD 2733(C), DBW 55(d), MACS 4106 (d), WH 1407, PBW 870

Table 4.1: Karnal bunt incidence in KBSN entries evaluated under artificially inoculated conditions at multilocations during 2021-22

S. No.	Entries	Karnal bunt incidence (%)						
		Hisar	Delhi	Karnal	Ludhiana	Jammu	Av.	HS
1	VL2041	9.3	0.0	0.0	4.4	6.4	4.0	9.3
2	VL2043	7.5	19.7	4.3	0.0	6.0	7.5	19.7
3	VL2044	8.3	2.0	0.0	0.0	5.2	3.1	8.3
4	HD3402	12.5	26.9	0.0	8.5	8.7	11.3	26.9
5	HPW481	11.2	15.0	8.3	1.0	4.2	7.9	15.0
6	HPW487	9.1	29.1	1.1	2.0	4.5	9.1	29.1
7	HPW488	8.6	28.1	0.0	0.0	6.6	8.7	28.1
8	HS692	12.5	0.0	6.9	1.1	9.2	5.9	12.5
9	HS693	11.1	4.5	0.0	8.7	0.3	4.9	11.1
10	HS694	10.0	44.4	0.0	10.3	2.0	13.4	44.4
11	UP3114	8.3	14.6	0.0	6.5	5.8	7.0	14.6
12	VL3028	7.5	27.4	0.0	7.5	1.3	8.7	27.4
13	VL3029	6.6	34.1	0.0	6.0	2.5	9.8	34.1
14	VL3030	6.6	27.3	6.6	0.0	8.7	9.8	27.3
15	HPW483	8.3	7.6	0.0	6.7	4.0	5.3	8.3
16	HPW484	8.3	13.5	0.0	0.0	10.6	6.5	13.5
17	HPW485	5.8	0.0	0.0	2.9	0.7	1.9	5.8
18	HPW486	9.6	11.7	0.0	5.2	4.0	6.1	11.7
19	HS688	6.6	23.7	0.0	2.2	4.0	7.3	23.7
20	HS689	7.5	28.0	1.9	0.0	6.7	8.8	28.0
20A	Infector	18.3	50.5	18.2	24.7	16.5	25.6	50.5
21	HS690	8.4	0.0	1.3	11.2	0.0	4.2	11.2

22	HS691	6.3	0.5	1.7	2.6	2.1	2.6	6.3
23	SKW362	7.5	46.2	5.7	4.4	0.0	12.8	46.2
24	UP3113	8.3	2.3	23.2	0.0	4.3	7.6	23.2
25	VL2047	9.1	25.9	0.0	1.4	3.0	7.9	25.9
26	VL2048	12.5	37.0	1.0	5.2	2.9	11.7	37.0
27	VL2049	11.1	29.5	4.5	0.0	2.9	9.6	29.5
28	VL2050	8.3	24.7	2.6	28.0	5.3	13.8	28.0
29	HS507(C)	9.3	26.7	0.0	4.4	1.0	8.3	26.7
30	HS562(C)	6.6	27.1	0.0	5.5	1.3	8.1	27.1
31	HS490(C)	5.0	0.0	0.0	0.0	5.3	2.1	5.0
32	HPW349(C)	6.3	24.7	0.0	5.7	4.1	8.1	24.7
33	VL907(C)	11.1	30.8	4.1	1.4	8.0	11.1	30.8
34	VL892(C)	12.5	27.2	0.0	10.7	3.3	10.7	27.2
35	DBW377	11.1	23.6	5.5	0.0	8.0	9.6	23.6
36	PBW870	9.3	15.4	10.3	0.0	5.5	8.1	15.4
37	DBW372	5.0	24.6	0.0	0.0	2.0	6.3	24.6
38	DBW318	6.6	21.0	0.9	9.1	5.0	8.5	21.0
39	DBW327 (C)	7.5	39.6	0.0	9.1	0.0	11.2	39.6
40	DBW332(C)	9.3	37.8	1.3	9.7	7.6	13.1	37.8
40A	Infector	16.6	37.5	22.5	21.4	16.4	22.9	37.5
41	DBW370	5.0	19.6	6.0	3.5	1.8	7.2	19.6
42	DBW371	8.6	3.1	0.0	0.8	1.6	2.8	8.6
43	DBW373	12.5	32.6	6.9	16.7	5.2	14.8	32.6
44	PBW868	14.2	14.7	6.3	0.0	5.6	8.2	14.7
45	PBW871	12.7	41.2	4.4	13.0	3.2	14.9	41.2
46	PBW872	14.2	31.4	0.0	0.0	5.3	10.2	31.4
47	HD3090(C)	11.3	45.7	2.9	13.4	3.0	15.3	45.7
48	HI1633(C)	12.6	40.2	1.1	0.0	2.0	11.2	40.2
49	RAJ4083(C)	10.0	37.5	0.0	0.0	8.0	11.1	37.5
50	DBW320#*	5.3	35.4	3.2	0.0	7.3	10.2	35.4
51	MP1380#	4.5	48.8	0.0	0.0	7.0	12.1	48.8
52	DBW407[B]	5.3	16.2	2.1	0.0	3.0	5.3	16.2
53	DDW48(d)(C)	3.5	5.6	0.0	0.0	0.0	1.8	5.6
54	HI8826(d)*	11.7	21.4	4.6	7.0	2.5	9.4	21.4
55	MACS4100(d)*	8.3	0.0	0.0	0.0	4.0	2.5	8.3
56	MP1378	5.0	13.6	0.0	3.2	1.3	4.6	13.6
57	MP3552	4.2	41.2	13.3	8.0	2.9	13.9	41.2
58	UAS3015	5.0	28.0	0.0	6.0	3.3	8.5	28.0
59	HI8839(d)	3.6	11.1	0.0	0.0	6.4	4.2	11.1
60	HI8840(d)	4.5	0.0	0.0	0.0	7.6	2.4	4.5
60A	Infector	19.5	40.2	26.2	22.7	18.0	25.3	40.2
61	MP1358(I)(C)	4.5	19.6	5.6	0.0	3.0	6.5	19.6
62	NIAW3922	6.2	5.7	0.0	5.7	5.9	4.7	6.2
63	NIDW1149(d)(C)	9.1	7.8	0.0	0.0	8.7	5.1	9.1
64	UAS478(d)	6.6	11.1	0.0	0.0	0.3	3.6	11.1
65	DBW352#	5.3	26.4	0.0	0.0	0.0	6.3	26.4
66	GW513(I)(C)	6.6	31.0	6.6	0.0	4.1	9.7	31.0
67	GW547[B]	6.5	15.9	0.0	0.0	0.0	4.5	15.9
68	HI1636(I)(C)	8.3	38.8	4.6	0.0	1.5	10.6	38.8
69	HI1650*	6.6	13.0	0.0	2.0	3.2	4.9	13.0
70	MACS6768*	5.0	36.0	6.5	11.4	4.9	12.8	36.0
71	MP3535*	9.1	17.0	0.0	5.2	0.0	6.3	17.0

72	NWS2194#	10.0	19.3	0.0	0.0	0.0	5.9	19.3
73	HI1665	8.3	23.9	13.4	0.0	4.1	9.9	23.9
74	NIAW4028	6.6	25.6	4.8	0.0	5.1	8.4	25.6
75	CG1036*	4.5	10.5	3.3	3.9	0.0	4.4	10.5
76	CG1040	5.0	9.7	0.0	0.0	6.1	4.2	9.7
77	DDW47(d)(C)	5.0	20.5	0.0	0.0	7.1	6.5	20.5
78	DDW55(d)^{Q}*	4.5	15.6	0.0	3.6	4.6	5.7	15.6
79	GW532	8.3	0.0	0.0	6.3	5.5	4.0	8.3
80	HD3401	5.0	45.8	0.0	0.0	0.3	10.2	45.8
80A	Infector	21.1	37.5	16.5	21.6	15.3	22.4	37.5
81	HI1655^{Q}*	6.7	41.2	0.0	0.0	5.2	10.6	41.2
82	HI1666	8.3	29.3	0.0	21.9	4.2	12.7	29.3
83	HI8823(d)(I)(C)	8.3	7.0	0.0	0.0	6.1	4.3	8.3
84	HI8830(d)*	11.1	9.5	7.0	4.8	8.1	8.1	11.1
85	MACS6795	9.6	7.4	0.0	0.0	0.0	3.4	9.6
86	MP1377	7.5	38.8	0.0	2.7	0.0	9.8	38.8
87	MP3288(C)	9.1	28.1	0.9	3.9	7.1	9.8	28.1
88	UAS3019	12.5	11.2	0.0	3.6	4.3	6.3	12.5
89	DBW316#*	6.6	24.0	0.0	6.0	0.0	7.3	24.0
90	HD3118(C)	8.3	13.9	1.7	9.9	5.9	7.9	13.9
91	HD3392	7.5	14.1	1.0	0.0	0.0	4.5	14.1
92	HI1621(C)	8.1	36.7	0.0	1.4	1.0	9.4	36.7
93	PBW833*	9.3	48.5	2.9	16.1	4.2	16.2	48.5
94	PBW835^{Q}*	12.5	38.8	1.4	17.2	3.3	14.6	38.8
95	HD3249(C)	10.0	1.7	0.0	0.0	5.2	3.4	10.0
96	PBW826#*	8.5	54.2	0.0	8.5	0.0	14.2	54.2
97	HD3388	13.3	16.3	0.0	0.0	4.2	6.8	16.3
98	PBW852	11.6	53.6	6.3	7.1	1.3	16.0	53.6
99	DBW252(C)	8.7	14.5	0.0	2.9	1.3	5.5	14.5
100	HD3171(C)	9.6	43.3	0.0	0.0	3.6	11.3	43.3
100A	Infector	25.0	45.5	21.8	24.7	17.3	26.9	45.5
101	HD3293(C)	12.5	56.0	0.0	0.0	0.0	13.7	56.0
102	DBW353	10.0	51.7	0.0	7.2	0.0	17.2	51.7
103	JKW261(I)(C)	9.1	30.0	0.0	6.1	4.1	9.9	30.0
104	PBW771(C)	11.1	3.8	0.8	2.1	6.7	4.9	11.1
105	WH1124(C)	8.3	7.7	0.0	3.3	4.3	4.7	8.3
106	HD2967(C)	7.5	0.0	0.0	13.0	1.8	4.5	13.0
107	HD3386	9.1	42.1	0.0	8.6	5.5	13.1	42.1
108	DBW359	11.1	52.9	0.5	7.1	1.8	14.7	52.9
109	DBW358	12.5	38.8	1.0	5.5	0.0	11.6	38.8
110	NIAW3170(C)	13.3	9.6	0.0	11.5	0.0	6.9	13.3
111	HD3043(C)	10.0	12.5	0.0	4.5	2.3	5.9	12.5
112	HD3369*	9.1	15.6	0.0	5.3	1.0	6.2	15.6
113	HD3397	7.5	34.5	0.0	7.2	2.5	10.3	34.5
114	HD3400	6.6	20.5	0.0	4.8	6.0	7.6	20.5
115	HD3418	5.0	29.7	0.0	0.0	4.0	7.7	29.7
116	HI1628(C)	6.6	34.9	1.9	9.1	5.5	11.6	34.9
117	HI1653*	8.3	41.5	1.3	17.1	4.2	14.5	41.5
118	HI1654*	6.6	22.1	0.0	4.8	2.9	7.3	22.1
119	HUW838(I)(C)	8.3	31.3	0.0	0.0	3.3	8.6	31.3
120	UP3090	9.1	0.5	1.5	9.1	6.4	5.3	9.1
120A	Infector	23.3	33.5	28.8	24.4	19.4	25.9	33.5

121	WH1402	12.5	20.3	0.0	2.9	2.0	7.5	20.3
122	WH1403	13.3	8.2	0.0	0.0	5.9	5.5	13.3
123	DBW365	15.0	27.6	1.8	10.7	7.1	12.4	27.6
124	DBW366	9.5	17.9	4.4	0.0	0.0	6.4	17.9
125	DBW402	8.3	19.6	0.0	0.0	0.0	5.6	19.6
126	HD3415	10.0	21.2	0.0	0.0	4.0	7.0	21.2
127	Kharchia65(C)	14.2	15.5	5.5	0.0	4.3	7.9	15.5
128	KRL19(C)	3.5	0.0	25.2	0.0	0.0	5.7	25.2
129	KRL2006	14.2	23.3	0.0	0.0	0.0	7.5	23.3
130	UAS310	12.5	38.8	0.0	4.9	0.0	11.2	38.8
131	KRL2021	8.3	18.9	0.0	0.0	0.0	5.4	18.9
132	KRL210(C)	5.0	22.5	0.0	10.9	4.1	8.5	22.5
133	RAJ4565	4.5	4.0	0.8	3.9	2.3	3.1	4.5
134	HD3438	5.6	43.0	0.0	0.0	0.0	9.7	43.0
135	HD3439	10.0	36.4	0.0	7.3	0.0	10.7	36.4
136	CG1029(C)	8.3	34.8	10.3	5.8	6.2	13.1	34.8
137	HD3407*	12.5	33.3	0.0	10.5	4.1	12.1	33.3
138	HI1634(C)	13.3	24.4	0.0	11.8	2.7	10.4	24.4
139	MP3336(C)	10.0	2.6	13.6	0.0	3.0	5.8	13.6
140	HI8498(C)	11.3	NG	7.2	0.0	2.7	5.3	11.3
140A	Infector	25.0	41.2	21.2	23.7	15.6	25.3	41.2
141	HI8759(C)	12.5	NG	0.0	3.9	5.1	5.4	12.5
142	HI8846	15.0	0.9	0.0	11.3	3.4	6.1	15.0
143	HI8847	6.6	0.0	4.2	4.8	0.0	3.1	6.6
144	HD2733(C)	8.6	3.0	0.0	0.0	0.0	2.3	8.6
145	HD3411*	10.0	30.8	0.0	0.0	4.2	9.0	30.8
146	HD3440	11.1	18.9	3.9	0.0	0.0	6.8	18.9
147	HD3406*	12.5	20.8	6.5	2.3	4.2	9.3	20.8
148	HD3436	9.6	34.4	8.6	16.2	0.0	13.8	34.4
149	HD3437	8.3	13.7	2.8	4.8	1.3	6.2	13.7
150	PBW175(C)	9.3	41.6	0.0	7.4	0.0	11.7	41.6
151	PBW677(C)	10.0	22.4	0.0	0.0	0.0	6.5	22.4
152	PBW901	12.5	41.2	2.6	4.0	0.0	12.1	41.2
153	PBW902	8.6	35.7	0.0	6.7	2.3	10.7	35.7
154	DBW 55 (d)	4.5	0.0	2.7	0.0	4.3	2.9	4.5
155	HI 8826(d)	11.5	0.0	13.5	0.0	0.0	6.3	13.5
156	MACS 4106 (d)	9.6	0.0	0.0	9.1	0.0	4.7	9.6
157	WH 1407	10.0	0.0	0.0	0.0	2.3	3.1	10.0
158	PBW 870	12.5	0.0	0.9	0.0	1.3	3.7	12.5
158A	Infector	22.2	40.5	24.4	21.1	13.3	24.3	40.5

COOPERATORS:

NAME	**CENTRE**
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PROGRAMME 5. LOOSE SMUT

5.1 Evaluation of AVT material (2020-21) 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 (2020-21), were inoculated with local isolates of loose smut pathogen using 'Go go' method at hot spot locations like Ludhiana, Almora, Durgapura, Hisar and Malan. The nursery was allotted to Malan first time hence the expression data will be from next season. The inoculated seeds were sown again during 2021-22 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, 2020-21

Free (No infection at any location): Nil

Resistant (Average score: 0.1-5.0 % infection):
DBW222 (C), DBW321, HI 8627(d)(C), HI 8830(d), WHD 965(d), UAS 428(d) (C), HI 8826(d), DDW 53(d), NIDW 1345(d), MACS 4106(d), NIDW 1348(d), HI 8827(d), DDW 48(d)(I)(C), AKDW 2997-16(d)(C), UAS 446(d)(C), DDK1029 (C), DDK 1060

Table 5.1. Per cent loose smut infection in the entries of AVTs of year 2020-21 expressed during 2021-22 crop season

S. No.	Entry	Loose smut incidence (%)					
		Durgapura	Almora	Hisar	Ludhiana	Avg.	HS
1	VL2041	0.0	18.6	16.3	9.5	11.1	18.6
2	HS562 (C)	5.9	14.2	12.5	21.7	13.6	21.7
3	HPW349 (C)	7.5	23.3	11.1	18.5	15.1	23.3
4	HS507 (C)	14.7	28.6	18.3	21.6	20.8	28.6
5	VL907 (C)	11.1	15.7	17.5	17.4	15.4	17.5
6	WH1105 (C)	14.3	24.4	46.6	18.6	26.0	46.6
7	DBW187 (C)	6.3	22.0	22.2	20.4	17.7	22.2
8	HD3349	23.4	0.0	16.6	16.9	14.2	23.4
9	PBW876[B]	0.0	33.0	25.0	0.0	14.5	33.0
10	HD3406[M]	23.5	37.7	20.0	20.0	25.3	37.7
11	DBW222 (C)	0.0	0.0	12.5	NG	4.2	12.5
12	DBW313[#]	9.4	19.8	65.0	9.6	25.9	65.0
13	HD2967 (C)	19.4	10.8	15.0	23.3	17.1	23.3
14	PBW826	5.6	13.2	28.5	10.5	14.5	28.5
15	RAJ4548[#]	16.8	25.9	30.0	1.6	18.6	30.0
16	HD3354	12.5	20.0	17.6	6.3	14.1	20.0
17	WH1283	6.1	25.3	12.5	17.7	15.4	25.3
18	HD3086 (C)	0.0	0.0	65.0	0.0	16.3	65.0
19	JKW261	37.6	17.5	35.0	23.5	28.4	37.6
20	WH1124 (C)	9.2	40.8	42.5	13.8	26.6	42.5
20A	Sonalika (Check)	68.4	46.5	75.0	20.6	52.6	75.0
21	PBW771 (C)	11.6	19.5	16.6	14.0	15.4	19.5
22	HD3059 (C)	24.6	37.7	25.0	19.2	26.6	37.7
23	PBW834	9.0	25.8	15.0	NG	16.6	25.8

24	DBW173 (C)	2.7	18.4	18.3	31.4	17.7	31.4
25	HUW838#*	19.1	57.6	26.6	29.2	33.1	57.6
26	NW7096	11.2	50.4	20.0	17.9	24.9	50.4
27	DBW321	0.0	0.0	18.6	0.0	4.7	18.6
28	K1910	19.8	62.9	26.6	26.5	34.0	62.9
29	HI1654	27.5	19.8	35.0	16.7	24.8	35.0
30	NIAW3170 (C)	27.9	41.7	32.0	47.1	37.2	47.1
31	PBW838	48.8	20.9	22.2	35.7	31.9	48.8
32	DBW296*	47.1	44.6	16.6	25.8	33.5	47.1
33	HI1628 (C)	43.1	47.5	20.0	15.7	31.6	47.5
34	HD3369	31.8	29.7	21.1	0.0	20.6	31.8
35	WH1142 (C)	26.3	13.6	25.0	37.1	25.5	37.1
36	UP3062	0.0	0.0	35.0	0.0	8.8	35.0
37	HD3368	12.1	15.8	32.0	38.9	24.7	38.9
38	HD3043 (C)	8.9	NG	30.0	21.4	20.1	30.0
39	PBW644 (C)	18.3	20.9	28.5	31.3	24.7	31.3
40	HI1653	22.9	26.8	20.0	31.7	25.4	31.7
40A	Sonalika (Check)	56.3	46.0	83.3	35.5	55.3	83.3
41	PBW848	51.9	82.7	16.6	15.1	41.6	82.7
42	HD2733 (C)	17.2	16.8	25.0	20.0	19.8	25.0
43	HD3249 (C)	22.6	36.2	21.1	16.9	24.2	36.2
44	DBW187 (C)	4.9	32.6	15.0	25.0	19.4	32.6
45	HD3406[M]	61.3	23.7	16.6	23.6	31.3	61.3
46	HD3411[M]	4.4	34.4	13.3.	52.4	30.4	52.4
47	DBW39 (C)	31.5	36.9	30.0	21.2	29.9	36.9
48	HD2967 (C)	9.2	17.4	71.1	15.5	28.3	71.1
49	PBW826#	1.8	8.4	15.0	9.5	8.7	15.0
50	HD3086 (C)	0.0	0.0	65.0	10.0	18.8	65.0
51	DBW317	9.8	47.9	30.0	9.7	24.4	47.9
52	DBW318	41.3	29.9	26.6	9.0	26.7	41.3
53	PBW835	14.0	4.7	22.2	9.4	12.6	22.2
54	HI1563 (C)	8.8	26.9	25.0	0.0	15.2	26.9
55	DBW107 (C)	2.9	53.3	18.6	25.6	25.1	53.3
56	PBW834	12.9	20.7	19.3	25.3	19.6	25.3
57	UP3060	10.6	9.6	36.6	1.3	14.5	36.6
58	HD3118 (C)	1.8	16.1	25.0	23.5	16.6	25.0
59	HI1621 (C)	5.3	2.9	26.6	0.0	8.7	26.6
60	DBW316	20.1	13.1	42.6	30.7	26.6	42.6
60A	Sonalika (Check)	48.3	55.2	81.1	18.0	50.7	81.1
61	PBW833	41.8	18.5	26.6	23.4	27.6	41.8
62	HD3360	0.0	0.0	33.3	0.0	8.3	33.3
63	HI1653	7.4	18.9	25.0	31.7	20.7	31.7
64	DBW322	0.0	0.0	26.6	0.0	6.7	26.6
65	HI1612 (C)	12.4	3.6	26.6	0.0	10.7	26.6
66	DBW252 (C)	11.2	16.5	28.5	28.6	21.2	28.6
67	DBW321	0.7	0.0	18.3	0.0	4.8	18.3
68	HD3368#	24.1	23.0	28.5	41.2	29.2	41.2
69	HI1654	13.3	27.5	45.0	26.3	28.0	45.0
70	HD3293(I) (C)	12.9	7.2	46.6	21.2	22.0	46.6
71	WH1281	23.2	10.0	43.3	14.8	22.8	43.3
72	PBW848#	30.9	30.8	35.0	29.6	31.6	35.0
73	HD3171 (C)	3.8	22.0	36.0	2.4	16.0	36.0
74	HD3369#	26.9	14.0	35.0	1.8	19.4	35.0

75	K1317 (C)	18.6	19.1	46.6	32.6	29.2	46.6
76	UP3062	0.0	0.0	53.3	0.0	13.3	53.3
77	HI8833(d)[M]	0.0	76.2	13.3	0.0	22.4	76.2
78	GW322 (C)	37.1	4.3	18.6	2.3	15.6	37.1
79	MP3535	16.0	26.6	26.6	14.0	20.8	26.6
80	GW523	6.6	45.9	35.0	0.0	21.9	45.9
80A	Sonalika (Check)	34.0	57.4	75.0	21.9	47.1	75.0
81	GW513*	4.5	5.8	30.0	0.0	10.1	30.0
82	HI1636*	11.9	24.7	25.0	3.5	16.3	25.0
83	HI8832(d)[M]	0.0	0.0	28.2	0.0	7.1	28.2
84	MACS6768	6.7	8.9	36.6	7.1	14.8	36.6
85	HI1544 (C)	2.9	4.6	27.3	10.2	11.2	27.3
86	HI1667[B]	38.2	24.5	28.5	0.0	22.8	38.2
87	HI8498(d) (C)	0.0	0.0	16.6	NG	5.5	16.6
88	HI8713(d) (C)	0.0	0.0	22.2	0.0	5.6	22.2
89	HI1650	17.3	27.7	25.0	20.7	22.7	27.7
90	MP4010 (C)	14.1	17.5	32.0	24.3	22.0	32.0
91	HD2864 (C)	34.2	15.8	36.0	7.9	23.5	36.0
92	MP3336 (C)	33.0	5.0	33.0	0.0	17.7	33.0
93	HD2932 (C)	4.4	25.6	45.0	7.8	20.7	45.0
94	HI1634(I) (C)	24.6	15.4	32.0	8.9	20.2	32.0
95	HD3407[M]	10.5	19.1	26.0	20.4	19.0	26.0
96	CG1029(I) (C)	8.5	5.7	25.0	27.9	16.8	27.9
97	HI8823(d)*	0.0	0.0	26.6	0.0	6.7	26.6
98	GW528	31.5	12.0	11.1	19.2	18.5	31.5
99	DDW47(d) (C)	11.7	0.0	18.3	0.0	7.5	18.3
100	DBW326	44.3	31.6	10.0	10.2	24.0	44.3
100A	Sonalika (Check)	46.4	41.2	76.6	23.8	47.0	76.6
101	UAS475(d)	0.0	0.0	16.6	5.4	5.5	16.6
102	HI8627(d) (C)	0.0	0.0	12.5	0.0	3.1	12.5
103	NIAW3851	1.7	34.2	13.3	13.1	15.6	34.2
104	HI8830(d)	0.5	2.9	11.1	0.0	3.6	11.1
105	CG1036	13.0	22.9	46.6	0.0	20.6	46.6
106	HI1655	4.5	46.6	45.0	4.6	25.2	46.6
107	DBW110 (C)	3.1	29.9	33.3	21.1	21.8	33.3
108	MP3288 (C)	1.9	47.8	46.6	30.3	31.6	47.8
109	DDW55(d)	2.4	10.9	5.0	5.6	6.0	10.9
110	WHD965(d)	0.0	0.0	5.0	0.0	1.3	5.0
111	UAS428(d) (C)	1.9	1.4	6.6	0.0	2.5	6.6
112	HI8826(d)	0.0	0.0	8.3	0.0	2.1	8.3
113	MACS4100(d)	0.0	5.8	10.0	6.1	5.5	10.0
114	MACS3949(d) (C)	0.0	2.1	7.5	16.7	6.6	16.7
115	DDW53(d)	1.2	0.0	8.3	0.0	2.4	8.3
116	NIDW1345(d)	0.6	0.0	12.5	0.0	3.3	12.5
117	MACS6222 (C)	0.0	8.6	15.0	16.5	10.0	16.5
118	MACS4106(d)	0.0	0.0	16.6	0.0	4.2	16.6
119	NIDW1348(d)	0.0	0.0	18.3	0.0	4.6	18.3
120	HI8828(d)	0.6	67.6	17.5	0.0	21.4	67.6
120A	Sonalika (Check)	49.1	60.8	76.6	28.6	53.8	76.6
121	GW322 (C)	30.1	23.1	35.0	14.8	25.7	35.0
122	HI8827(d)	0.0	0.0	11.1	0.0	2.8	11.1
123	DDW48(d)(I) (C)	0.0	0.0	10.0	0.0	2.5	10.0
124	HD3090 (C)	17.8	13.3	30.0	0.0	15.3	30.0

125	HI1633(I) (C)	6.6	4.0	25.0	0.0	8.9	25.0
126	HD2932 (C)	7.5	14.8	35.0	0.0	14.3	35.0
127	RAJ4083 (C)	18.6	37.0	42.8	1.6	25.0	42.8
128	DBW320	3.5	6.9	11.1	0.0	5.4	11.1
129	MACS6774	1.8	31.3	35.0	12.7	20.2	35.0
130	NWS2180#	7.5	9.2	45.0	19.6	20.3	45.0
131	HI1651	0.7	8.2	16.6	13.2	9.7	16.6
132	MP1358*	26.9	36.3	22.2	11.5	24.2	36.3
133	MACS6755	10.1	0.0	28.2	17.5	14.0	28.2
134	HI1605 (C)	8.3	23.7	32.0	30.0	23.5	32.0
135	MACS6753	20.0	38.1	26.6	16.9	25.4	38.1
136	AKDW2997-16(d) (C)	0.0	1.7	12.5	0.0	3.5	12.5
137	NIDW1149(d)(I) (C)	0.5	1.3	18.3	15.8	9.0	18.3
138	NIAW3170 (C)	2.5	31.3	22.2	12.0	17.0	31.3
139	UAS446(d) (C)	0.0	0.0	15.0	1.6	4.1	15.0
140	DBW325	1.2	15.8	16.6	36.4	17.5	36.4
140A	Sonalika (Check)	44.2	47.0	85.0	18.7	48.7	85.0
141	UAS3014	3.3	5.3	35.0	6.4	12.5	35.0
142	MACS5058	0.0	0.0	26.6	0.0	6.7	26.6
143	MACS6222(*a*) (C)	22.2	15.7	16.6	24.4	19.8	24.4
144	DDK1029 (C)	0.0	0.0	12.5	0.0	3.1	12.5
145	DDK1061	0.0	0.0	36.0	0.0	9.0	36.0
146	HW1098 (C)	0.0	0.0	26.6	0.0	6.7	26.6
147	MACS5057	0.0	0.0	22.2	2.5	6.2	22.2
148	DDK1060	0.0	0.0	16.6	0.0	4.2	16.6
149	DBW328*	11.7	0.0	13.3	18.2	10.8	18.2
150	DBW372	2.7	15.9	15.0	7.8	10.4	15.9
151	DBW370	5.4	5.8	18.6	16.7	11.6	18.6
152	DBW327*	7.0	23.4	12.5	23.1	16.5	23.4
153	WH1252*	17.7	19.5	12.5	32.8	20.6	32.8
154	PBW874	14.1	14.6	13.3	9.7	12.9	14.6
155	HD3410	11.6	4.3	18.3	10.6	11.2	18.3
156	DBW332*	17.4	22.7	11.1	43.1	23.6	43.1
157	PBW873	2.9	45.2	16.6	2.9	16.9	45.2
158	DBW371	0.0	27.8	15.0	33.3	19.0	33.3
159	HD3086 (C)	14.4	20.1	66.6	0.0	25.3	66.6
160	DBW333*	2.0	0.0	14.2	12.5	7.2	14.2
160A	Sonalika (Check)	43.8	61.6	80.0	20.8	51.6	80.0
161	PBW872	2.0	11.7	12.5	6.3	8.1	12.5
162	DBW187(I) (C)	0.0	25.2	62.5	11.9	24.9	62.5
163	WH1270(I) (C)	29.8	5.0	11.1	25.0	17.7	29.8
164	DBW303(I) (C)	10.0	25.0	12.5	5.4	13.2	25.0
165	HD3412	9.1	29.6	13.3	12.3	16.1	29.6
166	DBW375	1.2	15.2	16.6	18.8	12.9	18.8
167	DBW374	6.7	0.0	12.5	22.0	10.3	22.0
168	HD3403	2.5	15.0	11.1	11.5	10.0	15.0
169	WH1406	0.0	12.1	10.0	0.0	5.5	12.1
170	HD3413	8.0	32.5	18.6	13.3	18.1	32.5
171	PBW867	59.5	42.9	10.0	34.0	36.6	59.5
172	UP3096	15.6	14.8	12.5	23.3	16.5	23.3
173	WH1404	1.9	23.0	12.5	23.7	15.3	23.7
174	PBW868	1.8	14.7	16.6	19.2	13.1	19.2

175	DBW318	33.3	39.8	15.0	41.5	32.4	41.5
176	DBW378	7.1	17.7	26.6	7.3	14.7	26.6
177	WH1405	22.7	30.6	14.2	12.3	19.9	30.6
178	HD3405	1.5	58.3	11.1	20.9	23.0	58.3
179	DBW377	9.5	30.5	16.6	10.5	16.7	30.5
180	PBW869	14.2	0.0	22.2	1.5	9.5	22.2
180A	Sonalika (Check)	49.1	52.4	83.3	27.3	53.0	83.3
181	PBW871	10.5	35.2	25.0	5.3	19.0	35.2
182	HD3086 (C)	0.0	0.0	65.0	7.2	18.1	65.0
183	DBW376	0.0	0.0	25.0	0.0	6.3	25.0
184	DBW373	23.6	9.4	28.5	13.3	18.7	28.5
185	HD3404	3.8	43.0	53.3	7.7	26.9	53.3
186	DBW187(I) (C)	3.2	39.0	56.6	22.6	30.3	56.6
187	WH1407	3.7	25.7	26.6	12.3	17.1	26.6
188	PBW870	0.0	24.2	45.0	24.4	23.4	45.0
189	UP3095	2.2	17.5	56.6	12.5	22.2	56.6
190	DBW368	32.4	37.9	35.0	15.4	30.2	37.9
191	DBW363	24.4	54.7	42.8	6.1	32.0	54.7
192	DBW369	0.7	19.8	32.0	1.5	13.5	32.0
193	DBW367	8.9	69.0	36.0	20.0	33.5	69.0
194	DBW364	0.0	34.8	45.0	1.3	20.3	45.0
195	Kharchia 65 (C)	0.0	0.0	83.0	24.6	26.9	83.0
196	DBW366	0.0	59.7	28.0	3.9	22.9	59.7
197	KRL210 (C)	0.0	11.8	76.0	3.9	22.9	76.0
198	DBW365	34.6	63.7	28.0	23.5	37.5	63.7
199	K1805	0.0	62.5	75.0	21.2	39.7	75.0
200	KRL19 (C)	4.2	5.6	80.0	6.8	24.1	80.0
200A	Sonalika (Check)	49.4	45.3	86.6	34.2	53.9	86.6

COOPERATORS:

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PROGRAMME 6. POWDERY MILDEW

6.1: POWDERY MILDEW SCREENING NURSERY (PMSN)

Powdery mildew caused by Blumeria graminis (DC.) Speer f. sp. tritici is emerging as an important disease of wheat in NWPZ and NHZ during cool years and may cause heavy losses in susceptible varieties. Keeping in view the importance of powdery mildew, during 2021-22 crop season, 156 entries of AVTs and promising entries were screened against powdery mildew at hot spot locations in NHZ and NWPZ viz., Almora, Pantnagar, Shimla, Dhaulakuan, Wellington, Jammu and Malan. 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 2021-22

Resistant Entries (Av. score 0-3, highest score upto 5)**:**
VL2041, VL2044, HPW 487, VL 3028, HPW 486, VL 2049, NIAW 3922, HI 1650*, UAS 3019, HD 3118(C), HD 3392, PBW 826#*, DBW 252(C), DBW 353, WH 1124(C), HD 2967(C), DBW 359, HD 3043(C), KRL 2021, KRL 210(C), PBW 677(C), PBW 902, PBD 874. Besides these entries, some more entries with the average score upto 3 are VL3029, HPW 483, HS 688, NIDW 1149(d)(C), UAS 478(d), HI 1665, MACS 6795, MP 1377, HD 3388, HD3293(C), JKW 261(I)(C), NIAW 3170(C), HI 8846, HI 8847, HD 3437, but highest score exceeded above 5 at only one centre.

Table 6.1 Powdery mildew severity in PMSN entries evaluated under artificially inoculated conditions at multilocations during 2021-22

S. No.	Entries	Powdery Mildew Score (0-9)								
		Pantnagar	Almora	Dhaulakuan	Malan	Shimla	Wellington	Jammu	Average	HS
1	VL2041	3	3	1	2	5	0	4	3	5
2	VL2043	5	5	7	5	7	0	6	5	7
3	VL2044	1	5	1	5	5	0	3	3	5
4	HD3402	7	7	5	6	7	0	5	5	7
5	HPW481	5	7	5	5	5	9	5	6	9
6	HPW487	3	3	3	3	3	2	4	3	4
7	HPW488	3	7	5	6	5	9	6	6	9
8	HS692	7	7	7	4	3	2	4	5	7
9	HS693	7	9	9	7	7	9	4	7	9
10	HS694	7	7	5	8	5	2	5	6	8
11	UP3114	5	7	7	4	7	0	2	5	7
12	VL3028	3	1	3	2	5	1	5	3	5
13	VL3029	3	1	5	2	7	0	3	3	7
14	VL3030	3	3	5	4	7	2	4	4	7
15	HPW483	1	1	1	4	5	2	6	3	6
16	HPW484	1	5	1	5	7	1	4	3	7
17	HPW485	1	3	1	8	3	9	5	4	9
18	HPW486	3	1	3	4	3	0	4	3	4
19	HS688	3	1	3	6	5	1	1	3	6
20	HS689	5	5	7	4	5	1	5	5	7
20A	Infector	9	7	9	9	7	9	8	8	9
21	HS690	3	7	1	9	7	9	4	6	9
22	HS691	7	5	7	9	7	9	1	6	9

23	SKW362	5	5	7	7	7	9	0	6	9
24	UP3113	3	3	1	4	7	1	5	3	7
25	VL2047	3	1	3	6	7	0	6	4	7
26	VL2048	1	3	1	5	7	9	7	5	9
27	VL2049	3	1	3	4	3	3	4	3	4
28	VL2050	3	1	3	5	7	9	4	5	9
29	HS507(C)	3	7	5	4	7	2	5	5	7
30	HS562(C)	7	1	7	9	7	9	5	6	9
31	HS490(C)	5	1	5	4	3	2	5	4	5
32	HPW349(C)	5	1	3	4	5	3	6	4	6
33	VL907(C)	3	1	1	6	7	2	4	3	7
34	VL892(C)	5	3	3	5	7	3	3	4	7
35	DBW377	7	1	7	4	7	3	4	5	7
36	PBW870	3	3	5	9	7	9	3	6	9
37	DBW372	3	7	3	4	5	3	3	4	7
38	DBW318	5	1	5	4	5	9	3	5	9
39	DBW327 (C)	5	5	7	4	7	3	5	5	7
40	DBW332(C)	5	3	5	2	7	9	4	5	9
40A	Infector	7	5	7	8	7	9	8	7	9
41	DBW370	5	3	5	4	7	9	2	5	9
42	DBW371	5	5	5	5	7	3	6	5	7
43	DBW373	3	7	3	4	7	9	4	5	9
44	PBW868	7	7	9	5	7	9	5	7	9
45	PBW871	3	1	3	5	7	9	4	5	9
46	PBW872	5	5	3	9	7	9	4	6	9
47	HD3090(C)	7	1	9	5	5	2	3	5	9
48	HI1633(C)	5	5	5	4	5	9	4	5	9
49	RAJ4083(C)	3	5	3	5	7	9	7	6	9
50	DBW320#*	5	3	3	7	7	9	4	5	9
51	MP1380#	3	3	1	4	7	9	7	5	9
52	DBW407[B]	3	7	1	5	5	9	6	5	9
53	DDW48(d)(C)	7	5	7	7	9	0	6	6	9
54	HI8826(d)*	5	5	3	9	9	3	6	6	9
55	MACS4100(d)*	3	3	1	9	5	1	4	4	9
56	MP1378	5	3	3	9	7	9	2	5	9
57	MP3552	3	1	3	5	5	0	5	3	5
58	UAS3015	5	3	5	2	3	9	4	4	9
59	HI8839(d)	5	5	7	7	7	0	6	5	7
60	HI8840(d)	5	3	5	9	7	9	4	6	9
60A	Infector	7	5	9	9	7	9	9	8	9
61	MP1358(I)(C)	3	1	3	5	3	9	4	4	9
62	NIAW3922	3	1	1	4	3	0	5	2	5
63	NIDW1149(d)(C)	1	3	1	2	7	0	4	3	7
64	UAS478(d)	1	1	1	4	7	0	3	2	7
65	DBW352#	3	1	3	4	5	2	4	3	5
66	GW513(I)(C)	1	1	1	9	7	9	4	5	9
67	GW547[B]	5	1	5	7	5	2	5	4	7
68	HI1636(I)(C)	3	1	3	9	5	9	6	5	9
69	HI1650*	3	3	3	2	5	1	4	3	5
70	MACS6768*	5	3	5	4	7	2	4	4	7
71	MP3535*	3	3	5	5	7	1	4	4	7
72	NWS2194#	5	5	5	2	7	2	2	4	7
73	HI1665	3	1	3	5	7	0	1	3	7

74	NIAW4028	3	3	3	5	5	1	4	3	5
75	CG1036*	5	0	7	5	5	1	6	4	7
76	CG1040	3	3	3	6	5	0	4	3	6
77	DDW47(d)(C)	3	0	3	7	7	3	5	4	7
78	DDW55(d)^{Q}*	1	0	1	7	7	0	5	3	7
79	GW532	7	0	9	4	3	9	4	5	9
80	HD3401	5	0	3	4	7	3	4	4	7
80A	Infector	9	5	9	9	7	9	7	8	9
81	HI1655^{Q}*	5	0	3	4	5	0	6	3	6
82	HI1666	5	3	5	4	5	0	0	3	5
83	HI8823(d)(I)(C)	3	3	5	6	7	0	5	4	7
84	HI8830(d)*	5	3	5	3	5	9	5	5	9
85	MACS6795	3	0	1	4	5	0	6	3	6
86	MP1377	1	0	1	5	7	0	5	3	7
87	MP3288(C)	3	3	3	5	5	9	4	5	9
88	UAS3019	3	0	3	2	5	5	2	3	5
89	DBW316#*	1	3	1	5	5	9	2	4	9
90	HD3118(C)	3	1	3	4	5	0	2	3	5
91	HD3392	1	1	1	3	5	0	3	2	5
92	HI1621(C)	3	3	5	5	5	0	6	4	6
93	PBW833*	1	1	0	7	7	3	4	3	7
94	PBW835^{Q}*	3	1	1	5	5	9	5	4	9
95	HD3249(C)	0	3	0	7	7	0	6	3	7
96	PBW826#*	3	1	3	5	5	0	4	3	5
97	HD3388	0	1	0	5	5	1	6	3	6
98	PBW852	3	1	3	5	7	0	4	3	7
99	DBW252(C)	1	1	0	2	3	0	5	2	5
100	HD3171(C)	3	0	3	2	7	0	6	3	7
100A	Infector	7	7	7	8	7	9	7	7	9
101	HD3293(C)	3	1	3	3	7	0	3	3	7
102	DBW353	0	0	1	5	5	0	5	2	5
103	JKW261(I)(C)	0	0	0	5	7	0	3	2	7
104	PBW771(C)	0	3	0	6	7	9	4	4	9
105	WH1124(C)	1	0	1	5	5	0	4	2	5
106	HD2967(C)	0	3	0	4	5	2	4	3	5
107	HD3386	0	7	0	4	7	9	5	5	9
108	DBW359	0	0	0	4	5	3	4	2	5
109	DBW358	1	5	1	5	5	9	5	4	9
110	NIAW3170(C)	1	0	1	4	3	9	2	3	9
111	HD3043(C)	0	1	0	4	5	0	2	2	5
112	HD3369*	0	5	0	7	7	1	6	4	7
113	HD3397	3	5	5	5	7	3	6	5	7
114	HD3400	5	5	5	9	7	9	4	6	9
115	HD3418	1	7	1	5	7	9	6	5	9
116	HI1628(C)	3	5	3	7	7	9	5	6	9
117	HI1653*	3	3	3	9	7	9	4	5	9
118	HI1654*	3	0	1	7	7	9	2	4	9
119	HUW838(I)(C)	3	0	3	9	7	9	3	5	9
120	UP3090	7	1	7	9	7	9	2	6	9
120A	Infector	9	5	9	9	7	9	7	8	9
121	WH1402	5	3	5	7	7	9	4	6	9
122	WH1403	3	3	3	5	7	9	5	5	9
123	DBW365	7	3	9	5	5	9	5	6	9

124	DBW366	5	3	3	6	5	9	4	5	9
125	DBW402	3	3	3	4	5	9	6	5	9
126	HD3415	7	0	7	6	7	0	3	4	7
127	Kharchia65(C)	5	0	3	9	5	0	4	4	9
128	KRL19(C)	3	3	1	7	5	9	1	4	9
129	KRL2006	5	0	5	6	5	1	4	4	6
130	UAS310	3	3	3	4	5	0	6	3	6
131	KRL2021	3	0	3	2	5	0	4	2	5
132	KRL210(C)	1	3	1	5	5	0	5	3	5
133	RAJ4565	5	5	3	4	7	1	5	4	7
134	HD3438	3	7	1	4	5	9	5	5	9
135	HD3439	0	3	0	5	5	9	3	4	9
136	CG1029(C)	5	0	3	7	7	9	4	5	9
137	HD3407*	3	3	1	9	5	2	5	4	9
138	HI1634(C)	7		7	5	5	2	4	5	7
139	MP3336(C)	3	7	1	2	3	1	5	3	7
140	HI8498(C)	3	5	3	5	7	0	0	3	7
140A	Infector	7	5	7	8	7	1	1	5	8
141	HI8759(C)	0	7	1	5	5	0	5	3	7
142	HI8846	0	7	1	2	5	0	4	3	7
143	HI8847	0	5	0	3	5	0	6	3	6
144	HD2733(C)	1	5	0	5	7	2	7	4	7
145	HD3411*	0	3	0	7	7	9	5	4	9
146	HD3440	3	3	1	9	7	9	5	5	9
147	HD3406*	3	0	3	5	7	1	6	4	7
148	HD3436	5	1	5	5	7	9	4	5	9
149	HD3437	3	0	1	3	5	9	0	3	9
150	PBW175(C)	3	3	3	2	7	9	2	4	9
151	PBW677(C)	3	0	5	5	5	1	2	3	5
152	PBW901	5	0	1	5	7	0	4	3	7
153	PBW902	3	0	3	5	5	0	4	3	5
154	PBD 874	-	0	5	2	3	0	2	2	5
155	PBW 374	5	0	3	5	5	9	5	5	9
156	PBW 868	3	3	5	6	5	0	6	4	6
156A	Infector	9	5	9	9	7	9	7	8	9

COOPERATORS:

NAME	**CENTRE**
K. K. MISHRA	ALMORA
S.C. BHARDWAJ, O.P.GANGWAR, PARMOD PARSAD	SHIMLA
SHIWANI DHIMAN	DHAULAKUAN
SACHIN UPMANYU	MALAN
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RAKESH DEVLASH	BAJAURA
M.K. PANDEY	JAMMU
P NALLATHAMBI	WELLINGTON
SUDHEER KUMAR, PL KASHYAP AND RAVINDRA KUMAR	IIWBR, KARNAL (COORDINATING UNIT)

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 Delhi and Gurdaspur. The data from Gurdaspur was not included due to low disease. Disease scoring scale (0-5) has been used. A total 153 entries were evaluated and entry wise reaction of AVTs entries (2021-22) has been given in Tables 7.1.

Table7.1. Performance of AVTs material against head scab (% incidence) under multilocational testing during 2021-22

S. No.	Entries	Disease Grade (0-5)
		Delhi
1	VL2041	3
2	VL2043	4
3	VL2044	4
4	HD3402	4
5	HPW481	4
6	HPW487	5
7	HPW488	4
8	HS692	4
9	HS693	2
10	HS694	4
11	UP3114	3
12	VL3028	4
13	VL3029	4
14	VL3030	5
15	HPW483	4
16	HPW484	4
17	HPW485	3
18	HPW486	3
19	HS688	4
20	HS689	3
20A	Infector	4
21	HS690	3
22	HS691	3
23	SKW362	5
24	UP3113	5
25	VL2047	4
26	VL2048	4
27	VL2049	5
28	VL2050	3
29	HS507(C)	1
30	HS562(C)	3
31	HS490(C)	3
32	HPW349(C)	4
33	VL907(C)	4
34	VL892(C)	4
35	DBW377	4
36	PBW870	4
37	DBW372	4
38	DBW318	2
39	DBW327 (C)	4
40	DBW332(C)	4
40A	Infector	5
41	DBW370	4
42	DBW371	4
43	DBW373	4
44	PBW868	4
45	PBW871	5
46	PBW872	5
47	HD3090(C)	4
48	HI1633(C)	4
49	RAJ4083(C)	5
50	DBW320#*	5
51	MP1380#	5
52	DBW407^{B}	3
53	DDW48(d)(C)	4
54	HI8826(d)*	3
55	MACS4100(d)*	4
56	MP1378	5
57	MP3552	5
58	UAS3015	4
59	HI8839(d)	5
60	HI8840(d)	3
60A	Infector	4
61	MP1358(I)(C)	4
62	NIAW3922	4
63	NIDW1149(d)(C)	3
64	UAS478(d)	3
65	DBW352#	4
66	GW513(I)(C)	5
67	GW547^{B}	4
68	HI1636(I)(C)	5
69	HI1650*	5
70	MACS6768*	4
71	MP3535*	4
72	NWS2194#	4
73	HI1665	4
74	NIAW4028	5
75	CG1036*	5
76	CG1040	4

77	DDW47(d)(C)	3
78	DDW55(d)^{Q}*	5
79	GW532	4
80	HD3401	5
80A	Infector	5
81	HI1655^{Q}*	5
82	HI1666	4
83	HI8823(d)(I)(C)	4
84	HI8830(d)*	4
85	MACS6795	3
86	MP1377	5
87	MP3288(C)	4
88	UAS3019	4
89	DBW316#*	4
90	HD3118(C)	5
91	HD3392	5
92	HI1621(C)	4
93	PBW833*	4
94	PBW835^{Q}*	5
95	HD3249(C)	5
96	PBW826#*	5
97	HD3388	3
98	PBW852	5
99	DBW252(C)	5
100	HD3171(C)	5
100A	Infector	5
101	HD3293(C)	5
102	DBW353	5
103	JKW261(I)(C)	5
104	PBW771(C)	5
105	WH1124(C)	5
106	HD2967(C)	4
107	HD3386	5
108	DBW359	5
109	DBW358	5
110	NIAW3170(C)	4
111	HD3043(C)	5
112	HD3369*	5
113	HD3397	5
114	HD3400	5
115	HD3418	5
116	HI1628(C)	3
117	HI1653*	5
118	HI1654*	5
119	HUW838(I)(C)	5
120	UP3090	5
120A	Infector	4
121	WH1402	4
122	WH1403	4
123	DBW365	5
124	DBW366	5
125	DBW402	4
126	HD3415	4
127	Kharchia65(C)	4
128	KRL19(C)	4
129	KRL2006	5
130	UAS310	4
131	KRL2021	4
132	KRL210(C)	5
133	RAJ4565	5
134	HD3438	5
135	HD3439	4
136	CG1029(C)	4
137	HD3407*	4
138	HI1634(C)	4
139	MP3336(C)	4
140	HI8498(C)	5
140A	Infector	5
141	HI8759(C)	5
142	HI8846	5
143	HI8847	5
144	HD2733(C)	3
145	HD3411*	5
146	HD3440	5
147	HD3406*	5
148	HD3436	5
149	HD3437	3
150	PBW175(C)	5
151	PBW677(C)	3
152	PBW901	3
153	PBW902	4
153A	Infector	5

COOPERATORS

NAME	**CENTRE**
M.S. SAHARAN	DELHI
JASPAL KAUR	GURDASPUR
SUDHEER KUMAR, P.L. KASHYAP AND RAVINDRA KUMAR	KARNAL (COORDINATING UNIT)

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 centres. A total 153 entries were screened and entry-wise reaction of AVTs (2021-22) has been given in Table 7.2. Data for 2nd year entries has also been given in Table 1.3.

Free from infection: Nil

Resistant (average incidence upto 5%):
VL2041, VL2043, VL2044, HD3402, HPW481, HPW487, HPW488, HS693, UP3114, VL3028, VL3029, VL3030, HPW483, HPW484, HPW485, HPW486, HS688, SKW362, UP3113, VL2047, VL2050, HS507(C), HS562(C), PBW870, DBW318, DBW327 (C), DBW332(C), PBW868, MP1380#, DBW407B, DDW48(d)(C), MACS4100(d)*, MP1378, MP3552, UAS3015, HI8839(d), MP1358(I)(C), NIAW3922, NIDW1149(d)(C), UAS478(d), DBW352#, GW513(I)(C), GW547B, MACS6768*, MP3535*, NWS2194#, HI1665, NIAW4028, CG1036*, CG1040, DDW47(d)(C), DDW55(d)Q*, GW532, HD3401, HI1655Q*, HI8823(d)(I)(C), HI8830(d)*, MACS6795, MP1377, MP3288(C), DBW316#*, HD3118(C), HI1621(C), PBW833*, HD3249(C), PBW826#*, PBW852, HD3171(C), HD3293(C), WH1124(C), DBW358, NIAW3170(C), HD3043(C), HD3369*, HI1654*, HUW838(I)(C), WH1402, WH1403, DBW365, DBW366, DBW402, KRL2006, UAS310, KRL210(C), RAJ4565, HD3438, HD3407*, HI1634(C), MP3336(C), HI8498(C), HI8759(C), HI8846, HI8847, HD2733(C), HD3411*, HD3440, HD3406*, HD3436, HD3437, PBW175(C), PBW677(C), PBW902. The detail is given in Table 7.2 below:

Table 7.2. Performance of AVTs entries against flag smut (% incidence) under multilocational testing during 2021-22

S. No.	Entries	Flage smut screening nursery, 2021-22				
		Ludhiana	Durgapura	Hisar	Average	HS
1	VL2041	1.8	2.0	6.6	3.5	6.6
2	VL2043	1.7	0.8	8.3	3.6	8.3
3	VL2044	1.9	2.3	9.1	4.5	9.1
4	HD3402	1.4	0.0	10.0	3.8	10.0
5	HPW481	2.1	3.3	6.2	3.9	6.2
6	HPW487	-	0.6	5.0	2.8	5.0
7	HPW488	1.9	1.4	9.1	4.1	9.1
8	HS692	14.0	0.0	8.2	7.4	14.0
9	HS693	2.6	0.0	11.2	4.6	11.2
10	HS694	14.7	1.8	7.4	8.0	14.7
11	UP3114	2.0	4.9	6.3	4.4	6.3
12	VL3028	-	0.6	5.0	2.8	5.0
13	VL3029	-	0.0	8.2	4.1	8.2
14	VL3030	1.6	3.1	9.3	4.7	9.3
15	HPW483	-	1.3	8.1	4.7	8.1
16	HPW484	1.9	2.0	10.0	4.6	10.0
17	HPW485	-	0.0	8.6	4.3	8.6
18	HPW486	-	0.0	9.1	4.6	9.1
19	HS688	-	0.0	10.0	5.0	10.0
20	HS689	-	2.1	11.2	6.6	11.2
20A	Infector	21.7	16.0	23.3	20.3	23.3
21	HS690	5.9	3.9	11.6	7.1	11.6
22	HS691	10.3	0.0	8.1	6.1	10.3
23	SKW362	2.1	2.2	9.3	4.6	9.3

24	UP3113	3.9	0.6	10.0	4.9	10.0
25	VL2047	-	0.0	9.2	4.6	9.2
26	VL2048	-	2.6	8.3	5.5	8.3
27	VL2049	7.1	4.2	12.5	8.0	12.5
28	VL2050	2.7	0.7	11.1	4.8	11.1
29	HS507(C)	-	0.0	8.3	4.2	8.3
30	HS562(C)	1.8	1.3	9.1	4.1	9.1
31	HS490(C)	4.0	0.0	13.3	5.8	13.3
32	HPW349(C)	-	0.0	11.1	5.6	11.1
33	VL907(C)	-	1.3	10.0	5.7	10.0
34	VL892(C)	-	0.0	12.5	6.3	12.5
35	DBW377	-	2.1	8.3	5.2	8.3
36	PBW870	6.3	0.0	6.2	4.2	6.3
37	DBW372	-	2.9	11.1	7.0	11.1
38	DBW318	-	0.0	9.4	4.7	9.4
39	DBW327 (C)	-	0.0	7.3	3.7	7.3
40	DBW332(C)	1.8	3.9	8.6	4.7	8.6
40A	Infector	17.4	17.0	28.2	20.9	28.2
41	DBW370	-	4.1	11.3	7.7	11.3
42	DBW371	-	0.0	12.5	6.3	12.5
43	DBW373	-	2.1	9.3	5.7	9.3
44	PBW868	-	0.0	3.3	1.7	3.3
45	PBW871	4.2	2.8	12.5	6.5	12.5
46	PBW872	-	6.5	9.6	8.1	9.6
47	HD3090(C)	7.4	1.5	8.3	5.7	8.3
48	HI1633(C)	8.6	0.0	8.2	5.6	8.6
49	RAJ4083(C)	-	2.3	9.0	5.7	9.0
50	DBW320#*	-	0.7	10.0	5.4	10.0
51	MP1380#	-	0.0	9.1	4.6	9.1
52	DBW407[B]	2.7	1.5	7.3	3.8	7.3
53	DDW48(d)(C)	-	0.0	6.6	3.3	6.6
54	HI8826(d)*	-	0.0	1.5	0.8	1.5
55	MACS4100(d)*	3.9	0.0	2.6	2.2	3.9
56	MP1378	2.9	5.0	1.6	3.2	5.0
57	MP3552	5.6	1.3	4.5	3.8	5.6
58	UAS3015	-	4.1	2.5	3.3	4.1
59	HI8839(d)	-	5.8	3.2	4.5	5.8
60	HI8840(d)	-	2.0	8.3	5.1	8.3
60A	Infector	29.4	11.0	24.0	21.5	29.4
61	MP1358(I)(C)	-	1.4	4.2	2.8	4.2
62	NIAW3922	5.6	3.0	5.0	4.5	5.6
63	NIDW1149(d)(C)	-	0.0	5.0	2.5	5.0
64	UAS478(d)	-	0.0	3.5	1.8	3.5
65	DBW352#	-	0.0	2.6	1.3	2.6
66	GW513(I)(C)	-	1.4	8.5	5.0	8.5
67	GW547[B]	2.0	1.3	9.6	4.3	9.6
68	HI1636(I)(C)	-	5.9	11.5	8.7	11.5
69	HI1650*	4.0	0.0	12.2	5.4	12.2
70	MACS6768*	-	0.0	7.3	3.7	7.3
71	MP3535*	2.9	0.0	6.2	3.0	6.2
72	NWS2194#	-	0.0	6.5	3.3	6.5
73	HI1665	-	0.0	4.5	2.3	4.5
74	NIAW4028	-	1.7	4.5	3.1	4.5

75	CG1036*	4.4	0.0	5.0	3.1	5.0
76	CG1040	-	0.6	4.3	2.5	4.3
77	DDW47(d)(C)	-	1.2	5.0	3.1	5.0
78	DDW55(d)^{Q}*	-	0.0	4.2	2.1	4.2
79	GW532	-	1.9	4.3	3.1	4.3
80	HD3401	-	1.2	7.1	4.2	7.1
80A	Infector	24.0	20.3	21.1	21.8	24.0
81	HI1655^{Q}*	-	2.3	6.7	4.5	6.7
82	HI1666	10.5	1.4	7.2	6.4	10.5
83	HI8823(d)(I)(C)	-	0.0	3.5	1.8	3.5
84	HI8830(d)*	-	0.0	2.5	1.3	2.5
85	MACS6795	-	1.4	5.0	3.2	5.0
86	MP1377	-	1.3	7.1	4.2	7.1
87	MP3288(C)	4.8	0.0	8.2	4.3	8.2
88	UAS3019	-	4.1	6.6	5.3	6.6
89	DBW316#*	-	2.9	5.0	3.9	5.0
90	HD3118(C)	-	0.7	4.5	2.6	4.5
91	HD3392	2.2	6.2	7.2	5.2	7.2
92	HI1621(C)	-	0.0	8.3	4.2	8.3
93	PBW833*	-	0.0	9.1	4.6	9.1
94	PBW835^{Q}*	1.9	3.3	11.1	5.4	11.1
95	HD3249(C)	-	0.0	2.5	1.3	2.5
96	PBW826#*	-	1.5	7.3	4.4	7.3
97	HD3388	-	3.7	6.6	5.2	6.6
98	PBW852	-	0.7	5.0	2.9	5.0
99	DBW252(C)	8.1	0.7	7.5	5.4	8.1
100	HD3171(C)	-	1.3	5.0	3.2	5.0
100A	Infector	16.7	11.7	25.0	17.8	25.0
101	HD3293(C)	-	1.3	5.5	3.4	5.5
102	DBW353	-	3.2	7.5	5.4	7.5
103	JKW261(I)(C)	2.8	4.0	8.6	5.2	8.6
104	PBW771(C)	31.6	2.1	7.3	13.7	31.6
105	WH1124(C)	2.1	0.0	9.1	3.7	9.1
106	HD2967(C)	-	0.7	12.5	6.6	12.5
107	HD3386	-	4.4	11.5	7.9	11.5
108	DBW359	-	1.8	9.6	5.7	9.6
109	DBW358	5.3	0.0	8.7	4.7	8.7
110	NIAW3170(C)	5.4	0.6	6.3	4.1	6.3
111	HD3043(C)	-	0.0	5.3	2.7	5.3
112	HD3369*	-	0.0	6.8	3.4	6.8
113	HD3397	-	3.0	7.3	5.2	7.3
114	HD3400	-	1.9	8.5	5.2	8.5
115	HD3418	-	2.4	9.5	6.0	9.5
116	HI1628(C)	-	0.7	11.6	6.1	11.6
117	HI1653*	-	1.3	10.0	5.7	10.0
118	HI1654*	-	0.0	8.5	4.3	8.5
119	HUW838(I)(C)	-	0.0	9.3	4.7	9.3
120	UP3090	-	0.7	11.7	6.2	11.7
120A	Infector	19.1	23.9	26.6	23.2	26.6
121	WH1402	-	2.0	6.6	4.3	6.6
122	WH1403	-	0.0	8.3	4.2	8.3
123	DBW365	-	0.0	9.1	4.6	9.1
124	DBW366	-	1.4	7.2	4.3	7.2

125	DBW402	-	0.7	8.3	4.5	8.3
126	HD3415	9.1	1.3	7.1	5.8	9.1
127	Kharchia65(C)	9.7	2.8	14.2	8.9	14.2
128	KRL19(C)	-	0.7	10.0	5.3	10.0
129	KRL2006	-	0.0	9.1	4.6	9.1
130	UAS310	-	1.0	8.3	4.7	8.3
131	KRL2021	15.6	1.2	7.2	8.0	15.6
132	KRL210(C)	-	2.4	6.5	4.5	6.5
133	RAJ4565	1.4	0.8	5.0	2.4	5.0
134	HD3438	-	0.0	5.0	2.5	5.0
135	HD3439	19.5	1.4	5.0	8.6	19.5
136	CG1029(C)	10.0	0.0	12.5	7.5	12.5
137	HD3407*	4.2	0.0	6.6	3.6	6.6
138	HI1634(C)	8.3	1.4	5.0	4.9	8.3
139	MP3336(C)	7.4	2.4	4.5	4.8	7.4
140	HI8498(C)	-	0.0	3.5	1.8	3.5
140A	Infector	18.2	22.4	26.6	22.4	26.6
141	HI8759(C)	-	0.0	4.5	2.3	4.5
142	HI8846	-	0.0	3.3	1.7	3.3
143	HI8847	-	0.0	3.5	1.8	3.5
144	HD2733(C)	2.3	1.7	5.0	3.0	5.0
145	HD3411*	4.7	2.4	6.6	4.6	6.6
146	HD3440	-	0.6	6.7	3.7	6.7
147	HD3406*	4.6	0.0	5.0	3.2	5.0
148	HD3436	2.6	5.1	7.2	5.0	7.2
149	HD3437	2.2	2.0	6.8	3.7	6.8
150	PBW175(C)	-	2.7	6.7	4.7	6.7
151	PBW677(C)	-	0.7	5.0	2.9	5.0
152	PBW901	10.5	2.0	5.0	5.9	10.5
153	PBW902	1.6	0.0	6.6	2.7	6.6

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7.3 FOOT ROT (*Sclerotium rolfsii*)

AVT entries were evaluated at Dharwad centre. AVTs (2021-22) were evaluated against foot rot and entry 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 2021-22

Free: DBW252(C), HI 1628(C), HD 2733(C)

Resistant (0.1-10 % disease):
HS 692, HS 689, VL 2047, VL 907(C), VL 892(C), GW 513(I)(C), UAS 3019, HD 3397, CG 1029(C)

Table 7.3. Performance of AVTs material against foot rot (% incidence) at Dharwad during 2021-22

S. No.	Entries	Foot rot incidence (%)
		Dharwad
1	VL2041	25.0
2	VL2043	15.0
3	VL2044	33.3
4	HD3402	11.1
5	HPW481	25.0
6	HPW487	30.0
7	HPW488	27.8
8	HS692	7.1
9	HS693	27.8
10	HS694	33.3
11	UP3114	18.8
12	VL3028	31.3
13	VL3029	16.7
14	VL3030	25.0
15	HPW483	25.0
16	HPW484	35.0
17	HPW485	22.2
18	HPW486	30.0
19	HS688	35.0
20	HS689	5.6
21	HS690	18.8
22	HS691	30.0
23	SKW362	30.0
24	UP3113	22.2
25	VL2047	6.3
26	VL2048	25.0
27	VL2049	25.0
28	VL2050	30.0
29	HS507(C)	27.8
30	HS562(C)	11.1
31	HS490(C)	27.8
32	HPW349(C)	31.3
33	VL907(C)	7.1
34	VL892(C)	7.1
35	DBW377	31.3
36	PBW870	25.0
37	DBW372	22.2
38	DBW318	30.0
39	DBW327 (C)	27.8
40	DBW332(C)	22.2
41	DBW370	27.8
42	DBW371	35.0
43	DBW373	20.0
44	PBW868	25.0
45	PBW871	25.0
46	PBW872	20.0
47	HD3090(C)	27.8
48	HI1633(C)	27.8
49	RAJ4083(C)	25.0
50	DBW320#*	22.2
51	MP1380#	30.0
52	DBW407^{B}	21.4
53	DDW48(d)(C)	18.8
54	HI8826(d)*	14.3
55	MACS4100(d)*	33.3
56	MP1378	30.0
57	MP3552	25.0
58	UAS3015	30.0
59	HI8839(d)	33.3
60	HI8840(d)	27.8
61	MP1358(I)(C)	25.0
62	NIAW3922	25.0
63	NIDW1149(d)(C)	27.8
64	UAS478(d)	18.8
65	DBW352#	20.0
66	GW513(I)(C)	8.3
67	GW547^{B}	15.0
68	HI1636(I)(C)	25.0
69	HI1650*	27.8
70	MACS6768*	27.8
71	MP3535*	16.7
72	NWS2194#	11.1
73	HI1665	25.0
74	NIAW4028	33.3
75	CG1036*	27.8
76	CG1040	31.3
77	DDW47(d)(C)	25.0
78	DDW55(d)^{Q}*	27.8
79	GW532	20.0
80	HD3401	20.0
81	HI1655^{Q}*	30.0
82	HI1666	25.0
83	HI8823(d)(I)(C)	22.2
84	HI8830(d)*	11.1
85	MACS6795	35.0
86	MP1377	25.0
87	MP3288(C)	22.2
88	UAS3019	6.3
89	DBW316#*	35.0
90	HD3118(C)	20.0
91	HD3392	22.2
92	HI1621(C)	33.3
93	PBW833*	35.0
94	PBW835^{Q}*	16.7
95	HD3249(C)	33.3
96	PBW826#*	16.7
97	HD3388	25.0

98	PBW852	16.7
99	DBW252(C)	0.0
100	HD3171(C)	25.0
101	HD3293(C)	20.0
102	DBW353	22.2
103	JKW261(I)(C)	33.3
104	PBW771(C)	22.2
105	WH1124(C)	25.0
106	HD2967(C)	33.3
107	HD3386	27.8
108	DBW359	30.0
109	DBW358	11.1
110	NIAW3170(C)	30.0
111	HD3043(C)	16.7
112	HD3369*	35.0
113	HD3397	6.3
114	HD3400	25.0
115	HD3418	30.0
116	HI1628(C)	0.0
117	HI1653*	25.0
118	HI1654*	30.0
119	HUW838(I)(C)	25.0
120	UP3090	27.8
121	WH1402	16.7
122	WH1403	27.8
123	DBW365	16.7
124	DBW366	20.0
125	DBW402	25.0
126	HD3415	25.0
127	Kharchia65(C)	31.3
128	KRL19(C)	25.0
129	KRL2006	27.8
130	UAS310	30.0
131	KRL2021	25.0
132	KRL210(C)	30.0
133	RAJ4565	20.0
134	HD3438	27.8
135	HD3439	35.0
136	CG1029(C)	6.3
137	HD3407*	30.0
138	HI1634(C)	33.3
139	MP3336(C)	25.0
140	HI8498(C)	27.8
141	HI8759(C)	33.3
142	HI8846	30.0
143	HI8847	25.0
144	HD2733(C)	0.0
145	HD3411*	25.0
146	HD3440	33.3
147	HD3406*	28.6
148	HD3436	30.0
149	HD3437	30.0
150	PBW175(C)	33.3
151	PBW677(C)	30.0
152	PBW901	16.7
153	PBW902	30.0

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

Test Locations: Almora, Bajoura and Malan

A total 34 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 2021-22

Free: Nil
Resistant (0.1-10 % disease):
HPW 481, HPW 488, VL 3029, HPW 483, HPW 484, HPW 485, HS 689, UP 3113, VL 2047, VL 2048, HS 562(C), HS 490(C), VL 907(C).

Table 7.4. Performance of AVT material against hill bunt (% incidence) under multilocational testing during 2021-22

S. No.	Entries	Hill bunt incidence (%)				
		Almora	Bajaura	Malan	HS	AV.
1	VL2041	2.7	20.2	17.5	20.2	13.5
2	VL2043	6.7	25.4	16.4	25.4	16.2
3	VL2044	12.6	30.0	8.0	30.0	16.9
4	HD3402	5.1	31.0	11.5	31.0	15.9
5	HPW481	0.0	2.8	6.7	6.7	3.2
6	HPW487	14.4	25.5	9.8	25.5	16.6
7	HPW488	10.5	0.0	6.9	10.5	5.8
8	HS692	21.1	32.3	7.9	32.3	20.4
9	HS693	10.8	27.7	10.2	27.7	16.2
10	HS694	12.4	23.3	13.3	23.3	16.3
11	UP3114	8.3	38.2	5.9	38.2	17.5
12	VL3028	4.8	23.2	10.5	23.2	12.8
13	VL3029	1.5	16.9	10.0	16.9	9.5
14	VL3030	2.4	22.6	6.4	22.6	10.5
15	HPW483	2.9	4.3	6.1	6.1	4.4
16	HPW484	0.0	3.4	8.2	8.2	3.9
17	HPW485	0.0	7.8	8.6	8.6	5.5
18	HPW486	9.9	24.2	4.4	24.2	12.9
19	HS688	12.5	37.3	23.3	37.3	24.4
20	HS689	6.0	6.9	8.6	8.6	7.2
21	HS690	23.3	28.9	7.5	28.9	19.9
22	HS691	24.8	28.5	10.3	28.5	21.2
23	SKW362	2.5	32.5	13.7	32.5	16.2
24	UP3113	8.6	6.1	8.5	8.6	7.7
25	VL2047	0.0	3.5	7.3	7.3	3.6
26	VL2048	1.7	16.7	9.2	16.7	9.2
27	VL2049	1.5	37.5	9.5	37.5	16.2
28	VL2050	5.1	55.4	19.4	55.4	26.7
29	HS507(C)	0.8	29.1	11.4	29.1	13.8
30	HS562(C)	5.7	2.9	7.7	7.7	5.4
31	HS490(C)	4.0	3.9	9.8	9.8	5.9
32	HPW349(C)	4.0	27.9	4.0	27.9	12.0
33	VL907(C)	6.7	4.8	7.5	7.5	6.3
34	VL892(C)	34.7	18.3	17.5	34.7	23.5

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PROGRAMME 8. CROP HEALTH

8.1 Pre- Harvest Crop Health Monitoring

Wheat and barley crop health was monitored by regular surveys conducted with major emphasis on occurrence of yellow rust in NWPZ and surveillance for wheat blast near Bangaladesh boarder. The 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. 27 (Issues 1 to 5) which was issued during the crop season and also uploaded on ICAR-IIWBR website (www.iiwbr.icar.gov.in). The first appearance of yellow rust of wheat is reported from village Nikku Nangal at Sh Anandpur Sahib block of Rupnagar district of Punjab on 14.1.2022 on verities HD2967 and HD 3086. In month of Feburary the incidence of stripe rust was observed in farmers field in Anandpur Sahib block, Kiratpur Sahib block, Gurdaspur, Sangrur and Pathankot areas of Punjab and some villages in Yammunanagar and Karnal district of Haryana in the end of the month. Yellow rust infection was also observed in some areas of Kangra district of Himachal Pradesh.

Besides the yellow rust, leaf rust infection was first recorded at very low incidence in few farmers' fields in the Dharwad and Belagavi districts of Karnataka during the surveys conducted on 22.12.2021. Slight increase in the leaf rust severity and distribution has also been observed in Dharwad, Belgaum Bagalkote districts in the month of January. First natural incidence of leaf rust in Maharashtra has been recorded in farmers' field at Khed in Igatpuri (Dist. Nashik) on variety Lok-1 and also in few villages Vithe, Ghulewadi, Nandur shingote and Shinde at very low incidence. In the month of February miner incidence of leaf rust was observed in Sehore and Dewas districts of MP. Low to moderate incidence of leaf rust, Aphid and spot botch was observed in Nashik, Ahmednagar and Aurangabad districts of Maharashtra. Fusarium head scab was also observed in the area of Dhule and Savalivihir in few fields at low incidence. Surveys were conducted in Cooch Behar, Jalpaiguri and Darjeeling districts of West Bengal adjoining to Indo-Bangladesh Borders and no blast like symptoms were observed only moderate leave of spot blotch incidence was observed.

In the month of March stripe rust was observed in some farmers field in SBS nagar and Roopnagar areas of Punjab and some villages in Yammunanagar and Karnal district of Haryana. Similarly, leaf rust was also recorded in the month of March in various villages of SBS nagar, Roopnagar, Gurdaspur, Jalandhar and Hoshiarpur areas of Punjab. Yellow rust infection was also observed in some areas of Lakhamandal, Chahri, Bilaspur and Sirmaur of Himachal Pradesh. Miner incidence of leaf rust and yellow rust was observed in Dausa and Jaipur district of Rajasthan. Indore, Ujjain, Dewas, Hoshangabad, and Narsinghpur area of MP were surveyed and found that leaf rust is widely prevailed but at low intensity. Leaf rust and blight was also observed in Bhagalpur and their adjoining areas of Bihar. No incidence of Wheat blast like symptoms was noticed at farmer's field but incidence of leaf rust, Fusarium head blight and leaf blight in some varieties was noticed in farmer's field of Raiganj, Gangarampur, Hili, Gazole, Samsi, Ratua, Manikchak, Chopra, Kharibari and Cooch Behar of West Bengal. Leaf rust was found common in wheat fields in Maharashtra and Karnataka with low to medium severity depending on the resistance level in sown variety while free from the stem rust infection. Infestation of aphids was low in the initial stages of crop growth which increased in the months of February and March. Infestation of stem borer was also observed in some fields. Besides these few instance of disease and pest occurrence, no major report of disease and insects infestation observed. Overall the wheat crop health is good in all the wheat growing areas.

Training for human resource development

Under the coordinated programme the promising material is tested at multi-locations, therefore it becomes very important to follow the uniform disease recording and data reporting. Among coordinated centers, in some of centers new scientist joined either by direct recruitment or by transfer. to bring more uniformity in disease creation and data recording a training was organized on "Field

trial conduction, data recording and reporting under wheat and barley crop protection programme" from 1st – 3rd Februrary, 2022 through virtual mode at ICAR-IIWBR, Karnal for scientists working in crop protection under the coordinated system. The scientist and technical workers involved in disease and insect pest recording have been participated.

Advisory for stripe rust management:
During the current season 2021-22 the weather remained congenial in the month of Feburary for yellow rust in NWPZ however, disease severity remained low due to deployment of resistant cultivars. Need based advisories for stripe rust management and Karnal bunt were issued. Awareness among farmers for stripe rust management was created through mobile, internet, toll free number, newspapers, discussions and delivering lectures in farmers training programmes.

Preparedness to wheat blast
Survey were conducted during the cropping season 2021-22 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. Awareness was also created in farmers to take all preventive measures available against blast and to grow the resistant varieties identified.

For identification of wheat blast resistant sources advance breeding lines and potential germplasm were screened at Jashore, Bangladesh and Quirassallis through CIMMYT. A total 350 entries sent in 2020 screened against blast at Jashore, Bangladesh at two different dates of sowing during 2020-21 and out that 283 again tested at Jashore, Bangladesh at two different dates of sowing during 2021-22. Out of these 283, across the years, 3 entries found free from infection and 100 are categorised resistant on the basis of average disease upto 10% infection. The details are given as below:

Free Entries - 3	DBW342, DBW357 and PBW875
Av. score upto 10% Enteries - 100	DBW343, DBW344, DBW345, DBW346, HD3385, HD3386, HUW844, RAJ4555, TAW123, UP3080, UP3082, WH1292, WH1293, BRW3895, BRW3902, DBW347, DBW349, HD3391, HP1971, HUW845, HUW846, JKW287, KRL1912, RAJ4559, TAW119, WH1295, WH1296, MP1379, MP3545, MP3552, NWS2194, UAS3015, UP3086, BRW3897, DBW353, DBW354, DBW356, HD3393, HD3394, HD3395, HUW847, NW8004, NW8022, PBW859, PBW860, PBW862, UP3088, WH1299, MP1380, MP3541, NIAW3923, NIAW4028, BRW3901, DBW358, DBW359, DBW360, DBW361, HD3398, HD3399, HD3400, HP1973, HUW848, NW8010, PBW866, UP3090, UP3091, HD3401, HD3406, DBW363, DBW364, DBW370, DBW371, DBW372, PBW872, DBW375, DBW377, HD3405, PBW871, UP3096, WH1406, WH1407, DWAP-B-2001, DWAP-B-2002, DWAP-B-2003, DWAP-B-2005, RWP13, RWP15, QYB-2002, QYB-2003, QYB-2004, QYB-2005, QYB-2006, QYB-2009, QYB-2010, QYB-2011, QYB-2012, QYB-2013, LBP-2019-1, LBP-2019-2 and HI1562

Besides that 350 entries again sent in 2021 to screen against blast during 2021-22 at Jashore, Bangladesh at two different dates of sowing, and 6 entries found free from infection and 86 are categorised resistant on the basis of highest score upto 10% infection. The details are given as below:

Free Entries - 6	NW8045, PBW879, UP3116, DWAP 2174, DWAP 2175 and GRU 25
HS upto 10% Entries - 86	HD3421, DBW379, DBW380, DBW381, RAJ4567, NW8046, WH1301, K2101, UP3101, UP3102, HUW849, UBW16, DBW386, RAJ4570, NW8044, PBW890, TAW142, DBW387, DBW388, UAS3021, PBW891, MP1387, NWS2222, HD3427, HD3428, RAJ4572, NW8040, WH1309, K2108, PBW892, PBW893, PBW896, UP3109, JKW298, HUW852, DBW394, DBW395, WH1310, MP3556, MP3557, WH1312, HI8844(d), HD3431, HD3432, HI1682, PBW878, PBW880, DBW404, WH1313, WH1314, UP3115, RAJ4571, K2001, DBW401, DBW405, DBW406, GW543, RWP 1267, QYT 2031, QYT 2030, QYT 2049, QYT 2050, QYT 2047, QYT 2032, QYT 2073, QYT 2034, QYT 2036, PBS 21-08, PBS 21-09, DWAP 2168, DWAP 2171, DWAP 2176, DWAP 2178, LBP 2020-11, LBP 2020-22, LBP 2020-28, LBP 2020-37, LBP 2020-50, LBP 2020-51, LBP 2020-52, GRU 24, GRU 26, GRU 27, GRU 28, GRU 29 and GRU 30

8.2 Post Harvest Surveys

The post harvest grain analysis for presence of Karnal bunt and black point in grains of farmers' fields collected from grain mandies 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 7759 grain samples collected from various mandies in different zones and were analyzed at cooperating centers (Table 8.1). The overall 21.94% samples were found infected. The samples from Rajasthan showed maximum infection (37.10%). The average incidence of Karnal bunt infected gains was 0.227% ranging from 0 to 12.4%. The maximum grain infection of 12.4% was observed in a sample from Jammu. In general the samples fall in the category of less than 1% grains infected with Karnal bunt. In case of Madhya Pradesh in current year that samples collected from Seoni malwa, Harda mandi, Dolaria mandi, Itarsi mandi and Sagar having Karnal bunt infection in the range of 6.6 to 40.0 per cent but the average incidence level remained low (0.00079%) ranging from 0 to 1.1 percent grain infection. However, the samples collected from Ujjain, Indore, Dhar, Dewas and Sehore were found free from Karnal bunt infection. This year the sample collected from Uttarakhand, Karnataka and Maharastra were found free from Karnal bunt infection

Table 8.1: Status of Karnal bunt during Rabi, 2021-22

S. No.	Location	No of samples showing different level of Karnal bunt incidence (%)						Total samples	Samples infected (%)	Mean incidence (%)	Range of incidence (%)
		0	0.1-1.0	1.1-5.0	5.1-10	10-25	>25				
1	Jammu	184	23	26	10	1	0	244	24.59	1.50	0-12.40
2	Panjab	2121	470	28	0	0	0	2619	19.01	0.066	0.0-3.0
3	Haryana	1409	806	24	1	0	0	2240	37.1	0.09	0.05-8.6
4	Rajasthan	511	245	21	0	0	0	777	34.23	0.157	0.1-3.7
5	Uttarakhand	1078	0	0	0	0	0	1078	0	0	0
6	Madhya Pradesh	517	47	0	0	0	0	564	8.33	0.00079	0-1.1
7	Karnataka	50	0	0	0	0	0	50	0	0	0
8	Maharastra	187	0	0	0	0	0	187	0	0	0
	Total	**6057**	**1591**	**99**	**11**	**1**	**0**	**7759**	**21.94**	**0.227**	**0-12.40**

Jammu

The survey of Jammu province (J&K) wheat growing districts was conducted during the months of April and May 2022 to collect the wheat grain samples for the analysis of various post harvest diseases of the wheat. A total of 244 samples were collected and analyzed for the presence of Karnal bunt. A total of 60 samples out of 244 showed Karnal bunt infection i.e. 24.59 percent samples were found to be infected with KB (Table 8.2). District Samba (28.57%) showed the maximum KB infected samples followed by Jammu, Rajouri, Kathua and Udhampur districts. The rangeof incidence of KB infected grains was

maximum 0-12.40% (Jammu) and minimum 0-2.7% (Rajouri). As far as Mean incidence was maximum 2.33% in Jammu followed by Samba, Kathua, Rajouri and Udhampur.

Table 8.2: Status of Karnal bunt during Rabi, 2021-22 in Jammu

S. No.	Location	No of samples showing different level of Karnal bunt incidence (%)						Total samples	Samples infected (%)	Mean incidence (%)	Range of incidence (%)
		0	0.1-1.0	1.1-5.0	5.1-10	10.1-25	>25				
1	Jammu	57	6	10	4	1	0	78	26.92	2.33	0-12.40
2	Samba	30	3	6	3	0	0	42	28.57	1.67	0-6.25
3	Kathua	52	7	6	3	0	0	68	23.53	1.41	0-9.21
4	Udhampur	21	4	1	0	0	0	26	19.23	0.86	0-4.31
5	Rajouri	24	3	3	0	0	0	30	20.00	1.25	0-2.7
	Total	**184**	**23**	**26**	**10**	**1**	**0**	**244**	**24.59**	**1.50**	**0-12.40**

Harayana

A total 2240 post harvest wheat samples from gain mandies of Haryana were collected by ICAR-IIWBR and CCSHAU, Hisar during current year (2021-22). Out of these samples 831 found infected with Karnal bunt. The mean incidence was 0.09 percent. The highest infection of 8.6 % was odbereved in a sample from Karnal. The ranfe of infection vary from 0 to 8.6 percent (Table 8.3.)

Table 8.3: Status of Karnal bunt during Rabi, 2021-22 in Haryana

S. No.	Location	No of samples showing different level of Karnal bunt incidence (%)						Total samples	Samples infected (%)	Mean incidence (%)	Range of incidence (%)
		0	0.1-1.0	1.1-5.0	5.1-10	Oct-25	>25				
1	Kaithal	190	45	4	0	0	0	239	20.5	0.11	0.05-1.6
2	Kurukshetra	175	39	3	0	0	0	217	19.4	0.10	0.05-1.4
3	Karnal	139	46	4	1	0	0	190	26.8	0.11	0.05-8.6
4	Panipat	85	23	5	0	0	0	113	24.8	0.16	0.05-3.3
5	Sonipat	58	27	1	0	0	0	86	32.6	0.22	0.05-3.4
6	Ambala	43	6	0	0	0	0	49	12.2	0.01	0.05-0.05
7	Jind	171	60	4	0	0	0	235	27.2	0.11	0.05-1.7
8	Rohtak	61	38	3	0	0	0	102	40.2	0.17	0.05-2.5
9	Hisar	122	70	0	0	0	0	192	35.9	0.03	0.05-0.20
10	Fatehabad	46	23	0	0	0	0	69	33.3	0.04	0.05-0.40
11	Sirsa	94	23	0	0	0	0	117	19.7	0.01	0.05-0.10
12	Bhiwani	16	70	0	0	0	0	86	81.4	0.07	0.05-0.20
13	Charkhi Dadri	34	66	0	0	0	0	100	66.0	0.10	0.05-0.60

14	Mahendergarh	32	16	0	0	0	0	48	33.3	0.07	0.05-0.30
15	Rewari	7	17	0	0	0	0	24	70.8	0.09	0.05-0.30
16	Jhajjar	33	97	0	0	0	0	130	74.6	0.13	0.05-0.30
17	Gurugram	31	45	0	0	0	0	76	59.7	0.05	0.05-0.65
18	Nuh	33	8	0	0	0	0	41	19.5	0.02	0.05-0.50
19	Yamunanagar	22	21	0	0	0	0	43	48.8	0.05	0.05-0.20
20	Palwal	2	43	0	0	0	0	45	95.6	0.17	0.05-0.85
21	Faridabad	15	23	0	0	0	0	38	60.5	0.03	0.05-0.15
	Total	**1409**	**806**	**24**	**1**	**0**	**0**	**2240**	**37.1**	**0.09**	**0.05-8.6**

Punjab

A total of 2619 wheat grains samples were collected from major grain mandies of different districts during crop season Rabi 2020-2021. The data revealed that 498 samples (19.01%) were found infected with Karnal bunt with infection range 0 – 3.0 percent (Table 8.4).

Table 8.4: Status of Karnal bunt during Rabi, 2021-22 in Punjab

S. No.	Location	No of samples showing different level of Karnal bunt incidence (%)						Total samples	Samples infected (%)	Mean incidence (%)	Range of incidence (%)
		0	0.1-1.0	1.1-5.0	5.1-10	10-25	>25				
1	Amritsar	69	46	3	0	0	0	118	41.53	0.053	0.0-1.2
2	Barnala	127	4	0	0	0	0	131	3.05	0.003	0.0-0.4
3	Bathinda	78	6	3	0	0	0	85	10.34	0.012	0.0-2.1
4	Faridkot	93	8	0	0	0	0	101	7.92	0.008	0.0-0.2
5	Fatehgarh Sahib	81	0	0	0	0	0	81	0.00	0.000	0.0 - 0.0
6	Fazilka	77	8	0	0	0	0	87	9.41	0.009	0.0-0.4
7	Ferozepur	207	40	0	0	0	0	247	16.19	0.016	0.0-0.4
8	Gurdaspur	55	22	4	0	0	0	81	32.10	0.131	0.0-3.0
9	Hoshiarpur	68	46	4	0	0	0	118	42.37	0.153	0.0-2.1
10	Jallandhar	115	52	3	0	0	0	170	32.35	0.101	0.0-1.8
11	Kapurthala	50	47	1	0	0	0	98	48.98	0.154	0.0-1.1
12	Ludhiana	257	39	1	0	0	0	297	13.47	0.045	0.0-2.1
13	Mansa	95	5	0	0	0	0	100	5.00	0.02	0.0-0.9
14	Moga	112	17	0	0	0	0	129	13.18	0.041	0.0-1.1
15	Mohali	22	2	0	0	0	0	24	8.33	0.008	0.0-0.1
16	Muktsar	112	10	0	0	0	0	122	8.20	0.010	0.0-0.2

17	Pathankot	7	11	1	0	0	0	19	63.16	0.316	0.0-1.2
18	Patiala	112	3	0	0	0	0	115	2.61	0.003	0.0-0.1
19	Ropar	78	32	2	0	0	0	112	30.36	0.089	0.0-1.1
20	Sangrur	148	2	0	0	0	0	150	1.33	0.005	0.0-0.6
21	SBS Nagar	123	29	3	0	0	0	155	20.65	0.067	0.0-2.7
22	Tarantarn	35	41	3	0	0	0	79	55.70	0.222	0.0-3.0
	Total	**2121**	**470**	**28**	**0**	**0**	**0**	**2619**	**19.01**	**0.066**	**0.0-3.0**

Rajasthan

Post-harvest survey was conducted in three districts of Rajasthan namely Alwar, Jaipur, Dausa and Tonk from 27th May to 30th May, 2022. A total of 777 wheat grains samples were collected from 13 major grain mandies of these districts during crop season Rabi 2020-2021. The data revealed that 266 samples (34.23%) were found infected with Karnal bunt with infection range 0.1-3.7 percent being maximum was found in a sample collected from Deoli (Tonk) mandi. The highest KB infected samples were found in Khertal (66.2%), followed by Alwar (64.3%), Mahua (48.3%), Bansur (44.2%), Bandikui (36.84%), Lalsot (29.2), Mandawari (27.3%), Tonk (26.0%), Dausa (25.0%), Deoli (21.2%), Bassi (17.02%) Chaksu (16.28%) and Niwai (10.4%) mandies. However, among the total KB infected samples 245 samples (31.53%) were falling in the range of 0.1-1.0 percent disease incidence and rest 21 samples (2.7%) were falling in the range of 1.1-5.0. The infection range was 0.1-0.37. The mean incidence was ranging from 0.03-0.26 percent (Table 8.5).

Table 8.5: Status of Karnal bunt during Rabi, 2021-22 in Rajasthan

S. No.	Location	No. of samples showing different level of Karnal bunt incidence (%)						Total samples	Samples infected (%)	Mean incidence (%)	Range of incidence (%)
		0	0.1-1	1.1-5.0	5.1-10	10.1-25	>25				
A	District : Alwar										
1	Alwar	25	43	2	0	0	0	70	64.29	0.26	0.1-3.2
2	Khertal	22	38	5	0	0	0	65	66.15	0.33	0.1-3.6
3	Bansur	29	21	2	0	0	0	52	44.23	0.15	0.1-1.9
	Total	76	102	9	0	0	0	187	59.36	0.26	0.1-3.6
B	District : Dausa										
4	Dausa	60	19	1	0	0	0	80	25	0.08	0.1-1.2
5	Bandikui	36	20	1	0	0	0	57	36.84	0.18	0.1-2.6
6	Mahua	31	27	2	0	0	0	60	48.33	0.17	0.1-3.5
7	Lalsot	46	17	2	0	0	0	65	29.23	0.06	0.1-1.4
8	Mandawari	40	14	1	0	0	0	55	27.27	0.09	0.1-1.7
	Total	213	97	7	0	0	0	317	32.81	0.093	0.1-3.5
C	District: Jaipur										

9	Bassi	39	7	1	0	0	0	47	17.02	0.027	0.1-1.4
10	Chaksu	36	6	1	0	0	0	43	16.28	0.032	0.1-1.2
	Total	75	13	2	0	0	0	90	16.67	0.028	0.1-1.4
D	District: Tonk										
11	Tonk	37	13	0	0	0	0	50	26	0.083	0.1-0.9
12	Deoli	67	16	2	0	0	0	85	21.18	0.089	0.1-3.7
13	Niwai	43	4	1	0	0	0	48	10.42	0.03	0.1-1.2
	Total	147	33	3	0	0	0	183	19.67	0.069	0.1-3.7
	Grand Total	**511**	**245**	**21**	**0**	**0**	**0**	**777**	**34.23**	**0.157**	**0.1-3.7**

Delhi

During 2021-22, wheat grain samples were collected from IARI, New Delhi fields. In Entomology fields (natural conditions), 9 samples were taken from variety HD 3086. Out of nine samples, KB was observed in 6 samples. Eighty wheat grain samples were also collected (natural condition) from different fields of IARI. KB was observed in 6 samples out of 80 samples analyzed. From Shamli grain markets, 17 samples were taken. Out that only three samples were free from KB. Disease grade for KB ranged between 1-2 per cent.

Uttarakhand

A total 1078 samples were collected from Pantnagar, Dehradun, Haridwar and Nainital (Kotabagh) district of Uttarakhand during crop season 2021-22. None of the sample foud infected with Karnal bunt (Table 8.6).

Table 8.6: Status of Karnal bunt during Rabi, 2021-22 in Uttarakhand

S. No.	Location	No of samples showing different level of Karnal bunt incidence (%)						Total samples	Samples infected (%)	Mean incidence (%)	Range of incidence (%)
		0	0.1-1.0	1.1-5.0	5.1-10	10-25	>25				
1	Pantnagar	140	0	0	0	0	0	140	0	0	0
2	Gadarpur	196	0	0	0	0	0	196	0	0	0
3	Rudrapur	156	0	0	0	0	0	156	0	0	0
4	Bajpur	135	0	0	0	0	0	135	0	0	0
5	Khatima	162	0	0	0	0	0	162	0	0	0
6	Dehradun	80	0	0	0	0	0	80	0	0	0
7	Haridwar	61	0	0	0	0	0	61	0	0	0
8	Nainital (Kotabagh)	148	0	0	0	0	0	148	0	0	0
	Total	**1078**	**0**	**0**	**0**	**0**	**0**	**1078**	**0**	**0**	**0**

Madhya Pradesh

A total 564 wheat grain samples were collected from Seoni, Harda, Dolaria, Itarsi, Sagar, Ujjain, Indore, Dhar, Dewas and Sehore mandies of Madhya Pradesh in current year (2022).The sample analysis result reveals that samples collected from Seoni malwa, Harda mandi, Dolaria mandi, Itarsi mandi and Sagar having Karnal bunt infection. The samples found infected in the range of 6.6 to 40.0 per cent but the incidence level remained low (0.00079) ranging from 0 to 1.1 percent grain infection. However, the samples collected from Ujjain, Indore, Dhar, Dewas and Sehore were found free from Karnal bunt infection (Table 8.7).

Table 8.7: Status of Karnal bunt during Rabi, 2021-22 in Madhya Pradesh

S. No	Location[1]	No of samples showing different level of Karnal bunt incidence (%)						Total samples	Samples infected (%)	Mean incidence (%)	Range of incidence (%)
		0	0.1-1.0	1.1-5.0	5.1-10	10-25	>25				
1	Seoni malwa	39	3	-	-	-	-	42	7.14	0.04	0-1.0
2	Harda mandi	42	3	-	-	-	-	45	6.66	0.01	0-0.3
3	Dolaria mandi	23	4	-	-	-	-	27	14.81	0.04	0-0.4
4.	Itarsi mandi	34	16	1	-	-	-	51	33.33	0.16	0-1.1
5.	Sagar	30	19	1	-	-	-	50	40.0	0.20	0-1.1
6.	Ujjain	20	0	0	0	0	0	20	0	0	0
7.	Indore	110	0	0	0	0	0	110	0	0	0
8.	Dhar	8	0	0	0	0	0	8	0	0	0
9.	Dewas	167	0	0	0	0	0	167	0	0	0
10.	Sehore	44	0	0	0	0	0	44	0	0	0
	Total	**517**	**47**	**0**	**0**	**0**	**0**	**564**	**8.33**	**0.00079**	**0-1.1**

Karnataka

A total 50 samples were collected from Dharwad, Vijayapur, Gadag, Belagavi and Bagalkot district of Karnataka during crop season 2021-22. None of the sample foud infected with Karnal bunt (Table 8.8).

Table 8.8: Status of Karnal bunt during Rabi, 2021-22 in Karnataka

S. No.	Location	No. of samples showing different level of Karnal bunt incidence (%)						Total samples	Samples infected (%)	Mean incidence (%)	Range of incidence (%)
		0	0.1-1.0	1.1-5.0	5.1-10	10-25	>25				
1	Dharwad	34	0	0	0	0	0	34	0	0	0
2	Vijayapur	1	0	0	0	0	0	1	0	0	0
3	Gadag	3	0	0	0	0	0	3	0	0	0
4	Belagavi	8	0	0	0	0	0	8	0	0	0

5	Bagalkot	4	0	0	0	0	0	4	0	0	0
	Total	**50**	**0**	**0**	**0**	**0**	**0**	**50**	**0**	**0**	**0**

Maharastra

A total 187 samples were collected from Nashik, Ahmednagar, Dhule and Nandurbar district of Maharastra during crop season 2021-22. None of the sample foud infected with Karnal bunt (Table 8.9).

Table 8.9: Status of Karnal bunt during Rabi, 2021-22 in Maharastra

S. No.	Location	No. of samples showing different level of Karnal bunt incidence (%)						Total samples	Samples infected (%)	Mean incidence (%)	Range of incidence (%)
		0	0.1-1.0	1.1-5.0	5.1-10	10-25	>25				
1	Niphad	27	0	0	0	0	0	27	0	0	0
2	Yeola	13	0	0	0	0	0	13	0	0	0
3	Sinnar	15	0	0	0	0	0	15	0	0	0
4	Dindori	18	0	0	0	0	0	18	0	0	0
5	Nashik	24	0	0	0	0	0	24	0	0	0
6	Kopargaon	16	0	0	0	0	0	16	0	0	0
7	Sangamner	8	0	0	0	0	0	8	0	0	0
8	Dhule	15	0	0	0	0	0	15	0	0	0
9	Sakri	12	0	0	0	0	0	12	0	0	0
10	Akkalkuan	17	0	0	0	0	0	17	0	0	0
11	Nandurbar	22	0	0	0	0	0	22	0	0	0
	Total	**187**	**0**	**0**	**0**	**0**	**0**	**187**	**0**	**0**	**0**

Black Point (BP) and Shriveled Grains (SG)

Jammu

The survey of Jammu province (J&K) wheat growing districts was conducted during the months of April and May 2022 to collect the wheat grain samples for the analysis of various post harvest diseases of the wheat. A total of 244 samples were collected and analyzed for the presence of black point infected grains and also for shriveled grains. About 30.32% samples collected from Jammu province were found to be infected with black point infected while 32.69 percent samples had shriveled grains. The range of grain infection of black point and shriveled grains was 0.43-2.07 and 0.70-5.07%, respectively (Table 8.10).

Table 8.10: Status of black point during Rabi, 2021-22 in Jammu

S No.	Districts	Sample collected	Black point		Shriveled grain	
			Samples infected (%)	Range of grain infection (%)	Samples infected (%)	Range of grain infection (%)
1	Jammu	78	30.76	0.60-1.43	39.74	0.89-6.23
2	Samba	42	35.71	0.36-2.25	47.61	1.56-7.25
3	Kathua	68	32.35	0.41-3.62	39.70	0.41-7.86
4	Udhampur	26	19.23	0.45-0.86	23.07	0.33-2.26
5	Rajouri	30	26.66	0.33-2.14	13.33	0.33-1.78
	Total	**244**	**30.32**	**0.43-2.07**	**32.69**	**0.70-5.07**

Rajasthan

Among the total 777 wheat grain samples, 478 (61.5 %) samples were infected with black point in the range of 0.1-18.1 per cent incidence being highest incidence (18.1%) was noted in a sample collected from Bandikui (Dausa) mandi. Highest BP infected samples (84.7%) were found in Deoli mandi of district Tonk, followed by Bansur (69.2), Khertal (67.7%), Alwar (65.7%), Mhua (65.0%), Niwai (64.6%) Lalsot (63.1%), Chaksu (62.8%), Bandikui (59.6) Tonk (58.0%), Mandawari (56.4%), Bassi (46.8%) and Dausa (32.5%) mandies (Table 8.11).

Table 8.11: Status of black point during Rabi, 2021-22 in Rajasthan

S. No.	Location	Total samples	Number of BP infected samples	Per cent infected samples	Range of incidence (%)
1	Alwar	70	46	65.7	0.2-4.5
2	Khertal	65	44	67.7	0.2-1.8
3	Bansur	52	36	69.2	0.1-7.0
4	Dausa	80	26	32.5	0.2-1.6
5	Bandikui	57	34	59.6	0.1-18.1
6	Mahua	60	39	65	0.1-11.9
7	Lalsot	65	41	63.1	0.1-4.2
8	Mandawari	55	31	56.4	0.1-14.7
9	Bassi	47	22	46.8	0.1-1.5
10	Chaksu	43	27	62.8	0.2-5.3
11	Tonk	50	29	58	0.2-1.6
12	Deoli	85	72	84.7	0.2-4.1
13	Niwai	48	31	64.6	0.1-2.5
	Total	**777**	**478**	**61.5**	**0.1-18.1**

Karnataka

A total 50 samples were collected from Dharwad, Vijayapur, Gadag, Belagavi and Bagalkot district of Karnataka during crop season 2021-22. Out of these, 30 % sample found infected with black poin with rage of 1.0 to 2.0 percent.

Maharashtra

A total 187 samples were collected from Nashik, Ahmednagar, Dhule and Nandurbar district of Maharastra during crop season 2021-22. Out of these, 49.73 % sample found infected with black poin with rage of 1.0 to 12.6 percent (Table 8.12).

Table 8.12: Status of BP in Maharashtra during 2021-22

Sr. No.	Location		Total samples	Infected samples	Per cent infection	Range of infection (%)
	Tahasil	District				
1	Niphad	Nashik	27	16	59.26	1.6-9.8
2	Yeola	Nashik	13	6	46.15	1.0-8.2
3	Sinnar	Nashik	15	5	33.33	1.2-5.4
4	Dindori	Nashik	18	11	61.11	2.4-12.6
5	Nashik	Nashik	24	13	54.17	2.0-11.6
6	Kopargaon	Ahmednagar	16	9	56.25	1.4-9.6
7	Sangamner	Ahmednagar	8	3	37.50	1.0-5.6
8	Dhule	Dhule	15	7	46.67	1.6-6.4
9	Sakri	Dhule	12	4	33.33	1.4-5.0
10	Akkalkuan	Nandurbar	17	7	41.18	1.8-9.4
11	Nandurbar	Nandurbar	22	12	54.55	2.2-10.2
	Total		**187**	**93**	**49.73**	**1.0-12.6**

8.3 Pathotype distribution of rust pathogens in India and Nepal during 2021-22

Wheat crop health was monitored in different wheat growing areas by different monitoring teams during the crop season and advisories were issued by ICAR-IIWBR, Karnal, department of agriculture cooperation and farmers welfare, government of India and State Department of Agriculture. During the survey, rust samples are taken and sent to ICAR-IIWBR, RS, Flowerdale, Shimla for further analysis. During 2021-22, 565 samples including three rusts of wheat, stripe of barley collected/received from thirteen states, and two Union Territories (UTs) and Nepal were analyzed.

Stripe rust of wheat and barley (*Puccinia striiformis*)

During current cropping season, 126 rust samples of wheat and barley were analyzed from five states and two UTs of Indian, and Nepal. Six pathotypes {238S119, 110S119, 46S119, 46S103 (P), 47S103 (T) and 79S68} of wheat rust pathogen (*Puccinia striiformis* f. sp. *tritici*, *Pst*) were identified. Only one pathotype 57 (0S0) of *Puccinia striiformis* f. sp. *hordei* (*Psh*) was identified in 8 barley yellow rust samples collected from barley disease screening nursery at Durgapura, Rajasthan. The *Pst* population was avirulent to *Yr5*, *Yr10*, *Yr15*, *Yr16*, *Yr32*, and *YrSP*. Maximum number of wheat stripe rust samples analyzed were from Punjab (48) followed by Himachal Pradesh (28). The frequency of *Pst* pathotype 110S119 was maximum (34.9%) followed by 238S119 (31.0%) (Table 8.13). The frequency of pathotype 238S119 was higher in Himachal Pradesh, Punjab and Nepal. The frequency of 46S119 (virulent on *Yr2*, *Yr3*, *Yr4*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr18*, *Yr19*, *Yr21*, *Yr22*, *Yr23*, *Yr25*, *Yr*A) increased to 20.6% from 15.12% previous cropping season. Pathotypes 47S103, 46S103 and 79S68 were identified in 5, 3 and 1 samples, respectively (Table 8.13).

Table 8.13: Pathotype distribution of stripe rust (*Puccinia striiformis*) pathotypes on wheat and barley in India and Nepal during 2021-22

S. No.	Indian states /country	Samples Analyzed	Pathotype						
			238S119	110S119	46S119	T (47S103)	P (46S103)	79S68	57 (0S0)
1	Himachal Pradesh	28	14	7	6	01	-	-	-
2	Jammu and	02	-	02	-	-	-	-	-

	Kashmir								
3	Uttarakhand	11	-	02	02	03	03	01	-
4	Punjab	48	18	14	16	-	-	-	-
5	Haryana	04	01	01	02	-	-	-	-
6	Rajasthan	23	01	14	-	-	-	-	08
7	Delhi	02	-	02	-	-	-	-	-
Other country									
1	Nepal	08	05	02	-	01	-	-	-
Total		**126**	**39**	**44**	**26**	**05**	**03**	**01**	**08**

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

A total of 67 black rust samples received from Gujrat, Maharashtra, Madhya Pradesh and Tamil Nadu were pathotyped on wheat differentials. Five pathotypes 11, 21, 34-1, 40-2 and 40A of *Puccinia graminis* f. sp. *tritici* (*Pgt*) were identified. The *Pgt* population was avirulent to *Sr26, Sr27, Sr31, Sr32, Sr35, Sr39, Sr40, Sr43, SrTt3* and *SrTmp*. Maximum number of samples was pathotyped from Madhya Pradesh (28) followed by Gujrat (19) (Table 8.14). Pathotype 11 (79G31=RRTSF), virulent to *Sr2, Sr5, Sr6, Sr7b Sr9a, Sr9b, Sr9c, Sr9d, Sr9f, Sr9g, Sr10, Sr13, Sr14, Sr15, Sr16, Sr17, Sr18, Sr19, Sr20, Sr21, Sr28, Sr29, Sr30, Sr34, Sr36, Sr38* and *Sr*McN, was recorded in 69.4% of the samples. Pathotypes 40-2 and 40A were in equal frequency. Pathotypes 21 and 34-1 were identified in 4 and 1 samples, respectively.

Table 8.14: Pathotype distribution of stem rust (*Puccinia graminis* f. sp. *tritici*) in India and Nepal during 2021-22

S. No.	States/Countries	Number of isolates analyzed	Pathotype*¥				
			11	21	34-1	40A	40-2
1	Gujarat	19	18	01	-	-	-
2	Madhya Pradesh	28	24	03	01	-	-
3	Maharashtra	01	01	-	-	-	-
4	Tamil Nadu	14	-	-	-	07	07
Total		**62**	**43**	**04**	**01**	**07**	**07**

Indian binomial names ¥North American equivalents 11 (79G31; RRTSF¥), 21 (9G5; CHMSC), 34-1 (10G13; MCGGP), 40A (62G29; PTHSC), 40-2 (58G13-3; PKRSC) based on Jin *et al*., *Plant Dis.* 2008,92: 923-6.

Leaf rust of wheat (*Puccinia triticina*)

A total of 377 samples of wheat leaf rust were pathotyped from 13 states and one UT of India and neighboring country Nepal. Among the 18 pathotypes of *Puccinia triticina* that were identified in these samples, pathotype 77-9 (121R60-1) was the most widely distributed and occurred in 59.9% of the samples followed by 121R60-1,7 in 19.4% samples (Table 3). Pathotype 77-5 (121R63-1), that remained the most predominant for more than 20 years was observed in 9.5% samples only. The remaining 15 pathotypes were identified in 11.1% samples only. In Nepal, four pathotypes were identified in 31 samples. Pathotype 77-9 was the most predominant in Nepal (Table 8.15).

Table 8.15 Pathotype distribution of leaf rust (*Puccinia triticina*) in India and Nepal during 2021-22

S. No.	State/Country	No. of isolates Analyzed	Pathotype																	
			10-1 (56R27)	12-1(5R37`)	12-3 (49R37)	12-4 (69R13)	12-6 (5R45)	77-1 (109R63)	77-3 (125R55)	77-5 (121R63-1)	77-6 (121R55-1)	77-8 (253R31)	77-9 (121R60-1)	779+Raj1555 (121R60-1,7)	104-1 (21R31-1)	104-2 (21R55)	104-3 (21R63)	104A (21R31)	162-4 (29R39)	1R31
1	Himachal Pradesh	37						1		2		9	12	10	1	1			1	
2	Punjab	6											5	1						
3	Haryana	20								2			7	11						
4.	Delhi	5											3	2						
5	Rajasthan	3											3							
6	Uttar Pradesh	40											22	17		1				
7	Uttarakhand	23							1	1			15	6						
8	Madhya Pradesh	50		1		1		3	3	10			24	4	1	2		1		
9	Chhattisgarh	6								1			4	1						
10	West Bengal	9											9							
11	Gujarat	6								4			2							
12	Maharashtra	68			1		1			4			56	6						
13	Karnataka	42	1							2			34	3		1	1			
14	Tamil Nadu	31		1						10			14			6				
Other country																				
1	Nepal	31									1		16	12						2
Total		**377**	**1**	**2**	**1**	**1**	**1**	**4**	**4**	**36**	**1**	**9**	**226**	**73**	**2**	**11**	**1**	**1**	**1**	**2**

8.4 54th Wheat Disease Monitoring Nursery (WDMN) 2021-22

Wheat disease monitoring nursery (earlier trap plot nursery/TPN) is effective tool for monitoring the occurrence of wheat diseases especially rusts in 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 54th 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 34 locations (Table 8.16).

Table 8.16: Co-operators and locations where WDMN was planted during 2021-22

State	Co-operators	Location
Northern Hills and High-Altitude Zone		
Himachal Pradesh	R. Devlash Head, ICAR-IIWBR, RS, Shimla Bipan Sharma Dharam Pal Pankaj Sood	Bajaura Flowerdale, Shimla CSKHPKV RSS, Akrot IARI, RS, Tutikandi, Shimla KVK Sundernagar
Uttarakhand	K.K. Mishra	Hawalbagh (Almora)
Jammu & Kashmir	F. A. Mohiddin	Khudwani
North Western Plains Zone		
Jammu & Kashmir	M.K. Pandey	Udhaywalla (Jammu) Kathua Rajouri
Haryana	Rajender Singh Beniwal	Hisar
Himachal Pradesh	Shiwali Dhiman	Dhaulakuan
Rajasthan	P.S. Shekhawat	Bassi (Durgapura, Jaipur)
Punjab	Jaspal Kaur	Gurdaspur Ludhiana Ropar SBS Nagar
Uttarakhand	Deepshikha and Kanak Srivastava	Pantnagar
North Eastern Plains Zone		
Bihar	C. S. Azad K.K. Singh	Sabour Pusa
Jharkhand	H.C. Lal	Kanke, Ranchi
Uttar Pradesh	J.B. Khan and C. Kanchan S.S. Vaish S.P. Singh	Araul (Kanpur) B.H.U. Varanasi Kumarganj, Ayodhya
Central Zone		
Chhattisgarh	S.K. Jain	Baronda, Raipur
Gujarat	Ronak Thakkar and Premabati Devi IB 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 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	M. Sivasamy	Wellington

There were 20 (21 for High Altitude Zone and North Hills Zone) entries in the nursery during 2021-22. 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 2021-22 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, C306, 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 GW322

iv) Peninsular and Southern Hills Zone
MACS2496, Bijaga Yellow, HW971, HD2501 and HW2022 (*Sr24/Lr24*)

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, Regional Station, Flowerdale, Shimla.

Disease incidence in WDMN
Information on wheat disease situation was received from Dhaulakuan, Bajaura, Akrot, Sundernagar, Tutikandi (Shimla) & Flowerdale (Shimla) in Himachal Pradesh, Udhaywalla (Jammu), Kathua, Rajouri & Khudwani in Jammu & Kashmir, Pantnagar & Almora in Uttarakhand, Gurdaspur, SBS Nagar, Ludhiana & Ropar in Punjab, Hisar (Haryana), Pusa & Sabour (Bihar), Ranchi (Jharkhand), Kanpur, Ayodhya 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 Flowerdale, Shimla and Durgapura where maximum yellow rust severity was TS on WL1562 (Shimla) and 10S on Lal Bahadur, Kharchia Mutant and Agra Local (Durgapura). At least six entries of WDMN had more than 40S severity at Almora, Bajaura, Akrot, Khudwani, Hisar, Dhaulakuan, Gurdaspur, Ropar, SBS Nagar, Ludhiana and Pantnagar. Entry HP1633 at Khudwani and WH147 at Hisar had 100S yellow rust severity.

Brown rust was reported from nine locations of NHZ and NWPZ *viz*. Almora and Pantnagar in Uttarakhand, Flowerdale in Himachal Pradesh, Rajouri, Kathua and Jammu (Jammu), Hisar (Haryana), Ropar and Ludhiana in Punjab. It was reported from all the locations of NEPZ except Ranchi. In central zone brown rust appeared at Raipur, Vijapur, Indore and Powarkheda and in PZ and SHZ at Dharwad, Niphad and Pune and Wellington. At Varanasi brown rust appeared only on

Kharchia Mutant (20S) while at Almora it was reported only on two entries i.e. HD2329 (TS) and HS420 (TS) while other entries were brown rust free.

Of the 34 locations of WDMNs black rust was observed only at Powarkheda in CZ and Wellington in SHZ. All the entries of WDMN were black rust free in NHZ, NWPZ, PZ and NEPZ. Leaf blight was reported from WDMNs planted at Rajouri, Kathua, Jammu (Udhaywalla), Durgapura, Sabaur, Pusa, Ranchi, Ayodhya, Kanpur, Varanasi, Niphad and Dharwad. Powdery mildew was observed only at Almora, Akrot, Rajouri, Kathua, Jammu, Dhaulakuan and Wellington.

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 received, yellow rust on WDMN was first observed at Shimla (02.11.21) followed by Jammu (10.01.22), Kathua (12.01.22), Rajouri and Almora (16.02.22), Dhaulakuan (22.02.22), Hisar (01.03.22), Bassi (Durgapura) (05.03.22), and Bajaura (10.03.22). Brown rust was first observed at Shimla (20.10.21), followed by Dharwad (13.01.22), Powarkheda (11.02.22), Pune (14.02.22), Indore and Niphad (15.02.22), Raipur (19.02.22), Varanasi and Vijapur (20.02.22), Kathua and Jammu (24.02.22), Kanpur (05.03.22), Sabour and Ayodhya (07.03.22), Almora (08.03.22), Hisar (19.03.22) and Rajouri (15.04.22). Black rust was observed only at Powarkheda (26.02.22) and Wellington.

Varietal Performance against wheat rusts

High Altitude and Northern Hills Zone

Maximum severity of yellow rust was observed at Khudwani, where sixteen entries of WDMN were showing more than 40S severity of yellow rust. Yellow rust was observed only on one WDMN entry {WL1562 (TS)} at Flowerdale (Shimla) in NHZ, though this nursery was planted during offseason. WDMN entries PBW752, VL892, HS507 and Barley local were yellow rust free at all the NHZ locations except Sundernagar. PBW752 was yellow rust free at all the locations of NHZ, except at Khudwani during off season. WDMN entry Kharchia Mutant was 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 HD2329, Agra local, HD2160, and Lal Bahadur at all the locations of NHZ except Flowerdale, Sundernagar and Tutikandi. Brown rust appeared only at Flowerdale and Almora in NHZ. Only two WDMN entries *viz.* HD2329 (TS) and HS420 (TS) had brown rust infection at Almora; whereas at Shimla eight entries *viz.* PBW752 (10S) HD2329 (10MS), Agra Local (80S), Lal Bahadur (80S), WL1562 (5S), HD2204 (5S), C306 (5S) and HS507 (TS), were showing brown rust infection. Black rust was not reported from NHZ.

North Western Plain Zone

Yellow rust severity was very high at Dhaulakuan, Hisar, Gurdaspur, SBS Nagar, Ludhiana and Ropar in NWPZ, where at least eight entries had more than 40S severity of yellow rust. Similarly, five entries at Rajouri, three in Kathua had more than 40S yellow rust severity. WDMN entry PBW752 was yellow rust free at all the locations of NWPZ except Hisar, Dhaulakuan, SBS Nagar and Pantnagar, where 15S, 5S, 5MS and 10S yellow rust severity, respectively, was reported on it. Similarly, PBW757 was yellow rust free at all the locations except Hisar, Dhaulakuan, SBS Nagar, Ropar and Pantnagar. 100 S severity of yellow rust was observed on Kharchia Mutant and WH147 at Hisar. More than 40S severity of yellow rust was recorded on Agra Local at all the locations of NWPZ except Dhaulakuan and Pantnagar.

Brown rust appeared at all the locations of NWPZ except Dhaulakuan, Bassi (Durgapura), SBS Nagar and Gurdaspur. Minimum brown rust incidence was reported from Ropar and Ludhiana with only 3 and 5 entries, respectively, of WDMN were infected with brown rust. Highest brown rust severity in NWPZ was recorded from Pantnagar, where five entries (HD2329, Agra Local, Lal Bahadur, HD2204, and C306) had 100S severity of brown rust. Similarly, at Hisar more than 40S brown rust

severity was observed on seven entries with 100S brown rust severity on Kharchia Mutant. Black rust was not reported from any of the locations in NWPZ.

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 Varanasi it was reported only on Kharchia Mutant (20S). Only seven entries had brown rust infection at Sabour with highest disease severity of 20S on Agra Local, Lal Bahadur and HUW468. Maximum brown rust severity was recorded from Kanpur, where more than 40S brown rust severity was observed on 8 entries of which Agra Local, Lal Bahadur and K8804 had 100S brown rust severity. WDMN entries C306, HP1633, RNB1001 and HD2888 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 HD2329 (5S), Agra Local (20S), and C306 (5S) were the only entries showing brown rust infection. Similarly, at Vijapur three entries i.e. Lal Bahadur (TR), HW2021 (TR) and HD2204 (TR) were infected with brown rust. At Powarkheda only five entries *viz.* Agra Local (40S), C306 (40S), DL784-3 (40S), Lok1 (40S) and GW322 (20MS) were infected with brown rust. Black rust was observed only at Powarkheda in central zone, where it was detected on LOK-1 (TR). 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. Maximum brown rust severity was observed at Dharwad, where all the entries except Kharchia Mutant and Bijaga Yellow had more than 40S severity of brown rust. At Niphad all the WDMN entries were brown rust free except HD2329 (TMS), Agra Local (10S), Lal Bahadur (20S), HD2204 (TMS), MACS2497 and Bijaga Yellow (5S). Six entries (HD2329, Agra Local, Lal Bahadur, HD2204, WH147 and HD2501) had 80S severity of brown rust at Wellington. WDMN entries (HW2021, HW2008, DL784-3, RNB1001, HW2022, Kharchia Mutant and HP1633) were brown rust free at all the locations of PZ and SHZ except Dharwad. Black rust was observed only at Wellington, where all the entries had black rust infection except HD2021 and HD2022. Eight WDMN entries (HD2329, Lal Bahadur, HD2204, C306, WH147, Kharchia Mutant, HP1633 and Bijaga Yellow) had 80S black rust severity at Wellington.

Other diseases

Blights

Information on foliar blights was received from twelve locations. Earliest record of blight was from Ranchi (03.01.22) followed by Niphad (14.01.22), Ayodhya (18.01.22), Sabour (15.02.22), Varanasi (18.02.22), Kathua (28.02.22) and Rajouri (15.04.22). Leaf blight was not reported from any of the locations in the Northern Hills Zone. Kathua, Rajouri, Durgapura 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 were infected with leaf blight at all the locations in NEPZ except at Kanpur, where eleven entries were leaf blight free. Maximum severity of leaf blight was recorded at Varanasi and Pusa, where fifteen WDMN entries had more than 52 score of leaf blight. In central zone leaf blight was not observed. In PZ and SHZ blight was reported only from Niphad and Dharwad. Leaf blight was reported only on six WDMN entries (Agra Local, C306, Kharchia Mutant, MACS2496, Bijaga Yellow and HW971) from Niphad, where leaf blight score ranged between 01 to 24. Leaf blight infection (12 to 46) was observed on all the entries of WDMN at Dharwad

Powdery mildew

Powdery mildew was reported only from six locations *viz*. Almora, Akrot, Kathua, Rajouri, Jammu, and Dhaulakuan in NHZ and NWPZ. It was not observed in NEPZ, CZ, and PZ, whereas all the entries had powdery mildew infection at Wellington in SHZ. Powdery mildew was first detected at Almora on 06.02.22 followed by Dhaulakuan (15.02.22), Kathua (28.02.22) and Rajouri (30.03.22). All the entries of WDMN were showing powdery mildew symptoms at Akrot, Rajouri, Kathua, Jammu and Dhaulakuan, whereas 14 entries were powdery mildew free at Almora. Maximum powdery mildew severity was recorded at Jammu where ten WDMN entries had disease score of 6 or more. Minimum severity of powdery mildew was observed at Almora where only six entries showed powdery mildew severity ranging between 3 to 7.

Loose smut

All the WDMN entries were loose smut free in all the zones and locations.

8.5. SAARC Wheat Disease Monitoring Nursery (2021-22)

Under the umbrella of Regional Station, ICAR-IIWBR, Shimla and CIMMYT, Delhi, SAARC wheat disease monitoring nursery is being conducted in SAARC countries with the objectives similar to the wheat disease monitoring nursery (WDMN) in India. During 2021-22, SAARC-wheat disease monitoring nursery was planted at 27 locations across the six SAARC countries (Table 8.17).

Table 8.17.Detail of SAARC-WDMN locations and contact persons.

S. No.	Country/ Locations	Contact person
1.	Nepal (3 sets)	CIMMYT, New Delhi, India*
2.	Bangladesh (5 sets)	-do-
3.	Pakistan (2 sets)	-do-
4.	Bhutan (1 set)	-do-
5.	Afghanistan (1set)	-do-
6.	India (15 sets)	Head, ICAR-IIWBR, RS, Flowerdale, Shimla
Total	**27 locations**	

*Coordinator: Dr. A.K. Joshi, CIMMYT, Delhi.

Information on wheat diseases in SAARC Wheat Disease Monitoring Nursery has been received from all the locations in India (Table 8.18). Data from other locations of Nepal, Bangladesh, Pakistan, Bhutan and Afghanistan is awaited.

Table 8.18: Locations of SAARC wheat disease monitoring nursery in India

State	Co-operator	Locations
Delhi	V. K. Singh	Delhi
Himachal Pradesh	Shiwali Dhiman	Dhaulakuan
Jammu & Kashmir	M.K. Pandey	Jammu (Udhaywalla) Kathua Rajouri
Punjab	Jaspal Kaur	Ludhiana Gurdaspur Ropar SBS Nagar
Uttar Pradesh	SP Singh	Kumarganj, Ayodhya
Bihar	KK Singh	Pusa
Rajasthan	P. S. Shekhawat	Bassi (Durgapura)
Tamil Nadu	M Siva samoi	Wellington
Uttarakhand	Deepshikha and Kanak Srivastava K. K. Mishra	Pantnagar Almora

The SAARC wheat disease monitoring nursery comprised 20 lines contributed by four SAARC countries (Table 8.19).

Table 8.19: Composition of SAARC wheat disease monitoring nursery.

S. No.	Variety	S. No.	Variety
1.	Annapurna-1	11.	Punjab 85
2.	WL 1562	12.	Chakwal 86
3.	HD 2204	13.	Faisalabad 85
4.	PBW 343	14.	Inquilab 91
5.	HD 2687	15.	Faisalabad 83
6.	HD 2189	16.	Rawal 87
7.	HP 1633	17.	Kohsar
8.	RAJ 3765	18.	Bakhtawar 94
9.	PBW 660	19.	Gourab
10.	Pak 81	20.	Susceptible Check

Wheat Disease Situation in SAARC countries

Disease situation in India

Rusts

SAARC nursery was planted at 12 locations of NHZ and NWPZ, Ayodhya and Pusa in NEPZ and Wellington in SHZ (Table 4). Yellow rust was observed at all the SAARC-WDMN nursery locations in India except Wellington, Pusa and Ayodhya. Yellow rust was first observed at Jammu (10.01.22), followed by Kathua (12.01.22), Almora and Rajouri (16.02.22), Dhaulakuan (22.02.22), Delhi (25.02.22) and Bassi (Durgapura) (15.03.22). All the entries of SAARC nursery were infected with yellow rust at all the locations of NHZ and NWPZ except Almora, Pantnagar, Delhi, Rajouri and Durgapura. More than eight entries of SAARC-WDMN had more than 40S severity of yellow rust at Almora, Jammu, Kathua, Ludhiana, Ropar, SBS Nagar, Gurdaspur and Dhaulakuan. Maximum yellow rust severity was at SBS Nagar, where all the entries except WL1562, HD2204, HD2189, PBW660, Bakhtawar 94, had more than 40S severity of yellow rust, of which Inquilab 91 showed 80S severity of yellow rust. Yellow rust appeared only on four entries (PBW343, Faisalabad 85, Inquilab 91 and susceptible check) at Durgapura and five entries {PBW343 (60S), HD2687 (10S), Inquilab 91 (TR), Kohsar (5S) and susceptible check (60S) at Delhi. Entries HD2189 and PBW660 were the least sensitive to yellow rust as they were yellow rust free at least four locations. Two entries (Susceptible check and PBW 343) were most susceptible for yellow rust as they had more than 40S severity of yellow rust at least at eight locations. Yellow rust severity was more than 40S at all the locations except Pantnagar (0R) and Durgapura (20S).

Brown rust was observed at all the SAARC nursery locations except Ropar, SBS Nagar, Gurdaspur and Dhaulakuan (Table 8.20). First report of brown rust was from Kathua on 28.02.22 followed by Ayodhya (07.03.22), Jammu (10.03.22), Delhi (25.03.22), Almora (06.04.22) and Rajouri (15.04.22). All the entries of SAARC-WDMN were brown rust free at Durgapura except RAJ3765 and Delhi except WL1562, Faisalabad 85 and susceptible check. Similarly, at Almora brown rust appeared only on HD2687 (5S), Faisalabad 85 (10S), Rawal 87 (TMS), Kohsar (5S), Bakhtawar 94 (10S) and S. check (20S), while at Rajouri it appeared on Annapurna (5S), Raj3765 (TMS), Pak81 (10S), Faisalabad 85 (10S), Inquilab 91 (20S) and S. check (20S). SAARC-WDMN entry Chakwal 86 was brown rust free at all the locations except Pantnagar, where 30S severity of brown rust was reported on it. HP1633 was brown rust free at all the locations except Pantnagar (TR), Jammu (5MS) and Wellington (80S). Similarly, PBW660 was brown rust free at all the locations except Pantnagar (5S), Jammu (TMS), Kathua (TMS). Maximum severity of brown rust was reported from Pantnagar where all the entries except HP1633 (TR), PBW660 (5S), Chakwal 86 (30S) and Gourab (15S) had more

than 40S severity. At Wellington brown rust (10MR to 80MS) appeared on all the entries of SAARC-WDMN except PBW660, Chakwal 86.

Black rust was observed only at Wellington, where all the entries except Annapurna, PBW660 were showing black rust symptoms. Black rust severity at Wellington was ranging from 5MR on Pak 81 and Kohsar to 80S on HD2204 and HP1633 (Table 8.20).

Blights

Leaf Blight of wheat was observed only at five locations (Jammu, Kathua, Rajouri, Ayodhya and Pusa) of SAARC nursery, where all the entries were infected with leaf blight. Maximum leaf blight severity was observed at Pusa, where 16 entries had equal or more than 52 leaf blight disease severity (Table 8.21).

Powdery mildew

Powdery mildew (PM) was reported only from five SAARC-WDMN locations i.e. Jammu, Kathua, Rajouri, Wellington and Dhaulakuan, where all the entries had powdery mildew infection except PBW660 at Wellington. All the entries of the nursery were infected with PM at Kathua, where seventeen entries had equal or more than 5 powdery mildew score while four entries had powdery mildew score 4. Entry RAJ3765 had 8 powdery mildew score at Kathua and Dhaulakuan (Table 8.22).

Loose Smut

Loose smut was not reported on any of the SAARC-WDMN entries from any of the locations of SAARC nursery in India.

Disease situation in other SAARC countries

Disease situation in Bangladesh

SAARC wheat disease monitoring nursery was planted at four locations in Bangladesh i.e. Jashore, Dinajpur, Jamalpur and Joydebpur. Only leaf blight disease of wheat was observed at all four locations (Table 8.23). Brown rust was observed only at Jashore and Dinajpur. At Jashore all the entries of the nursery except HD2189, HP1633, Punjab 85 and Gourab were infected with brown rust whereas at Dinajpur all the entries except HD2687 were showing brown rust infection, though the severity was less than 10S on 15 entries. Leaf blight was very severe at all the locations.

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

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Table 8.20: Incidence of rusts in SAARC Wheat Disease Monitoring Nursery in India during 2021-22

S. No.	Varieties	Yellow												Brown										Black
		ALM	BAS	DEL	DKN	GUR	JAM	KAT	LUD	PAN	RAJ	ROP	SBS	ALM	AYO	BAS	DEL	JAM	KAT	LUD	PAN	PUS	RAJ	WEL	WEL
1	Annapurna	20S	0	0	40S	40S	60S	20S	60S	15S	40S	20S	40S	0	40 S	0	0	20S	20S	0	80S	0	5S	80S	0
2	WL1562	5S	0	0	20S	10S	60S	10S	20S	0	20S	10S	20S	0	0	0	TR	10MS	20S	0	80S	20 S	0	80S	10MR
3	HD2204	40S	0	0	20S	10S	40S	5MS	20MS	0	20S	5MR	20MS	0	30 S	0	0	10MS	5MS	10S	80S	10 S	0	40S	80S
4	PBW343	5S	10S	60S	60S	40S	60S	60S	60S	20S	40S	60S	60S	0	20 S	0	0	5S	5MS	0	80S	10 S	0	40MS	20MR
5	HD2687	10S	0	10S	60S	40S	20S	40S	40S	10S	5S	20MS	40S	5S	0	0	0	0	0	5S	100S	5 S	0	40S	10MR
6	HD2189	0	0	0	20S	20S	40S	10MS	10S	0	10S	20S	10S	0	0	0	0	0	5S	0	70S	0	0	40S	40S
7	HP1633	10S	0	0	60S	60S	60S	60S	40S	30S	20S	60S	60S	0	0	0	0	5MS	0	0	TR	0	0	80S	80S
8	RAJ3765	40S	0	0	80S	40S	60S	10S	60S	20S	10S	80S	60S	0	10 S	10S	0	0	0	10S	90S	10 S	TMS	40S	20MR
9	PBW660	0	0	0	5S	10S	10MS	5MR	10S	TR	0	10S	10S	0	0	0	0	TMS	TMS	0	5S	0	0	0	0
10	PAK81	80S	0	0	40S	60S	40S	40S	60S	15S	20S	80S	60S	0	60 S	0	0	20S	20S	10S	90S	0	10S	80S	5MR
11	Punjab85	0	0	0	5S	20S	20MS	5S	10S	TR	10S	20S	40S	0	10 S	0	0	5MS	0	10S	80S	10 S	0	60S	20MR
12	Chakwal86	60S	0	0	10S	40S	5MS	10S	10S	15S	TMS	20S	40S	0	0	0	0	0	0	0	30S	0	0	0	20S
13	Faisalabad85	40S	20S	0	40S	60S	40S	40S	60S	5S	20S	80S	40S	10S	5 S	0	0	20S	20S	0	100S	50 S	10S	80S	60S
14	Inquilab91	60S	10S	TR	40S	6S	40S	60S	80S	10S	20S	80S	80S	0	40 S	0	0	20S	40S	10S	100S	30 S	20S	80S	40MS
15	Faisalabad83	0	0	0	20S	40S	40S	40S	40S	5S	20S	10S	60S	0	TS	0	0	0	0	5S	80S	20 S	0	10MR	20MR
16	Rawal87	10S	0	0	10S	40S	40S	20S	10S	5S	5S	40S	40S	TMS	40 S	0	0	20S	TMS	40S	80S	20 S	0	80S	10MR
17	Kohsar	10S	0	5S	20S	60S	40S	20S	80S	5S	10S	20S	60S	5S	10 S	0	0	0	5S	0	80S	10 S	0	80S	5MR
18	Bakhtawar94	10S	0	0	5S	20S	40S	20S	40S	TR	20S	20S	20S	10S	0	0	0	0	TMS	0	70S	10 S	0	10S	10MR
19	Gourab	40S	0	0	40S	40S	40S	TMS	60S	TR	0	40S	60S	0	10 S	0	0	TMS	0	0	15S	0	0	20MR	20MR
20	Susceptible check	40S	20S	60S	80S	80S	60S	60S	80S	0	40S	60S	60S	20S	70 S	0	10S	40S	40S	10S	100S	10 S	20S	80S	60S
	Date of first Appearance	16.02.22	15.03.22	25.02.22	22.02.22	-	10.01.22	12.01.22	-	-	16.02.22	-	-	06.04.22	07.03.22	-	25.03.22	10.03.22	28.02.22	-	-	-	15.04.22	-	-

*ALM= Almora, BAS= Bassi, DEL=New Delhi, DKN=Dhaulakuan, GUR=Gurdaspur, JAM=Jammu, KAT=Kathua, LUD=Ludhiana, PAN=Pantnagar, RAJ=Rajouri, ROP=Ropar, SBS= SBS Nagar, AYO= Ayodhya, PUS= Pusa, WEL=Wellington

Table 8.21: Leaf blight in SAARC-Wheat Disease Monitoring Nursery in India during 2021-22

S. No.	Varieties	Leaf blight severity				
		Ayodhya	Jammu	Kathua	Rajouri	Pusa
1	Annapurna	45	35	34	24	75
2	WL1562	57	56	24	23	62
3	HD2204	58	57	26	12	62
4	PBW343	46	35	23	23	55
5	HD2687	46	47	26	23	55
6	HD2189	57	46	12	24	45
7	HP1633	58	56	23	36	58
8	RAJ3765	46	46	46	36	57
9	PBW660	35	24	24	12	57
10	PAK81	46	35	26	24	48
11	Punjab85	57	24	26	24	56
12	Chakwal86	35	24	34	24	65
13	Faisalabad85	46	35	36	12	57
14	Inquilab91	46	24	26	23	45
15	Faisalabad83	57	35	36	12	58
16	Rawal87	67	25	24	23	54
17	Kohsar	57	24	16	24	52
18	Bakhtawar94	35	13	24	24	52
19	Gourab	57	35	12	12	45
20	Susceptible check	78	46	36	36	57
Date of first appearance		18.01.22	24.02.22	02.02.22	15.04.22	-

Table 8.22: Powdery mildew in SAARC-Wheat Disease Monitoring Nursery in India, 2021-22.

S. No.	Varieties	Powdery Mildew severity					
		Almora	Dhaulakuan	Jammu	Kathua	Rajouri	Wellington
1	Annapurna	0	7	3	6	5	4
2	WL1562	0	6	5	6	5	2
3	HD2204	0	5	6	7	7	6
4	PBW343	0	8	5	6	5	4
5	HD2687	5	7	7	6	4	6
6	HD2189	0	3	7	4	3	4
7	HP1633	0	4	3	7	3	2
8	RAJ3765	0	9	3	8	5	4
9	PBW660	0	6	3	4	2	0
10	PAK81	0	7	5	7	5	4
11	Punjab85	0	6	7	6	7	3
12	Chakwal86	0	5	3	7	3	2
13	Faisalabad85	0	6	2	5	5	3
14	Inquilab91	5	2	9	7	7	4
15	Faisalabad83	0	3	7	6	7	3
16	Rawal87	5	9	7	6	5	4
17	Kohsar	7	6	7	7	7	4
18	Bakhtawar94	0	4	7	4	5	2
19	Gourab	5	2	6	5	7	2
20	Susceptible check	3	9	5	7	5	4
Date of first appearance		06.02.22	15.02.22	24.02.22	28.02.22	30.03.22	-

Table 8.23: Incidence of wheat diseases in SAARC Wheat Disease Monitoring Nursery in Bangladesh during 2021-22

S. No.	Variety	Brown rust				Leaf Blight			
		Jashore	Dinajpur	Jamalpur	Joydebpur	Jashore	Dinajpur	Jamalpur	Joydebpur
1	Annapurna-1	20MS	20S	0	0	74	75	32	65
2	WL1567	5MR	TMS	0	0	87	87	53	65
3	HD2204	5MR	TMSS	0	0	87	88	64	76
4	PBW343	5MR	5MSS	0	0	85	75	21	65
5	HD2687	TR	0	0	0	75	75	32	65
6	HD2189	0	TMSS	0	0	75	64	42	65
7	HP1633	0	TMSS	0	0	87	87	76	65
8	Raj 3765	5MR	10S	0	0	54	75	53	65
9	PBW373	20MS	10S	0	0	75	76	43	76
10	Pak 81	5MR	TMSS	0	0	87	54	32	65
11	Punjab 85	0	TMSS	0	0	87	76	32	65
12	Chakwal 86	5MR	20S	0	0	76	76	33	65
13	Faisalabad 85	10MS	20S	0	0	87	75	32	66
14	Inquilab 91	10MS	TMSS	0	0	87	87	33	65
15	Faisalabad 83	TR	5MS	0	0	87	86	42	76
16	Rawal 87	5MR	5MR	0	0	87	86	32	65
17	Kohsar	10MS	TMSS	0	0	75	76	33	55
18	Bakhtwar 94	TR	TMS	0	0	87	88	42	65
19	Gourab	0	TMSS	0	0	75	86	32	55
20	Susceptible Check	40MSS	50S	0	0	75	87	52	66

PROGRAMME 9. INTEGRATED PEST MANGEMENT IN WHEAT

9.1 HOST RESISTANCE AGAINST DISEASES

I. Elite Plant Pathological Screening Nursery (EPPSN), 2021-22

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: 68
Diseases: Stem, Leaf and Stripe rusts
Yellow Rust: Khudwani, Malan, Dhaulakuan, Almora, Jammu, Ludhiana, Karnal, Hisar, Delhi, Durgapura and Pantnagar)
Leaf Rust (North): Almora, Jammu, Ludhiana, Karnal, Hisar, Delhi, Durgapura, Pantnagar, Kanpur, Ayodhya and Kalyani
Leaf (South) and Stem Rusts: Vijapur, Indore, Powarkheda, Niphad, Pune, Mahabaleshwar, Dharwad and Wellington

Data were not considered due to poor/erratic disease development from the following centres:
Stripe rust: Khudwani, Delhi; **Leaf rust (N):** Durgapura, Kalyani Jammu and Ayodhaya;
Leaf rust (S): Vijapur, and Indore; **Stem rust:** Dharwad and Pune

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: HI 1654, DBW 296, HI 8830 (d), WHD 965 (d), HD 3368, HD 3410, PBW 867, DBW 318, UP 3060, HI 8833 (d), HI 8826 (d), HI 8828 (d), HI 8827 (d), PBW 826, HD 3368, DBW 316, HD 3407, HD 3413, DBW 318, WH 1405, PBW 870, CPIIWBR-121 and CPIIWBR-185
Resistant to stem and leaf rusts: HI 1655, GW 513, HI 1636, GW 528, CG 1036, HI 1651, UP 3095, UP 3096, CPIIWBR-100, CPIIWBR-153 and CPIIWBR-266
Resistant to leaf and stripe rusts: PBW 835, UAS 475 (d), PBW 874 and CPIIWBR-144
Resistant to stem and stripe rusts: UP 3062

Table 9.1: Entries tested in Elite Plant Pathological Screening Nursery, 2021-22

S. No.	Entries	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
1	HI 1654	6.1	40MS	0.3	5MR	0.7	5S	9.0	20S
2	DBW 296	4.0	20S	0.0	0	0.8	5S	7.0	30S
3	HI 8830 (d)	1.7	10MS	1.2	R	0.0	TR	4.6	20MS
4	HI 1655	0.9	5R	0.0	0	0.0	0	29.6	60S
5	WHD 965 (d)	4.7	20MS	0.0	0	0.0	0	4.4	10S
6	HD 3368	7.0	20MS	0.6	5MS	4.1	20S	9.0	20S
7	HD 3410	0.9	5MR	4.6	5MR	5.7	20S	8.9	20S
8	PBW 867	2.4	20MR	0.9	10MR	0.6	5MS	6.3	40S
9	DBW 318	3.6	20MS	0.6	5MS	4.7	20S	7.2	40S
10	UP 3060	7.0	40S	5.8	20S	3.3	10S	9.0	40S

11	NW 7096	11.3	40S	3.8	10MS	5.7	20S	29.1	60S
12	UP 3062	5.0	20MS	5.0	10S	13.3	30S	9.4	60S
13	HI 8833 (d)	3.6	10MS	2.9	5MS	4.3	20S	3.1	10S
14	GW 513	0.4	10R	0.0	0	0.0	0	60.9	100S
15	HI 1636	0.9	5R	0.0	TR	0.0	0	62.2	100S
16	GW 528	1.0	10MR	0.0	R	1.4	10S	53.3	100S
17	CG 1036	1.3	20R	0.0	R	0.0	0	58.7	100S
18	HI 8826 (d)	3.1	10MS	0.6	R	0.0	0	5.8	20S
19	HI 8828 (d)	1.8	5R	0.1	R	6.7	40S	6.7	20MS
20	HI 8827 (d)	4.7	20MR	1.2	R	0.0	0	4.1	10S
20A	Infector	80.0	100S	82.9	100S	57.1	80S	73.3	100S
21	HI 1651	3.3	10S	2.1	15MS	0.7	5S	45.1	80S
22	WH 1404	1.7	5S	2.3	20MS	12.1	80S	19.8	40S
23	UP 3095	2.9	10MS	0.1	R	4.4	20S	26.2	60S
24	PBW 826	6.3	20MS	5.0	30MS	7.1	40S	8.6	20S
25	PBW 835	12.4	60MS	0.0	R	1.4	10S	3.0	10S
26	HD 3368	5.8	20S	1.2	10MS	0.0	0	6.3	20MS
27	DBW 316	1.4	10MS	0.0	15MR	0.7	5S	3.5	10S
28	DBW 321	38.3	80S	18.4	40S	12.1	80S	6.4	40S
29	HD 3407	1.1	10MR	0.0	5S	6.4	20S	3.3	40S
30	UAS 475 (d)	10.1	40MS	0.4	TR	2.9	20S	0.4	5MS
31	PBW 874	21.3	80S	0.8	TMR	5.7	40S	2.2	20MS
32	HD 3413	9.7	20S	5.9	20S	8.6	60S	4.9	40S
33	DBW 318	0.7	10MR	1.5	10S	0.1	TS	0.8	20S
34	WH 1405	7.5	20MS	5.2	20MS	4.4	30S	4.6	20MS
35	DBW 376	21.5	60S	17.7	60S	12.1	40S	3.3	40S
36	PBW 870	2.1	20MR	0.0	R	6.4	40S	6.7	20S
37	UP 3096	6.0	20MS	0.6	5MS	5.0	20S	12.2	40S
38	CPIIWBR-9	25.8	40S	12.6	40S	23.6	60S	14.6	40S
39	CPIIWBR-15	19.2	40S	10.2	40MS	16.4	60S	8.1	40S
40	CPIIWBR-34	18.3	40S	13.6	40S	5.0	15S	11.9	60S
40A	Infector	76.7	100S	77.1	100S	54.3	80S	68.9	80S
41	CPIIWBR-38	17.7	40S	0.1	TR	4.2	20S	10.6	20S
42	CPIIWBR-100	4.1	10MS	2.3	10MS	1.7	10S	19.6	40S
43	CPIIWBR-121	2.0	10MR	3.1	5MS	3.3	10S	0.0	0
44	CPIIWBR-144	12.3	40S	4.6	20MS	1.0	5MS	4.9	20MS
45	CPIIWBR-145	29.2	80S	4.6	10MS	3.8	15S	13.3	60S
46	CPIIWBR-153	9.5	20S	2.5	10MS	1.7	10S	18.9	60S
47	CPIIWBR-185	0.8	5MR	3.5	10MS	2.5	10S	5.5	20MS
48	CPIIWBR-190	30.0	60S	13.7	40S	8.8	40S	18.2	80S
49	CPIIWBR-210	56.7	100S	58.3	100S	30.0	90S	49.3	100S
50	CPIIWBR-211	21.8	60S	10.4	40S	23.3	90S	14.9	40S
51	CPIIWBR-212	22.0	60S	6.6	20MS	24.0	80S	20.0	60S
52	CPIIWBR-214	14.3	40S	27.1	60S	31.7	70S	29.1	60S
53	CPIIWBR-216	40.0	80S	16.0	40S	25.0	60S	38.6	80S
54	CPIIWBR-241	6.0	20MS	1.7	5S	13.3	70S	29.6	60S
55	CPIIWBR-242	14.5	40S	6.0	10MS	10.8	50S	13.0	40S
56	CPIIWBR-243	38.7	60S	20.0	40S	26.7	70S	41.8	100S
57	CPIIWBR-247	3.2	10S	7.1	40S	18.7	60S	33.1	60S
58	CPIIWBR-248	42.7	60S	29.1	60S	21.7	50S	54.4	100S
59	CPIIWBR-255	38.3	60S	20.0	40S	30.0	70S	28.2	60S
60	CPIIWBR-266	4.0	10MS	0.0	0	0.0	0	10.5	40S
60A	Infector	76.7	100S	80.0	100S	70.0	100S	76.7	90S

61	CPIIWBR-281	34.3	60S	10.9	20S	26.7	80S	36.4	90S
62	CPIIWBR-302	23.7	60S	10.9	40S	18.2	60S	16.7	40S
63	CPIIWBR-309	31.2	60S	13.0	40S	20.0	50S	50.6	80S
64	CPIIWBR-316	16.0	40S	12.6	40S	6.7	20S	44.9	80S
65	CPIIWBR-404	33.3	60S	22.6	60S	30.0	80S	45.1	80S
66	CPIIWBR-455	13.2	20S	3.9	10S	17.5	80S	18.1	50S
67	CPIIWBR-457	13.2	20S	6.9	10S	15.8	80S	19.3	60S
68	CPIIWBR-458	11.2	20S	6.0	20MS	13.5	60S	22.4	50S

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SACHIN UPMANYU	MALAN
V.K. SINGH	DELHI
SHIWANI DHIMAN	DHAULAKUAN
JASPAL KAUR, RITU BALA	LUDHIANA
DEEP SHIKHA	PANTNAGAR
R. S. BENIWAL	HISAR
M. K. PANDEY	JAMMU
P.S. SHEKHAWAT	DURGAPURA
K. K. MISHRA	POWARKHEDA
T.L. PRAKASHA	INDORE
MS. ELANGBAM PREMABATI DEVI, RONAK THAKKAR	VIJAPUR
GURUDATT M. HEGDE	DHARWAD
SUDHIR NAVATHE	PUNE
M. A. SUSHIR, V. M. SALI	MAHABALESHWAR
B. M. ILHE, B.C. GAME	NIPHAD
P. NALLATHAMBI	WELLINGTON
JAVED BAHAR KHAN	KANPUR
S. P. SINGH	AYODHYA
SUNITA MAHAPATRA	KALYANI
SUDHEER KUMAR, PREM LAL KASHYAP AND RAVINDRA KUMAR	KARNAL (COORDINATING UNIT)

II. Multiple Disease Screening Nursery, 2021-22

Thirty one 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:

Yellow Rust: Khudwani, Malan, Dhaulakuan, Almora, Jammu, Ludhiana, Karnal, Hisar, Delhi, Durgapura and Pantnagar; **Leaf Rust (North):** Almora, Jammu, Ludhiana, Karnal, Delhi, Durgapura, Pantnagar, Kanpur, Ayodhya and Kalyani; **Leaf (South) and Stem Rusts:** Vijapur, Indore, Powarkheda, Niphad, Pune, Mahabaleshwar, Dharwad and Wellington; **Leaf blight:** Ludhiana, Karnal, Pantnagar, Ayodhya, Varanasi, Sabour, Kalyani, Coochbehar, Indore, Powarkheda, Pune and Dharwad; **Karnal bunt:** Malan, Jammu, Ludhiana, Karnal, Hisar, New Delhi, and Pantnagar; **Loose smut**: Malan, Almora, Ludhiana, Hisar and Durgapura**; Powdery mildew:** Malan, Dhaulakuan, Almora, Jammu, Pantnagar and Wellington; **Flag smut:** Ludhiana, Hisar, Delhi and Durgapura; **Head scab:** Dhulakuan, Gurdaspur, Delhi and Wellington; **Nematodes (CCN):** Hisar and Durgapura.

Data were not considered due to poor/erratic disease development from the following centres: **Stripe rust:** Khudwani, Delhi; **Leaf rust (N):** Durgapura, Kalyani Jammu and Ayodhaya; **Leaf rust (S):** Vijapur, and Indore; **Stem rust:** Dharwad and Pune; **Leaf blight:** Sabour, Indore, Powarkheda, Pune and Dharwad; **Karnal bunt:** Malan, Jammu, New Delhi; **Powdery mildew:** Malan, **Flag smut:** Delhi; **Head scab:** Wellington.

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:

Resistant to all three rust: MPO 1357 (d)
Resistant to stem and leaf rust: HS 679,HS 681,DDK 1058 (dic.),HUW 838,RAJ 4541,HI 8823(d), DDK 1059 (dic.),GW 513,HD 2864,HI 1544,HI 1633,HI 8627(d),HI 8818(d),VL 3024
Resistant to stem and leaf rust +PM: HD 2733
Resistant to leaf and stripe rust +PM+FS: DDW 47(d)
Resistant to leaf & stripe rust +KB: UAS 466(d)
Moderately Resistant to Leaf Blight: HS 507, HI 1636

COOPERATORS:

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SHIWANI DHIMAN	DHAULAKUAN
JASPAL KAUR, RITU BALA	LUDHIANA
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FOR CCN

DURGAPURA	S.P. BISHNOI
HISAR	PRIYANKA DUGGAL

Table 9.2 Reactions of different entries of Multiple Diseases Screening Nursery 2021-22 against diseases and CCN

S. No.	Entries	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		LB (dd)		KB (%)		PM (%)		FS (%)		FHB (%)	CCN
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	HS	HS
1	HS 507	5S	2.4	20MS	7.5	30S	8.3	40S	10.3	34	57	2.7	6.3	6	7	3.0	4.5	3	HS
2	HS 679	5MR	0.5	10S	3.1	20S	3.3	20S	7.0	45	68	3.8	7.2	4	7	2.1	4.6	3	HS
3	UAS 472(d)	40MS	6.5	10MR	1.1	15S	3.3	40S	9.7	45	67	5.0	16.5	5	9	0.0	0.0	3	HS
4	DDW47 (d)	20MS	3.6	5MR	0.6	5S	0.9	10MS	1.6	45	68	6.0	14.5	1	1	0.0	0.0	5	HS
5	HD 3334	10MR	1.0	R	0.1	40S	12.5	20MS	6.4	45	68	10.3	23.8	5	7	7.2	16.7	3	HS
6	HS 681	5MR	0.4	20MR	3.5	10S	3.5	20S	6.0	34	68	12.9	46.8	6	9	2.1	5.0	4	HS
7	MPO 1357(d)	10MS	2.4	R	0.1	TMS	0.1	10MS	1.5	56	68	3.9	11.0	5	7	0.0	0.0	5	HS
8	DDK 1058 (dic.)	20MR	4.1	5MR	0.6	TR	0.0	40S	15.6	45	57	4.7	13.6	3	5	0.8	2.5	2	HS
9	HD 3377	10S	2.3	5MR	0.5	10S	1.7	40S	14.9	57	68	6.9	20.9	3	4	2.7	5.0	3	HS
10	HI 1636	20MS	11.2	R	0.1	5S	1.7	20S	9.3	35	57	16.6	53.6	5	9	3.5	6.6	3	HS
11	HUW 838	5S	1.5	R	0.1	0	0.0	20S	7.4	46	77	11.3	29.0	4	7	2.8	5.0	4	S
12	RAJ 4541	5R	0.5	10MS	2.1	0	0.0	60S	29.1	46	68	7.1	22.7	4	5	16.2	40.0	4	HS
13	VL 2036	10MS	3.2	20MS	4.1	5S	0.8	20S	10.3	46	78	8.6	29.4	7	9	2.3	3.5	3	HS
14	HI8823 (d)	10MR	1.2	5MR	1.1	10MS	1.4	40S	12.9	46	69	10.7	38.3	5	9	0.8	2.5	2	HS
15	CG 1029	10MR	1.8	20MS	4.1	10MR	0.7	100S	70.0	57	78	8.2	27.9	5	7	11.9	33.3	4	HS
16	DDK 1059 (dic.)	10MS	2.4	R	0.1	0	0.0	80S	29.8	56	78	27.1	81.3	6	9	1.5	4.5	2	HS
17	GW513	5MR	0.6	5MR	0.5	TMR	0.1	100S	51.8	56	78	15.1	47.8	6	7	1.2	3.5	3	HS
18	HD 2864	10MR	1.2	15MR	3.1	0	0.0	100S	64.0	46	68	4.8	14.7	6	7	3.0	6.6	4	HS
19	HI 1544	5MR	1.0	5MR	0.6	0	0.0	100S	55.6	57	78	9.5	27.2	6	9	19.7	50.0	4	HS
20	HI 1633	5MS	1.2	5MR	0.6	0	0.0	100S	66.7	46	79	3.1	6.5	6	9	2.4	6.2	3	HS
20A	Infector for Rust (C)	100S	72.0	80S	75.0	100S	58.3	100S	77.8	-	-	-	-	-	-	-	-	-	-
20B	A9-30-1 for L.B.(C)	-	-	-	-	-	-	-	-	78	78	22.9	25.0	-	-	23.3	23.3	5	-
20C	HD 2967 for K.B.(C)		-	-	-	-	-	-	-	-	-	23.8	28.2	-	-	22.2	22.2	3	-
20D	PBW343 for P.M.(C)		-	-	-	-	-	-	-	-	-	21.9	25.0	7	8	34.5	60.0	4	-
20E	Sonalika for L.S.(C)		-	-	-	-	-	-	-	89	89	28.9	35.5	-	-	28.1	28.1	5	-
21	HI 1634	10MR	1.2	20MS	6.0	0	0.0	80S	48.0	57	79	10.1	32.0	6	9	1.7	5.0	4	HS
22	HI 8627(d)	40MR	3.4	10MR	1.1	0	0.0	20S	10.7	57	68	11.1	39.0	6	7	0.8	2.3	2	HS
23	NIAW 3170	40MS	7.0	5MR	0.6	TR	0.0	15MS	5.6	57	78	1.2	4.6	6	9	0.8	2.5	5	S

24	HD 3249	20S	6.0	20MS	6.2	20S	3.3	40S	13.4	46	68	8.4	18.8	6	9	6.1	10.0	4	HS
25	HI 8805 (d)	40S	21.2	5MR	0.6	0	0.0	60S	13.0	57	78	8.3	29.0	7	9	0.0	0.0	4	HS
26	HI 8818 (d)	60MS	13.0	20MR	2.6	10S	1.7	5MS	1.7	46	68	13.4	50.0	6	7	0.0	0.0	3	HS
27	UAS 466(d)	20MS	8.9	10MS	2.2	5S	0.8	10MS	2.6	45	79	2.1	4.5	6	9	0.0	0.0	4	HS
28	VL 3024	5R	0.4	5MR	0.6	10MR	0.7	20MS	4.8	46	68	2.9	6.0	6	9	0.0	0.0	3	HS
29	DBW 48 (d)	60S	18.0	5MR	0.6	10MR	0.7	20S	6.1	56	68	3.2	6.1	6	9	0.0	0.0	2	HS
30	DBW 49 (d)	40S	11.6	R	0.1	10MS	1.3	30S	7.9	46	68	1.2	2.6	4	5	0.0	0.0	3	HS
31	DBW 329	10S	6.4	10MS	1.1	5S	1.9	80S	22.4	46	78	4.2	10.0	4	7	0.0	0.0	4	HS

III. Screening of MDSN 2020-21 entries against loose smut during 2021-22

Thirty entries of MDSN were inoculated with loose smut during 2020-21 crop season and expression of loose smut was observed during 2021-22 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, 2020-21, against loose smut during 2021-22 crop season.

S. No.	Entry Name	Durgapura	Hisar	Ludhiana	AV.	HS
Sources: EPPSN 2019-20						
A. Resistant to all three rusts						
1	NIDW1158(d)	34.5	3.3	0.00	12.6	34.5
2	HI8811(d)	0	6.2	0.00	2.1	6.2
3	HI8812(d)	0	6.6	0.00	2.2	6.6
4	GW1348(d)	0	8.3	0.00	2.8	8.3
5	PBW822	0	14.2	14.29	9.5	14.3
6	DDW 48(d)	26.8	4.5	0.00	10.4	26.8
7	DDW 47(d)	0	5	0.00	1.7	5.0
8	HI8808(d)	0	5.6	0.00	1.9	5.6
9	HI8807(d)	0	6.6	0.00	2.2	6.6
10	PBW823	0	5	19.57	8.2	19.6
11	NIDW1149(d)	1.6	6.6	3.79	4.0	6.6
12	HI8802(d)	0	4.6	0.00	1.5	4.6
13	WH1270	7.4	5	0.00	4.1	7.4
14	PWB 825	22	5	8.33	11.8	22.0
15	VL 3020	6.4	4.5	13.51	8.1	13.5
16	VL 3021	0	4.5	9.09	4.5	9.1
17	PBW 796	8.5	5.3	14.55	9.4	14.5
18	PBW 820	5.3	8.2	24.00	12.5	24.0
B. Resistant to stem and leaf rusts						
19	HPW 467	0.8	6.6	0.00	2.5	6.6
20	PBW 771	0	7.5	8.97	5.5	9.0
20A	INFECTOR(for rust)	-	-	32.00	32.0	32.0
20B	HD 2967(for KB)	-	-	18.52	18.5	18.5
20C	PBW 343(for PM)	-	-	15.38	15.4	15.4
20D	Sonalika(for LS)	-	-	22.77	22.8	22.8
20E	WH147 (for LB)	-	-	24.66	24.7	24.7
21	HD 3249	23.5	5.6	20.00	16.4	23.5
22	DBW 303	20.2	5.5	12.04	12.6	20.2
23	DBW 302	13.5	7.5	8.22	9.7	13.5
24	PBW 550	33.1	8.3	27.06	22.8	33.1
25	HI 1628	25.4	5.5	21.43	17.4	25.4
26	DBW 277	35.6	6.5	19.64	20.6	35.6
27	CG 1029	20.7	8.1	0.00	9.6	20.7
28	HI 1633	13.4	8.2	13.48	11.7	13.5

29	HI 1634	14.3	9.1	NI	11.7	14.3
30	GW 509	6.1	8.5	27.59	14.1	27.6
31	GW 1346	0	7.5	0.00	2.5	7.5
32	MACS 5052	0	9.1	0.00	3.0	9.1
33	DDK 1056	0	4.5	0.00	1.5	4.5
34	DDK 1057	0	4.2	0.00	1.4	4.2
35	DBW 304	20.9	4.6	20.00	15.2	20.9
C. Resistant to leaf and stripe rusts						
36	PBW 752	17.2	11.1	25.00	17.8	25.0
37	UP 3043	27.1	5.6	28.57	20.4	28.6
D. Resistant to stem and stripe rusts						
38	PBW 821	15.1	8.1	5.71	9.6	15.1
39	HI 8805(d)	3.6	4.6	0.00	2.7	4.6
40	WHD 963(d)	8.9	4.5	2.12	5.2	8.9
40A	INFECTOR(for rust)	-	-	25.53	25.5	25.5
40B	HD 2967(for KB)	-	-	21.11	21.1	21.1
40C	PBW 343(for PM)	-	-	25.33	25.3	25.3
40D	Sonalika(for LS)	-	-	18.96	19.0	19.0
40E	WH147 (for LB)	-	-	20.07	20.1	20.1

COOPERATORS:

NAME	**CENTRE**
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IV. National Genetic Stock Nursery (NGSN), 2021-22

The NGSN comprising 20 entries with confirmed sources of high level of disease resistance were shared with 20 breeding centers across different agro climatic zones of country for their utilization in breeding for resistance to biotic stresses. All the 20 entries were utilized in the range of 12.5 – 50.0% by different breeding centers (Fig. 9.1). The most utilized entries at many centers were UP 3043, PBW 821, PBW 752 and WH 1270 (Table 9.4). Khudwani center, utilized maximum 15 entries in their breeding programme followed by Jabalpur and Durgapura (Fig. 9.2).

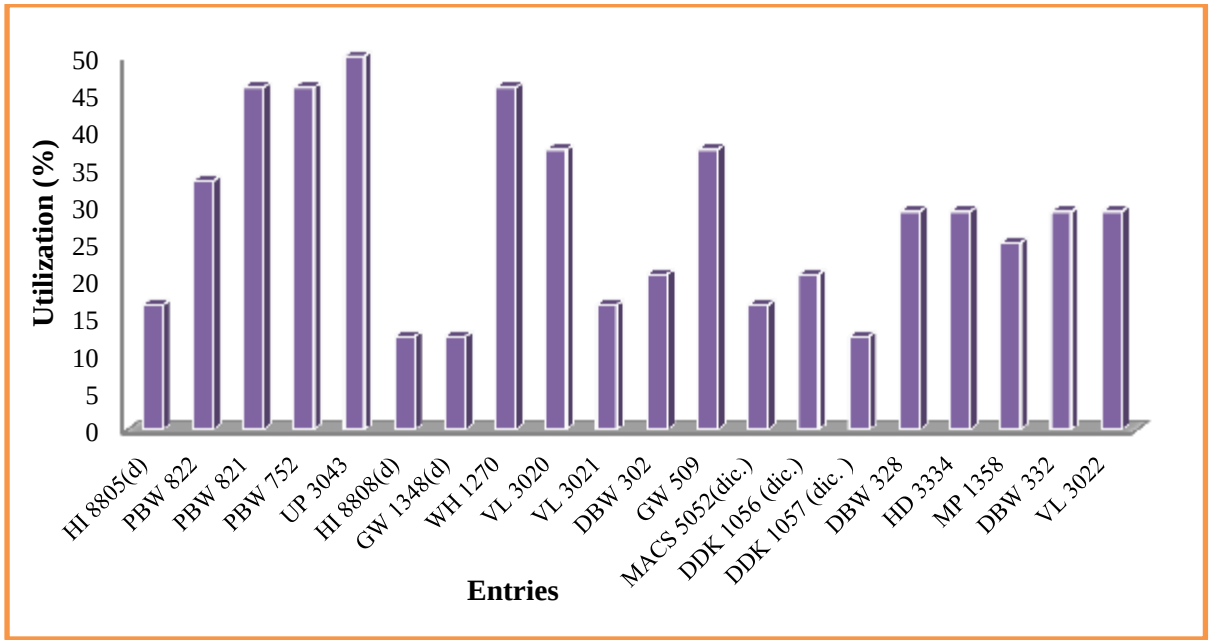

Fig. 9.1. Utilization (%) of promising resistant genotypes at different breeding centres in NGSN, 2021-22

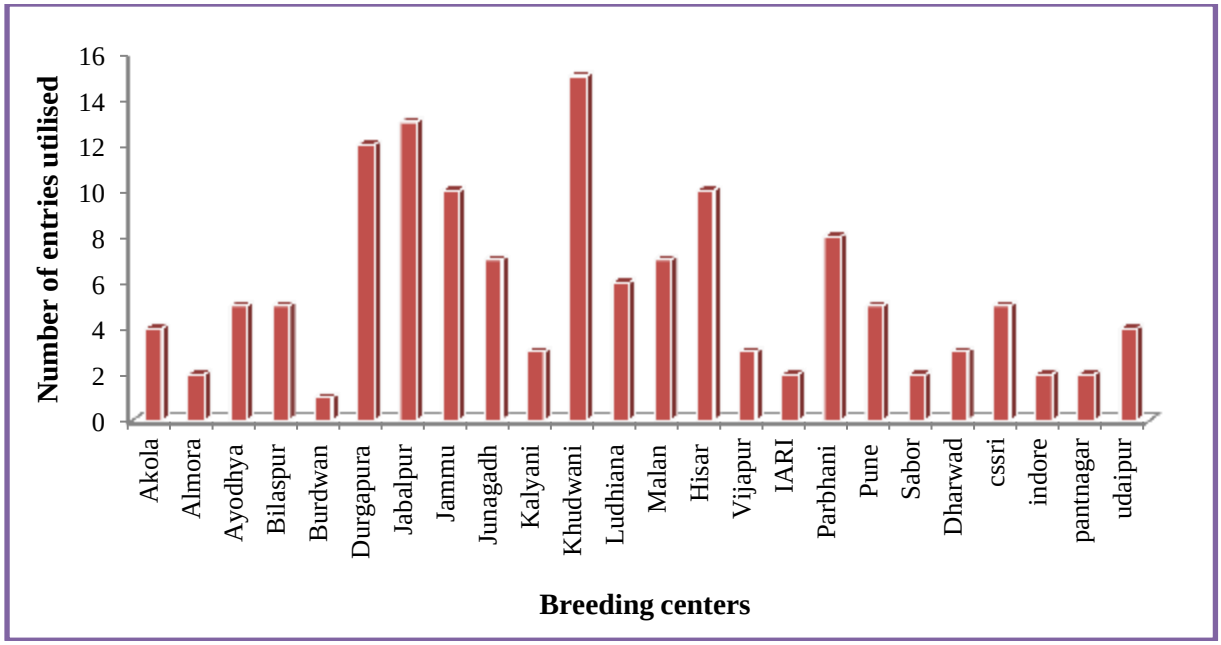

Fig. 9.2. Centre wise utilization of promising resistant genotypes from NGSN, 2021-22

Table 9.4. National genetic stock nursery (NGSN), 2021-22

S. No.	Entries	Akola	Almora	Ayodhya	Bilaspur	Burdwan	Durgapura	Jabalpur	Jammu	Junagadh	Kalyani	Khudwani	Ludhiana	Malan	Hisar	Vijapur	IARI	Parbhani	Pune	Sabour	Dharwad	CSSRI	Indore	Pantnagar	Udaipur	Total
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	HI 8805(d)											1				1		1	1							**4**
2	PBW 822				1		1	1	1		1	1		1		1										**8**
3	PBW 821		1	1	1		1	1	1	1	1	1			1	1										**11**
4	PBW 752			1	1		1		1	1	1	1		1	1				1			1				**11**
5	UP 3043	1		1	1		1	1		1		1	1	1						1				1	1	**12**
6	HI 8808(d)						1					1							1							**3**
7	GW 1348(d)											1						1							1	**3**
8	WH 1270			1	1		1	1				1		1	1		1	1				1	1			**11**
9	VL 3020							1	1			1			1		1	1			1		1		1	**9**
10	VL 3021						1	1				1									1					**4**
11	DBW 302						1	1	1			1			1											**5**
12	GW 509		1				1	1		1		1		1	1			1						1		**9**
13	MACS 5052(dic.)	1					1					1						1								**4**
14	DDK 1056 (dic.)	1				1						1						1	1							**5**
15	DDK 1057 (dic.)	1										1						1								**3**
16	DBW 328							1	1	1			1	1	1							1				**7**
17	HD 3334						1	1	1				1		1					1		1				**7**
18	MP 1358							1	1				1		1				1		1					**6**
19	DBW 332			1				1	1	1			1		1							1				**7**
20	VL 3022						1	1	1	1			1	1											1	**7**
	Total	**4**	**2**	**5**	**5**	**1**	**12**	**13**	**10**	**7**	**3**	**15**	**6**	**7**	**10**	**3**	**2**	**8**	**5**	**2**	**3**	**5**	**2**	**2**	**4**	

Cooperators: Sudheer Kumar, P.L. Kashyap, Ravindra Kumar, A. K. Gupta

9.2 Management of Diseases: Chemical Control

Powdery mildew

A. Pantnagar

Different fungicides *viz*., Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC, Azoxystrobin 11% + Tebuconazole 18.3% w/w SC, Propiconazole and Tebuconazole were evaluated at 0.1% concentration to control powdery mildew of wheat under field conditions during cropping season 2021-22 at Pant Nagar centre and their ultimate effect on disease control and grain yield was presented in the Table 9.5. It shows the disease severity, percentage disease control, grain yield (q ha^{-1}) from various fungicidal treatments. During the field experiment, disease severity was found to be significantly less in all treated plots over control ones. The result shows that after the application of various fungicides as foliar spray at the time of disease initiation followed by second spray at 14 days intervals on wheat foliage, Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1% (T2) was found most effective treatment, reflecting significantly less disease severity (1.67) as compare to others treatments. A range of disease control (38.14 to 76.14 %) was noticed from various fungicides. Maximum per cent disease control was recorded from 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%), whereas, Tebuconazole @ 0.1% showing least effect on disease control (38.14% disease reduction over control). It has been noticed that all the treatments resulted in significantly more yield and showed per cent yield gain (20.92 to 26.72 %) than the unsprayed control (Table 9.1). Highest yield gain was recorded in the plot sprayed with Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1% (T2) and showed 26.72% yield gain over the control. No phytotoxicity was recorded with any of the fungicides on wheat plants.

Table 9.5: Chemical control of powdery mildew of wheat at Pant Nagar during 2021-22

Treatments	Description	Dose (%)	Disease severity	Disease control over check (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	2.33	66.71	48.03	25.93
T2	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC	0.1	1.67	76.14	48.33	26.72
T3	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	3.67	47.57	46.43	21.74
T4	Propiconazole	0.1	2.67	61.86	47.84	25.43
T5	Tebuconazole	0.1	4.33	38.14	46.12	20.92
T6	Control		7.00	-	38.14	-
	CD (P=0.05)		0.72		0.15	

B. Malan

Field evaluation of chemical 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%), Azoxystrobin 11% + Tebuconazole 18.3% w/w SC (0.1%), along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] as foliar applications against powdery mildew of wheat was performed in randomized block design with three replications at Malan centre during 2021-22. All the tested fungicides resulted in significantly less disease severity (4.00- 4.67) in comparison to the unsprayed plot i.e. 8.33 (Table 9.6). The treatments of Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @0.1% (T1) and Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1% (T2) provided significant higher level of disease protection (51.98%) in comparison to other tested fungicides, when applied at disease initiation followed by second spray at 14 days intervals on wheat foliage. It has been noticed that all the treatments resulted in significantly more yield and showed per cent yield gain (36.89 to 42.14 %) than the unsprayed control (Table 9.6). Highest yield gain was recorded in the plot sprayed with Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC (0.1%) and Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC (0.1%). No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.6: Chemical control of powdery mildew of wheat at Malan during 2021-22

Treatments	Description	Dose (%)	Disease severity	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	4.00	51.98	22.50	42.14
T2	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC	0.1	4.00	51.98	22.50	42.14
T3	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	4.33	48.02	21.67	36.89
T4	Propiconazole	0.1	4.67	43.94	21.67	36.89
T5	Tebuconazole	0.1	4.33	48.02	21.67	36.89
T6	Control		8.33		15.83	
	CD (P=0.05)		1.47		3.18	

C. Dhaulakuan

Field evaluation of chemical 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%), Azoxystrobin 11% + Tebuconazole 18.3% w/w SC (0.1%), along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] was performed for the management of powdery mildew disease of wheat in randomized block design with three replications at Dhaulakuan location during cropping season 2021-2022. The results mentioned in Table 9.7 indicated that all the tested fungicides resulted in significantly less diseases severity (1.33 to 4.0) in comparison to the unsprayed plot i.e. 7.0 (Table 9.7). Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC @ 01% (T2) provided significant higher level of disease protection (81.00%) in comparison to other tested fungicides, applied at disease initiation followed by two repeated sprays at 14 days intervals. Besides this, all the fungicidal treatments resulted in significantly more yield and per cent yield gain over unsprayed control plot. No phytotoxic symptoms were recorded with any of the tested concentrations of the fungicides i.e. 0.1% on wheat plants.

Table 9.7 : Chemical control of powdery mildew of wheat at Dhaulakuan during 2021-22

Treatments	Description	Dose (%)	Disease severity	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	1.67	76.14	54.16	24.61
T2	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC	0.1	1.33	81.00	55.72	26.72
T3	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	2.67	61.86	51.57	20.83
T4	Propiconazole	0.1	3.33	52.43	50.11	18.52
T5	Tebuconazole	0.1	4.00	42.86	52.49	22.21
T6	Control		7.00		40.83	
	CD (P=0.05)		0.84		0.13	

D. Jammu

Field efficacy of different fungicides viz., *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%), Azoxystrobin 11% + Tebuconazole 18.3% w/w SC (0.1%), along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] was tested in randomized block design with three replications at Jammu centre for the management of powdery mildew disease of wheat during the crop season 2021-22. All the tested fungicides resulted in significantly less disease severity in comparison to the unsprayed plots (Table 9.8). It has been noticed that Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @0.1% (T2) showed least level of disease severity (1.67) in comparison to unsprayed control check (7.67). Highest level of protection from powdery mildew disease was obtained with the foliar application of fungicides at disease initiation followed by one more spray at 14 days intervals. Overall, all the fungicide treatments showed significant gain in per cent yield (16.12 – 23.37 %) in

comparison to the unsprayed control (Table 9.8). No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.8 : Chemical control of powdery mildew of wheat at Jammu during 2021-22

Treatments	Description	Dose (%)	Disease severity	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	2.67	65.22	41.18	17.40
T2	Azoxystrobin 18.2% w/w + Difenoconazole11.4% w/w SC	0.1	1.67	78.26	44.39	23.37
T3	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	2.00	73.91	43.36	21.54
T4	Propiconazole	0.1	2.67	65.22	41.97	18.95
T5	Tebuconazole	0.1	4.00	47.83	40.55	16.12
T6	Control		7.67		34.02	
	CD (P=0.05)		1.41		0.65	

Field experimental trials for the evaluation of efficiency of three chemical 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%), Azoxystrobin 11% + Tebuconazole 18.3% w/w SC (0.1%), along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] were performed in randomized block design with three replications for the management of powdery mildew of wheat during the crop season 2021-22 at four different locations i.e. Pantnagar, Malan, Dhaulakuan and Jammu. Multi-location evaluations of the efficacy of the tested fungicides clearly highlighted that Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1% (T2) is the best performing fungicide across the locations. No phytotoxicity was recorded with any of the tested concentrations of the fungicides on wheat plants.

2. Head scab of Wheat

A. Ludhiana

The field efficacy of six different fungicides viz., Picoxystrobin 7.05% + Propiconazole 11.7% SC (0.1%), yraclostrobin 133g/l + Epoxiconaxole 50g/l SE (0.1%), Tebuconazole 50% + Trifloxystrobin 25% WG (0.06%), Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC (0.1%), Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC (0.1%) and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC (0.1%) along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] was performed for the management of head scab disease of wheat during the crop season 2021-22 under field conditions and results were mentioned in Table 9.5. The experiment was laid out in randomized block design with three replications at Ludhiana centre. All the tested fungicides resulted in significantly low disease severity (<1.84) in comparison to the unsprayed plot i.e. 6.13 (Table 9.9). It has been recorded that Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% showed significant per cent gain yield over control (33.69%) when compared with recommend standard fungicides [i.e. Tebuconazole (0.1%) and Propiconazole (0.1%)]. Highest level of protection from head scab diseases was obtained with the foliar application of fungicides at disease initiation followed by second spray at 14 days intervals. Overall, all the fungicide treatments showed significant level of protection from head scab infection as well as per cent yield gain in comparison to the unsprayed control (Table 9.9). No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9. 9: Chemical control of Head scab of wheat at Ludhiana during 2021-22

Treatments	Description	Dose (%)	Disease severity	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	1.45	76.29	38.22	26.75
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	1.53	74.99	36.89	24.10

T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	1.19	80.53	42.22	33.69
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	1.58	74.23	39.44	29.01
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	1.37	77.71	35.89	21.98
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	1.35	77.92	35.00	20.00
T7	Propiconazole	0.1	1.63	73.46	34.77	19.49
T8	Tebuconazole	0.1	1.84	70.04	32.44	13.70
T9	Control		6.13		28.00	-
	CD (P=0.05)		0.69		6.99	

B. Karnal

The experiment for the field evaluation of six different fungicides viz., Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] was executed for the management of head scab disease of wheat during the crop season 2021-22 at Karnal centre and results are depicted in Table 9.10. The experiment was conducted in randomized block design with three replications. All the tested fungicides showed less disease severity of head scab disease (0.67-3.00) in comparison to the unsprayed plot (8.00). The results mentioned in Table 9.10 revealed that Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) is the most effective fungicides in controlling the head scab diseases in, when applied at disease initiation stage followed by second spray at 14 days interval. Highest level of protection from head scab disease (91.67%) along with maximal increment in per cent yield gain over unsprayed check plot (29.40%) was observed, when Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) was applied as foliar spray at the time of disease onset followed by another spray at 14 days interval. No symptoms of phytotoxic were noticed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.10: Chemical control of head scab of wheat at Karnal during 2021-22

Treatments	Description	Dose (%)	Disease severity	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	2.67	66.67	37.58	15.18
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	3.00	62.50	40.22	20.75
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	0.67	91.67	45.15	29.40
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	2.33	70.83	44.27	28.00
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	2.67	66.67	44.15	27.80
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	2.33	70.83	42.62	25.21
T7	Propiconazole	0.1	1.00	87.50	40.02	20.36
T8	Tebuconazole	0.1	2.00	75.00	40.44	21.18
T9	Control		8.00		31.88	
	CD (P=0.05)		1.52		2.48	

C. Gurdaspur

The field efficacy of six different fungicides viz., Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] was evaluated in

randomized block design with three replications at Gurdaspur location for the management of head scab disease of wheat during the crop season 2021-22. All the tested fungicides resulted in significantly less disease severity in comparison to the unsprayed plots (Table 9.11). It has been noticed that treatment of Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% (T3) followed by Azoxystrobin 11% + Tebuconazole 18.3% w/w SC @0.1% (T6) found highly effective in reducing the disease severity level, when compared with other fungicidal treatments and unsprayed check (T9). Highest level of protection from head scab disease was obtained with the foliar application of fungicides at disease initiation followed by one more spray at 14 days intervals. Overall, all the fungicide treatments showed significant gain in per cent yield in comparison to the unsprayed control (Table 9.11). No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.11: Chemical control of head scab of wheat at Gurdaspur during 2021-22

Treatments	Description	Dose (%)	Disease severity	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	1.71	73.64	36.80	16.97
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	1.55	76.21	37.19	17.84
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	1.17	82.05	39.92	23.46
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	1.72	73.59	49.81	38.66
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	1.67	74.36	38.28	20.17
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	1.33	79.49	43.70	30.08
T7	Propiconazole	0.1	2.06	68.36	38.21	20.03
T8	Tebuconazole	0.1	2.17	66.67	35.54	14.04
T9	Control		6.50		30.56	
	CD (P=0.05)		0.90		9.61	

Field experiments conducted for the evaluation of different fungicides for the management of head scab disease of wheat during 2021-22 at three different locations i.e. Ludhiana, Karnal and Gurdaspur indicated that all the fungicides at their respective dosages are effective in controlling the disease in comparison to unsprayed control check plot. Further, it has been noticed that application of Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) is the most effective fungicides in checking the head scab infection in wheat across the locations and among all the tested fungicides, when applied at disease initiation stage followed by second spray at 14 days interval.

3. Leaf rust of wheat

A. Ayodhaya

Field experiment was carried at Ayodhaya location during the 2021-22 cropping season to evaluate the effects of different fungicide combinations *viz.*, viz., Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)]for the management of leaf rust of wheat. The experiment was conducted in randomized block design with three replications and results were presented in Table 9.8. 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 disease followed by two sprays at two weeks interval on wheat foliage (Table 9.12). Similar trends in yield gain were recorded in the plots treated with fungicides in comparison to unsprayed control plots. All the fungicide treatments showed significant gain in per cent yield in comparison to the unsprayed

control (Table 9.12). No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.12: Chemical control of leaf rust of wheat at Ayodhaya during 2021-22

Treatments	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	3.80	92.4	35.30	0.51
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	3.00	94.0	37.20	5.59
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	1.80	96.4	41.52	15.41
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	2.30	95.4	41.40	15.17
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	2.80	94.4	39.50	11.09
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	2.60	94.8	41.12	14.59
T7	Propiconazole	0.1	3.10	93.8	36.23	3.06
T8	Tebuconazole	0.1	3.60	92.8	35.32	0.57
T9	Control		50.0		35.12	
	CD (P=0.05)		0.56		0.95	

B. Pantnagar

Field experiment was carried at Pantnagar location to evaluate the efficacy of different fungicide combinations *viz.*, viz., Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] for the management of leaf rust of wheat during 2021-22 cropping season. The experiment was conducted in randomized block design with three replications and results were presented in Table 9.13. All the tested fungicidal treatments resulted in significantly less ACI (< 4.16) in comparison to the unsprayed plots (60.00). It has been noticed that treatment of Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) followed by Azoxystrobin 11% + Tebuconazole 18.3% w/w SC @0.1% (T6) resulted in maximum per cent disease reduction over control, when compared with unsprayed check (T9). Highest level of protection from leaf rust was obtained with the foliar application of fungicide at disease initiation followed by one more spray at 14 days intervals. All the fungicide treatments showed significant gain in per cent yield in comparison to the unsprayed control (Table 9.13). No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.13: Chemical control of leaf rust of wheat at Pantnagar during 2021-22

Treatments	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	4.16	93.1	44.82	32.02
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	2.66	95.6	47.72	36.15
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	1.66	97.2	50.28	39.41
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	2.33	96.1	48.83	37.61
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	2.66	95.6	47.18	35.43
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	2.50	95.8	48.42	37.07
T7	Propiconazole	0.1	2.80	95.3	46.78	34.88

T8	Tebuconazole	0.1	3.83	93.6	46.25	34.13
T9	Control		60.00		30.47	
	CD (P=0.05)		0.96		0.16	

C. Indore

Field evaluation of different fungicidal combinations *viz*., Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] was performed at Indore location for the management of leaf rust of wheat. The experiment was conducted in randomized block design with three replications and results were presented in Table 9.14. Foliar application of Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) along with Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @ 0.1% (T4) and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC @0.1% (T6) were found effective in controlling the leaf rust infection (Table 9.8). All the fungicides were found effective in providing protection against leaf rust in comparison to unsprayed control plot. Highest yield was recorded in the plot sprayed with Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) followed by Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @ 0.1% (T4) and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC @ 0.1% (T6), when applied at disease initiation followed by two sprays at 14 days interval on wheat foliage. No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.14: Chemical control of leaf rust of wheat at Indore during 2021-22

Treatments	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	8.97	82.52	24.58	53.07
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	0.50	99.03	29.39	60.76
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	0.18	99.65	32.80	64.84
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	0.28	99.45	31.10	62.92
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	1.83	96.43	28.04	58.87
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	0.29	99.44	30.28	61.91
T7	Propiconazole	0.1	12.39	75.86	23.30	50.51
T8	Tebuconazole	0.1	1.13	97.80	28.97	60.19
T9	Control		51.33		11.53	
	CD (P=0.05)		9.83		2.22	

D. Kanpur

Six different combinations of fungicides *viz.*, Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] were evaluated at Kanpur location for the management of leaf rust of wheat during the cropping season 2021-22. The experiment was conducted in randomized block design with three replications and results were presented in Table 9.15. It has been observed that treatment T3 (Tebuconazole 50 % + Trifloxystrobin 25 % WG @ 0.6%) followed by T6 (Azoxystrobin 11% + Tebuconazole 18.3% w/w SC @0.1%) was flooudn effective in redicing the leaf rust ACI below 10.0 when compared with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] and control checks (T9).

Significant yield and per cent disease reduction was noticed 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. No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.15: Chemical control of leaf rust of wheat at Kanpur during 2021-22

Treat ments	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	40.00	40.00	32.22	12.66
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	13.33	80.00	37.70	25.36
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	5.00	92.50	45.55	38.22
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	20.00	70.00	36.66	23.24
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	20.00	70.00	35.55	20.84
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	6.67	90.00	43.70	35.61
T7	Propiconazole	0.1	20.00	70.00	36.66	23.24
T8	Tebuconazole	0.1	33.33	50.00	34.44	18.29
T9	Control		66.67		28.14	
	CD (P=0.05)		7.127		3.103	

E. Mahableshwar

The efficacy of different fungicide combinations *viz*., Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] were tested for the management of leaf rust of wheat during 2021-22 at Mahableshwar location (Table 9.16). The experiment was arranged in randomized block design with three replications. Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% followed by Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE @0.1% and Picoxystrobin 7.05% + Propiconazole 11.7% SC @ 0.1 showed efficient control of leaf rust in comparison to unsprayed control treatment where ACI of 59.01 was recorded, when applied at disease initiation followed by two sprays at 15 days interval on wheat foliage. Significant yield and per cent disease reduction was noticed in the plots sprayed with all the tested fungicide treatments. No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.16: Chemical control of leaf rust of wheat at Mahableshwar during 2021-22

Treat ments	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	24.31	58.8	32.66	30.43
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	21.1	64.2	34.34	33.84
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	17.39	70.5	36.7	38.09
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	28.4	51.9	31.14	27.04
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	29.75	49.6	30.22	24.82
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	27.47	53.4	31.4	27.64
T7	Propiconazole	0.1	30.19	48.8	30.14	24.62

T8	Tebuconazole	0.1	30.65	48.1	29.3	22.46
T9	Control		59.01		22.72	
	CD (P=0.05)		3.78		3.76	

F. Niphad

Different fungicides *viz.*, Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] were evaluated to control leaf rust of wheat under field conditions during cropping season 2021-22 at Niphad centre and their effect on disease control and grain yield was presented in the Table 9.17. The experiment was conducted in randomized block design with three replications. During the field experiment, disease severity was found to be significantly less in all treated plots over control ones. The result shows that after the application of various fungicides as foliar spray at the time of disease initiation followed by second spray at 14 days intervals on wheat foliage, Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) was found most effective treatment, reflecting significantly less disease severity (9.67) as compare to others treatments. A range of disease control (60.0 to 86.8 %) was noticed from various fungicides. Maximum per cent disease control was recorded from Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% followed by Picoxystrobin 7.05% + Propiconazole 11.7% SC (0.1%), whereas, Propiconazole @ 0.1% observed least effective in checking leaf rust disease (60% disease reduction) over control check. It has been noticed that all the treatments resulted in significantly more yield and showed per cent yield gain (18.61 to 33.43%) than the unsprayed control (Table 9.17). Highest yield gain was recorded in the plot sprayed with Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) and showed 33.43% yield gain over the control. No phytotoxicity was noticed with any of the fungicides on wheat plants.

Table 9.17: Chemical control of leaf rust of wheat at Niphad during 2021-22

Treatments	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	10.67	85.4	29.19	28.51
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	13.67	81.4	27.38	23.79
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	9.67	86.8	31.34	33.43
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	11.00	85.0	29.35	28.91
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	12.67	82.7	27.90	25.22
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	22.00	70.0	26.39	20.92
T7	Propiconazole	0.1	29.33	60.0	25.64	18.61
T8	Tebuconazole	0.1	22.33	69.5	27.13	23.08
T9	Control		73.33		20.87	
	CD (P=0.05)		3.67		3.43	

G. Ludhiana

The effect of different fungicide treatments (Table 9.18) against leaf rust of wheat was studied under field conditions during 2021-22 at Ludhiana location. The results of field evaluation of foliar applications of Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] and control against leaf rust disease of wheat are presented in Table 9.18. The experiment was conducted in randomized block design with three

replications. All the tested fungicides resulted in significantly less average coefficient of infection (ACI) in comparison to the unsprayed plot i.e. 60.00% (Table 9.14). Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% provided significant higher level of disease protection in comparison to other tested fungicides. Although, the effect of foliar application of Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% (T3) is recorded as best among all the fungicide treatments, but statistically at par with other standard check fungicide [i.e. Tebuconazole (0.1%) and Propiconazole (0.1%)], when applied at disease initiation followed by another sprays at 15 days intervals on wheat foliage. It has been noticed that all the treatments resulted in significantly more yield than the unsprayed control (Table 9.18). Highest yield gain (55.23%) was recorded in the plots sprayed with Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% (T3) in comparison to control plot. No phytotoxicity was noticed with any of the fungicides on wheat plants.

Table 9.18: Chemical control of leaf rust of wheat at Ludhiana during 2021-22

Treatments	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	3.67	93.9	41.00	48.78
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	3.33	94.4	37.44	35.88
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	2.00	96.7	42.77	55.23
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	2.67	95.6	36.66	33.06
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	2.33	96.1	33.89	22.98
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	3.33	94.4	37.11	34.67
T7	Propiconazole	0.1	3.33	94.4	33.66	22.17
T8	Tebuconazole	0.1	4.67	92.2	32.44	17.73
T9	Control		60.00		27.55	
	CD (P=0.05)		3.45		5.69	

H. Karnal

The field efficacy of different fungicide combinations *viz*., Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] against leaf rust of wheat was studied under field conditions during 2021-22 at Karnal. The experiment was arranged in randomized block design with three replications. The results of field evaluation of foliar applications of different fungicides and their effect on the leaf rust disease and wheat yield are shown in Table 9.19. All the tested fungicides resulted in significantly less average coefficient of infection (ACI) in comparison to the unsprayed plot i.e. 66.67% (Table 9.19). Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% provided significant higher level of disease protection in comparison to other tested fungicides. Although, the effect of foliar application of Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% (T3) is recorded as best among all the fungicide treatments, but statistically at par with other standard check fungicide [i.e. Tebuconazole (0.1%) and Propiconazole (0.1%)], when applied at disease initiation followed by another sprays at 15 days interval on wheat foliage. It has been noticed that all the treatments resulted in significantly more yield than the unsprayed control (Table 9.19). Highest yield gain (39.29%) was recorded in the plots sprayed with Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% (T3) in comparison to unsprayed control plots. No phytotoxicity was noticed with any of the fungicides on wheat plants.

Table 9.19: Chemical control of leaf rust of wheat at Karnal during 2021-22

Treatments	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)

T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	20.00	70.00	37.11	29.34
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	16.67	75.00	42.76	38.68
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	11.67	82.50	43.18	39.29
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	20.00	70.00	35.62	26.40
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	20.00	70.00	34.22	23.38
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	15.33	77.00	35.11	25.32
T7	Propiconazole	0.1	13.67	79.50	33.00	20.54
T8	Tebuconazole	0.1	18.33	72.50	32.16	18.48
T9	Control		66.67		26.22	
	CD (P=0.05)		13.79		3.34	

During the cropping season 2021-22, multi-location field testing of six different fungicide 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%), Azoxystrobin 11% + Tebuconazole 18.3% w/w SC (0.1%), along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] for the management of leaf rust of wheat was conducted at eight different locations i.e. Ayodhya, Pant Nagar, Indore, Kanpur, Mahableshwar, Niphad, Ludhiana and Karnal locations. Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.06 % (T3) is identified as most effective fungicide across the locations for the control of leaf rust of wheat. Further, it has been noticed that the tested concentrations of the fungicides are safe as no phytotoxcity symptoms on wheat host were noticed in all the experimental locations.

4. Stem rust of Wheat

A. Pune

The field efficacy of different fungicide combinations *viz*., Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] against stem rust of wheat was studied under field conditions during 2021-22 at Pune location. The results of the effect of fungicides on stem rust disease control and grain yield are presented in the Table 9.20. The experiment was conducted in randomized block design with three replications. During the field experiment, disease severity was found to be significantly less in all treated plots over control ones. The result shows that after the application of various fungicides as foliar spray at the time of disease initiation followed by second spray at 14 days intervals on wheat foliage, Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) was found most effective treatment, reflecting significantly less ACI (6.00) as compare to others treatments. A range of per cent disease reduction (69.41 to 89.41 %) over control check was noticed from various fungicides. Maximum per cent disease control was recorded from Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% followed by Propiconazole (0.1%), whereas, Azoxystrobin 11% + Tebuconazole 18.3% w/w SC @ 0.1% showing least effect on disease control (69.41% disease reduction over control). It has been noticed that all the treatments resulted in significantly more yield and showed per cent yield gain (9.19 to 29.02 %) than the unsprayed control (Table 9.20). Highest yield gain was recorded in the plot sprayed with Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) and showed 29.02% yield gain over the control. No phytotoxicity was recorded with any of the fungicides on wheat plants.

Table 9.20: Chemical control of stem rust of wheat at Pune during 2021-22

Treatments	**Description**	**Dose (%)**	**ACI**	**Disease reduction over control (%)**	**Yield (q ha^{-1})**	**Yield gain (%)**

T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	16.67	70.59	33.05	15.34
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	15.00	73.53	32.79	14.69
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	6.00	89.41	39.42	29.02
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	13.33	76.47	33.77	17.15
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	16.00	71.76	35.82	21.90
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	17.33	69.41	30.81	9.19
T7	Propiconazole	0.1	6.67	88.24	39.38	28.95
T8	Tebuconazole	0.1	10.67	81.18	38.66	27.63
T9	Control		56.67		27.98	
	CD (P=0.05)		6.91		5.39	

B. Dharward

Different fungicides *viz*., Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] against stem rust of wheat was evaluated under field conditions during 2021-22 at Dharward location. The experiment was conducted in randomized block design with three replications and results were presented in Table 9.21. The results of field experiment revealed that the stem rust ACI score was significantly less in all treated plots over control ones (53.33). The result showed that after the application of various fungicides as foliar spray at the time of disease initiation followed by second spray at 14 days intervals on wheat foliage, Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) identified as most effective treatment, reflecting significantly low ACI (11.33) as compared to others treatments. Highest yield gain was recorded in the plot sprayed with Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) and showed 29.64 % yield gain over the control. No phytotoxicity was noticed with any of the fungicides on wheat plants.

Table 9.21: Chemical control of stem rust of wheat at Dharward during 2021-22

Treatments	**Description**	**Dose (%)**	**ACI**	**Disease reduction over control (%)**	**Yield (q ha^{-1})**	**Yield gain (%)**
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	13.33	75.01	33.54	28.36
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	14.67	72.49	32.46	25.98
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	11.33	78.76	34.15	29.64
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	20.00	62.50	33.01	27.21
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	22.00	58.75	33.92	29.16
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	16.00	70.00	30.86	22.13
T7	Propiconazole	0.1	23.33	56.26	29.63	18.92
T8	Tebuconazole	0.1	18.67	64.99	28.11	14.53
T9	Control		53.33		24.03	
	CD (P=0.05)		7.861		3.85	

C. Indore

Field experiment was carried out at Indore location to evaluate the efficacy of different fungicide combinations *viz.*, Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l +

Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] against stem rust of wheat during 2021-22 cropping season. The experiment was conducted in randomized block design with three replications and results were presented in Table 9.22. All the tested fungicidal treatments resulted in significantly low ACI in comparison to the unsprayed plots (54.67). It has been noticed that treatment of Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) show least ACI score (13.21) followed by Azoxystrobin 11% + Tebuconazole 18.3% w/w SC @0.1% (T6). Similarly, highest per cent stem rust reduction over control was noticed in case of T3 (75.84) followed by T6 (Azoxystrobin 11% + Tebuconazole 18.3% w/w SC @0.1%) and T1 (Picoxystrobin 7.05% + Propiconazole 11.7% SC @0.1%). Highest level of protection from stem rust was obtained with the foliar application of fungicide at disease initiation followed by one more spray at 14 days intervals. All the fungicide treatments showed significant gain in per cent yield in comparison to the unsprayed control (Table 9.22). No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.22: Chemical control of stem rust of wheat at Indore during 2021-22

Treatments	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	15.85	71.01	32.25	60.92
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	22.40	59.02	27.41	92.48
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	13.21	75.84	34.83	63.81
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	21.72	60.27	28.57	55.89
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	21.52	60.64	29.99	57.97
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	15.30	72.01	32.33	61.01
T7	Propiconazole	0.1	29.34	46.32	25.61	50.78
T8	Tebuconazole	0.1	24.18	55.77	26.15	51.81
T9	Control		54.67		12.60	
	CD (P=0.05)		5.98		2.06	

D. Mahableshwar

Field experiments were performed during the crop season 2021-22 to test the effect of six different fungicides viz., Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] for the management of stem rust of wheat at Mahableshwar location. The study was laid out in randomized block design with three replications. The results of the study demonstrated that all fungicide treatments resulted in significantly less ACI score in comparison to the unsprayed plot i.e. 54.78 (Table 9.23). Six fungicides viz., Picoxystrobin 7.05% + Propiconazole 11.7% SC (0.1%), Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE (0.1%), Tebuconazole 50% + Trifloxystrobin 25% WG (0.06%), Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC (0.1%) and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC (0.1%) showed significantly higher level of protection than standard recommended fungicide (Propiconazole @ 0.1% and Tebuconazole @0.1%). Highest level of protection from stem rust disease was obtained with the foliar application of Tebuconazole 50% + Trifloxystrobin 25% WG @0.06 (T3) at disease initiation followed by second spray at 14 days intervals. No phytotoxic symptoms were noticed with any of the tested concentrations of the fungicides on wheat plants. The fungicidal treatments i.e. Tebuconazole 50% + Trifloxystrobin 25% WG @0.06 also displayed significant per cent yield gain over unsprayed check in comparison to the other fungicidal treatments (Table 9.23).

Table 9.23: Chemical control of stem rust of wheat at Mahableshwar during 2021-22

Treatments	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	22.73	58.51	31.82	36.52
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	19.34	64.70	33.08	38.94
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	15.24	72.18	35.44	43.00
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	27.00	50.71	29.97	32.60
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	27.47	49.85	29.71	32.01
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	26.04	52.46	30.39	33.53
T7	Propiconazole	0.1	28.40	48.16	28.54	29.22
T8	Tebuconazole	0.1	28.85	47.33	27.95	27.73
T9	Control		54.78		20.2	
	CD (P=0.05)		3.88		3.47	

E. Niphad

The field efficacy of six different fungicides viz., Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] was evaluated in randomized block design with three replications at Niphad location for the management of stem rust of wheat during the crop season 2021-22. All the tested fungicides resulted in significantly less disease severity in comparison to the unsprayed plots (Table 9.24). It has been noticed that treatment of Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% (T3) is highly effective in reducing the disease severity level (ACI = 10.00), when compared with other fungicidal treatments and unsprayed check (T9). Highest level of protection from stem rust disease was obtained with the foliar application of fungicides at disease initiation followed by one more spray at 14 days intervals. Overall, all the fungicide treatments showed significant gain in per cent yield in comparison to the unsprayed control (Table 9.24). No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.24: Chemical control of stem rust of wheat at Niphad during 2021-22

Treatments	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	16.00	76.70	27.95	29.50
T2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	17.67	74.27	28.45	87.42
T3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	10.00	85.44	29.11	32.31
T4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	14.67	78.64	28.48	30.81
T5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	27.00	60.68	24.82	20.63
T6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	19.33	71.85	28.01	29.65
T7	Propiconazole	0.1	21.00	69.42	26.93	26.83
T8	Tebuconazole	0.1	20.67	69.90	26.32	25.13
T9	Control		68.67		19.70	
	CD (P=0.05)		5.31		3.58	

The field experiments were conducted to evaluate the efficacy of eight fungicides against stem rust of wheat at five different locations (Pune, Dharward, Indore, Mahableshwar, Niphad) during 2021-22. The trends of disease reduction as well as yield attributes were more or less similar across the locations. Among all of fungicides, Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% (T3) is identified as most effective fungicide across the locations for the control of stem rust of wheat.

4. Leaf blight of Wheat

A. Ayodhaya

For the evaluation of different chemicals against leaf blight of wheat, a field trial was conducted with nine treatments including control (Table 9.25) with three replications at Ayodhaya location during 2021-22. The result revealed that Tebuconazole 50% + Trifloxystrobin 25%@ 0.1% (T1) gave the maximum disease reduction over control (55.13%) followed by Propiconazole 25% @ 0.1% (53.85%). Similarly, maximum yield was recorded in Tebuconazole 50% + Trifloxystrobin 25% @ 0.1% (39.98 qha^{-1}) followed by Propiconazole 25% @0.1% (39.65qha^{-1}) and Picoxystrobin 7.05% + Propiconazole 11.7% @0.1% (39.65 qha^{-1}). Highest level of protection from leaf blight disease was obtained with the foliar application of fungicides at disease initiation followed by one additional spray after 14 days. Overall, all the fungicide treatments showed significant gain in per cent yield in comparison to the unsprayed control (Table 9.25). No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.25: Chemical control of leaf blight of wheat at Ayodhaya during 2021-22

Treatments	Description	Dose (%)	Mean disease score (dd)	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Tebuconazole 50% + Trifloxystrobin 25%	0.1	35	55.13	39.98	16.25
T2	Propiconazole 13.9% + Difenconazole 13.9%	0.1	46	41.03	37.48	10.67
T3	Azoxystrobin 12.5% + Tebuconazole 12.5%	0.1	47	39.74	37.15	9.89
T4	Picoxystrobin 7.05% + Propiconazole 11.7%	0.1	57	26.92	39.65	15.55
T5	Kresoxim Methyl 44.3% SC	0.1	57	26.92	36.15	7.38
T6	Propiconazole 25%	0.1	36	53.85	39.65	15.55
T7	Tebuconazole 25.9%	0.1	46	41.03	38.31	12.62
T8	Mancozeb 75%	0.1	68	12.82	34.81	3.81
T9	Control		78		33.48	
	CD (P=0.05)				3.37	

B. Pune

The field efficacy of different fungicides *viz*., Tebuconazole 50% + Trifloxystrobin 25% @0.1%, Propiconazole 13.9% + Difenconazole 13.9% @0.1%, Azoxystrobin 12.5% + Tebuconazole 12.5% @0.06%, Picoxystrobin 7.05% + Propiconazole 11.7% @0.1%, Kresoxim Methyl 44.3% SC @0.1%, Propiconazole 25% @0.1%, Tebuconazole 25.9% @0.1% and Mancozeb 75% @ 0.1% was evaluated in randomized block design with three replications at Pune centre for the field management of leaf blight of wheat during the crop season 2021-22. All the tested fungicides resulted in significantly less disease severity in comparison to the unsprayed plots (Table 9.26). It has been noticed that treatment of Tebuconazole 50% + Trifloxystrobin 25% @ 0.1% (T1) is highly effective in controlling the disease when compared with other fungicidal treatments and unsprayed check (T9). Highest level of protection from leaf blight disease was obtained with the foliar application of fungicides at disease initiation at boot leaf stage followed by one more spray after 14 days intervals. Overall, all the fungicide treatments showed significant gain in per cent yield in comparison to the unsprayed control (Table 9.26). No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.26: Chemical control of leaf blight of wheat at Pune during 2021-22

Treatments	Description	Dose (%)	Mean disease score (dd)	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Tebuconazole 50% + Trifloxystrobin 25%,	0.1	16	79.49	45.71	22.31
T2	Propiconazole 13.9% + Difenconazole 13.9%	0.1	25	67.95	40.42	12.14
T3	Azoxystrobin 12.5% + Tebuconazole 12.5%	0.06	25	67.95	47.22	24.80
T4	Picoxystrobin 7.05% + Propiconazole 11.7%	0.1	24	69.23	42.49	16.41
T5	Kresoxim Methyl 44.3% SC	0.1	48	38.46	45.17	21.38
T6	Propiconazole 25%	0.1	24	69.23	44.92	20.94
T7	Tebuconazole 25.9%	0.1	37	52.56	44.65	20.47
T8	Mancozeb 75%	0.1	56	28.21	45.06	21.18
T9	Control		78		35.51	
	CD (P=0.05)				7.27	

C. Sabour

The experiment was conducted at Sbaour location during 2021-22 under field conditions for the evaluation of different chemicals (Table 9.27) against leaf blight of wheat. The design of experiment was randomized complete block (RCB) with three replications. Significant variation was found with various fungicides in reducing leaf blight disease severity on wheat plants (Table 9.23). The results revealed that among all of treatments, the least mean disease score was recorded in Tebuconazole 50% + Trifloxystrobin 25% @ 0.1% (T1) followed by Azoxystrobin 12.5% + Tebuconazole 12.5%@ 0.06% (T3) and Picoxystrobin 7.05% + Propiconazole 11.7% @0.1% (T4). The other fungicide sprayed plots showed varying levels of disease severity score on the leaves with ranges from 35 to 56. The fungicide treatment plots showed a good level of disease reduction ranging from 1.75 -78.95% over control check plots. On the other hand, the unsprayed plots, there was maximum disease severity score (57) which was higher than any other treatments. Highest level of protection from leaf blight disease was obtained with the foliar application of fungicides at disease initiation followed by one more spray at 14 days intervals. The fungicide treatments showed significant gain in per cent yield in comparison to the unsprayed control (Table 9.27). No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.27: Chemical control of leaf blight of wheat at Sabour during 2021-22

Treatments	Description	Dose (%)	Mean disease score (dd)	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Tebuconazole 50% + Trifloxystrobin 25%	0.1	12	78.95	45.47	22.09
T2	Propiconazole 13.9% + Difenconazole 13.9%	0.1	35	38.60	43.39	18.34
T3	Azoxystrobin 12.5% + Tebuconazole 12.5%	0.06	23	59.65	44.37	20.14
T4	Picoxystrobin 7.05% + Propiconazole 11.7%	0.1	24	57.89	43.54	18.63
T5	Kresoxim Methyl 44.3% SC	0.1	56	1.75	37.48	5.48
T6	Propiconazole 25%	0.1	47	17.54	42.38	16.41
T7	Tebuconazole 25.9%	0.1	45	21.05	42.42	16.48
T8	Mancozeb 75%	0.1	46	19.30	38.00	6.77
T9	Control		57		35.43	
	CD (P=0.05)				1.85	

D. Karnal

Field experimentation of nine different treatments including eight different fungicides *viz.*, Tebuconazole 50% + Trifloxystrobin 25% @0.1%, Propiconazole 13.9% + Difenconazole 13.9% @0.1%, Azoxystrobin 12.5% + Tebuconazole 12.5% @0.06%, Picoxystrobin 7.05% + Propiconazole

11.7% @0.1%, Kresoxim Methyl 44.3% SC @0.1%, Propiconazole 25% @0.1%, Tebuconazole 25.9% @0.1% and Mancozeb 75% @ 0.1% and one untreated control (check) were evaluated against leaf blight of wheat during 2021-22 at Karnal centre. The experiment was arranged in randomized complete block (RCB) with three replications. Significant variation in reducing leaf blight disease severity on wheat plants was noticed among the tsted fungicides (Table 9.28). The results revealed that among all of treatments, the least mean disease score of 13 was recorded in Tebuconazole 50% + Trifloxystrobin 25% @ 0.1% (T1) and Propiconazole @0.1% (T7). The other fungicide sprayed plots showed varying levels of disease severity score on the leaves with ranges from 23 to 25. The fungicide treatment plots showed a good level of disease reduction ranging from 67.11-82.89% over control check plots. On the other hand, the unsprayed plots, there was maximum disease severity score (76) which was higher than any other treatments. Highest level of protection from leaf blight disease was obtained with the foliar spray of fungicides at disease initiation followed by additional spray after 14 days. The fungicide treatments showed significant gain in per cent yield in comparison to the unsprayed control. No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.28: Chemical control of leaf blight of wheat at Karnal during 2021-22

Treatments	Description	Dose (%)	Mean disease score (dd)	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T1	Tebuconazole 50% + Trifloxystrobin 25%	0.1	13	82.89	41.16	15.19
T2	Propiconazole 13.9% + Difenconazole 13.9%	0.1	24	68.42	38.77	9.97
T3	Azoxystrobin 12.5% + Tebuconazole 12.5%	0.06	25	67.11	43.61	19.96
T4	Picoxystrobin 7.05% + Propiconazole 11.7%	0.1	23	69.74	41.00	14.85
T5	Kresoxim Methyl 44.3% SC	0.1	24	68.42	42.29	17.46
T6	Propiconazole 25%	0.1	24	68.42	37.89	7.88
T7	Tebuconazole 25.9%	0.1	13	82.89	36.39	4.07
T8	Mancozeb 75%	0.1	24	68.42	35.72	2.27
T9	Control	-	76	-	34.91	
	CD (P=0.05)				3.65	

Field experimental trials for the evaluation of different combinations of fungicides *viz*., *viz*., Tebuconazole 50% + Trifloxystrobin 25% @0.1%, Propiconazole 13.9% + Difenconazole 13.9% @0.1%, Azoxystrobin 12.5% + Tebuconazole 12.5% @0.06%, Picoxystrobin 7.05% + Propiconazole 11.7% @0.1%, Kresoxim Methyl 44.3% SC @0.1%, Propiconazole 25% @0.1%, Tebuconazole 25.9% @0.1% and Mancozeb 75% @ 0.1% for the management of leaf blight disease of wheat during the crop season 2021-22 at four different locations i.e. Ayodhaya, Pune, Sabour and Jammu. The results of multi-location testing of fungicides identified Tebuconazole 50% + Trifloxystrobin 25% @ 0.1% (T1) as the best performing fungicide against leaf blight disease in wheat across the testing locations.

PROGRAMME 10. WHEAT ENTOMOLOGY

RESULTS OF COORDINATED ENTOMOLOGICAL EXPERIMENTS

Wheat entomology programme includes three aspects viz. host plant resistance, integrated pest management (IPM) and stored grain pest management. During 2021-22 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, and multiple pest screening nursery. The integrated pest management aspect covered survey and surveillance of insect-pests and their natural enemies, effect of silicon application on major insect pest incidence and natural enemies,evaluation of biodegradable insecticide loaded hydrogels for management of termites in wheat.Besides, studies were also conducted on influence of sowing time on the incidence and population build-up of major insect pest of wheat and management of foliar aphid and termites through bio-pestcides and chemical insecticides. The salient findlings of the experiments conducted during 2021-22 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

Based on the average infestation of shoot fly at three locations viz., Ludhiana, Dharwad and Kanpur, the lowest infestation index (2.91 %) of shoot fly entry was reported in RAJ4083(C) had highest index of 12.64 % in DBW371. At Ludhiana centre, maximum infestation index of 7.95 per cent was reported on HI8759(C) and minimum (3.60 per cent) on KRL19(C). Nine entries viz., SKW362, UP3113, RAJ4083(C), HI1665, HI8830(d)*, MACS6795, HI1621(C), HD3249(C) and HD3386 at Dharwad had zero infestation of shootfly while highest infestation (19.61 %) was observed on PBW175(C). At Kanpur location, lowest infestation 2.85 % was observed on HD3400 and highest infestation of 20% was recorded on entry PBW835Q*. (Table A1-10.1a).

(b) Brown wheat mite

At Ludhiana, three entries HD3418, DBW365 and VL2044 recorded the minimum mite population of 7.7/10 cm2 area while maximum mite population of 24.0 /10 cm2 in entry PBW902. This seasonal incidence of mite was very low at Durgapura and Kanpur locations; therefore data of insect incidence was not included. (Table A1-10.1a).

(c) Foliar wheat aphid and root aphid

Foliar aphid: Based on the average score of aphids at five locations; Ludhiana, Karnal, Niphad, Khudwani and Kharibari ten entries; UAS310, VL2041,VL2043,VL2044,HD3402,HPW481,HPW487 HS693,HPW486,HD3249(C) and HD3386 scored in moderately resistance category (grade 3) and rest of entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category. The infestation of aphids at Vijapur, Durgapura and Pusa Bihar was recorded to very low and therefore data was rejected.

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

At Ludhiana Entry number HD3386 and UAS310 while at Karnal eight entries viz., UAS310,VL2041,DBW358, MP1380#, DBW359, HI8847,DBW370 and DBW371 were to be moderately resistant while rest of the entries were either susceptible (grade 4) or highly susceptible (grade 5) to wheat aphid (Table A1-10.1b).

Root aphid: Out of total 153 entries, all entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category. None of the entry showed the moderately resistance (grade 3) or resistance (grade 2) reaction at Ludhiana (Table A1-10.1b).

NIVT-Entries

(a) Foliar aphid:
NIVT entries were screened at three locations i.e. Ludhiana, Karnal and Niphad, all the entries were found to be either in moderately resistant (grade 3), susceptible (grade 4) or highly susceptible (grade 5) categories. Out of 280 tested NIVT entries, none of the entry showed the moderately resistance (grade 3) or resistance (grade 2) reaction based average score of three locations i.e. Ludhiana, Niphad and Karnal. All 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 of shootfly recorded at three locations (Ludhiana, Dhardwad & Kanpur) was to be lowest (3.97%) in entry HI8823 (d) and the maximum score of 11.55% was recorded for GW513 (Table A2-10.1a).
(b)Brown wheat mite: The lowest population of 5.67 brown wheat mites/10 cm2 was recorded in entry HUW 838 while entry HS 681 had highest population of 15.67 mites/10 cm2 at Ludhiana(Table A2-10.1a).
(c) Foliar aphid: Based on average score of five locations (Ludhiana, Karnal, Khudwani, Kharibari and Niphad), 8 entries HS507, HS679, HD3334, VL2036, HI8823 (d), HD2864, NIAW3170 and VL3024 showed moderately resistance (grade 3) response to foliar aphid(Table A2-10.1b).
(d)Root aphid: At Ludhiana, all entries were found to be either in susceptible (grade 4) or highly susceptible (grade 5) category to root aphid (Table A2-10.1b).

Table A1-10.1a: Screening of AVT lines against Shootfly and Brown Wheat mite (Year-2021-22)

AVT No.	Entry	Shoot fly incidence (%)				No. of brown wheat mites/10 cm sq area
		Ludhiana	Dharwad	Kanpur	Average	Ludhiana
1	VL2041	4.90	14.71	10.00	**9.87**	13.0
2	VL2043	5.14	15.25	4.00	**8.13**	13.7
3	VL2044	5.90	15.29	6.67	**9.29**	13.3
4	HD3402	6.00	16.26	5.55	**9.27**	13.7
5	HPW481	5.28	15.96	4.50	**8.58**	12.7
6	HPW487	5.99	17.93	11.11	**11.68**	13.0
7	HPW488	5.60	15.79	10.00	**10.46**	13.7
8	HS692	5.68	16.15	8.00	**9.94**	14.0
9	HS693	7.32	9.23	3.33	**6.63**	13.7
10	HS694	6.43	17.39	6.25	**10.02**	13.3
11	UP3114	6.44	**13.83**	**10.00**	**10.09**	14.3
12	VL3028	6.35	12.86	15.80	**11.67**	13.3
13	VL3029	6.20	12.50	16.00	**11.57**	13.7

14	VL3030	6.05	3.13	6.66	**5.28**	7.7
15	HPW483	6.48	2.17	18.75	**9.13**	13.7
16	HPW484	6.81	11.11	15.00	**10.97**	12.7
17	HPW485	6.78	6.85	11.76	**8.46**	14.0
18	HPW486	5.52	8.82	11.53	**8.62**	10.7
19	HS688	4.57	8.51	13.33	**8.80**	12.3
20	HS689	5.51	3.23	5.00	**4.58**	14.0
20A	**Susceptible check**	**8.60**	**5.13**	**10.25**	**7.99**	**22.0**
21	HS690	5.20	9.52	14.28	**9.67**	14.3
22	HS691	6.27	7.81	18.18	**10.75**	14.3
23	SKW362	6.06	**0.00**	**15.78**	**7.28**	10.0
24	UP3113	6.80	**0.00**	**11.11**	**5.97**	13.7
25	VL2047	5.81	4.17	4.00	**4.66**	14.7
26	VL2048	5.07	8.75	5.55	**6.46**	14.0
27	VL2049	4.81	5.41	7.14	**5.79**	9.3
28	VL2050	6.30	7.14	10.50	**7.98**	14.0
29	HS507(C)	6.28	4.88	11.11	**7.42**	13.7
30	HS562(C)	6.43	4.08	12.50	**7.67**	13.7
31	HS490(C)	5.92	0.00	13.63	**6.52**	14.3
32	HPW349(C)	5.65	3.06	12.50	**7.07**	12.7
33	VL907(C)	7.10	6.52	4.00	**5.87**	11.7
34	VL892(C)	6.56	5.48	7.14	**6.39**	12.7
35	DBW377	5.11	5.74	11.11	**7.32**	12.3
36	PBW870	5.40	8.22	4.54	**6.05**	11.3
37	DBW372	5.49	12.70	7.14	**8.44**	12.3
38	DBW318	5.01	0.98	15.38	**7.12**	13.3
39	DBW327 (C)	6.43	13.33	3.33	**7.70**	14.0
40	DBW332(C)	6.44	20.31	8.33	**11.69**	12.0
40A	**Susceptible check**	**6.35**	**16.28**	**8.36**	**10.33**	**17.7**
41	DBW370	6.20	7.14	3.12	**5.49**	13.7
42	DBW371	6.05	15.22	16.66	**12.64**	9.0
43	DBW373	6.48	12.86	3.12	**7.49**	10.0
44	PBW868	7.87	10.29	13.63	**10.60**	12.3
45	PBW871	4.85	11.90	6.89	**7.88**	10.3
46	PBW872	5.51	17.39	3.57	**8.82**	7.7
47	HD3090(C)	6.60	9.72	3.84	**6.72**	12.7
48	HI1633(C)	5.93	15.91	6.25	**9.36**	13.0
49	RAJ4083(C)	5.40	0.00	3.33	**2.91**	13.7
50	DBW320#*	6.12	6.82	3.12	**5.35**	13.0
51	MP1380#	5.49	12.82	3.33	**7.21**	8.3
52	DBW407[B]	5.01	13.46	3.84	**7.44**	13.7
53	DDW48(d)(C)	6.43	6.67	10.52	**7.87**	8.0
54	HI8826(d)*	6.44	6.56	4.00	**5.67**	13.7
55	MACS4100(d)*	6.35	9.52	3.12	**6.33**	10.0
56	MP1378	6.20	6.93	11.11	**8.08**	14.3
57	MP3552	6.05	18.18	4.54	**9.59**	12.0
58	UAS3015	6.48	2.97	3.33	**4.26**	11.7
59	HI8839(d)	7.87	5.48	6.66	**6.67**	12.7
60	HI8840(d)	7.69	3.28	3.12	**4.70**	9.0
60A	**Susceptible check**	**8.60**	**7.69**	**9.36**	**8.55**	**19.0**
61	MP1358(I)(C)	7.30	13.33	6.25	**8.96**	12.7
62	NIAW3922	6.07	8.82	11.11	**8.67**	14.0
63	NIDW1149(d)(C)	6.21	9.09	13.33	**9.54**	13.7

64	UAS478(d)	5.91	5.88	3.33	**5.04**	12.7
65	DBW352#	5.80	4.55	13.33	**7.89**	14.0
66	GW513(I)(C)	6.40	6.76	15.78	**9.65**	8.3
67	GW547^{B}	6.04	7.08	18.18	**10.43**	14.0
68	HI1636(I)(C)	6.13	5.88	3.33	**5.11**	14.3
69	HI1650*	6.50	10.71	3.12	**6.78**	13.3
70	MACS6768*	6.49	12.70	7.14	**8.78**	14.3
71	MP3535*	5.90	6.78	3.84	**5.51**	11.3
72	NWS2194#	7.90	5.13	8.69	**7.24**	9.0
73	HI1665	5.77	0.00	10.71	**5.49**	12.3
74	NIAW4028	5.55	2.13	15.38	**7.69**	8.7
75	CG1036*	4.34	5.10	15.38	**8.27**	8.0
76	CG1040	6.61	2.88	18.75	**9.41**	9.0
77	DDW47(d)(C)	4.82	3.20	12.50	**6.84**	13.3
78	DDW55(d)^{Q}*	6.95	6.99	6.66	**6.87**	14.3
79	GW532	5.28	3.85	7.69	**5.61**	13.7
80	HD3401	5.80	15.56	3.33	**8.23**	12.0
80A	**Susceptible check**	**7.69**	**6.76**	**8.36**	**7.60**	**20.7**
81	HI1655^{Q}*	6.41	2.86	3.84	**4.37**	12.0
82	HI1666	6.29	1.55	3.84	**3.89**	11.3
83	HI8823(d)(I)(C)	7.05	0.70	4.54	**4.10**	10.7
84	HI8830(d)*	5.24	0.00	5.00	**3.41**	11.0
85	MACS6795	4.37	0.00	4.54	**2.97**	12.0
86	MP1377	6.37	4.48	4.54	**5.13**	8.0
87	MP3288(C)	5.33	7.84	3.33	**5.50**	11.0
88	UAS3019	6.59	0.00	16.00	**7.53**	13.3
89	DBW316#*	6.49	1.14	13.33	**6.99**	12.3
90	HD3118(C)	6.24	8.00	3.33	**5.86**	14.0
91	HD3392	5.63	3.92	12.00	**7.18**	14.0
92	HI1621(C)	6.59	0.00	4.54	**3.71**	12.7
93	PBW833*	6.10	12.77	4.00	**7.62**	13.7
94	PBW835^{Q}*	6.93	6.49	20.00	**11.14**	13.3
95	HD3249(C)	6.01	0.00	12.00	**6.00**	14.0
96	PBW826#*	6.84	5.60	5.00	**5.81**	13.7
97	HD3388	5.38	15.19	11.53	**10.70**	12.0
98	PBW852	5.12	2.78	6.66	**4.85**	12.3
99	DBW252(C)	6.77	1.67	4.00	**4.15**	13.3
100	HD3171(C)	7.33	12.20	5.00	**8.18**	14.3
100A	**Susceptible check**	**9.34**	**10.71**	**12.36**	**10.80**	**21.0**
101	HD3293(C)	6.38	3.06	4.00	**4.48**	12.7
102	DBW353	6.07	1.54	9.09	**5.57**	14.0
103	JKW261(I)(C)	7.94	2.21	12.00	**7.38**	14.0
104	PBW771(C)	7.43	6.85	18.18	**10.82**	13.7
105	WH1124(C)	5.77	9.76	11.11	**8.88**	14.0
106	HD2967(C)	5.98	7.02	3.33	**5.44**	13.3
107	HD3386	6.67	0.00	11.42	**6.03**	13.3
108	DBW359	6.30	5.75	6.66	**6.24**	15.7
109	DBW358	7.14	4.23	5.00	**5.46**	11.7
110	NIAW3170(C)	5.47	8.16	3.33	**5.65**	14.3
111	HD3043(C)	5.53	12.90	5.77	**8.07**	14.3
112	HD3369*	5.14	2.99	3.12	**3.75**	14.0
113	HD3397	7.07	7.69	6.66	**7.14**	14.0
114	HD3400	4.65	3.88	2.85	**3.79**	13.3

115	HD3418	6.22	4.08	3.12	**4.47**	9.3
116	HI1628(C)	5.76	4.63	3.33	**4.57**	7.7
117	HI1653*	4.72	2.97	7.74	**5.14**	11.3
118	HI1654*	5.14	4.71	12.50	**7.45**	13.7
119	HUW838(I)(C)	5.07	6.85	8.57	**6.83**	14.7
120	UP3090	4.56	6.67	3.80	**5.01**	14.0
120A	**Susceptible check**	**7.64**	**16.67**	**10.35**	**11.55**	**24.0**
121	WH1402	6.71	18.82	7.14	**10.89**	13.7
122	WH1403	5.47	17.07	3.57	**8.70**	14.0
123	DBW365	5.53	5.71	6.66	**5.97**	13.7
124	DBW366	5.14	3.23	7.14	**5.17**	12.3
125	DBW402	7.07	8.57	7.69	**7.78**	11.3
126	HD3415	4.65	2.36	7.69	**4.90**	12.7
127	Kharchia65(C)	6.22	2.44	4.16	**4.27**	12.3
128	KRL19(C)	3.60	3.23	7.69	**4.84**	13.3
129	KRL2006	7.94	5.95	6.66	**6.85**	9.3
130	UAS310	7.43	2.97	3.84	**4.75**	10.7
131	KRL2021	5.77	2.56	4.34	**4.22**	14.0
132	KRL210(C)	5.98	13.46	3.84	**7.76**	13.3
133	RAJ4565	6.67	18.31	4.34	**9.77**	13.0
134	HD3438	6.30	8.33	3.84	**6.16**	9.3
135	HD3439	7.14	9.09	5.00	**7.08**	11.7
136	CG1029(C)	5.47	13.98	7.14	**8.86**	8.3
137	HD3407*	5.53	18.09	4.34	**9.32**	13.3
138	HI1634(C)	5.14	8.70	8.33	**7.39**	12.7
139	MP3336(C)	7.07	17.50	4.54	**9.70**	14.3
140	HI8498(C)	4.65	11.76	5.26	**7.22**	12.7
140A	**Susceptible check**	**9.02**	**21.33**	**13.25**	**14.53**	**21.3**
141	HI8759(C)	7.95	12.96	15.62	**12.18**	12.7
142	HI8846	5.29	7.14	4.16	**5.53**	14.3
143	HI8847	5.98	6.10	4.54	**5.54**	9.3
144	HD2733(C)	6.22	6.67	11.53	**8.14**	13.7
145	HD3411*	6.32	15.56	12.50	**11.46**	14.3
146	HD3440	7.09	15.79	14.28	**12.39**	14.7
147	HD3406*	6.98	14.29	7.69	**9.65**	12.7
148	HD3436	6.96	14.04	6.25	**9.08**	12.0
149	HD3437	6.40	19.44	6.66	**10.83**	11.7
150	PBW175(C)	6.76	19.61	6.25	**10.87**	10.7
151	PBW677(C)	6.92	13.33	3.84	**8.03**	13.3
152	PBW901	6.28	19.51	4.00	**9.93**	12.7
153	PBW902	6.13	18.75	3.84	**9.57**	13.3
153A	**Susceptible check**	**5.23**	**20.83**	**15.00**	**13.69**	**24.0**

* Brown wheat mite screeing data rejected at Durgapura (Jaipur) & Kanpur Data due to low infestation of the mite. Susceptible checks: SONALIKA (C) for shootfly & IWP (72) for Brown mite

Table A1-10.1b: Screening of AVT lines against foliar wheat aphid and root aphid (Year-2021-22)

AVT No.	Entry	Foliar aphid score (1-5 scale)					Average score	Maximum Score	Root aphid (No./plant) Ludhiana Centre only
		Ludhiana	Karnal	Niphad	Kharibari	Khudwani			
1	VL2041	5	3	3	2	5	3.6	5	4
2	VL2043	5	4	4	1	5	3.8	5	5
3	VL2044	5	4	3	2	5	3.8	5	5
4	HD3402	5	4	3	2	5	3.8	5	4
5	HPW481	5	4	3	3	4	3.8	5	4
6	HPW487	5	4	3	3	4	3.8	5	4
7	HPW488	4	4	4	4	5	4.2	5	4
8	HS692	5	5	4	2	5	4.2	5	4
9	HS693	5	4	4	2	4	3.8	5	4
10	HS694	5	5	4	3	4	4.2	5	5
11	UP3114	5	4	3	5	4	4.2	5	5
12	VL3028	5	4	3	5	4	4.2	5	4
13	VL3029	5	4	4	5	4	4.4	5	5
14	VL3030	5	4	5	5	4	4.6	5	4
15	HPW483	5	5	4	5	5	4.8	5	5
16	HPW484	5	5	3	3	4	4.0	5	5
17	HPW485	5	5	4	3	5	4.4	5	5
18	HPW486	5	4	3	3	4	3.8	5	4
19	HS688	5	5	4	3	5	4.4	5	5
20	HS689	5	5	4	5	5	4.8	5	5
20A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5**	**5**	**5.0**	**5**	**5**
21	HS690	5	5	5	4	5	4.8	5	4
22	HS691	5	4	5	2	4	4.0	5	4
23	SKW362	5	5	5	2	4	4.2	5	4
24	UP3113	5	4	5	3	4	4.2	5	5
25	VL2047	4	4	4	4	5	4.2	5	5
26	VL2048	4	5	4	5	5	4.6	5	5
27	VL2049	5	5	5	3	5	4.6	5	5
28	VL2050	5	5	5	5	5	5.0	5	5
29	HS507(C)	5	5	5	3	5	4.6	5	5
30	HS562(C)	5	5	5	3	5	4.6	5	4
31	HS490(C)	5	5	5	2	5	4.4	5	5
32	HPW349(C)	5	5	5	3	5	4.6	5	4
33	VL907(C)	5	5	5	5	4	4.8	5	4
34	VL892(C)	5	5	5	5	5	5.0	5	4
35	DBW377	5	5	5	5	4	4.8	5	4
36	PBW870	5	5	5	5	5	5.0	5	4
37	DBW372	5	5	5	3	5	4.6	5	4
38	DBW318	5	5	5	3	5	4.6	5	4
39	DBW327 (C)	5	5	5	3	5	4.6	5	4
40	DBW332(C)	5	5	5	3	5	4.6	5	5
40A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5**	**5**	**5.0**	**5**	**5**
41	DBW370	5	3	5	2	5	4.0	5	5
42	DBW371	5	3	5	4	5	4.4	5	4

43	DBW373	5	4	5	5	5	4.8	5	5
44	PBW868	4	4	4	5	5	4.4	5	5
45	PBW871	5	5	5	3	5	4.6	5	4
46	PBW872	4	5	4	4	5	4.4	5	4
47	HD3090(C)	4	4	4	4	5	4.2	5	4
48	HI1633(C)	4	4	4	5	5	4.4	5	4
49	RAJ4083(C)	5	5	5	4	5	4.8	5	4
50	DBW320#*	5	4	5	4	5	4.6	5	5
51	MP1380#	4	3	4	5	5	4.2	5	4
52	DBW407[B]	5	5	5	4	5	4.8	5	5
53	DDW48(d)(C)	5	5	5	5	5	5.0	5	5
54	HI8826(d)*	5	5	5	4	5	4.8	5	5
55	MACS4100(d)*	5	5	5	5	5	5.0	5	5
56	MP1378	5	5	5	4	5	4.8	5	4
57	MP3552	4	4	4	5	5	4.4	5	5
58	UAS3015	4	4	4	5	5	4.4	5	5
59	HI8839(d)	5	4	5	5	5	4.8	5	4
60	HI8840(d)	4	4	4	5	5	4.4	5	4
60A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5**	**5**	**5.0**	**5**	**5**
61	MP1358(I)(C)	4	5	4	5	5	4.6	5	4
62	NIAW3922	5	5	5	5	5	5.0	5	4
63	NIDW1149(d)(C)	5	5	5	4	5	4.8	5	4
64	UAS478(d)	5	5	5	3	5	4.6	5	4
65	DBW352#	5	4	5	4	5	4.6	5	4
66	GW513(I)(C)	5	5	5	5	5	5.0	5	4
67	GW547[B]	5	5	5	5	5	5.0	5	4
68	HI1636(I)(C)	5	4	5	4	5	4.6	5	5
69	HI1650*	5	5	5	5	5	5.0	5	4
70	MACS6768*	5	5	5	3	5	4.6	5	5
71	MP3535*	5	4	5	4	5	4.6	5	4
72	NWS2194#	5	5	5	5	5	5.0	5	4
73	HI1665	5	5	5	3	5	4.6	5	5
74	NIAW4028	5	4	5	4	5	4.6	5	4
75	CG1036*	5	5	5	5	5	5.0	5	5
76	CG1040	5	5	5	5	5	5.0	5	5
77	DDW47(d)(C)	5	4	5	4	4	4.4	5	5
78	DDW55(d)[Q]*	5	4	5	5	5	4.8	5	5
79	GW532	5	5	5	5	5	5.0	5	5
80	HD3401	5	4	5	4	4	4.4	5	5
80A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5**	**5**	**5.0**	**5**	**5**
81	HI1655[Q]*	5	5	5	4	5	4.8	5	5
82	HI1666	5	4	5	5	5	4.8	5	5
83	HI8823(d)(I)(C)	5	5	5	4	5	4.8	5	5
84	HI8830(d)*	5	5	5	5	5	5.0	5	4
85	MACS6795	4	4	4	4	4	4.0	4	4
86	MP1377	4	4	4	5	4	4.2	5	4
87	MP3288(C)	5	5	5	4	5	4.8	5	4
88	UAS3019	5	4	5	5	5	4.8	5	4
89	DBW316#*	5	4	5	4	5	4.6	5	5
90	HD3118(C)	5	5	5	5	5	5.0	5	5
91	HD3392	5	4	5	4	5	4.6	5	4
92	HI1621(C)	5	5	5	3	5	4.6	5	5
93	PBW833*	5	4	5	5	5	4.8	5	5

94	PBW835[Q]*	4	5	4	4	5	4.4	5	5
95	HD3249(C)	4	4	4	3	4	3.8	4	4
96	PBW826#*	5	5	5	5	5	5.0	5	5
97	HD3388	5	5	5	4	5	4.8	5	4
98	PBW852	5	5	5	5	5	5.0	5	4
99	DBW252(C)	5	5	5	4	5	4.8	5	3
100	HD3171(C)	5	5	5	5	5	5.0	5	4
100A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5**	**5**	**5.0**	**5**	**5**
101	HD3293(C)	5	5	5	4	5	4.8	5	5
102	DBW353	5	5	5	5	5	5.0	5	5
103	JKW261(I)(C)	4	5	4	4	5	4.4	5	5
104	PBW771(C)	4	4	4	5	5	4.4	5	5
105	WH1124(C)	4	5	4	4	5	4.4	5	5
106	HD2967(C)	5	5	5	2	5	4.4	5	5
107	HD3386	3	5	3	3	5	3.8	5	5
108	DBW359	4	3	4	5	5	4.2	5	5
109	DBW358	4	3	4	4	5	4.0	5	4
110	NIAW3170(C)	5	5	5	5	5	5.0	5	4
111	HD3043(C)	5	5	5	4	5	4.8	5	4
112	HD3369*	5	5	5	3	5	4.6	5	4
113	HD3397	4	5	4	5	5	4.6	5	5
114	HD3400	5	5	5	4	5	4.8	5	5
115	HD3418	4	4	4	4	5	4.2	5	5
116	HI1628(C)	5	5	5	4	4	4.6	5	5
117	HI1653*	5	5	5	3	4	4.4	5	5
118	HI1654*	4	5	4	5	5	4.6	5	4
119	HUW838(I)(C)	5	5	5	4	5	4.8	5	5
120	UP3090	5	5	5	3	5	4.6	5	5
120A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5**	**5**	**5.0**	**5**	**5**
121	WH1402	5	5	5	5	5	5.0	5	5
122	WH1403	5	5	5	4	5	4.8	5	5
123	DBW365	5	5	5	3	5	4.6	5	5
124	DBW366	5	5	5	5	5	5.0	5	5
125	DBW402	4	4	4	4	4	4.0	4	5
126	HD3415	4	5	4	3	5	4.2	5	4
127	Kharchia65(C)	5	5	5	5	5	5.0	5	4
128	KRL19(C)	5	5	5	4	5	4.8	5	4
129	KRL2006	5	5	5	3	5	4.6	5	4
130	UAS310	3	3	3	5	3	3.4	5	4
131	KRL2021	4	5	4	4	5	4.4	5	3
132	KRL210(C)	4	5	4	4	5	4.4	5	4
133	RAJ4565	4	4	4	5	4	4.2	5	4
134	HD3438	5	5	5	3	5	4.6	5	4
135	HD3439	5	5	5	4	5	4.8	5	4
136	CG1029(C)	5	5	5	5	5	5.0	5	4
137	HD3407*	4	4	4	4	4	4.0	4	4
138	HI1634(C)	5	5	5	5	5	5.0	5	4
139	MP3336(C)	5	5	5	3	5	4.6	5	5
140	HI8498(C)	5	5	5	4	5	4.8	5	5
140A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5**	**5**	**5.0**	**5**	**5**
141	HI8759(C)	5	5	5	3	5	4.6	5	5
142	HI8846	4	4	4	4	4	4.0	4	4
143	HI8847	4	3	4	5	5	4.2	5	4

144	HD2733(C)	4	4	4	3	5	4.0	5	4
145	HD3411*	5	5	5	4	5	4.8	5	4
146	HD3440	5	4	5	5	5	4.8	5	4
147	HD3406*	5	5	5	3	4	4.4	5	4
148	HD3436	5	5	5	3	4	4.4	5	4
149	HD3437	5	5	5	5	4	4.8	5	4
150	PBW175(C)	5	5	5	4	5	4.8	5	4
151	PBW677(C)	5	5	5	3	4	4.4	5	5
152	PBW901	5	5	5	5	5	5.0	5	5
153	PBW902	5	5	5	4	5	4.8	5	5
153A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5**	**5**	**5.0**	**5**	**5**

** Data from Vijapur, Durgapura and Pusa Bihar rejected due to low infestation of foliar aphids*

Table A1-10.1c: Screening of NIVT lines against foliar wheat aphids (Year-2021-22)

NIVT No.	Entry	Foliar aphid score (1-5 scale)				
		Ludhiana	Karnal	Niphad	Average Score	Highest Score
1	DBW187(C)	4	4	4	4.0	4
2	HD3086(C)	4	4	4	4.0	4
3	DBW222(C)	3	4	4	3.7	4
4	DBW379	5	4	4	4.3	5
5	DBW380	5	3	4	4.0	5
6	DBW381	4	4	4	4.0	4
7	DBW382	5	3	4	4.0	5
8	DBW383	5	3	4	4.0	5
9	BRW3921	4	5	5	4.7	5
10	BW17R6045	4	5	5	4.7	5
11	HD3419	4	4	4	4.0	4
12	HD3420	5	4	4	4.3	5
13	HD3421	4	4	4	4.0	4
14	HP1974	5	4	4	4.3	5
15	HUW849	5	4	4	4.3	5
16	JAUW695	4	4	4	4.0	4
17	K2101	4	4	4	4.0	4
18	KRL2002	5	4	4	4.3	5
19	NW8046	5	4	4	4.3	5
20	PBW882	5	5	5	5.0	5
20A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5.0**	**5**
21	PBW883	4	5	4	4.3	5
22	PBW884	4	4	5	4.3	5
23	PBW885	5	4	5	4.7	5
24	PBW886	5	4	4	4.3	5
25	RAJ4566	5	5	4	4.7	5
26	RAJ4567	5	5	4	4.7	5
27	RAJ4568	4	5	5	4.7	5
28	RVW4350	5	5	4	4.7	5
29	UBW16	5	5	4	4.7	5
30	UP3101	5	5	4	4.7	5
31	UP3102	4	5	4	4.3	5
32	UP3103	4	5	4	4.3	5

33	UP3104	4	5	4	4.3	5
34	WH1301	5	5	4	4.7	5
35	WH1302	5	5	4	4.7	5
36	WH1303	5	5	5	5.0	5
37	AAI-W49	5	4	4	4.3	5
38	BRW3910	5	4	4	4.3	5
39	BRW3926	5	4	4	4.3	5
40	DBW384	5	3	4	4.0	5
40A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5.0**	**5**
41	DBW385	4	4	5	4.3	5
42	DBW386	4	4	5	4.3	5
43	HD3422	5	4	4	4.3	5
44	HD3423	4	4	4	4.0	4
45	HI1668	5	5	4	4.7	5
46	HP1975	5	5	4	4.7	5
47	HUW850	4	4	4	4.0	4
48	HUW851	5	5	5	5.0	5
49	JKW297	4	5	5	4.7	5
50	K2103	4	4	4	4.0	4
51	K2104	5	5	5	5.0	5
52	K2105	5	4	4	4.3	5
53	KRL2020	4	5	5	4.7	5
54	NW8044	4	5	5	4.7	5
55	NW8049	4	5	5	4.7	5
56	NWS2214	5	4	4	4.3	5
57	PBW887	5	4	4	4.3	5
58	PBW888	5	4	4	4.3	5
59	PBW889	5	4	4	4.3	5
60	PBW890	5	4	4	4.3	5
60A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5.0**	**5**
61	RAJ4569	5	5	5	5.0	5
62	RAJ4570	4	5	4	4.3	5
63	RVW4353	4	5	5	4.7	5
64	TAW142	5	5	5	5.0	5
65	UP3105	4	5	4	4.3	5
66	UP3106	4	5	4	4.3	5
67	WH1304	5	4	4	4.3	5
68	WH1305	4	4	4	4.0	4
69	GW322(C)	5	5	4	4.7	5
70	HI1544(C)	5	5	4	4.7	5
71	MACS6222(C)	5	5	4	4.7	5
72	RVW4355	5	5	4	4.7	5
73	AKAW5314	5	5	5	5.0	5
74	AKAW5100	5	5	5	5.0	5
75	BLK-Balaji	5	5	5	5.0	5
76	CG1043	4	4	4	4.0	4
77	DBW387	5	4	5	4.7	5
78	DBW388	5	4	4	4.3	5
79	GW536	5	5	4	4.7	5
80	GW537	5	5	5	5.0	5
80A	**A 9-30-1 (C)**	**5**	**4**	**4**	**4.3**	**5**
81	GW540	5	5	4	4.7	5
82	GW541	5	5	5	5.0	5

83	HD3424	5	5	5	5.0	5
84	HI1669	4	5	4	4.3	5
85	HI1670	5	5	5	5.0	5
86	HI1671	5	5	4	4.7	5
87	MACS6808	5	4	5	4.7	5
88	MACS6809	5	4	5	4.7	5
89	MACS6811	5	5	5	5.0	5
90	MACS6815	5	5	4	4.7	5
91	MP1386	5	5	5	5.0	5
92	MP1387	4	4	4	4.0	4
93	MP3558	5	5	5	5.0	5
94	MP3559	4	4	5	4.3	5
95	NIAW4153	5	5	5	5.0	5
96	NIAW4183	4	4	5	4.3	5
97	NWS2222	4	5	5	4.7	5
98	PBW891	5	5	5	5.0	5
99	PWU15	5	5	5	5.0	5
100	RAJ4575	4	4	4	4.0	4
100A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5.0**	**5**
101	RVW4358	5	5	5	5.0	5
102	UAS3020	5	4	5	4.7	5
103	UAS3021	5	4	5	4.7	5
104	WH1306	4	5	5	4.7	5
105	DBW107(C)	5	4	5	4.7	5
106	DBW173(C)	5	5	5	5.0	5
107	HD3059(C)	5	4	4	4.3	5
108	HI1563(C)	5	4	4	4.3	5
109	AAI-W42	5	5	4	4.7	5
110	BRW3923	5	4	5	4.7	5
111	DBW389	5	4	5	4.7	5
112	DBW390	5	4	5	4.7	5
113	DBW391	4	4	4	4.0	4
114	DBW392	4	4	5	4.3	5
115	DBW393	4	4	4	4.0	4
116	HD3425	5	5	4	4.7	5
117	HD3426	4	5	4	4.3	5
118	HD3427	5	5	5	5.0	5
119	HD3428	4	5	4	4.3	5
120	HUW852	4	5	4	4.3	5
120A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5.0**	**5**
121	JKW298	5	5	5	5.0	5
122	K2107	5	5	4	4.7	5
123	K2108	5	5	5	5.0	5
124	K2109	5	5	4	4.7	5
125	NW8040	5	5	4	4.7	5
126	NW8045	4	4	4	4.0	4
127	PBW892	5	5	4	4.7	5
128	PBW893	5	5	4	4.7	5
129	PBW894	5	5	4	4.7	5
130	PBW895	4	4	4	4.0	4
131	PBW896	5	5	4	4.7	5
132	RAJ4572	5	5	4	4.7	5
133	RAJ4573	5	5	5	5.0	5

134	RAJ4574	5	5	5	5.0	5
135	UP3108	5	5	5	5.0	5
136	UP3109	5	5	5	5.0	5
137	UP3110	4	5	5	4.7	5
138	WH1307	5	5	4	4.7	5
139	WH1308	4	4	5	4.3	5
140	WH1309	5	5	4	4.7	5
140A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5.0**	**5**
141	HD2932(C)	4	5	5	4.7	5
142	HD2864(C)	5	4	4	4.3	5
143	AKAW5104	5	5	5	5.0	5
144	CG1042	5	5	4	4.7	5
145	DBW394	5	4	4	4.3	5
146	DBW395	5	4	4	4.3	5
147	GW538	5	4	4	4.3	5
148	GW542	5	4	4	4.3	5
149	HI1672	4	4	4	4.0	4
150	HI1673	5	5	4	4.7	5
151	HI1674	4	5	4	4.3	5
152	HI1675	5	5	4	4.7	5
153	LOK79	5	5	4	4.7	5
154	MACS6805	5	4	4	4.3	5
155	MACS6814	4	4	4	4.0	4
156	MP1388	5	5	4	4.7	5
157	MP3556	4	5	5	4.7	5
158	MP3557	5	4	4	4.3	5
159	NIAW4114	4	4	4	4.0	4
160	NIAW4120	4	4	4	4.0	4
160A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5.0**	**5**
161	PBW897	4	4	4	4.0	4
162	UAS3022	5	4	5	4.7	5
163	UAS3023	5	5	5	5.0	5
164	WH1310	5	4	5	4.7	5
165	HI8713(C)	4	4	5	4.3	5
166	HI8737(C)	5	5	5	5.0	5
167	MACS3949(C)	5	5	5	5.0	5
168	UAS428(C)	4	5	5	4.7	5
169	DDW59	4	5	5	4.7	5
170	DDW60	4	4	5	4.3	5
171	GW1360	4	5	4	4.3	5
172	GW1361	5	5	5	5.0	5
173	GW1363	4	4	5	4.3	5
174	GW1364	4	4	5	4.3	5
175	HI8841	4	4	5	4.3	5
176	HI8842	5	5	5	5.0	5
177	HI8843	4	4	5	4.3	5
178	MACS4120	5	4	4	4.3	5
179	MACS4121	4	4	4	4.0	4
180	MACS4122	5	5	5	5.0	5
180A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5.0**	**5**
181	MPO1389	4	4	5	4.3	5
182	MPO1390	5	4	5	4.7	5
183	NIDW1485	5	5	5	5.0	5

184	PDW362	5	5	5	5.0	5
185	PDW363	4	4	5	4.3	5
186	PWU18	5	5	5	5.0	5
187	PWU19	4	4	5	4.3	5
188	UAS479	5	4	5	4.7	5
189	UAS480	4	4	5	4.3	5
190	AKDW4773	4	4	5	4.3	5
191	DBW397	5	5	5	5.0	5
192	HI1612(C)	5	5	5	5.0	5
193	K1317(C)	4	4	5	4.3	5
194	PBW644(C)	5	4	5	4.7	5
195	BRW3924	5	4	4	4.3	5
196	DBW396	5	4	5	4.7	5
197	DBW398	5	4	5	4.7	5
198	DBW399	5	4	5	4.7	5
199	HD3429	5	5	5	5.0	5
200	HD3430	5	5	5	5.0	5
200A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5.0**	**5**
201	HI1676	4	5	5	4.7	5
202	HP1976	4	5	5	4.7	5
203	HUW853	4	5	5	4.7	5
204	JAUW704	4	4	4	4.0	4
205	JKW292	4	5	5	4.7	5
206	K2121	4	5	5	4.7	5
207	NW8048	4	4	4	4.0	4
208	PBW898	4	4	5	4.3	5
209	PBW899	4	4	5	4.3	5
210	PBW900	4	4	5	4.3	5
211	TAW133	5	5	5	5.0	5
212	UP3111	5	5	5	5.0	5
213	UP3112	5	5	5	5.0	5
214	WH1311	5	5	5	5.0	5
215	WH1312	4	5	5	4.7	5
216	DBW110(C)	4	5	5	4.7	5
217	HI1605(C)	5	5	5	5.0	5
218	HI8627(d)(C)	4	5	5	4.7	5
219	UAS446(d)(C)	4	4	4	4.0	4
220	CG1041	4	4	4	4.0	4
220A	**A 9-30-1 (C)**	**5**	**4**	**4**	**4.3**	**5**
221	DBW400	4	5	4	4.3	5
222	DDW61(d)	3	5	5	4.3	5
223	GW1362(d)	4	5	5	4.7	5
224	GW539	4	4	5	4.3	5
225	HI1677	4	4	5	4.3	5
226	HI1678	4	4	5	4.3	5
227	HI1679	4	5	4	4.3	5
228	HI8844(d)	4	5	4	4.3	5
229	HI8845(d)	3	4	4	3.7	4
230	MACS6797	4	4	4	4.0	4
231	MACS6801	5	5	4	4.7	5
232	MP1384	4	5	5	4.7	5
233	MP1385	5	5	5	5.0	5
234	MP3562	4	4	5	4.3	5

235	NIAW4172	4	4	4	4.0	4
236	NIAW4178	5	5	5	5.0	5
237	UAS3024	5	5	5	5.0	5
238	UAS481(d)	4	5	5	4.7	5
239	WSM253	4	5	5	4.7	5
240	DBW303(C)	4	5	5	4.7	5
240A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5.0**	**5**
241	DBW296	5	4	4	4.3	5
242	BRW3922	4	4	4	4.0	4
243	DBW403	4	5	5	4.7	5
244	DBW404	5	4	4	4.3	5
245	HD3431	5	4	4	4.3	5
246	HD3432	4	4	4	4.0	4
247	HD3433	4	5	5	4.7	5
248	HI1682	5	5	4	4.7	5
249	K2001	5	4	4	4.3	5
250	PBW877	5	4	4	4.3	5
251	PBW878	5	5	4	4.7	5
252	PBW879	5	5	4	4.7	5
253	PBW880	4	5	4	4.3	5
254	RAJ4571	4	5	4	4.3	5
255	UP3115	4	4	4	4.0	4
256	UP3116	5	4	4	4.3	5
257	WH1313	4	5	4	4.3	5
258	WH1314	4	5	4	4.3	5
259	CG1044	4	4	4	4.0	4
260	DBW401	5	5	5	5.0	5
260A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5.0**	**5**
261	DBW405	4	5	5	4.7	5
262	DBW406	5	5	5	5.0	5
263	GW543	4	5	5	4.7	5
264	GW544	5	4	5	4.7	5
265	GW545	5	4	4	4.3	5
266	GW546	5	5	4	4.7	5
267	HD3435	5	5	4	4.7	5
268	HI1680	5	5	4	4.7	5
269	HI1681	5	5	5	5.0	5
270	HP1977	5	5	5	5.0	5
271	MACS6802	5	5	5	5.0	5
272	MACS6803	5	4	4	4.3	5
273	MP1391	4	5	4	4.3	5
274	MP3564	5	4	4	4.3	5
275	MP3567	4	4	4	4.0	4
276	NIAW4040	5	4	5	4.7	5
277	NIAW4174	4	4	5	4.3	5
278	PBW881	4	4	4	4.0	4
279	UAS3025	5	5	5	5.0	5
280	UAS3026	4	5	5	4.7	5
280A	**A 9-30-1 (C)**	**5**	**5**	**5**	**5.0**	**5**

Table A2-10.1a: Screening of MPSN nursery against shoot fly and brown wheat mite (Year-2021-22)

S. No.	Entry	Code	Shoot fly incidence (%)			Average score	No. of brown wheat mites/10 cm sq area
			Ludhiana	Dhardwad	Kanpur		Ludhiana
1	HS 507	MDSN 1	4.37	13.33	15.78	11.16	13.00
2	HS 679	MDSN 2	4.98	4.38	8.00	5.79	11.67
3	UAS 472(d)	MDSN 3	4.67	6.15	6.66	5.83	8.33
4	DDW47 (d)	MDSN 4	5.17	1.18	6.66	4.34	12.67
5	HD 3334	MDSN 5	5.69	5.00	12.50	7.73	13.33
6	HS 681	MDSN 6	6.28	2.38	14.28	7.65	15.67
7	MPO 1357(d)	MDSN 7	4.97	8.75	4.00	5.91	12.00
8	DDK 1058 (dic.)	MDSN 8	5.32	8.54	11.11	8.32	11.67
9	HD 3377	MDSN 9	5.68	6.41	10.71	7.60	7.33
10	HI 1636	MDSN 10	4.51	5.71	3.33	4.52	12.33
11	HUW 838	MDSN 11	4.97	7.46	15.62	9.35	5.67
12	RAJ 4541	MDSN 12	5.51	5.69	18.75	9.98	13.67
13	VL 2036	MDSN 13	4.41	0.00	9.37	4.59	12.67
14	HI8823 (d)	MDSN 14	3.52	3.88	4.50	3.97	13.00
15	CG 1029	MDSN 15	4.68	24.62	3.33	10.88	12.67
16	DDK 1059 (dic.)	MDSN 16	5.74	5.15	3.12	4.67	12.00
17	GW513	MDSN 17	6.62	20.34	7.69	11.55	13.00
18	HD 2864	MDSN 18	4.64	2.83	9.67	5.71	12.00
19	HI 1544	MDSN 19	6.23	5.32	6.67	6.07	12.33
20	HI 1633	MDSN 20	5.67	5.68	3.84	5.06	13.67
20A	Infector	Infector	-	10.61	9.67	5.64	20.67
21	HI 1634	MDSN 21	5.31	15.00	3.12	7.81	12.33
22	HI 8627(d)	MDSN 22	4.48	10.64	3.16	6.09	12.33
23	NIAW 3170	MDSN 23	5.45	16.67	5.55	9.22	13.33
24	HD 3249	MDSN 24	4.49	9.62	9.09	7.73	13.00
25	HI 8805 (d)	MDSN 25	5.57	9.30	13.63	9.50	11.00
26	HI 8818 (d)	MDSN 26	6.44	7.69	3.57	5.90	9.00
27	UAS 466(d)	MDSN 27	3.34	4.69	9.09	5.71	9.00
28	VL 3024	MDSN 28	5.77	8.75	3.71	6.08	12.33
29	DBW 48 (d)	MDSN 29	6.56	14.47	3.12	8.05	13.33
30	DBW 49 (d)	MDSN 30	5.44	2.98	3.22	3.88	13.00
31	DBW 329	MDSN 31	5.68	10.87	8.69	8.41	11.00

Table A2-10.1b: Screening of MPSN nursery against foliar aphid and root aphid (Year-2021-22)

S. No.	Entry	Code	Foliar aphid score (1-5 scale)					Average score	Maximum Score	Root Aphid Score (1-5)
			Ludhiana	Karnal	Khudwani	Kharibari	Niphad			
1	HS 507	MDSN 1	4	3	4	2	4	3.4	4	4
2	HS 679	MDSN 2	4	4	5	2	4	3.8	5	5
3	UAS 472(d)	MDSN 3	5	4	5	4	5	4.6	5	4
4	DDW47 (d)	MDSN 4	4	4	5	3	4	4.0	5	4
5	HD 3334	MDSN 5	4	4	4	2	4	3.6	4	4
6	HS 681	MDSN 6	5	4	5	5	5	4.8	5	5
7	MPO 1357(d)	MDSN 7	5	5	5	5	5	5.0	5	5
8	DDK 1058 (dic.)	MDSN 8	5	5	5	4	5	4.8	5	4
9	HD 3377	MDSN 9	5	5	4	4	5	4.6	5	4
10	HI 1636	MDSN 10	5	5	4	3	5	4.4	5	4
11	HUW 838	MDSN 11	5	5	4	3	5	4.4	5	5
12	RAJ 4541	MDSN 12	5	3	4	5	5	4.4	5	5
13	VL 2036	MDSN 13	3	3	4	2	3	3.0	4	5
14	HI8823 (d)	MDSN 14	4	4	4	2	4	3.6	4	5
15	CG 1029	MDSN 15	5	4	5	5	5	4.8	5	5
16	DDK 1059 (dic.)	MDSN 16	5	4	4	2	5	4.0	5	4
17	GW513	MDSN 17	5	4	5	2	5	4.2	5	4
18	HD 2864	MDSN 18	4	4	4	3	4	3.8	4	4
19	HI 1544	MDSN 19	5	5	5	3	5	4.6	5	4
20	HI 1633	MDSN 20	5	5	5	3	5	4.6	5	5
20A	Infector	Infector	-	5	5	4	5	4.8	5	-
21	HI 1634	MDSN 21	5	4	5	5	5	4.8	5	5
22	HI 8627(d)	MDSN 22	5	5	4	3	5	4.4	5	4
23	NIAW 3170	MDSN 23	4	4	4	3	4	3.8	4	3
24	HD 3249	MDSN 24	4	4	4	4	4	4.0	4	4
25	HI 8805 (d)	MDSN 25	5	4	5	3	5	4.4	5	5
26	HI 8818 (d)	MDSN 26	5	4	5	4	5	4.6	5	5
27	UAS 466(d)	MDSN 27	5	4	5	3	5	4.4	5	5
28	VL 3024	MDSN 28	4	4	5	2	4	3.8	5	5
29	DBW 48 (d)	MDSN 29	5	3	5	3	5	4.2	5	5
30	DBW 49 (d)	MDSN 30	4	3	5	4	4	4.0	5	4
31	DBW 329	MDSN 31	4	3	5	5	4	4.2	5	4

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 were also recorded.

Centre: Ludhiana

In order to monitor the insect pest of wheat and barley, survey of Punjab state were undertaken during 2021-22 crop season. The aphid incidence was above economic threshold level in some places viz. village Tapa (Barnala) and Bhucho mandi (Bhatinda) during the second fortnight of March. The natural enemies

viz. grubs and adults of coccinellid beetles, syrphid fly and chrysoperla were observed in most of the fields infested with aphids. Surveys were also carried out in the months of November-December to monitor the pest prevalence in residue managed wheat fields. No serious infestation of pink stem borer or armyworm was recorded during 2021-22 crop year except few minor infestations.

Centre: Niphad

Survey was carried out in the villages of Nashik and adjoining district Ahemednagar and Aurangabad at different crop stages on farmers field during the season (Dec 2021 to March 2022). Medium to Heavy incidence of aphids was recorded during the survey. The Coccinellid & Crysoparla predator grubs and beetles feeding on the aphid were also observed. The incidence of jassids was recorded in low intensity in (Table B1-10.2a).

Centre: Vijapur

Survey of wheat & barley fields were carried out during the *Rabi* 2021-22 crop season. The termite damage in wheat fields was negligible in the fields across the area surveyed. The incidence of aphid was observed moderate during ear head stage of the crop. The population of *H. armigera*, pink stem borer and surface grasshopper were not observed. Besides, in barley fields the aphid population was moderate to high. Among natural enemies, predators like coccinellid beetles, chrysoperla and syrphid fly were noticed predating on wheat and barley aphids.

Centre: Kanpur

In Kanpur, survey was conducted in villages viz., Araul, Kannauj, Hardoi and Unnao during 2021-22. Incidence of shootfly was recorded to be 2 per cent aat all three locations. The incidence of termite was observed 10 per cent wheat variety HD2967 of wheat in Hardoi. However, it was 8% in locations Unnao and Araul on variety HD2967. Moderate infestation (25-30 aphid/tiller) of foliar aphid was on barley variety namely, 'Barley Local' while the shootfly infestation was observed 1.66% at the village Araul (Kanpur). The moderate incidence of pink stem of 2% borer was observed in irrigated crop one per cent in variety HD-2967 (Table B1-10.2b).

Centre: Karnal

In Haryana, survey was conducted field season from December -March in Ladwa, Yamunanagar, Kunjpura, Subhari, Racina and Hajwana, Karnal etc. This year incidence of aphids, termites, pink stem borer and army worm was reported to be low (1-3%). Termites and root aphid was reported to be around 2-4% during November and December. Aphid infestation started appearing in the month of January and the population in the beginning was around 4-5 aphids/tiller but in February, higher infestation of aphids (27-39 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.

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

Centre: Ludhiana: The field experiment on influence of sowing time on insect-pest incidence was conducted in the experimental area of Department of Plant Breeding and Genetics, PAU, Ludhiana. The PBW 725 variety of wheat was sown 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 2021-22. Each treatment was replicated four times. The data on major pest viz. foliage feeding aphids, termites and pink stem borer were recorded at peak period of activity. The first incidence and population build of aphids were recorded by counting the number of aphids per tiller from randomly selected five tillers from each replicate during the months of

February-March. The observations on termite damage were 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 weeks after sowing (WAS) (Table B2-10.2a).

Termite damage: The termite damage recorded at seedling stage in different dates of sowing indicated that early sown crop (first fortnight of Nov 2021) suffered more termite damage as compared to timely, late and very late sown crop. At earing stage, again termite damage was highest (2.53%) in early sown crop followed by timely (2.17%) and late sown (1.95%) and very late sown (1.79%) crop.

Root Aphid incidence: Root aphid incidence was recorded by uprooting 10 tillers from each treatments and counting the number of aphids per tillers. The root aphid appeared in the early growing season and its attack was observed on 3-5 week old crop. Root aphid incidence in I, II, III and IV date of sowing ranged from 3.92-7.13, 3.16-5.54, 1.92-3.31 and 1.12-2.39 aphid/tiller.

Foliar aphid incidence: Foliar aphid incidence first appeared in first week of February in I, II, III sowing dates and second week of February in IV sowing time. 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 2022 in I sowing date. However, peak of aphid population was recorded in10th SMW for II sowing time and it was in 11th SMW for III & IV sowing time.

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).

Aphid incidence: The data revealed indicated that the incidence of root aphids were first started appearing on wheat crop during 51st standard week. Root aphid incidence D1, D2, D3 and D4 date of sown crops ranged from 1.52-5.30, 2.53-4.05, 1.39-4.02 and 0.78-2.01 aphid/tiller. The incidence of foliar aphid first appeared in 5th standard week in D1, D2, & D3 sowing dates and during 6th standard week in D4 sowing time. The population reached to its peak during 9th Standard week on D1 (20.30 aphids/plant) and during 9th standard week on D2 sown crop (18.89 aphids/plant) in the month of February. In case of D3 (1st Dec.) and D4 (31 Dec.) sown crops, the aphid appeared during 5th and 6th standard weeks with incidence of 0.88 and 0.89 aphids/plant, respectively. The aphid population reached peaked during 10th & 11th standard weeks on D3 and D4 sown crops, respectively with aphid incidence as 18.98 and 16.60 aphids/plant, respectively.

Termite damage: The termite damage was first recorded at seedling stage on D1, D2, D3 and D4 sown crops with infestation of 3.45, 1.99, 2.90 and 2.02%, respectively during 51th standard week. The early sown crop (first week of Nov 2020) suffered more termite damage as compared to timely, late and very late sown crop.

Pink stem borer damage: The damage was first recorded at seedling stage with 3.23, 1.35, 1.67 and 1.89% infesation on D1, D2, D3 and D4 date of sown crops, respectively during 51th standard week. The early sown crop (first week of Nov 2021) 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 DBW-252 was sown on 1st December'2021, 15th December'2021 and 01st January'2022. 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).

Table B1-10.2a: Survey of wheat and barley pests and their natural enemies during 2021-22 (Centre: Niphad)

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
Naitale, Yeola, Andarsul, Suregaon and Vaijapur (28.12.2021)	Irrigated	25	Lok 1 and Other Private Varieties	Aphids	Major	Medium to Heavy	*Coccinellids* Beetles and *Crysoperla carnia*
				Jassids	Minor	Low	
			CRI, Booting, flowering	S. Borer	Minor	Very Low	
Khadak (Ozar), Gurhale and Khadak (Malegav) (03.01.2022)	Irrigated	15	Lok 1 and Other Private Varieties	Aphids	Major	Medium to Heavy	*Coccinellids* Beetles and *Crysoperla carnia*
				Jassids	Minor	Low	
			CRI, Booting, flowering	S. Borer	Minor	Very Low	
Pimpalgaon(Mor), Khed, Tal Igatpuri (24/01/2022)	Irrigated	10	Lok 1 and Other Private Varieties (CRI, Boting Stage & Milk stage)	Aphids	Major	Medium to Heavy	*Coccinellids* Beetles and *Crysoperla carnia*
Waki, Malegaon, Rajur, Indori fata, Shekaye wadi, Dhandarfal, Chkhali (24.01.2022)	Irrigated	35		Jassids	Minor	Low	
				S. Borer	Minor	Very Low	
Sangamner, Ghulewadi(MAIDC), Palaskhede(Nandur), Nandur-Shingote, Dodi, Shinde(Palase) (24.01.2022)	Irrigated	30	Lok 1, GW-496 and Other Private Varieties (CRI, Boting Stage, Milk stage & Dough Stage)	Aphids	Major	Medium to Heavy	*Coccinellids* Beetles and *Crysoperla carnia*
				Jassids	Minor	Low	
				S. Borer	Minor	Very Low	
Manori, Kanalad, Dhamori, Rawande, Takali, Shinganapur(Kopergaon), Vaijapur, Andarsul, Rayate(Yeola)(25.02.2022)	Irrigated	30	Lok 1, GW-496 and Other Private Varieties (CRI, Boting Stage, Milk stage & Dough Stage)	Aphids	Major	Medium to Heavy	Coccinellids Beetles and Crysoperla carnia
				Jassids	Minor	Low	
				S. Borer	Minor	Very Low	
Khadamba (Ahmednagar), Khospuri, Nimbe(Shevgav), Telwadi(Paithan), Sirner(Jalana), Jalana(14.03.2022)	Irrigated	30	Lok 1, GW-496 and Other Private Varieties (Milk stage & Dough Stage)	Aphids	Major	Medium to Heavy	Coccinellids Beetles and Crysoperla carnia
				Jassids	Minor	Low	
				S. Borer	Minor	Very Low	
Hasnabwadi(Aurangabad), Bagtlab, Mirzapur, Navin Kaigav(Gangapur), Bakupimpalgaon(Nevasa), Nevasa Khu., Manori(Rahuri)(15.03.2022)	Irrigated	35	Lok 1, GW-496 and Other Private Varieties (Milk stage & Dough Stage)	Aphids	Major	Medium to Heavy	Coccinellids Beetles and Crysoperla carnia
				Jassids	Minor	Low	
				S. Borer	Minor	Very Low	

Table B1-10.2b: Survey of wheat and barley pests and their natural enemies during 2021-22 (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
02.03.2022 Araul (Kanpur)	Irrigated	10	HD2967	Shootfly	Minor	2%	-	-
	irrigated	10	K1006 and HD2967	Termite	Major	8%	Swan & Bird	Adult
	Irrigated	10	K1006	Pink Stem borer	Minor	1%	-	-
	Irrigated	10	K-551 (Barley)	Aphid	Major	HS	*Coccinella-septumpuntata*	Adult
02.03.2022 Kannauj	Irrigated	10	1006	Shoot Fly	Minor	2%	-	-
	Irrigated	10	HD2967	Pink Stem Borer	Minor	1%	-	-
	Irrigated	10	Barley Local	Aphid	Major	HS	*Coccinella-septumpuntata*	Adult
	Irrigated	10	HD2967	Shoot Fly	Minor	2%	-	-
03.03.2022 Hardoi	Irrigated	10	HD2967	Termite	Major	10%	Swan & Bird	Adult
	Irrigated	10	HD2967	Stemborer	Minor	1%	-	
	Irrigated	10	Barley-K551	Aphid	Major	HS	*Coccinella-septumpuntata*	Adult
	Irrigated	10	HD2967	Pink stem borer	Minor	1%	-	-
03.03.2022 Unnao	Irrigated	10	HD2967	Termite	Major	8%	Swan & Bird	Adult
	Irrigated	10	HD2967	Shootfly	Minor	2%	-	-
	Irrigated	10	Barley-K551	Aphid	Major	HS	*Coccinella-septumpuntata*	Adult
	Irrigated	10	HD2967	Pink stem borer	Minor	2%	-	-

Table B2-10.2a: Effect of sowing dates on population build of major insect-pests in wheat during 2021-22 (Centre-Ludhiana)

Standard Weeks	Rain-fall (mm)	Temperature (^{0}C)		Relative humidity (%)		Mean Foliar Aphid incidence (Aphids/plant/tiller)				Termites damage (% affected tillers/meter row)				Mean root Aphid incidence (Aphids/plant/tiller)			
		Max	Min	Max	Min	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.)	Ist DOS (1 Nov)	IInd DOS (16 Nov.)	IIIrd DOS (1 Dec.)	IVth DOS (16 Dec.)
50	0.00	20.80	6.14	96.14	49.71	-	-	-	-	-	-	-	-	-	-	-	-
51	0.00	18.40	5.09	95.29	48.29	-	-	-	-	3.86	3.45	3.01	2.69	6.32*	4.69*	3.31*	1.15*
52	0.00	19.09	4.94	96.71	52.43	-	-	-	-	3.55	3.29	3.03	2.65	7.13*	5.54*	3.13*	2.39*
1	51.60	17.60	8.76	93.00	68.00	-	-	-	-	3.06	2.84	2.50	2.11	3.92*	3.16*	1.92*	1.12*
2	47.80	15.46	9.69	95.43	83.14	0	0	0	0	-	-	-	-	-	-	-	-
3	0.80	13.57	8.31	92.71	76.57	0	0	0	0	-	-	-	-	-	-	-	-
4	13.20	14.57	8.06	95.86	76.43	0	0	0	0	-	-	-	-	-	-	-	-
5	31.00	17.57	7.49	94.29	62.00	2	2.2	1.0	0	-	-	-	-	-	-	-	-
6	0.00	19.90	7.83	93.14	49.00	7.4	4.9	6.9	6.60	-	-	-	-	-	-	-	-
7	0.00	23.40	7.21	94.14	42.43	15.72	14.02	11.44	9.84	-	-	-	-	-	-	-	-
8	3.40	23.49	10.29	85.86	41.00	16.44	14.37	12.60	11.15	2.53	2.17	1.95	1.79	-	-	-	-
9	9.10	21.88	10.43	89.83	54.20	24.77	20.97	19.02	14.58	-	-	-	-	-	-	-	-
10	0.00	27.20	13.09	91.43	40.14	17.27	21.32	19.69	15.24	-	-	-	-	-	-	-	-
11	0.00	31.83	17.39	90.00	45.71	14.34	18.32	21.29	18.22	-	-	-	-	-	-	-	-
12	0.00	33.57	18.96	82.71	32.57	4.18	6.35	8.41	10.26	-	-	-	-	-	-	-	-
13	0.00	35.63	17.14	79.43	22.71	0	1	1.2	3.4	-	-	-	-	-	-	-	-
14	0.00	38.29	17.69	72.71	13.71	0	0	0	0	-	-	-	-	-	-	-	-

*** Root aphid/tiller**

Table B2-10.2b: Effect of sowing dates on population build of major insect-pests in wheat 2021-22 (Centre-Karnal)

Standard Weeks	Rain-fall (mm)	Temperature (^{0}C)		Av. Relative humidity (%)	Mean Aphid incidence (Aphids/plant/tiller)				Termite damage (% affected tillers/meter row)				Pink stem borer damage (% affected tillers/meter row)			
		Max	Min		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.)	Ist DOS (1 Nov)	IInd DOS (16 Nov.)	IIIrd DOS (1 Dec.)	IVth DOS (16 Dec.)
50	0	22.0	07.2	78.1	-	-	-	-	-	-	-	-	-	-	-	-
51	0	18.1	04.9	83.7	5.30*	4.05*	4.02*	2.01*	3.45	1.99	2.09	2.02	3.23	1.35	1.67	1.89
52	1.2	27.0	06.5	85.4	5.10*	3.75*	2.25*	1.11*	2.99	2.25	2.19	1.89	-	-	-	-
1	11.2	18.5	04.2	85.4	3.25*	2.53*	1.39*	0.78*	2.42	2.02	1.29	1.78	1.34	2.89	1.54	1.34
2	45.7	15.7	10.5	96.1	1.52*	0.00	0.00	0.00	3.96	2.56	2.87	1.23	0.79	1.07	0.67	0.57
3	1.2	12.5	07.4	91.9	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-
4	35	13.2	08.2	94.6	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-
5	5.2	17.5	06.8	82.0	1.45	0.99	0.88	0.00	-	-	-	-	-	-	-	-
6	15.2	18.5	07.7	81.4	4.25	3.02	1.78	0.89	-	-	-	-	-	-	-	-
7	0	22.2	06.1	73.1	12.02	12.75	8.09	6.26	1.98	1.12	1.67	1.02	-	-	-	-
8	0	23.7	09.4	71.3	13.45	11.98	10.35	9.45	3.02	2.49	3.01	2.89	-	-	-	-
9	9.5	23.5	09.9	72.4	20.30	18.89	16.89	15.89	-	-	-	-	-	-	-	-
10	0	26.7	12.2	70.7	14.39	18.28	16.96	12.45	-	-	-	-	-	-	-	-
11	0	29.8	15.2	74.9	13.10	16.79	18.98	16.60	-	-	-	-	-	-	-	-
12	0	33.5	18.1	65.6	10.52	13.29	14.23	16.23	-	-	-	-	-	-	-	-
13	0	35.7	15.6	52.3	0.39	1.79	2.99	2.52	-	-	-	-	-	-	-	-

*** Root aphid/till**

Table B2-10.2c: Effect of sowing dates on population build of major insect-pests in wheat 2021-22 (Centre-Kharibari)

Standard Weeks	RAIN FALL IN mm	Relative humidity		Temperature ^{0}C		Aphid incidence (Aphids/tiller)					
		Max RH	Min RH	Max Temp	Min Temp	Date of sowing 01.12.21	Yield qt/ha	Date of sowing 16.12.21	Yield qt/ha	Date of sowing 01.01.22	Yield qt/ha
48	0.00	89.29	43.43	29.17	12.31	0		0		0	
49	0.00	91.86	54.71	28.44	13.01	0		0		0	
50	0.00	91.43	47.00	26.34	10.43	8		0		0	
51	0.00	90.57	46.43	25.51	8.69	12.56		0		0	
52	0.23	91.71	52.71	24.50	10.36	25.64		16.56		0	
53	0.00	92.71	50.43	24.51	9.17	45.55		55.72	**20.65**	0	**18.55**
1	0.97	93.43	63.57	23.59	10.59	75.35		62.35		0	
2	0.00	91.86	59.00	22.77	9.51	105.97		75.45		9.75	
3	0.00	92.00	59.57	22.19	8.64	135.15		135.78		35.96	
4	5.89	93.86	62.43	21.00	7.78	155.35	**24.35**	185.8		85.85	
5	0.00	89.71	56.00	22.49	9.26	197.86		225.56		155.76	
6	0.00	87.14	43.57	25.74	9.77	176.40		212.69		225.90	
7	0.00	85.43	48.43	24.76	10.91	125.82		186.64		180.75	
8	0.00	83.71	47.86	28.39	13.01	85.85		145.25		167.75	
9	0.00	81.71	29.29	32.71	13.29	45.37		105.3		145.65	
10	0.00	81.57	38.86	34.94	16.30	20.35		85.15		120.89	
11	1.51	83.86	54.14	33.69	19.46	11.25		65.20		95.68	
12	5.03	94.57	72.43	29.86	19.80	6.95		35.56		78.15	
13	1.06	94.43	76.43	29.19	21.30	3.15		20.95		45.23	
14	3.03	89.86	66.14	31.71	21.71	1.15		10.75		29.15	

B3. Population dynamics of insect-pests and natural enemies under different residue management scenarios in rice-wheat cropping system.

The effect of different sowing methods viz. Happy-Seeder, Super-Seeder, Rotavator along with conventional sowing in wheat was tested to study the population dynamics of major insect-pests and natural enemies in rice-wheat cropping system. Wheat crop was grown under different sowing method after paddy by keeping residue@ 5 tonnes/ha. The incidence of pink stem borer was recorded 3-7 weeks after sowing in each tillage conditions by counting the damaged tiller and total tiller. Root aphid incidence was recorded by uprooting 10 tillers from each treatment and counting the number of aphids per tillers. Similarly, foliar aphid incidence was also recorded at peak period of their activity at earing stage of the crop.

Centre: Ludhiana: The data revealed that pink stem borer incidence was significantly higher in all residue management conditions as compared to conventional tillage conditions (0.92-1.24%). It was highest in Rotavator sown wheat (1.54-2.14%) crop followed by Super seeder (1.30-2.07%) and Happy-Seeder sown crop (1.26-1.65) at different observation time (3-7 weeks after sowing). In case of root aphids, all residue management conditions recorded significantly lower number of root aphids/tillers as compared to conventional tillage (4.70-5.00 aphids/tiller). However, there was no difference in foliar aphid incidence among all tillage conditions. Coccinellid population at peak period of their activity was significantly highest in Super Seeder conditions (4.20/sq m) as compared to Rotavator sown wheat (3.00/sq m) but super seeder sown crop at par with Happy Seeder sown wheat crop (4.00/sq m). However, all residue managed wheat fields harbour greater coccinellid population as compared to conventionally sown wheat crop (2.40/sq m) (Table B3-10.2a).

Centre: Karnal: The date indicated that the pink stem borer incidence was significantly higher in rotavator sown wheat with 1.82, 2.26, 2.42,2.09 and 1.67% incidence after 3, 4, 5,6 & 7 weeks after sowing, respectively. However, it was lowest weeks in conventionally sown wheat crop with 1.27, 1.52, 1.51, 1.52, and 1.21% incidence after 3, 4, 5,6 & 7, respectively. Overall, the pink stem borer incidence was significantly higher in all residue management conditions as compared to conventional tillage conditions. Root aphid infestation was highest in conventionally sown wheat crop (5.00 -5.69 aphids/tiller) and all residue management conditions recorded significantly lower number of root aphids/tillers. Foliar aphid incidence was significantly higher in conventionally sown wheat crop with with 20.67, 23.13, 2.42 and 19.56 aphids/tiller during different observation time. Coccinellid population at peak period of their activity was significantly highest in Super Seeder conditions (5.93/sq m) and lowest (2.23/sq m) in conventionally sown wheat. Overall, all residue managed wheat fields harbour greater coccinellid population as compared to conventionally sown wheat crop (Table B3-10.2b).

Table B3-10.2a: Population dynamics of insect-pests and natural enemies under different residue management scenarios in rice-wheat cropping system during 2021-22(Centre: Ludhiana)

Pink stem borer damage (%)					
	3 WAS	**4 WAS**	**5 WAS**	**6 WAS**	**7 WAS**
Happy Seeder	1.26	1.58	1.65	1.43	1.20
Super Seeder	1.39	1.82	2.07	1.73	1.30
Rotavator	1.54	1.98	2.14	1.81	1.39
Conventional tillage	0.99	1.24	1.23	1.22	0.92
CD (p=0.05)	0.20	0.19	0.24	0.18	0.23
Root aphid/tiller	**3 WAS****	**4 WAS**	**5 WAS**		
Happy Seeder	3.20 (2.03)*	2.80 (1.94)	2.70 (1.88)		
Super Seeder	3.60 (2.12)	2.90 (1.94)	2.70 (1.87)		
Rotavator	3.50 (2.09)	3.10 (1.98)	3.10 (2.00)		
Conventional tillage	5.00 (2.43)	4.70 (2.37)	5.00 (2.44)		
CD (p=0.05)	(0.25)	(0.33)	(0.30)		
Foliar aphid/tiller	**25-2.2022**	**4-3-2022**	**11-3-2022**		
Happy Seeder	15.10 (4.00)	20.30 (4.61)	16.20 (4.14)		
Super Seeder	14.90 (3.96)	20.80 (4.65)	16.40 (4.15)		
Rotavator	15.20 (4.00)	21.40 (4.71)	16.80 (4.21)		
Conventional tillage	15.60 (4.05)	21.10 (4.68)	16.30 (4.14)		
CD (p=0.05)	NS	NS	NS		
Coccinellids/sq m	**24-3-2022**				
Happy Seeder	4.00 (2.23)				
Super Seeder	4.20 (2.27)				
Rotavator	3.00 (1.98)				
Conventional tillage	2.40 (1.82)				
CD (p=0.05)	(0.28)				

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

**** WAS = Weeks after sowing**

Table B3-10.2b: Population dynamics of insect-pests and natural enemies under different residue management scenarios in rice-wheat cropping system during 2021-22(Centre: Karnal)

Pink stem borer damage (%)					
	3 WAS	**4 WAS**	**5 WAS**	**6 WAS**	**7 WAS**
Happy Seeder	1.54	1.86	1.93	1.71	1.48
Super Seeder	1.67	2.10	2.35	2.01	1.58
Rotavator	1.82	2.26	2.42	2.09	1.67
Conventional tillage	1.27	1.52	1.51	1.52	1.21
CD (p=0.05)	0.48	0.47	0.52	0.46	0.51
Root aphid/tiller	**3 WAS**	**4 WAS**	**5 WAS**		
Happy Seeder	4.19(2.28)	3.79(2.19)	2.69(1.92)		
Super Seeder	4.59(2.36)	3.89(2.21)	2.68(1.92)		
Rotavator	4.49(2.34)	4.09(2.26)	4.09(2.26)		
Conventional tillage	5.99(2.64)	5.69(2.59)	5.00 (2.44)		
CD (p=0.05)	(0.89)	(0.49)	(0.47)		
Foliar aphid/tiller	**27-2.2022**	**7-3-2022**	**13-3-2022**		
Happy Seeder	17.13(4.26)	21.30(4.72)	14.23(3.90)		
Super Seeder	16.93(4.23)	20.36(4.62)	15.23(4.03)		
Rotavator	18.25(4.39)	22.39(4.84)	17.56(4.31)		
Conventional tillage	20.69(4.66)	23.13(4.91)	19.56(4.53)		
CD (p=0.05)	(0.21)	(0.19)	(0.13)		
Coccinellids/sq m	**29-3-2022**				
Happy Seeder	5.24 (2.50)				
Super Seeder	5.93 (2.63)				
Rotavator	2.23 (1.80)				
Conventional tillage	2.95 (1.99)				
CD (p=0.05)	(0.28)				

*** Figures in parentheses are square root transformed means**
**** WAS = Weeks after sowing**

B4: Effect of silicon application on the incidence of major insect pest and natural enemies of wheat (Centres: Ludhiana & Karnal)

Effect of silicon application in the form sodium meta-silicate was tested to determine its effect on aphid abundance and their coccinellid predators in wheat. Single and two foliar application sodium meta-silicate @ 10, 30 and 50 g/litre were tested along- with one and two sprays of Actare (thiamethoxam 25WG) @ 50 g/ha in randomized complete block design (RCBD). First spray of sodium meta-silicate was made at boot leaf stage and second spray was made 10 days after boot leaf stage. Similarly, one and two sprays of thiamethoxam 25 WG @ 50 g/ha were applied at same stage of crop and served as standard check. Observations were recorded on population of aphids/tillers, coccinellid predators (adult and grubs) and grain yield at the time of harvest.

Centre: Ludhiana: The data revealed revealed that one or two foliar applications of sodium meta-silicate have little effect on aphid population. Although some reduction in aphid control was recorded in foliar application of sodium meta-silicate but it remained above economic threshold level of 5 aphid/earhead. However, application of thiamethoxam 25wg significantly reduced the aphid population. Coccinellid population was statistically at par with each other in all sodium meta-silicate application and it was significantly lower than foliar application of thiamethoxam 25WG. The grain yield recorded in all silicon treatment was also significantly lower than foliar application of thiamethoxam 25WG (Table B4-10.2a).

Centre: Karnal: The effect of sodium meta-silicate was studied to check its effect on aphid abundance and their coccinellid predators in wheat. The data revealed that the application sodium meta-silicate @ 10, 30 and 50 g/litre showed little reduction in aphid population. Amongst sodium meta-silicate application treatments, an increasing trend in reduction was observed with increased dose of sodium meta-silicate from 10 to and 50 g/litre. The trend was same with single and two foliar application sodium meta-silicate @ 10, 30 and 50 g/litre single. However, the reduction of aphid was significantly higher in one and two sprays of Actare (thiamethoxam 25WG) @ 50 g/ha. Coccinellid population was statistically at par with each other in all sodium meta-silicate application and it was significantly lower than foliar application of thiamethoxam 25WG. The grain yield was recorded highest in plots treated with foliar application of thiamethoxam 25WG as compared to all silicon treated plots (Table B4-10.2b).

B5: Evaluation of biodegradable insecticide loaded hydrogels for management of termites in wheat (Centres: Ludhiana & Karnal)

Seed treatments with different insecticides are recommended for the control termites in wheat. Farmers are also applying hydrogels near root zone of the crop at the time of sowing or at tillering stage in order to slowly release the soil moisture to plant. As the time of application of insecticide for termites control coincides with hydrogel application, an experiment was conducted to study their compatibility with each other. Insecticides recommended for termites control viz. thiamethoxam 70WS @ 1 g/kg of seed, chlorpyriphos @ 4 ml/kg of seed and Neonix @ 2 ml/kg of seed, were loaded with commonly available Hydrogel (Goond Katira along with Jaggery) and tested for their efficacy along with seed treatments without hydrogels and untreated control. Fipronil 0.3 G @ 7 kg/ac and chlorpyriphos 20 EC @ 1.2 litres/ac alone or in combination with hydrogels were also applied before first irrigation and tested for their efficacy in Randomized complete block design (RCBD) in a replicated trial.

Centre: Ludhiana: 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 & 6 weeks of germination indicated that all seed treatments recorded significantly lower per cent damaged effective tillers/m row as compared to plot treated with soil application of insecticides before first irrigation and untreated check. There was no difference in insecticides applied alone or in combination goond katira for termite control. Among the different insecticide seed treatments, termites damage was lowest in Goond Katira (100 g/kg) + Jaggery (250 g/litre)+ Neonix @ 2 ml/kg of seed) (0.56-0.82%) whereas among the soil application, it was minimum in goond Katira (5kg/ha) + fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation (0.47-1.21%). However, all the insecticide treated plots recorded significantly lower termite damage as compare to untreated check except.

The grain yield obtained was maximum in plot treated with goond katira (100 g/kg) + jaggery (250 g/litre)+ neonix @ 2 ml/kg of seed) (42.56 q/ha) followed by goond katira (5kg/ha)+ fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation (42.50 q/ha) and all treatments were at par with each except untreated check (39.35 q/ha) (Table B5-10.2a).

Centre: Karnal: The data showed no significant difference in plant population/m row recorded amongst treatment recorded after 3 weeks of germination. So, it was clear there is no harmful effect of treatment. During different observation time, lowest per cent damaged effective tillers/m row after 3, 4, 5 & 6 weeks of germination was recorded in treatment of Goond Katira (100 g/kg) + Jaggery (250 g/litre) + Neonix @ 2 ml/kg of seed). The treatment had 0.88, 0.94, 1.00 & 1.06 per cent damaged effective tillers/m row after 3, 4, 5 & 6 weeks of germination, respectively). However, among the soil application, the lowest per cent damaged effective tillers/m row after 3, 4, 5 & 6 weeks of germination was recorded in treatment of goond Katira (5kg/ha) + fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation ranging from 1.27-1.45 per cent damaged effective tillers/m row during different observation time.Highest grain yield (44.88 q/ha)was recorded in treatment of Goond Katira (100 g/kg) + Jaggery (250 g/litre)+ Neonix @ 2 ml/kg of seed) followed by Katira (5kg/ha) + fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation treated plots (44.82 qt/ha)(Table B5-10.2b).

B6. Basic studies for development of IPM strategies (Centres: Ludhiana, Niphad & Karnal)

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: Ludhiana

The data on aphid incidence was recorded by randomly selecting ten individual tillers from 100 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 25.01.2021 on wheat crop and it started rising and reached its peak on 15.03.2021. Thereafter population of wheat aphid started declining and it drastically decreased after 05.04.2021. The population of Coccinellid beetle remained low up to 08.03.2021 and thereafter it started rising and reach its peak on 29.03.2021 (two weeks after the peak period of activity of wheat aphid) (Table B6-10.2a).

Population dynamics of barley aphid: The aphid population first appeared on 27.01.2022 on barley crop and it started rising and reached its peak on 24.02.2022. Thereafter aphid population started declining and became very low after 31.03.2022. The population of coccinellid beetles remained low up to 10.02.2022 and thereafter it stated rising and reached its peak on 17.03.2022.

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 B6-10.2a).

Centre: Niphad

The weekly observations on wheat aphids were recorded along with different weather parameters. The maximum 26.9 number of aphids/shoot/plant was jassid population of 5.6 per shoot per plant and 1.50 natural enemies per square meter was recorded in the 51st meteorological week (Table B4-10.2c and Table B4-10.2d).

Centre: Karnal

Population dynamics of Wheat aphid: The aphid first appeared on 04.1.2021 on wheat crop and it started rising and reached its peak (65.5 aphids/plant) on 07.03.2022 (Table B4-10.2e.). Thereafter population of wheat aphid started declining. The population of Coccinellid beetle started from 31-01-2022 and reaches its peak (11.1 beetles/m^2) on 07.03.2022.

Population dynamics of barley aphid: The aphid population was higher as compared to wheat during the whole crop season (Table B4-10.2f.). It first appeared on 3.01.2022 on barley crop and it started rising and reached its first peak 65.5 aphids/plant) on 07.03.2022. The population of coccinellid beetles remained low up to 31.01.2022 and thereafter it stated rising and reached its peak (11.6 beetles/m^2) on 14.03.2022. 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.

Table B4-10.2a: Effect of sodium metasilicate application on aphid incidence in wheat during 2021-22(Centre: Ludhiana)

Treatments	Number of aphids/ earhead								Grain yield (q/ha)
	Before spray	After 1st spray			After 2nd spray			Coccinellid/sq m	
	1day	1 Day	3 Days	7 Days	1day	3 Day	7 Days	7 Days after 2nd spray	
One spray of sodium meta-silicate @ 10g/litre at booting stage	14.06	12.39	12.25	12.92	12.28	12.33	13.44	2.26	42.56
Two sprays of sodium meta-silicate @ 10g/litre at booting stage and 10 days after first spray	13.23	12.45	12.14	12.81	11.93	11.84	12.72	2.23	42.67
One spray of sodium meta-silicate @ 30g/litre at booting stage	13.90	12.00	11.77	12.44	11.56	11.73	12.84	2.32	42.69
Two sprays of sodium meta-silicate @ 30g/litre at booting stage and 10 days after first spray	13.29	11.96	11.38	12.05	11.17	11.35	12.23	2.15	42.90
One spray of sodium meta-silicate @ 50g/litre at booting stage	13.50	11.83	11.25	12.43	11.55	11.63	12.95	2.29	42.72
Two sprays of sodium meta-silicate @ 50g/litre at booting stage and 10 days after first spray	13.83	12.16	11.22	12.18	11.30	11.02	11.94	2.22	42.64
One spray of Actara (thiamethoxam 25 WG) @ 50g/ha at booting stage	14.20	1.74	0.88	1.13	1.06	1.23	4.11	0.75	44.79
Two sprays of Actara (thiamethoxam 25 WG) @ 50g/ha at booting stage and 10 days after first spray	14.11	1.46	1.01	1.21	0.55	0.40	0.54	0.43	44.98
Untreated Check	14.36	13.49	13.07	13.83	12.95	13.08	14.19	2.54	42.22
CD (p =0.05)	NS	1.08	0.74	0.79	0.84	0.48	0.75	0.25	1.29

Date of sowing	:	10.11.2021	Plot size	:	7.5 m^2
Date of treatments	:	4&11.03.2022	Variety	:	PBW 725
Date of harvest	:	25. 04.2022	Replications	:	Three

Table B4-10.2b: Effect of sodium metasilicate application on aphid incidence in wheat during 2021-22(Centre: Karnal)

Treatments	Number of aphids/ earhead								Grain yield (q/ha)
	Before spray	After 1st spray			After 2nd spray			Coccinellid/ sq m	
	1day	1 Day	3 Days	7 Days	1day	3 Day	7 Days	7 Days after 2nd spray	
One spray of sodium meta-silicate @ 10g/litre at booting stage	15.31	13.64	13.5	14.17	13.53	13.58	14.69	3.51	43.81
Two sprays of sodium meta-silicate @ 10g/litre at booting stage and 10 days after first spray	14.48	13.70	13.39	14.06	13.18	13.09	13.97	3.48	43.92
One spray of sodium meta-silicate @ 30g/litre at booting stage	15.15	13.25	13.02	13.69	12.81	12.98	14.09	3.57	43.94
Two sprays of sodium meta-silicate @ 30g/litre at booting stage and 10 days after first spray	14.54	13.21	12.63	13.3	12.42	12.6	13.48	3.4	45.15
One spray of sodium meta-silicate @ 50g/litre at booting stage	14.75	13.08	12.5	13.68	12.8	12.88	14.2	3.54	43.97
Two sprays of sodium meta-silicate @ 50g/litre at booting stage and 10 days after first spray	15.08	13.41	12.47	13.43	12.55	12.27	13.19	3.47	43.89
One spray of Actara (thiamethoxam 25 WG) @ 50g/ha at booting stage	15.45	2.99	2.13	2.38	2.31	2.48	5.36	2	46.04
Two sprays of Actara (thiamethoxam 25 WG) @ 50g/ha at booting stage and 10 days after first spray	15.36	2.71	2.26	2.46	1.8	1.65	1.79	1.68	47.23
Untreated Check	15.61	14.74	14.32	15.08	14.2	14.33	15.44	3.79	43.47
CD (p =0.05)	NS	0.86	0.52	0.57	0.62	0.26	0.53	0.03	1.69

Date of sowing	:	13.11.2021	Plot size	: 7.5 m^2
Date of treatments	:	13.03.2022 & 23.03.22	Variety	:HD2967
Date of harvest	:	25. 04.2022	Replications	: Three

Table B5-10.2a: Effect of insecticidal seed treatment on germination, termite damage and yield in wheat during 2021-22(Centre: Ludhiana)

S. No	Treatment and dosages	Method of application	Plant population/m row	Per cent damaged shoots/m row (weeks after sowing)				Grain yield (q/ha)
				3	4	5	6	
1.	Goond Katira (100 g/kg) + Jaggery (250 g/litre)+ Thiamethoxam 70WS @ 1 g/kg of seed)	Seed treatment	43.63	0.97 (6.95)	0.80 (6.55)	0.68 (6.24)	0.54 (5.85)	42.05
2.	Goond Katira(100 g/kg) + Jaggery (250 g/litre)+ chlorpyriphos @ 4 ml/kg of seed)	Seed treatment	43.96	0.99 (7.00)	0.85 (6.67)	0.67 (6.21)	0.51 (5.75)	42.38
3.	Goond Katira (100 g/kg) + Jaggery (250 g/litre)+ Neonix @ 2 ml/kg of seed)	Seed treatment	43.57	0.82 (6.60)	0.73 (6.36)	0.64 (6.13)	0.56 (5.90)	42.56
4.	Thiamethoxam 70WS @ 1 g/kg of seed	Seed treatment	43.66	0.97 (6.93)	0.88 (6.74)	0.65 (6.13)	0.49 (5.71)	41.69
5.	Chlorpyriphos @ 4 ml/kg of seed	Seed treatment	43.97	0.90 (6.79)	0.92 (6.84)	0.66 (6.17)	0.46 (5.61)	42.22
6.	Neonix @ 2 ml/kg of seed	Seed treatment	43.88	0.97 (6.95)	0.81 (6.54)	0.65 (6.13)	0.53 (5.81)	42.44
7.	Goond Katira (5kg/ha)+ Fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation	Soil application	43.74	1.21 (7.50)	0.77 (6.47)	0.60 (5.99)	0.47 (5.64)	42.50
8.	Goond Katira (5kg/ha)+ Chlorpyriphos 20 EC(2.5 litres/ha) before Ist irrigation	Soil application	43.80	1.24 (7.58)	0.92 (6.82)	0.62 (6.06)	0.52 (5.79)	42.04
9.	Fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation	Soil application	43.73	1.27 (7.65)	0.84 (6.65)	0.64 (6.10)	0.49 (5.70)	41.80
10	Chlorpyriphos 20 EC(2.5 litres/ha) before Ist irrigation	Soil application	43.71	1.22 (7.51)	0.81 (6.57)	0.61 (6.00)	0.56 (5.88)	42.16
11.	Untreated seed+ no application of chemical (Control)	-	43.79	4.46 (12.86)	4.38 (12.75)	4.14 (12.44)	3.68 (11.80)	39.35
CD (p=0.05)			NS	(0.81)	(0.44)	(1.03)	(0.85)	1.62

* Figures in parentheses are transformed means

Date of sowing	:	10-11-2021	Plot size	:	40 m^2
Date of insecticidal application	:	09-11-2021 & 28-11-21	Variety	:	PBW 660
Date of harvest	:	23-04-2022	Replications	:	Three

Table B5-10.2b: Effect of insecticidal seed treatment on germination, termite damage and yield in wheat during 2021-22(Centre: Karnal)

S. No	Treatment and dosages	Method of application	Plant population/ m row	Per cent damaged shoots/m row (weeks after sowing)				Grain yield (q/ha)
				3	4	5	6	
1.	Goond Katira (100 g/kg) + Jaggery (250 g/litre)+ Thiamethoxam 70WS @ 1 g/kg of seed)	Seed treatment	45.02	1.03 (5.82)	1.09 (5.99)	1.15 (6.16)	1.21 (6.32)	43.37
2.	Goond Katira(100 g/kg) + Jaggery (250 g/litre)+ chlorpyriphos @ 4 ml/kg of seed)	Seed treatment	45.23	1.05 (5.88)	1.11 (6.05)	1.17 (6.21)	1.23 (6.37)	44.31
3.	Goond Katira (100 g/kg) + Jaggery (250 g/litre)+ Neonix @ 2 ml/kg of seed)	Seed treatment	45.35	0.88 (5.38)	0.94 (5.56)	1.00 (5.74)	1.06 (5.91)	44.88
4.	Thiamethoxam 70WS @ 1 g/kg of seed	Seed treatment	45.01	1.03 (5.82)	1.09 (5.99)	1.15 (6.16)	1.21 (6.32)	43.01
5.	Chlorpyriphos @ 4 ml/kg of seed	Seed treatment	44.96	0.96 (5.62)	1.02 (5.80)	1.08 (5.97)	1.14 (6.13)	43.54
6.	Neonix @ 2 ml/kg of seed	Seed treatment	45.05	1.03 (5.82)	1.09 (5.99)	1.15 (6.16)	1.21 (6.32)	43.76
7.	Goond Katira (5kg/ha)+ Fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation	Soil application	45.36	1.27 (6.47)	1.33 (6.62)	1.39 (6.77)	1.45 (6.92)	44.82
8.	Goond Katira (5kg/ha)+ Chlorpyriphos 20 EC(2.5 litres/ha) before Ist irrigation	Soil application	45.27	1.30 (6.55)	1.36 (6.70)	1.42 (6.84)	1.48 (6.99)	43.36
9.	Fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation	Soil application	45.13	1.33 (6.62)	1.39 (6.77)	1.45 (6.92)	1.51 (7.06)	43.12
10	Chlorpyriphos 20 EC(2.5 litres/ha) before Ist irrigation	Soil application	45.19	1.28 (6.50)	1.34 (6.65)	1.40 (6.80)	1.46 (6.94)	43.48
11.	Untreated seed+ no application of chemical (Control)	-	45.12	4.52 (12.27)	4.58 (12.36)	4.64 12.44)	4.70 (12.52)	40.67
CD (p=0.05)			NS	(0.96)	(0.75)	(0.99)	(0.94)	1.36

* Figures in parentheses are transformed means

Date of sowing	:	13-11-2021	Plot size	:	40 m^2
Date of insecticidal application	:	13-11-2021 & 30-11-21	Variety	:	HD2967
Date of harvest	:	25-04-2022	Replications	:	Three

Table B6-10.2a: Pest modeling for foliage aphids and their natural enemies during 2021-22 (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.
06.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
13.01.2022	0	0	0	0	1	0	0	0	0	0	0.1	0	0	0	0.0
20.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
27.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
03.02.2022	0	0	2	0	0	1	0	0	0	0	0.3	4	0	0	1.3
10.02.2022	0	0	0	0	2	0	0	0	2	0	0.4	2	0	1	1.0
17.02.2022	2	0	8	1	4	0	4	2	2	0	2.3	14	12	18	14.7
24.02.2022	10	8	3	8	5	5	8	9	4	11	7.1	20	24	28	24.0
03.03.2022	11	15	11	14	12	20	8	17	14	14	13.6	14	18	20	17.3
10.03.2022	18	24	12	22	28	14	19	19	16	18	19	11	12	10	11.0
17.03.2022	14	10	8	19	7	14	12	10	14	12	12	7	8	4	6.3
24.03.2022	7	4	5	0	11	4	5	3	6	8	5.3	4	2	0	2.0
31.03.2022	1	0	0	2	0	0	0	2	0	4	0.9	0	0	0	0.0
	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.
06.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
13.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
20.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
27.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
03.02.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
10.02.2022	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0.3
17.02.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3
24.02.2022	0	0	0	0	0	0	0	1	1	0	0.2	2	0	0	0.7
03.03.2022	1	0	0	1	1	1	0	1	2	4	1.1	4	8	10	7.3
10.03.2022	5	2	7	0	0	8	0	0	4	5	3.1	0	0	0	0.0
17.03.2022	10	8	10	3	4	2	0	5	4	0	4.6	10	8	9	9.0
24.03.2022	12	4	13	4	5	8	4	8	11	9	7.8	0	0	0	0.0
31.03.2022	2	0	2	3	0	2	0	0	1	1	1.1	0	0	0	0.0

Table B6-10.2b: Pest modeling for foliage aphids and their natural enemies during 2021-22 (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.
06.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
13.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
20.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
27.01.2022	0	0	0	2	1	0	0	0	0	0	0.3	0	0	0	0.0
03.02.2022	4	0	0	0	0	0	2	0	3	0	0.9	0	0	2	0.7
10.02.2022	2	0	1	0	1	0	4	0	2	3	1.3	0	0	0	0.0
17.02.2022	14	12	18	14	19	20	8	9	11	10	13.5	2	0	8	3.3
24.02.2022	20	24	28	30	28	27	18	15	28	21	23.9	10	8	3	7.0
03.03.2022	14	18	20	24	20	14	10	21	10	22	17.3	11	15	11	12.3
10.03.2022	11	12	10	14	8	9	20	11	10	8	11.3	18	24	12	18.0
17.03.2022	7	8	4	9	11	15	7	8	9	4	8.2	14	10	8	10.7
24.03.2022	4	2	0	0	4	6	0	0	1	2	1.9	7	4	5	5.3
31.03.2022	0	0	0	0	0	0	2	0	0	0	0.2	1	0	0	0.3
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.
06.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
13.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
20.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
27.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
03.02.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
10.02.2022	1	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0.0
17.02.2022	0	0	1	0	2	0	0	2	0	0	0.5	0	0	0	0.0
24.02.2022	2	0	0	2	0	4	0	0	0	5	1.3	0	0	0	0.0
03.03.2022	4	8	10	4	4	7	4	2	2	1	4.6	1	0	0	0.3
10.03.2022	0	0	0	0	2	4	6	2	4	0	1.8	5	2	7	4.7
17.03.2022	10	8	9	10	7	3	8	7	11	4	7.7	10	8	10	9.3
24.03.2022	0	0	0	1	0	1	0	1	2	0	0.5	12	4	13	9.7
31.03.2022	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1.3

Table B6-10.2c: Population dynamics of wheat aphids during 2021-22 (Centre: Niphad)

Date of observation	MW	Plant No. (No. of aphids/tiller)											Collateral host				RF (mm)	Temperature (^{0}C)		Humidity (%)	
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Avg.	P1	P2	P3	Avg.		Max	Min	Morn	Even
07-12-21	**49**	26	30	24	18	22	21	30	16	12	10	**20.9**	0	0	0	**0**	6	27.5	16.2	84	60
10-12-21	**50**	24	24	35	20	25	26	32	29	24	26	**26.5**	0	0	0	**0**	0	27.1	13.1	80	45
17-12-21	**51**	28	24	35	20	25	26	32	29	24	26	**26.9**	0	0	0	**0**	0	26.9	9.7	81	43
24-12-21	**52**	27	25	22	15	25	24	18	12	21	22	**21.1**	0	0	0	**0**	0	27.5	8.3	78	51
01-01-22	**1**	15	28	25	28	22	16	22	18	21	20	**21.5**	0	0	0	**0**	0.0	26.8	11.4	77	50
08-01-22	**2**	24	26	12	26	20	18	21	15	21	26	**20.9**	0	0	0	**0**	0.0	25.5	9.7	80	52
15-01-22	**3**	12	16	20	12	12	14	11	25	16	21	**15.9**	0	0	0	**0**	0.0	26.8	9.6	80	52
22-01-22	**4**	8	11	14	10	18	10	16	11	8	12	**11.8**	0	0	0	**0**	0.0	24.0	6.3	80	44
29-01-22	**5**	14	12	10	15	14	16	10	18	10	10	**12.9**	0	0	0	**0**	0.0	28.9	6.0	77	29
05-02-22	**6**	15	10	12	8	14	10	10	12	11	10	**11.2**	0	0	0	**0**	0.0	29.0	7.2	77	36
12-02-22	**7**	12	11	8	10	12	10	12	12	10	10	**10.7**	0	0	0	**0**	0.0	28.8	9.4	78	42
19-02-22	**8**	8	0	10	0	10	10	12	0	0	10	**6.0**	0	0	0	**0**	0.0	31.3	8.7	80	29
26-02-02	**9**	4	4	0	7	0	5	3	8	0	4	**3.5**	0	0	0	**0**	0.0	32.8	10.9	77.7	25.4

Table B6-10.2d: Population dynamics of coccinellid beetle during 2021-22 (Centre: Niphad)

Date of observation	MW	Plant No. (No. of beetle/sq m area)											Collateral host				RF (mm)	Temperature (^{0}C)		Humidity (%)	
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Avg.	P1	P2	P3	Avg.		Max	Min	Morn	Even
07-12-21	**49**	0	0	1	0	0	1	2	0	1	1	0.6	0	0	0	**0**	6	27.5	16.2	84	60
10-12-21	**50**	2	0	0	0	0	0	1	1	3	2	0.9	0	0	0	**0**	0	27.1	13.1	80	45
17-12-21	**51**	1	2	1	3	0	1	2	1	2	2	1.5	0	0	0	**0**	0	26.9	9.7	81	43
24-12-21	**52**	0	2	0	0	1	1	1	0	2	2	0.9	0	0	0	**0**	0	27.5	8.3	78	51
01-01-22	**1**	1	2	0	0	2	2	1	2	0	0	1	0	0	0	**0**	0.0	26.8	11.4	77	50
08-01-22	**2**	1	2	0	1	0	2	1	1	0	0	0.8	0	0	0	**0**	0.0	25.5	9.7	80	52
15-01-22	**3**	1	1	2	2	2	1	2	0	2	1	1.4	0	0	0	**0**	0.0	26.8	9.6	80	52
22-01-22	**4**	0	0	1	0	0	1	1	2	1	0	0.6	0	0	0	**0**	0.0	24.0	6.3	80	44
29-01-22	**5**	2	2	0	0	0	0	1	0	0	1	0.6	0	0	0	**0**	0.0	28.9	6.0	77	29
05-02-22	**6**	0	2	2	0	1	1	1	2	0	0	0.9	0	0	0	**0**	0.0	29.0	7.2	77	36
12-02-22	**7**	2	2	0	0	1	2	0	2	0	1	1	0	0	0	**0**	0.0	28.8	9.4	78	42
19-02-22	**8**	0	0	2	0	0	0	0	0	2	1	0.5	0	0	0	**0**	0.0	31.3	8.7	80	29
26-02-02	**9**	0	1	0	0	1	0	0	2	0	0	0.4	0	0	0	**0**	0.0	32.8	10.9	77.7	25.4
05-03-22	**10**	0	1	0	0	0	0	0	0	0	0	0.1	0	0	0	**0**	13.2	30.8	13.0	79.7	43.7

Table B6-10.2e: Population dynamics of wheat aphid and Coccinellid beetle during 2021-22 (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.
03.01.2022	2	5	2	1	3	2	3	4	6	2	3.0	9	17	10	12.0
10.01.2022	3	6	2	2	4	3	4	5	7	3	3.9	12	13	15	13.3
17.01.2022	7	4	4	11	9	6	9	7	8	10	7.5	17	28	22	22.3
24.01.2022	12	11	9	17	18	12	16	17	20	25	15.7	32	47	32	37.0
31.01.2022	14	27	22	14	13	19	17	5	11	16	15.8	38	38	46	40.7
07.02.2022	34	22	18	25	19	27	36	40	15	13	24.9	52	38	48	46.0
14.02.2022	26	40	24	28	28	39	46	29	26	29	31.5	69	51	47	55.7
21.02.2022	56	37	57	28	38	25	30	44	45	36	39.6	61	80	48	63.0
28.02.2022	67	34	58	17	78	48	66	58	50	66	54.2	91	70	118	93.0
07.03.2022	86	52	69	40	49	64	46	78	89	82	65.5	38	22	41	33.7
14.03.2022	64	37	39	28	47	51	28	50	17	69	43.0	15	30	15	20.0
21.03.2022	3	5	6	1	0	0	5	0	10	2	3.2	12	11	8	10.3
28.03.2022	1	4	3	1	0	0	0	0	0	0	0.9	5	7	3	5.0
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.
03.01.2022	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0.0
10.01.2022	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0.0
17.01.2022	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0.0
24.01.2022	0	0	0	0	0	0	0	0	0	0	0.0	6	5	6	5.0
31.01.2022	2	1	6	4	1	3	4	6	6	3	2.5	5	8	6	6.3
07.02.2022	8	5	4	5	2	6	9	12	5	5	5.1	7	6	3	5.3
14.02.2022	9	8	7	6	3	11	9	4	6	7	6.0	5	10	7	7.3
21.02.2022	27	4	17	11	4	6	10	5	5	9	8.8	7	9	17	11.0
28.02.2022	20	11	18	19	5	18	6	8	9	7	11.1	10	9	16	11.7
07.03.2022	15	8	16	10	6	8	15	16	14	8	10.6	14	19	9	14.0
14.03.2022	7	11	8	12	7	6	16	10	8	5	8.0	7	9	14	10.0
21.03.2022	4	2	5	1	8	6	4	5	2	1	2.8	4	7	8	6.3
28.03.2022	1	2	1	1	9	4	2	1	1	1	1.3	7	6	3	5.3

Table B6-10.2f: Population dynamics of barley aphid and Coccinellid beetle during 2021-22 (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.
03.01.2022	3	1	2	4	3	4	3	1	3	5	3.9	3	2	1	2.0
10.01.2022	5	3	4	6	5	6	5	3	5	7	5.9	14	12	12	12.7
17.01.2022	13	8	10	8	23	18	28	23	13	13	16.7	31	16	21	22.7
24.01.2022	14	23	43	13	33	13	28	33	23	38	27.1	21	31	36	29.3
31.01.2022	38	33	48	58	33	63	47	38	33	43	44.4	41	56	51	49.3
07.02.2022	28	18	78	48	78	36	28	48	18	33	42.3	46	61	41	49.3
14.02.2022	30	20	80	50	80	38	30	50	20	35	44.3	51	81	71	67.7
21.02.2022	58	73	93	48	43	78	98	43	103	58	70.5	53	83	73	69.7
28.02.2022	58	68	98	38	78	83	48	73	63	98	71.5	81	67	86	78.0
07.03.2022	78	108	93	113	103	78	123	48	63	80	89.7	14	16	17	15.7
14.03.2022	11	9	23	8	12	10	18	28	13	23	16.5	2	4	6	4.0
21.03.2022	0	2	5	0	1	3	4	2	3	4	3.3	1	2	4	2.3
28.03.2022	0	0	0	0	0	0	0	0	0	0	0.0	1	2	4	2.3
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.
03.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10.01.2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.01.2022	0	0	0	0	0	0	0	0	0	0	0.0	7	5	6	7
24.01.2022	0	0	3	4	0	5	0	0	0	0	1.2	9	7	8	8
31.01.2022	5	0	6	7	0	4	5	4	4	0	3.5	13	7	8	9.3
07.02.2022	8	5	4	5	0	5	8	11	4	5	5.5	8	15	7	10
14.02.2022	9	8	7	6	8	11	9	3	6	7	7.4	10	11	13	11.3
21.02.2022	27	4	17	11	5	6	10	5	5	9	9.9	12	13	10	11.7
28.02.2022	15	8	16	10	5	8	15	13	14	8	11.2	11	12	14	12.3
07.03.2022	15	8	16	10	5	8	15	15	14	8	11.4	10	4	12	8.7
14.03.2022	17	13	15	18	8	17	5	7	9	7	11.6	2	1	0	0.7
21.03.2022	3	2	7	4	1	4	6	4	6	6	4.3	0	0	1	0
28.03.2022	5	0	6	7	0	5	5	5	5	0	3.8	8	8	8	8.0

B7. 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 & brown wheat mite incidence as well as termite & pink stem borer (PSB) damage between IPM module and farmer's practices were studied during 2021-22. The differences in IPM plot and farmer's practices were significant for all the pests. The termite damage varied 3.84-4.07 per cent in farmer's practices while it was only 0.38-0.43 per cent in IPM field (Table B7). Similarly the PSB damage was 1.08-1.45 per cent in farmer's practice while it was 0.32-0.36 in IPM field. The aphid incidence remained below economic threshold level of 5 aphids per earhead in IPM field while it ranged from 9.53-24.40 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 B7.10.2a).

Centre: Niphad

The data of IPM module recorded 4.95 cumulative population of aphids/shoot/plant as against 15.33 aphids/shoot/plant in farmer practice was recorded. The cumulative population of jassids was recorded IPM 1.33 per shoot per plant as against 3.22 jassids per shoot per plant in farmers practice plot. The optimum population of natural enemies was recorded in both plot of IPM and farmer practices i.e. 0.85 and 1.33 per square meter respectively. Incidence of termite and stem borer was not recorded in IPM treated as well as farmer practices plot. The highest grain yield of 40.76 q/ha was recorded in IPM treated plot as against 36.93 q/ha in farmers practice plot (Table B7-10.2b).

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. 189.0 aphids/shoot in FP treatment, and even infestation of termites and pink stem borer was highest (7.12% & 6.92%, at after 40 & 50 days, respectively) as compared to IPM treatment. The highest grain yield of 50.32 q/ha was recorded in IPM treated plot and lowest (45.24 q/ha) in farmers practice plot (Table B7-10.2c).

Centre: Durgapura

The data indicated that the population of insect-pests in IPM module treatment was higher than Farmer's practice treatment. The highest population of aphids was recored at maturity stage i.e. 4.67 aphids/shoot in FP treatment, and even infestation of termites and brown wheat mite was highest (10.33% & 6.33 mites/10 sq.cm, respectively) as compared to IPM treatment. The highest grain yield of 36.78 q/ha was recorded in IPM treated plot and lowest (33.66 q/ha) in farmers practice plot (Table B5-10.2d).

Table B7-10.2a: 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	0.38 (5.36)*	-	0.36 (5.25)*
		FP	0	0	4.07 (12.34)*	-	1.45 (8.01)*
		t value	-	-	(0.40)	-	(0.56)
3.	45	IPM	0	0	0.43 (5.48)*	-	0.32 (5.14)*
		FP	0	0	3.84 (11.93)*	-	1.08 (7.13)*
		t value	-	-	(0.83)	-	(0.86)
4.	60	IPM	0	0	0	-	0
		FP	0	0	0	-	0
		t value	-	-		-	
5.	75	IPM	0	0	0	-	0
		FP	0	0	0	-	0
		t value					
6.	90	IPM	1.20 (1.44)	0	0	-	0
		FP	9.53 (3.17)	0	0	-	0
		t value	(0.41)				
7.	105	IPM	-	0	0	-	0
		FP	-	0	0	-	0
		t value	-	-	-	-	
8.	At earhead stage	IPM	3.40 (1.98)**	5.40 (2.45)**	0	6.53 (2.68)**	0
		FP	24.40 (5.01)**	1.46 (1.52)**	0	1.66 (1.52)**	0
		t value	(0.50)	(0.41)	-	(0.38)	-
9.	Yield (qt/ha)	IPM	45.13				
		FP	43.09				
		t value	0.80				

IPM = Integrated Pest Management; FP = Farmers Practice

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

Table B7-10.2b: Effect of treatments of IPM modules on pests of wheat (Centre: Niphad)

Sr.No.	Days after sowing	Treatments	Av. No. of aphids/shoot/plant	Av. No. of jassids/plant	Av. No. of natural enemies/m^2
1	**30**	**IPM**	4.70	1.20	0.80
		FP (Control)	15.60	3.60	1.00
2	**45**	**IPM**	1.90	1.30	1.40
		FP (Control)	18.10	4.50	1.70
3	**60**	**IPM**	8.80	1.50	1.50
		FP (Control)	20.80	4.20	1.90
4	**75**	**IPM**	5.50	2.10	0.80
		FP (Control)	18.30	3.80	1.20
5	**90**	**IPM**	7.90	1.40	0.40

		FP (Control)	16.20	2.30	0.60
6	**105**	**IPM**	0.90	0.50	0.20
		FP (Control)	3.00	0.90	0.40
7	**Cumulative mean**	**IPM**	4.95	1.33	0.85
		FP (Control)	15.33	3.22	1.13
7	**Yield q/ha**	**IPM**	40.76		
		FP (Control)	36.93		

Characters **Treatments**	Yield q/ha	Plant height (cm)	Earhead length (cm)	No. of spikelet/ spike	No. of grains/ spike	1000 grain weight (g)
IPM	40.76	82.10	12.40	16.80	48.00	50.31
FP Control	36.93	81.30	11.65	13.20	37.80	44.14

IPM= Integrated Pest Management, FP= Farmer practice (Non IPM Control)

Table B7-10.2c: 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	15	0.00	0.00	0.00	3.42	0.00	
		FP	30	0.00	0.00	0.00	4.12	2.10	
2.	40	IPM	65	0.00	0.00	2.22	5.28	1.56	IPM 50.32
		FP	126	0.00	0.00	2.59	7.12	3.99	
3.	50	IPM	98	0.00	0.00	1.99	3.15	0.85	
		FP	189	0.00	0.00	4.85	6.92	6.08	
4.	60	IPM	58	0.00	0.00	3.89	0.00	0.00	
		FP	96	0.00	0.00	14.59	0.00	0.00	
5.	70	IPM	46	0.00	0.00	15.89	0.00	0.00	FP (Non IPM) 45.24
		FP	73	0.00	0.00	12.89	0.00	0.00	
6.	80	IPM	13	0.00	0.00	9.78	0.00	0.00	
		FP	28	0.00	0.00	14.09	0.00	0.00	

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

Table B7-10.2d: Effect of IPM modules on incidence and infestation of major insect-pests of wheat 2021-22 (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	65.76	3				12
		FP	75.95	3				10
		t value	-	-				-

2	30	IPM	48.55	2				3
		FP	45.56	2				2
		t value	-	-				-
3	45	IPM	31.89	2				2
		FP	20.75	0				1
		t value	-	-				-
4	60	IPM	19.75	2				0
		FP	9.95	1				0
		t value	-	-				-
5	75	IPM	12.65	3				0
		FP	3.85	0				0
		t value	-	-				-
6	90	IPM	7.45	3				1
		FP	1.15	1				3
		t value	-	-				-
7	At maturity	IPM	0.00	5				0
		FP	0.00	2				0
		t value	-	-				-
8	Yield (qt/ha)	IPM	26.75					
		FP	25.12					
		t value						

Table B7-10.2d: Effect of IPM modules on incidence and infestation of major insect-pests of wheat 2021-22 (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	-	-	1.33	-	-	-
		FP	-	-	2.00	-	-	-
		t value			-			
3.	45	IPM	-	-	1.67	-	-	-
		FP	-	-	3.67	-	-	-
		t value			-			
4.	60	IPM	-	-	2.00	-	-	-
		FP	-	-	4.00	-	-	-
		t value			-			
5.	75	IPM		0.33	2.67	-	-	-
		FP		1.67	6.00	-	-	-
		t value			-			
6.	90	IPM	1.00	0.67	3.00	-	1.67	-
		FP	4.00	2.33	7.33	-	4.33	-
		t value						-

7.	At maturity	IPM	1.67	1.00	5.00	-	2.67	-
		FP	4.67	2.67	10.33	-	6.33	
		t value						
8.	Yield (q/ha)	IPM	36.78					
		FP	33.66					
		t value	-					

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

Centre: Ludhiana

The wheat variety PBW 725 was grown on 10th Nov.2021 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 (Table B8). When observed one day after spray, Beta-cyfluthrin 9% + imidacloprid 21%, sprayed plots recorded minimum (1.63 aphids/earhead) and was at par all other treatments and significantly better than all other insecticidal treatments. A similar trend was observed two, seven and fifteen days after treatment. Maximum Grain yield (q/ha) was also observed in plots treated with Beta-cyfluthrin 9% + imidacloprid 21%, (47.82) treated plots. However, all the insecticidal treatments recorded higher than grain yield than untreated check (44.93) (Table B8-10.2a).

Centre: Karnal

Aphid population did not differ significantly among all treatments one before spray. After day of spraying, treatment of Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC(Alika) @ 150 g/ha recorded minimum number of aphids(4.37 aphids/tiller) followed by treatment of Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon) @ 400 ml/ha which recorded 4.40 aphids/tiller. After 2 days of spraing of Thiamethoxam 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 (47.85 q/ha) treated plots followed by the treatment of Imidacloprid 17.8 SL (47.74 q/ha). However, all the insecticidal treatments recorded higher than grain yield than untreated check (42.39 q/ha) (Table B8-10.2b).

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 but all other treatments were found at par with it . At 7th days after spray again the treatment with Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon) @ 400 ml/ha was found significantly superior over all the treatments but, all the other treatments were found equally effective with it except Sulfoxaflor 12% SC @ 250 ml/ha. Similar trend was also observed at 15 days after spray. While the cumulative mean data showed the treatment with with Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon) was reflected the significantly superiority over all the other treatments but the treatments Imidacloprid 17.8 SL @ 400 ml/ha and Beta-cyfluthrin 25 SC @ 1450 ml/ha were found at par with it. During the experiment the uniform population of Coccinellids predators was observed (Table 10). Also no significance was observed in the wheat yield. The treatment with Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon) recorded the highest yield of 40.08 q/ha as against 32.26 q/ha in untreated control (Table B8-10.2c).

Centre: Vijapur

An experiment on management of wheat aphid through foliar application of new bio-chemical molecules was conducted under irrigated condition. Aphid populations did not differ statistically among all treatments during 24 h before spraying. On 1st day after spray, overall decrease in number of aphids/shoots in all the treatments as compared to untreated check was observed. Significantly, the lowest number of aphids (5.4) were recorded in T6 i.e., Thiomethoxam 25 WG however, it was at par with T4, T5, T1 & T2. After 2nd day of spray, the minimum aphid population was also recorded in T6 (3.33) which was at par with T1 & T4. More or less similar trend was observed on 7th and 15th days after spray. The grain yield (q/ha) didn't differ significantly among the treatments (Table B7-10.2d).

Table B8-10.2a: Efficacy of various insecticides and their combinations against foliar aphid during 2021-22 (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	20.30	1.69 (1.63)	1.45 (1.56)	1.55 (1.59)	1.86 (1.59)	47.37
2	Thiamethoxam 25% WG	50	20.80	1.74 (1.65)	1.47 (1.57)	1.53 (1.58)	1.93 (1.71)	47.73
3	Lambda cyhalothrin 5% EC	500	20.47	1.76 (1.66)	1.54 (1.59)	1.61 (1.61)	1.99 (1.72)	47.68
4	Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon)	400	20.72	1.63 (1.62)	1.38 (1.54)	1.48 (1.57)	1.77 (1.66)	47.82
5	Imidacloprid 17.8 SL	400	20.51	1.76 (1.66)	1.56 (1.60)	1.52 (1.58)	1.97 (1.72)	47.11
6	Beta-cyfluthrin 25 SC	1450	20.33	1.81 (1.67)	1.59 (1.60)	1.58 (1.60)	2.03 (1.74)	47.33
7	Sulfoxaflor 12% SC	250 ml	20.57	1.65 (1.62)	1.41 (1.55)	1.64 (1.62)	1.87 (1.69)	47.73
8	Untreated control	-	20.56	21.12 (4.70)	21.65 (4.75)	21.37 (4.72)	19.06 (4.47)	44.93
CD (p=0.05)				NS	(0.13)	(0.14)	(0.11)	(0.12)

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

Date of sowing	:	101.11.2021	Plot size	:	7.5 m^2
Date of insecticidal application	:	09.03.2022	Variety	:	PBW 725
Date of harvest	:	18. 04.2022	Replications	:	Three

Table B8-10.2b: Efficacy of various insecticides and their combinations against foliar aphid during 2021-22 (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	11.20	4.37 (2.32)	4.16 (2.27)	2.95 (1.99)	1.74 (1.66)	3.56 (2.13)	47.47
2	Thiamethoxam 25% WG	50	11.92	5.14 (2.48)	4.93 (2.44)	3.72 (2.17)	2.51 (1.87)	4.33 (2.31)	47.21
3	Lambda cyhalothrin 5% EC	500	11.52	5.47 (2.54)	5.26 (2.50)	4.05 (2.25)	2.84 (1.96)	4.66 (2.38)	47.52
4	Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon)	400	11.96	4.40 (2.32)	4.22 (2.28)	3.01 (2.00)	1.80 (1.67)	3.62 (2.15)	47.85
5	Imidacloprid 17.8 SL	400	11.23	4.51 (2.35)	4.30 (2.30)	3.09 (2.02)	1.88 (1.70)	3.70 (2.17)	47.74
6	Beta-cyfluthrin 25 SC	1450	10.89	4.54 (2.35)	4.33 (2.31)	3.12 (2.03)	1.91 (1.71)	3.73 (2.17)	47.28
7	Sulfoxaflor 12% SC	250 ml	11.25	4.43 (2.33)	4.19 (2.28)	2.98 (1.99)	1.77 (1.66)	3.59 (2.14)	47.38
8	Untreated control	-	11.90	17.51 (4.30)	17.30 (4.28)	17.09 (4.25)	16.88 (4.23)	17.45 (4.29)	42.39
CD (p=0.05)			**NS**	**(0.72)**	**(0.85)**	**(0.89)**	**(0.59)**	**(0.86)**	**1.25**

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

Date of sowing	:	13.11.2021	Plot size	:	7.5 m^2
Date of insecticidal application	:	10.02.2022	Variety	:	HD2967
Date of harvest	:	14. 04.2022	Replications	:	Three

Table B8-10.2c: Efficacy of various insecticides and their combinations against foliar aphid and natural enemies during 2021-22 (Centre: Niphad)

S.N	Treatments	Formal Dose g or ml/ha	Av population of aphids/shoot					NE/ m^2	Yield q/ha
			Pre count	1 DAS	2DAS	7 DAS	15 DAS		
1	Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC(Alika)	150 ml	30.67 (5.60)	25.53 (5.15)	23.67 (4.96)	20.07 (4.59)	18.67 (4.43)	23.72 (4.97)	37.72
2	Thiamethoxam 25% WG	50 g	35.67 (5.91)	25.67 (5.16)	22.47 (4.84)	19.60 (4.53)	17.53 (4.30)	24.19 (5.01)	39.76
3	Lambda cyhalothrin 5% EC	500 ml	36.67 (6.09)	28.13 (5.39)	21.73 (4.76)	18.00 (4.36)	20.27 (4.47)	24.96 (5.09)	38.30
4	Beta-Cyfluthrin 9%+ Imidacloprid 21% (Solomon)	400 ml	25.33 (5.11)	23.07 (4.89)	20.27 (4.54)	14.33 (3.90)	11.73 (3.56)	18.95 (4.46)	40.08
5	Imidacloprid 17.8 SL	400 ml	39.67 (6.28)	24.20 (5.02)	22.07 (4.79)	17.20 (4.27)	12.80 (3.71)	23.19 (4.91)	38.49
6	Beta-cyfluthrin 25 SC	1450 ml	30.33 (5.44)	27.00 (5.29)	19.73 (4.55)	18.47 (4.39)	15.40 (4.05)	22.19 (4.80)	39.31
7	Sulfoxaflor 12% SC	250 ml	31.33 (5.55)	25.47 (5.14)	20.00 (4.55)	24.07 (5.01)	20.40 (4.62)	24.25 (5.01)	38.73
8	Untreated control	-	26.33 (5.13)	41.87 (6.42)	43.47 (6.59)	47.13 (6.89)	46.00 (6.85)	40.96 (6.47)	32.26
		SE+	**NS**	**NS**	**0.34**	**0.28**	**0.30**	**0.11**	**2.60**
		CD 0.5%	**NS**	**NS**	**1.03**	**0.84**	**0.90**	**0.32**	**7.88**
		CV%	**14.19**	**11.35**	**11.88**	**10.10**	**11.46**	**3.60**	**11.84**

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

Table B8-10.2d: Efficacy of various insecticides and their combinations against foliar aphid during 2021-22 (Centre:Vijapur)

Sr. No.	Treatment	Doses g.a.i./ha	Aphid population per shoot					Grain yield (q/ha)
			Before spray (days)	Days after spray *				
				1st	2nd	7th	15th	
1.	Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% ZC	18.90 + 14.25	9.9 (0.99)	1.1 (0.37)	0.5 (0.24)	0.00 (0.71)	0.00 (0.71)	51.6
2.	Thiamethoxam 25% WG	12.50	10.5 (1.01)	1.6 (0.47)	0.9 (0.28)	0.1 (0.03)	0.00 (0.71)	48.4
3.	Lambda cyhalothrin 5% EC	25.00	7.5 (0.88)	0.90 (0.34)	0.5 (0.19)	0.3 (0.08)	0.1 (0.05)	50.6
4.	Beta cyfluthrin 9% + Imidacloprid 21%	8.49 + 19.81	10.3 (1.01)	2.1 (0.49)	0.4 (0.19)	0.1 (0.08)	0.00 (0.71)	51.4
5.	Imidacloprid 200 SL	20.00	10.8 (1.03)	0.7 (0.27)	0.2 (0.12)	0.00 (0.71)	0.00 (0.71)	53.6
6.	Beta cyfluthrin 25% EC	18.75	11.5 (1.05)	1.1 (0.40)	0.7 (0.27)	0.00 (0.71)	0.00 (0.71)	50.6
7.	Sulfoxaflor 12% SC	30.00	11.3 (1.04)	1.2 (0.36)	0.5 (0.19)	0.00 (0.71)	0.00 (0.71)	51.6
8.	Untreated control	---	11.7 (1.06)	11.0 (1.08)	12.7 (1.13)	13.8 (1.23)	11.0 (1.09)	46.0
	C.D. at 5%		**NS**	**0.09**	**0.069**	**0.035**	**0.029**	**NS**
	C.V %		**9.13**	**11.34**	**12.1**	**11.30**	**11.68**	**7.36**

*Figures in the parenthesis are squared root value

B9. Management of lepidoterous pests (pink stem borer, army worm & cutworms) of wheat: (**Centres:** Ludhiana & Karnal)

Centre: Ludhiana

The trial was conducted in the Happy Seeder sown wheat field at B-Block experimental area, The trial was conducted in the Happy Seeder sown wheat field at B-Block experimental area, Dept. of Plant Breeding and Genetics, PAU Ludhiana. The wheat variety PBW 725 was sown on 18th Nov 2021. The treatments included foliar application of chlorantraniliprole 18.5 SC @ 100 & 150 ml/ha, flubendiamide 480 SC @ 40 & 60 ml/ha and Bacillus thuringiensis @ 1 & 1.5 lt/ha and soli applications fipronil 0.6% GR @7.5. and 10 kg/ha along with untreated check. Each treatment was replicated thrice. Pink stem borer (PSB) damage was recorded from five spots of 1 m row lengths in each plot by counting damaged tiller and total tillers.

The data presented in Table B9 revealed that there was no difference in PSB damage among different treatments before insecticide application. However 3 days after treatment, the lowest PSB damage was recorded in fipronil 0.6% GR @10 kg/ha (0.88%) followed by it's higher dose (1.00%). Seven days after treatment, the lowest PSB damage was recorded in fipronil 0.6% GR @10 kg/ha (0.71%) followed by chlorantraniliprole 18.5 SC @ 150 (0.73%) and it was at par with of fipronil 0.6% GR @7.5 kg/ha (0.84%) and flubendiamide 480 SC @ 60 ml/ha (0.85%). However *Bacillus thuringiensis* @ 1 & 1.5 lt/ha and lower dosage of flubendiamide 480 SC, chlorantraniliprole 18.5 SC were significantly inferior and were at par with untreated control (2.52%). Similar trend was recorded 15 days after treatment.

The grain yield (q/ha) obtained was maximum in plot treated with fipronil 0.6% GR @10 kg/ha (47.36) followed chlorantraniliprole 18.5 SC @ 150 (46.63) and it was at par with all treatment except lower dosage of flubendiamide 480 SC, chlorantraniliprole 18.5 SC, Bacillus thuringiensis @ 1 & 1.5 lt/ha and the untreated check (43.93 q/ha) (Table B9-10.2a).

Centre: Karnal

No difference in PSB damage was observed among different tested treatments before insecticide application. After 3 days after treatment, the lowest PSB damage was recorded in chlorantraniliprole 18.5 SC @ 150 (0.51%) followed by fipronil 0.6% GR @10 kg/ha (0.52%). Similar trends were seen after seven days after treatment. However *Bacillus thuringiensis* @ 1 & 1.5 lt/ha and lower dosage of flubendiamide 480 SC, chlorantraniliprole 18.5 SC were significantly inferior and were at par with untreated control (3.43%). Similar trend was recorded 15 days after treatment.

The grain yield (q/ha) obtained was maximum in plot treated with fipronil 0.6% GR @10 kg/ha (50.38) followed chlorantraniliprole 18.5 SC @ 150 (49.95) and it was at par with all treatment lower dosage of flubendiamide 480 SC, chlorantraniliprole 18.5 SC, *Bacillus thuringiensis* @ 1 & 1.5 lt/ha and the untreated check (47.25 q/ha)(Table B9-10.2b).

Table B9-10.2a: Efficacy of various insecticides and biopesticides against lepidopterous pests pink stem borer, army worm & cutworms) of wheat during 2021-22 (Centre: Ludhiana)

S. No	Treatments	Dosage	Per cent damage before treatment	Per cent damaged tillers			Grain yield (q/ha)
				3	7	15	
1	Coragen 18.5 SC (chlorantraniliprole)	100 ml	2.92	1.65	1.54	163	44.70
2	Coragen 18.5 SC (chlorantraniliprole)	150 ml	2.97	1.10	0.83	0.89	46.63
3	Fame 480 SC (flubendiamide)	40 ml	2.99	1.80	1.57	1.79	45.23
4	Fame 480 SC (flubendiamide)	60 ml	2.95	1.16	0.85	0.98	46.43
5	Fipronil 0.6% GR	7.5 Kg	2.96	1.00	0.84	0.97	46.53
6	Fipronil 0.6% GR	10 Kg	2.91	0.88	0.71	0.87	47.36
7	Dipel (*Bacillus thuringiensis*)	1litre	2.97	1.79	1.66	1.98	45.06
8	Dipel (*Bacillus thuringiensis*)	1.5 litre	2.90	1.57	1.54	1.74	45.20
9	Untreated Control	-	2.94	2.57	2.52	2.64	43.93
CD (p=0.05)		-	NS	NS	0.18	0.22	0.20

* Figures in parentheses are transformed means

Date of sowing	:	18-11-2021	Plot size	:	25 m^2
Date of insecticidal application	:	15-12-2021	Variety	:	PBW 725
Date of harvest	:	25-04-2022	Replications	:	Three

Table B9-10.2b: Efficacy of various insecticides and biopesticides against lepidopterous pests pink stem borer, army worm & cutworms) of wheat during 2021-22 (Centre: Karnal)

S. No	Treatments	Dosage	Per cent damage before treatment	Per cent damaged tillers			Grain yield (q/ha)
				3	7	15	
1	Coragen 18.5 SC (chlorantraniliprole)	100 ml	1.73	0.79	0.65	0.80	47.24
2	Coragen 18.5 SC (chlorantraniliprole)	150 ml	1.75	0.51	0.43	0.50	49.95
3	Fame 480 SC (flubendiamide)	40 ml	1.86	1.47	1.25	1.34	48.35
4	Fame 480 SC (flubendiamide)	60 ml	1.74	0.70	0.46	0.58	49.75
5	Fipronil 0.6% GR	7.5 Kg	1.93	0.71	0.58	0.74	49.65
6	Fipronil 0.6% GR	10 Kg	1.8	0.52	0.44	0.56	50.38
7	Dipel (*Bacillus thuringiensis*)	1litre	1.94	2.45	2.31	2.57	48.18
8	Dipel (*Bacillus thuringiensis*)	1.5 litre	1.88	2.32	2.42	2.5	48.32
9	Untreated Control	-	1.83	2.67	3.5	3.43	47.25
CD (p=0.05)		-	NS	NS	0.50	0.48	0.52

* Figures in parentheses are transformed means

Date of sowing	:	13-11-2021	Plot size	:	25 m^2
Date of insecticidal application	:	12-12-2021	Variety	:	HD2967
Date of harvest	:	14-04-2022	Replications	:	Three

B10. Management of termites, aphids and seed borne diseases of wheat through seed treatment of chemical molecules combinations (Centres: Durgapura, Kanpur, Ludhiana and Vijapur)

B10a. Management of termites through seed treatment

Centre: Ludhiana

Plant Breeding and Genetics, PAU Ludhiana. The wheat variety PBW 660 was sown on 10th Nov 2021. Before sowing, the seeds were treated with seven different insecticides separately by spraying on the spreaded layer of equal quantity of seed on polyethene sheet. The treated seed was dried overnight before sowing. The treatments included pre-mixed pesticides combination of imidacloprid 18.5%+ hexaconazole 1.5% FS and tank mixing Imidacloprid 600FS, thiamethoxam 25 WG, tebuconazole/hexaconazole alongwith 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 presented in Table B10 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 except seed treatment of tebuconazole/hexaconazole and untreated check. However, the lowest termite damage was recorded in pre-mixed insecticide imidacloprid 18.5%+ hexaconazole 1.5% FS@ 2 ml/ac.

At ear head stage, the per cent damaged effective tillers per meter row were minimum in the plot treated with pre-mixed insecticide imidacloprid 18.5%+ hexaconazole 1.5% FS @ 2 ml/ac (1.25 %) and it was on par with all the other treatments except seed treatment of tebuconazole/hexaconazole and 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 @ 2 ml/ac (10083). All these insecticide treated plots recorded significantly lower number of damaged tillers/ha as compare to untreated check except tebuconazole/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 @ 2 ml/ac (42.80 q/ha) and it was at par with all treatment except seed treatment with tebuconazole/hexaconazole (39.53) and the untreated check (38.89 q/ha) **(**Table B10a-10.2a).

Centre: Vijapur

This experiment was conducted under irrigated condition and the results are presented in Table B8a-10.1c. The plant population/m row length was counted after 3 weeks of sowing and confirmative test on germination where the counted number of seeds were sown separately in small replicated trial for all the treatments under field conditions were also recorded. The data indicated non-significant differences for plant population as well as confirmative test for seed germination which indicated that none of the insecticidal treatments affected the seed germination. The results on per cent damaged shoots per meter row were recorded from 3rd, 4th, 5th week after sowing. The shoot damage was not observed in T1, T2, T3, T5 and T6. However, 1.47 and 3.61 per cent damaged shoots were recorded in Tebuconazole 2 DS and untreated check, respectively.

The results indicated that lowest aphid population of 2.60 aphids per shoot was recorded in treatment of Thiamethoxam 25 WG + Tebuconazole 2 DS which was at par with Imidacloprid 600 FS + Tebuconazole 2 DS with aphid population of 1.87 per shoot. Same trend was also observed at 72 days after sowing with respective aphid population of 1.47 and 1.93, respectively. The aphis population in the untreated check was 5.20 and 5.67, respectively at 65 and 72 days after sowing.

During crop season, no incidence of seed borne disease was recorded. There were non-significant differences among all the treatment for wheat grain yield (q/ha) (Table B8a-10.1c).

Another experiment on eco-friendly management of termite through seed treatment was carried out under irrigated condition and the results are depicted in Table B8a-10.1d. The results pertaining to plant population/m row length counted after 3 weeks of sowing and confirmative test on germination found non-significant. In confirmative test on germination, the counted numbers of seeds of different treatments were sown separately in small replicated trial under field conditions. Thus, none of the insecticidal treatments affected the seed germination. The data further indicated that there was no termite damage observed during 3rd week after sowing. However, during 4th and 5th weeks

after sowing, the shoot damage due to termite was observed in the treatments of bio-control agents as well as untreated check. The respective per cent shoot damage was observed 3.34 and 3.85 in T6 i.e. *B. bassiana* while it was 1.61 and 2.18 in T7 i.e. *M. anisopliae* compared to 4.03 and 5.03 in untreated check. The result of percent damaged effective tillers/m row revealed that 4.36 and 2.92 per cent was recorded in T6 and T7, respectively. The termite damage was not recorded in all the chemical seed treatments. There were non-significant differences among all the treatment for grain yield (q/ha). However, the maximum grain yield (45.6 q/ha) was obtained from Fipronil+Imidacloprid 40 % WG treated plot (Table B10a-10.2d).

Experiment B10b: 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. There was no termite damage observed in all the treatments after 3rd and 4thweek of sowing. However, after 5th weeks of sowing, significant differences in termite damage were recorded in different treatments. There was no termite damage recorded in the treatments of broadcasting of chemicals. The treatments of bio-agents also recorded significantly less percent damaged shoots per meter row than untreated check. Among the treatments of bio-agents, T9 i.e. application of *M. anisopliae* in furrow at sowing recorded significantly the lowest per cent damaged shoots per meter row of 2.70 followed by T8 i.e.*B. bassiana* in furrow at sowing with 3.54 per cent damaged shoots. The data on per cent damaged effective tillers per meter row also indicated the same trend. None of the insecticidal treatments significantly affected the grain yield (q/ha). However, maximum grain yield was recorded in the plot treated with Thiamethoxam 30FS (Table B10b-10.2a).

Table B10a-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 + Tebulconzole/Hexaconazole	4 ml + 2 ml	40.53	0.98 (7.00)	0.86 (6.70)	0.59 (5.99)	1.23 (7.57)	10250 (101.23)	42.29
2	Thiamethoxam 25 WG + Tebuconazole/Hexaconazole	3 g +2 ml	40.30	1.05 (7.13)	0.91 (6.81)	0.65 (6.14)	1.36 (7.84)	10666 (103.20)	42.30
3	Thiamethoxam 25WG	3 gm	40.50	0.89 (6.77)	0.96 (6.90)	0.68 (6.19)	1.41 (7.93)	11083 (105.22)	41.96
4	Tebuconazole/Hexaconazole	2 ml	40.33	3.65 (11.74)	3.55 (11.61)	3.41 (11.40)	3.29 (11.22)	23416 (152.99)	39.53
5	Imidacloprid 600 FS	2 ml	40.36	0.96 (6.95)	0.85 (6.68)	0.58 (5.93)	1.24 (7.57)	11083 (105.20)	42.17
6	Neonix (Imidacloprid 18.5%+ Hexaconazole 1.5% FS)	1.5 ml	40.43	1.03 (7.11)	0.89 (6.75)	0.61 (6.05)	1.26 (7.61)	10916 (104.34)	42.42
7	Neonix (Imidacloprid 18.5%+ Hexaconazole 1.5% FS)	2 ml	40.53	0.84 (6.64)	0.70 (6.29)	0.55 (5.86)	1.25 (7.59)	10083 (100.36)	42.80
8	Untreated control	-	40.43	4.03 (12.27)	3.88 (12.06)	3.44 (11.44)	3.36 (11.33)	23666 (153.83)	38.89
CD (p=0.05)			NS	NS	(0.58)	(0.73)	(0.67)	(0.72)	(7.28)

* Figures in parentheses are transformed means

Date of sowing	:	10-11-2021	Plot size	:	40 m^2
Date of insecticidal application	:	09-11-2021	Variety	:	PBW 660
Date of harvest	:	22-04-2022	Replications	:	Three

Table B10a-10.2b: Management of termites through seed treatment of chemical molecules combinations during 2021-22 (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	61	85.67	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	3.80 (0.69)	0.13 (0.71)	42.8
2.	Thiamethoxam 25 WG + Tebuconazole 2 DS(2 % w/w- Raxil)	3 g + 2 ml	62	86.33	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	7.93 (0.94)	3.40 (0.91)	45.1
3.	Thiamethoxam 25 WG	3 g	60	84.33	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	5.47 (0.80)	1.13 (0.77)	46.6
4.	Tebuconazole 2 DS(2 % w/w- Raxil)	2 ml	59	83.67	0.00 (0.71)	1.47 (1.23)	3.22 (1.92)	3.86 (2.47)	5.53 (0.83)	1.07 (0.77)	40.2
5.	Imidacloprid 600 FS	2 ml	58	84.67	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	2.60 (0.57)	0.33 (0.73)	43.7
6.	Imidacloprid 18.5 % + Hexaconazole 1.5 % FS(Neonix)	4 ml	62	85.00	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	6.53 (0.89)	0.53 (0.74)	45.1
7.	Hexaconazole 5 % EC	2 ml	60	84.33	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	3.13 (0.63)	0.13 (0.71)	44.5
8.	Untreated Check	-	61	87.00	0.00 (0.71)	3.61 (1.91)	5.21 (2.38)	6.39 (3.18)	10.27 (1.04)	6.93 (1.06)	38.8
	C.D. at 5% C.V.%					**0.10** **10.71**	**0.21** **11.35**	**0.183** **8.46**	**0.112** **8.05**	**0.158** **11.34**	**NS** **14.65**

Table B10a-10.2c: Management of termites through seed treatment of chemical molecules combinations during 2021-22 (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	Grain yield q/ha
					3rd	4th	5th		
1	Thiamethoxam 25 WG	0.80	59	85.67	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	42.1
2	Thiamethoxam 30 FS	0.72	55	86.33	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	41.9
3	Fipronil 5 SC	0.30	56	86.00	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	42.0
4	Imidacloprid 600 FS *	1.20	60	85.67	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	42.4
5	Clothianidin 50 WDG	0.75	57	87.00	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	40.1
6	*Beauveria bassiana* (g/kg seed)	5	61	85.00	0.00 (0.71)	3.34 (1.96)	3.85 (2.08)	4.36 (2.19)	38.5
7	*Metarhizium anisopliae* (g/kg seed)	3	60	86.67	0.00 (0.71)	1.61 (1.44)	2.18 (1.62)	2.92 (1.84)	39.6
8	Bifenthrin 10 EC	0.20	60	88.00	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	42.4
9.	Fipronil+Imidacloprid 40 % WG (Lacenta)	1.20	59	87.33	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	45.6
10.	Untreated Check	-	60	90.00	0.00 (0.71)	4.03 (2.12)	5.03 (2.34)	10.3 (3.27)	37.5
	C.D. at 5% C.V.%				**-** **-**	**0.16** **9.14**	**0.17** **9.18**	**0.21** **10.18**	**NS** **9.67**

Table B10b-10.2a: Management of termites through broadcast application in standing crop during 2021-22 (Location: Vijapur)

Sr. No.	Treatment	Dose g a.i./ ha	Per cent damaged shoots/m row after sowing (week) *			% Damaged effective tillers/ m row *	Grain yield (q/ha)
			3rd	4th	5th		
1.	Fipronil 5 SC	80	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	43.0
2.	Thiamethoxam 30FS	75	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	43.7
3.	Imidacloprid 600 FS	180	0.00 (0.71)	0.45 (1.12)	1.10 (1.26)	1.14 (1.26)	42.0
4.	Fipronil 0.3 G broadcast at the time of sowing	60	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	45.7
5.	Fipronil+Imidacloprid 40 % WG (Lacenta)	400	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	42.3
6.	*Beauveria bassiana* g/ha	500	0.00 (0.71)	0.00 (0.71)	3.06 (1.88)	5.18 (2.37)	37.7
7.	*Metarhizium anisopliae* g/ha	500	0.00 (0.71)	0.00 (0.71)	2.67 (1.77)	4.56 (2.23)	41.9
8.	*Beauveria bassiana*in furrow at sowing g/ha	500	0.00 (0.71)	0.00 (0.71)	1.53 (1.42)	3.54 (1.99)	39.4
9.	*Metarhizium anisopliae* in furrow at sowing g/ha	500	0.00 (0.71)	0.14 (0.79)	1.29 (1.32)	2.70 (1.76)	39.7
10.	Untreated Check	-	0.00 (0.71)	4.27 (2.17)	5.64 (2.47)	10.24 (3.25)	36.4
	C.D. (0.05) C.V.%		- -	**0.71** **11.01**	**0.27** **12.49**	**0.34** **12.03**	**NS** **9.91**

* Arcsin transformed values and in parentheses are actual mean values

Date of sowing : 25/11/2020 Date of insecticide application : 19/12/2020

Date of harvesting : 24/03/2021 Design: R.B D Replications : Three

Spacing : 20 cm between row No. of rows / plot : 12

Plot size: Gross: 6.0m x 2.40 m Net: 5.0 m x 1.60 m Variety: GW 496 Condition : Irrigated

C. STORED GRAIN PEST MANAGEMENT

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

Centre: Karnal: The experiment was conducted at Karnal and Kharibari to evaluate the comapartive efficacy of storage bags against storage insect-pests infesatation. The infestation of Sitophilus oryzae and Rhizopertha dominica was recorded.The observation were taken after 1, 3, 4, 6 months of the storage. Avearge number of live insects after 6 months of storage ranged from 6.4 to 24.8 insects being highest in Jute bags and lowest in BOPP bags. Similarly, the % infesatation and % weight loss was also lowest in BOPP bags i.e. 2.2% and 0.7%, respectively. The next best baga were High Density Polyethylene Woven (HDPE) bags and recorded 11.7 insects, 4.1 per cent infesatation and 1.4 per cent weight loss (Table C1-10.3a).

Centre: Kharibari: The experiment was conducted at Regional Research sub-station (Terai Zone) UBKV, Kharibari, Darjeeling to evaluate the comparative efficacy of storage bags against storage insect-pests infestation. The infestation of *Sitophilus oryzae* and *Rhizopertha dominica* was recorded. The observations were taken after 1, 3, 4, 6 months of the storage. Average number of live insects after 6 months of storage ranged from 7.58 to 28.53 insects being highest in Jute bags and lowest in BOPP bags. Similarly, the % infestations and % weight loss was also lowest in BOPP bags i.e. 2.90 % and 1.18%, respectively. The next best bags were High Density Polyethylene Woven (HDPE) bags and recorded 11.45 insects, 4.4 per cent infestations and 2.03 per cent weight loss (Table C1-10.3b).

C2: Evaluation of seed protectants for management of storage insect pests of wheat during 2021-22 (Centre: Kharibari, Niphad, Karnal)

Experiemnt was conducted to study the effect of seed protectants against infestation of major store grain insect pests in wheat. Clean and pest free seed of wheat (0.25 kg) was taken for each treatment with three replications in cloth bags. Five pair of adults of *Sitophilus oryzae* or *Rhizopertha dominica* was added in each treatment. The 1st census count initiated 30 days after inoculation of insects and continued at 60, 90, 120, 150 and 180 days. At each census the dead insects should be removed. The data on adult survival population, percent grain damage, percent repellence and percent seed germination should work out for statistical analysis. Also, the weight of seed grains was taken at the end of each census and the data analyzed statistically.

Centre: Kharibari: The data revealed that the mean adult mortality and repellency of *S. oryzae* was maximum in the treatment with Karanj oil (*Pongamia pinnata*) 26% and 6.33% respectively. While the data regarding per cent grain damage and per cent germination was statistically non-significant, where minimum grain damage of 11.82 % and maximum seed germination of 96.67 % with highest seedling vigour index of 1268.92 was recorded in the treatment with Karanj oil. The data regarding percent weight loss revealed that the treatment with Karanj oil (Pongamia pinnata) was significantly superior treatment which recorded

2.71% weight loss but the treatment with Neem oil (*Azadiracta indica*), Castor oil (Ricinus cumunis) and Diatomaceous earth were at par with it recorded 3.02, 2.73 and 3.22 per cent weight loss respectively (Table C2-10.3b).

Centre: Niphad: The data revealed that the mean adult mortality and repellency of *S. oryzae* was maximum in the treatment with Karanj oil (Pongamia pinnata) 26% and 6.33% respectively. While the data regarding per cent grain damage and per cent germination was statistically non significant, where minimum grain damage of 11.82 % and maximum seed germination of 96.67 % with highest seedling vigour index of 1268.92 was recorded in the treatment with Karanj oil. The data regarding percent weight loss revealed that the treatment with Karanj oil (*Pongamia pinnata*) was significantly superior treatment which recorded 2.71% weight loss but the treatment with Neem oil (*Azadiracta indica),* Castor oil (*Ricinus cumunis*) and Diatomaceous earth were at par with it recorded 3.02, 2.73 and 3.22 per cent weight loss respectively (Table C2-10.3c to Table C2-10.3f).

Centre: Karnal: The data revealed that the mean adult mortality of S. oryzae was maximum in the treatment with Castor oil (15.66%) and Sweet flag (15.66%) after one of treatment. After 2 days of treatment with Karanj oil (*Pongamia pinnata*) treatment recorded 25% of mortality.Mean adult mortality after 10 days after treatment was highest in Karanj oil (28.3%) followed by Sweet flag (17.8%) and Castor oil (13.8%) (Table C2-10.3g).

Table C1-10.3a: Evaluation of different packaging bags for storage insect-pest infestation during 2021-22 (Location: Karnal)

Type of bag	Number of live insects after					% infestation					% Weight loss				
	1 *	3	4	6	Av.	1	3	4	6	Av.	1	3	4	6	Av.
Cloth Bags	9.4	14.7	20.0	25.2	**17.3**	3.3	5.0	6.7	8.4	**5.8**	1.0	3.3	4.3	5.3	**3.4**
Jute bags	16.9	22.2	27.5	32.7	**24.8**	5.4	7.1	8.8	10.5	**7.9**	3.4	5.7	6.7	7.7	**5.9**
High Density Polyethylene Woven (HDPE) bags	4.0	9.0	14.3	19.6	**11.7**	1.6	3.3	5.0	6.7	**4.1**	0.0	0.9	1.9	2.9	**1.4**
Biaxially Oriented Polypropylene (BOPP) bags	1.0	3.0	8.3	13.6	**6.4**	-0.2	1.4	3.1	4.8	**2.2**	-0.2	0.0	1.0	2.0	**0.7**

*after different months of storage

Table C1-10.3b: Evaluation of different packaging bags for storage insect-pest infestation during 2021-22 (Location: Kharibari)

Type of bag	Number of live insects after					% infestation					%Weight loss				
	1	3	4	6	Avg.	1	3	4	6	Avg.	1	3	4	6	Avg.
Cloth Bags	8.5	20.6	30.7	35.6	**23.85**	4.5	7.2	8.5	10.2	**7.60**	1.5	3.8	5.5	6.5	**4.33**
Jute bags	19.2	25.5	32.1	37.3	**28.53**	5.5	8.7	9.5	10.6	**8.58**	3.8	6.7	7.9	8.94	**6.84**
High Density Polyethylene Woven (HDPE) bags	5.2	8.5	13.6	18.5	**11.45**	1.5	3.4	5.6	7.1	**4.40**	0.5	1.6	2.20	3.8	**2.03**
Biaxially Oriented Polypropylene (BOPP) bags	2.1	4.2	9.5	14.5	**7.58**	0.0	1.8	4.5	5.3	**2.90**	0.0	0.5	1.4	2.8	**1.18**

Table C2-10.3b: Evaluation seed protectants for management of storage insect pests of wheat 2021-22 (Centre: Kharibari)

Name of Treatment	Dose (/ kg seed)	Fresh grain Treated (gm)	Before spray Population	Mean no. of adults after indicated days of storage				% reduction over control	Before spray Population	Mean no. of adults after indicated days of storage				% reduction over control
				15 DAT	30 DAT	45 DAT	60 DAT			15 DAT	30 DAT	45 DAT	60 DAT	
Neem oil (*Azadirachta indica*)	**15 ml**	**250**	30.00 (5.48)	22.00 (4.69)	14.67 (3.83)	8.33 (2.89)	15.50 (3.94)	62.45	30.00 (5.48)	20.00 (4.47)	14.33 (3.79)	7.33 (2.71)	16.67 (4.08)	66.21
Blue gum oil (*Eucalyptus globulus*)	**15 ml**	**250**	30.00 (5.48)	24.00 (4.90)	18.55 (4.31)	13.33 (3.65)	18.75 (4.33)	54.58	30.00 (5.48)	25.00 (5.00)	19.55 (4.42)	14.33 (3.79)	19.33 (4.40)	60.81
Karanj oil *(Pongamia pinnata*)	**15 ml**	**250**	30.00 (5.48)	22.67 (4.76)	20.33 (4.51)	14.33 (3.79)	22.67 (4.76)	45.08	30.00 (5.48)	21.67 (4.66)	18.33 (4.28)	12.33 (3.51)	19.67 (4.44)	60.13
Castor oil (*Ricinus comunis*)	**15 ml**	**250**	30.00 (5.48)	23.67 (4.87)	16.33 (4.04)	12.00 (3.46)	19.33 (4.40)	53.17	30.00 (5.48)	22.67 (4.76)	15.33 (3.92)	11.00 (3.32)	18.33 (4.28)	62.84
Sweet Flag powder (*Acorus calamus*)	**5 g**	**250**	30.00 (5.48)	20.67 (4.55)	16.67 (4.08)	12.67 (3.56)	19.67 (4.44)	52.35	30.00 (5.48)	19.67 (4.44)	14.67 (3.83)	10.67 (3.27)	18.67 (4.32)	62.15
Turmeric powder (*Curcuma longa*)	**5 g**	**250**	30.00 (5.48)	24.67 (4.97)	21.00 (4.58)	19.33 (4.40)	22.67 (4.76)	45.08	30.00 (5.48)	23.33 (4.83)	18.33 (4.28)	15.67 (3.96)	20.67 (4.55)	58.10
Diatomaceous earth	500 ppm	**250**	30.00 (5.48)	25.67 (5.07)	22.00 (4.69)	19.33 (4.40)	23.33 (4.83)	43.48	30.00 (5.48)	22.67 (4.76)	19.67 (4.44)	16.33 (4.04)	21.33 (4.62)	56.76
Control No Application	-	**250**	30.00 (5.48)	33.67 (5.80)	35.33 (5.94)	41.00 (6.40)	46.33 (6.81)		30.00 (5.48)	32.67 (5.72)	36.33 (6.03)	43.00 (6.56)	49.33 (7.02)	
CD at 5%			NS	1.58	1.88	1.75	1.26		NS	1.74	1.36	1.58	1.36	

Table C2-10.3c: Evaluation seed protectants for management of storage insect pests of wheat 2021-22 (Centre: Niphad)

Tr.No.	Treatments	Doses/kg seed	Per cent adult mortality of *S. oryzae*										
			1 DAT	2 DAT	3 DAT	4 DAT	5 DAT	6 DAT	7 DAT	8 DAT	9 DAT	10 DAT	Mean
1	Neem oil (*Azadiracta indica)*	15 ml	3.33	6.67	10.00	10.00	13.33	6.67	3.33	0.00	0.00	0.00	5.33
2	Blue gum oil (*Eucalyptus globulus*)	15 ml	3.33	3.33	3.33	0.00	10.00	6.67	6.67	3.33	3.33	3.33	4.33
3	Karanj oil (*Pongamia pinnata*)	15 ml	3.33	23.33	46.67	40.00	46.67	46.67	30.00	13.33	6.67	3.33	26.00
4	Castor oil (*Ricinus cumunis*)	15 ml	13.33	10.00	13.33	20.00	16.67	13.33	13.33	10.00	6.67	0.00	11.67
5	Sweet flag (Vekhand) powder (*Acorus calamus*)	5 g	13.33	16.67	26.67	26.67	26.67	23.33	13.33	6.67	3.33	0.00	15.67
6	Turmeric Powder (*Curcuma longa*)	5 g	6.67	10.00	16.67	16.67	16.67	16.67	10.00	6.67	3.33	3.33	10.67
7	Diatomaceous earth	500 ppm	10.00	13.33	20.00	13.33	13.33	13.33	10.00	6.67	3.33	3.33	10.67
8	Untreated control	-	0.00	0.00	0.00	3.33	3.33	3.33	0.00	0.00	0.00	0.00	1.00

Table C2-10.3d: Evaluation seed protectants for management of storage insect pests of wheat 2021-22 (Centre: Niphad)

Tr.No.	Treatments	Doses/kg seed	Per cent adult repellency of *S. oryzae*										
			1 DAT	2 DAT	3 DAT	4 DAT	5 DAT	6 DAT	7 DAT	8 DAT	9 DAT	10 DAT	**M e a n**
1	Neem oil (*Azadiracta indica)*	15 ml	3.33	10.00	0.00	6.67	0.00	3.33	0.00	0.00	0.00	0.00	**2.33**
2	Blue gum oil (*Eucalyptus globulus*)	15 ml	3.33	3.33	3.33	3.33	0.00	3.33	3.33	3.33	0.00	0.00	**2.33**
3	Karanj oil (*Pongamia pinnata*)	15 ml	33.33	23.33	6.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**6.33**
4	Castor oil (*Ricinus cumunis*)	15 ml	6.67	3.33	0.00	6.67	0.00	0.00	0.00	0.00	0.00	0.00	**1.67**
5	Sweet flag (Vekhand) powder (*Acorus calamus*)	5 g	0.00	0.00	3.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.33**
6	Turmeric Powder (*Curcuma longa*)	5 g	10.00	6.67	10.00	10.00	3.33	3.33	3.33	0.00	0.00	0.00	**4.67**
7	Diatomaceous earth	500 ppm	0.00	6.67	10.00	6.67	6.67	0.00	3.33	3.33	3.33	3.33	**4.33**
8	Untreated control	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**

Table C2-10.3e: Evaluation seed protectants for management of storage insect pests of wheat 2021-22 (Centre: Niphad)

Tr.No.	Treatments Per cent grain damage	Doses/kg seed	% Grain Damage	% Seed germination	Seedling vigour Index
1	Neem oil (*Azadiracta indica)*	15 ml	14.01 (21.94)	93.33 (77.71)	1034.15
2	Blue gum oil (*Eucalyptus globulus*)	15 ml	15.51 (23.12)	90.00 (75.00)	1243.67
3	Karanj oil (*Pongamia pinnata*)	15 ml	11.82 (20.10)	96.67 (83.86)	1268.92
4	Castor oil (*Ricinus cumunis*)	15 ml	14.40 (22.28)	86.67 (72.29)	1245.67
5	Sweet flag (Vekhand) powder (*Acorus calamus*)	5 g	13.62 (21.59)	86.67 (72.29)	1148.49
6	Turmeric Powder (*Curcuma longa*)	5 g	13.51 (21.52)	83.33 (70.07)	1003.33
7	Diatomaceous earth	500 ppm	12.58 (20.77)	83.33 (70.07)	1067.33
8	Untreated control	-	18.99 (25.45)	82.31 (65.43)	749.56
		SE+	**NS**	**NS**	
		CD @5%	**NS**	**NS**	
		C.V.	**12.349**	**17.127**	

Table C2-10.3f: Evaluation seed protectants for management of storage insect pests of wheat 2021-22 (Centre: Niphad)

Tr.No.	Treatments	Doses/kg seed	Per cent weight loss due to infestation of *S.oryzae*						
			30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	180 DAT	Mean
1	Neem oil (*Azadiracta indica)*	15 ml	1.47 (6.84)	2.80 (9.62)	3.20 (10.29)	3.33 (10.49)	3.60 (10.93)	3.73 (11.12)	**3.02 (9.98)**
2	Blue gum oil (*Eucalyptus globulus*)	15 ml	2.93 (9.84)	3.20 (10.25)	3.60 (10.89)	3.87 (11.33)	4.13 (11.73)	4.27 (11.91)	**3.67 (11.02)**
3	Karanj oil (*Pongamia pinnata*)	15 ml	2.80 (9.62)	2.40 (8.89)	2.80 (9.62)	2.53 (9.15)	2.80 (9.63)	2.93 (9.86)	**2.71 (9.48)**
4	Castor oil (*Ricinus cumunis*)	15 ml	2.27 (8.57)	2.53 (9.15)	2.93 (9.86)	2.67 (9.36)	2.93 (9.83)	3.07 (10.05)	**2.73 (9.49)**
5	Sweet flag (Vekhand) powder (*Acorus calamus*)	5 g	2.80 (9.63)	2.67 (9.38)	3.07 (10.07)	3.87 (11.34)	4.13 (11.72)	4.27 (11.92)	**3.47 (10.72)**
6	Turmeric Powder (*Curcuma longa*)	5 g	2.13 (8.34)	3.47 (10.72)	3.87 (11.33)	3.87 (11.33)	4.13 (11.73)	4.27 (11.91)	**3.62 (10.96)**
7	Diatomaceous earth	500 ppm	2.13 (8.36)	2.67 (9.36)	3.07 (10.05)	3.60 (10.93)	3.87 (11.32)	4.00 (11.53)	**3.22 (10.33)**
8	Untreated control	-	2.80 (9.62)	5.33 (13.34)	5.73 (13.85)	5.47 (13.52)	5.73 (13.85)	5.87 (14.02)	**5.16 (13.12)**
		SE+	**0.605**	**0.469**	**0.457**	**0.401**	**0.357**	**0.347**	**0.342**
		CD @5%	**1.829**	**1.417**	**1.383**	**1.211**	**1.079**	**1.049**	**1.034**
		C.V.	**11.837**	**4.395**	**7.377**	**6.347**	**5.447**	**3.030**	**5.568**

Table C2-10.3g: Evaluation seed protectants for management of storage insect pests of wheat 2021-22 (Centre: Karnal)

Tr.No.	Treatments	Doses/ kg seed	Per cent adult mortality of *S. oryzae*										
			1 DAT	2 DAT	3 DAT	4 DAT	5 DAT	6 DAT	7 DAT	8 DAT	9 DAT	10 DAT	Mean
1	Neem oil (*Azadiracta indica)*	15 ml	5.66	9.00	12.33	12.33	15.66	9.00	5.66	2.33	2.33	2.33	**7.7**
2	Blue gum oil (*Eucalyptus globulus*)	15 ml	5.66	5.66	5.66	2.33	12.33	9.00	9.00	5.66	5.66	5.66	**6.7**
3	Karanj oil (*Pongamia pinnata*)	15 ml	5.66	25.66	49.00	42.33	49.00	49.00	32.33	15.66	9.00	5.66	**28.3**
4	Castor oil (*Ricinus cumunis*)	15 ml	15.66	12.33	15.66	22.33	19.00	15.66	15.66	12.33	9.00	0.00	**13.8**
5	Sweet flag (Vekhand) powder (*Acorus calamus*)	5 g	15.66	19.00	29.00	29.00	29.00	25.66	15.66	9.00	5.66	0.00	**17.8**
6	Turmeric Powder (*Curcuma longa*)	5 g	9.00	12.33	19.00	19.00	19.00	19.00	12.33	9.00	5.66	5.66	**13.0**
7	Diatomaceous earth	500 ppm	12.33	15.66	22.33	15.66	15.66	15.66	12.33	9.00	5.66	5.66	**13.0**
8	Untreated control	-	0.00	0.00	0.00	5.66	5.66	5.66	2.33	0.00	0.00	0.00	**1.9**
	CD @5%		0.23	0.45	0.67	0.84	0.78	0.22	0.87	0.54	0.32	0.43	**0.99**

PROGRAMME 11: NEMATOLOGY

11.1 Crop Health Survey

Rajasthan

Survey was conducted in the different cultivator's fields of five districts of Rajasthan for studying the incidence and intensity of Cereal Cyst Nematode (CCN). Diseased fields were randomly selected on the basis of above ground symptoms of the crops. Symptoms of stunting, yellowing, patchy and poor growth were recorded during survey of each field. Roots samples were collected from the rhizospere of wheat and barley crops looking above ground symptoms alongwith composite soil sample. Root & soil sample were processed with standard technique of nematode identification (Cobb's sieving and decanting method). Presence of cereal cyst nematode was further confirmed by seeing the bushy roots with white cyst on it. Cereal cyst nematode infestation was recorded in all five districts e.i. Alwar, Dausa, Jaipur, Sikar and Tonk districts. A large number of infested fields were observed in Amber, Bassi, Chomu, Jamwa Ramgarh, Kotputli, Sahapura, Sanganer and Viratnagar tehsil of Jaipur district. Post-harvest survey was also conducted to observe the infestation of Ear Cockle disease in various grain market of Jaipur district. Consequently three year, ECN was not found in collected grain sample of wheat.

Haryana

Crop health monitoring survey of important plant parasitic nematodes associated with wheat in Hisar, Sirsa and Fatehabad districts was done during March, 2022. A total of 50 soil and root samples were collected and around 10-15 soil samples were received from the farmer in Deptt. of Nematology during the season. Out of 50, cereal cyst nematode (CCN) was reported from 16 samples while the samples brought by the famer were mostly found infested with CCN. Number of cysts ranged from 3-52 per 200 cc soil (Table 11.1). Plant parasitic nematodes present in 200 cc soil samples were *Pratylenchus* sp. 48% (24/50); *Tylenchorhynchus* sp. 54% (27/50); *Hoplolaimus* sp. 28% (14/50) and *Helicotylenchus* sp. 18% (09/50). Wheat seed gall nematode (*Anguina tritici*) was not recorded from the samples. One field was also found to have a light infestation of root-knot nematode in wheat *i.e. M. graminicola*.

Table 11.1: Community analysis of plant parasitic nematodes associated with wheat in Hisar, Fatehabad and Sirsa districts

Nematode species	No. of infested samples	Frequency of occurrence (%)	No of cyst/200 cc soil	No of J_2/200 cc soil
Heterodera avenae	16/50	32.00	03-52	-
Tylenchorhynchus sp.	27/50	54.00	-	16-259
Pratylenchus sp.	24/50	48.00	-	3-38
Helicotylenchus sp.	09/50	18.00	-	1-16
Hoplolaimus sp.	14/50	28.00	-	2-35
M. graminicola	01/50	00.02	-	-
Criconematids sp.	05/50	10.00	-	2-16
Dorylaimids sp.	42/50	84.00	-	25-374

11.2. Studies of Pathotypes of *Heterodera avenae*:

The cereal cyst nematode pathotyping were carried out during the crop season 2021-22 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 11.2).

Table 11.2: 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 cereal cyst nematode (*Heterodera avenae*)

One hundred fifty three entries of AVT were screened for resistance against *H. avenae* (CCN) under sick plot conditions or pot condition at Hisar and Durgapura centers. No entry found resistant or moderately resistant across all the centers however only one entry VL3028 shown moderate level of resistance at Hisar center (Table 11.3).

Table 11.3: Screening of AVT entries CCN during 2021-22 at different locations.

S. No.	Entries	Durgapura	Hisar	Highest reaction
1	VL2041*	HS	S	HS
2	VL2043	HS	S	HS
3	VL2044	HS	S	HS
4	HD3402	HS	S	HS
5	HPW481	HS	S	HS
6	HPW487	HS	S	HS
7	HPW488	S	S	S
8	HS692	S	HS	HS
9	HS693	HS	S	HS
10	HS694	HS	S	HS
11	UP3114	HS	S	HS
12	VL3028	HS	MR	HS
13	VL3029	HS	S	HS
14	VL3030	HS	S	HS
15	HPW483	HS	HS	HS
16	HPW484	HS	HS	HS
17	HPW485	S	HS	HS
18	HPW486	HS	S	HS
19	HS688	HS	S	HS
20	HS689	HS	S	HS
21	HS690	HS	S	HS

22	HS691	HS	S	HS
23	SKW362	S	S	S
24	UP3113	S	NC	S
25	VL2047	S	S	S
26	VL2048	S	S	S
27	VL2049	S	S	S
28	VL2050	HS	S	HS
29	HS507(C)	S	S	S
30	HS562(C)	HS	S	HS
31	HS490(C)	HS	S	HS
32	HPW349(C)	HS	HS	HS
33	VL907(C)	HS	HS	HS
34	VL892(C)	HS	HS	HS
35	DBW377	HS	S	HS
36	PBW870	HS	S	HS
37	DBW372	HS	S	HS
38	DBW318	S	S	S
39	DBW327 (C)	S	S	S
40	DBW332(C)	HS	HS	HS
41	DBW370	HS	S	HS
42	DBW371	HS	HS	HS
43	DBW373	S	HS	HS
44	PBW868	S	S	S
45	PBW871	S	HS	HS
46	PBW872	S	HS	HS
47	HD3090(C)	S	S	S
48	HI1633(C)	HS	HS	HS
49	RAJ4083(C)	HS	HS	HS
50	DBW320#*	S	S	S
51	MP1380#	S	HS	HS
52	DBW407[B]	S	HS	HS
53	DDW48(d)(C)	S	HS	HS
54	HI8826(d)*	S	HS	HS
55	MACS4100(d)*	S	HS	HS
56	MP1378	S	S	S
57	MP3552	HS	HS	HS
58	UAS3015	S	HS	HS
59	HI8839(d)	S	HS	HS
60	HI8840(d)	HS	S	HS
61	MP1358(I)(C)	HS	HS	HS
62	NIAW3922	S	HS	HS
63	NIDW1149(d)(C)	S	HS	HS
64	UAS478(d)	S	HS	HS
65	DBW352#	HS	HS	HS
66	GW513(I)(C)	S	S	S
67	GW547[B]	HS	HS	HS
68	HI1636(I)(C)	S	HS	HS
69	HI1650*	HS	HS	HS

70	MACS6768*	HS	S	HS
71	MP3535*	S	HS	HS
72	NWS2194#	HS	HS	HS
73	HI1665	HS	HS	HS
74	NIAW4028	HS	S	HS
75	CG1036*	HS	S	HS
76	CG1040	S	S	S
77	DDW47(d)(C)	S	S	S
78	DDW55(d)^{Q}*	S	S	S
79	GW532	S	S	S
80	HD3401	S	S	S
81	HI1655^{Q}*	S	S	S
82	HI1666	S	S	S
83	HI8823(d)(I)(C)	HS	S	HS
84	HI8830(d)*	S	S	S
85	MACS6795	S	NC	S
86	MP1377	S	HS	HS
87	MP3288(C)	S	HS	HS
88	UAS3019	HS	HS	HS
89	DBW316#*	S	HS	HS
90	HD3118(C)	S	HS	HS
91	HD3392	HS	HS	HS
92	HI1621(C)	HS	S	HS
93	PBW833*	S	S	S
94	PBW835^{Q}*	S	HS	HS
95	HD3249(C)	HS	NG	HS
96	PBW826#*	S	HS	HS
97	HD3388	S	HS	HS
98	PBW852	HS	HS	HS
99	DBW252(C)	HS	HS	HS
100	HD3171(C)	HS	HS	HS
101	HD3293(C)	S	HS	HS
102	DBW353	S	S	S
103	JKW261(I)(C)	HS	S	HS
104	PBW771(C)	HS	S	HS
105	WH1124(C)	S	S	S
106	HD2967(C)	HS	S	HS
107	HD3386	S	S	S
108	DBW359	S	S	S
109	DBW358	S	S	S
110	NIAW3170(C)	HS	S	HS
111	HD3043(C)	S	S	S
112	HD3369*	HS	S	HS
113	HD3397	S	S	S
114	HD3400	S	S	S
115	HD3418	S	S	S
116	HI1628(C)	HS	S	HS
117	HI1653*	HS	S	HS

118	HI1654*	S	HS	HS
119	HUW838(I)(C)	S	HS	HS
120	UP3090	HS	HS	HS
121	WH1402	S	S	S
122	WH1403	S	HS	HS
123	DBW365	S	HS	HS
124	DBW366	HS	HS	HS
125	DBW402	S	NG	S
126	HD3415	HS	HS	HS
127	Kharchia65(C)	S	HS	HS
128	KRL19(C)	S	HS	HS
129	KRL2006	HS	HS	HS
130	UAS310	S	HS	HS
131	KRL2021	S	HS	HS
132	KRL210(C)	HS	HS	HS
133	RAJ4565	S	S	S
134	HD3438	HS	S	HS
135	HD3439	HS	S	HS
136	CG1029(C)	S	S	S
137	HD3407*	HS	S	HS
138	HI1634(C)	HS	NG	HS
139	MP3336(C)	S	S	S
140	HI8498(C)	HS	S	HS
141	HI8759(C)	S	S	S
142	HI8846	S	S	S
143	HI8847	HS	S	HS
144	HD2733(C)	HS	S	HS
145	HD3411*	HS	S	HS
146	HD3440	HS	HS	HS
147	HD3406*	HS	HS	HS
148	HD3436	HS	HS	HS
149	HD3437	S	HS	HS
150	PBW175(C)	S	HS	HS
151	PBW677(C)	S	HS	HS
152	PBW901	HS	HS	HS
153	PBW902	HS	HS	HS

For Cereal Cyst Nematode, HS- Highly susceptible, S- Susceptible, MR- Moderately Resistant, R- Resistant,

11.4 Multiple Disease/ Pest Screening Nursery (MDSN)

Thirty one entries were screened against cereal cyst nematode at Durgapura and Hisar. Out of these entries none of the entry showed high or moderately level of resistance, all the entries fall in susceptible or highly susceptible category. Only at Hisar three entries *viz.* HI 8627(d), HI 8805 (d) and HI 8818 (d) showed moderate level of resistance.

11.5 Management of Cereal Cyst Nematode (CCN)

Durgapura

An experiment was conducted to test efficacy of new chemical as a replacement of old recommended chemical (Carbofuran @2 kg a.i/ ha) at Rajasthan Agricultural Research Institute, Durgapura, Jaipur in sick field of Molya disease. Inoculums level was 7.2 larvae/g soil. The experiment consisted of six treatments *viz* Fluensulfone 2% GR @0.5 Kg a.i./ha at sowing (25 Kg formulation/ha), Fluensulfone 2% GR @1.0 Kg a.i./ha at sowing (50 Kg formulation/ha), Fluensulfone 2% GR @1.5 Kg a.i./ha at sowing (75 Kg formulation/ha), Fluensulfone 2% GR @2.0 Kg a.i./ha at sowing (100 Kg formulation/ha), Carbofuran @2 kg a.i/ ha at sowing and untreated check in a completely randomized block design with seven replication. The crop was examined for count the white no. of cyst/plant in each treatment. The yield was taken at the time of harvesting of the crop in each treatment block wise. The results revealed that treatment TI (Fluensulfone 2% GR @0.5 Kg a.i./ha at sowing 25 Kg formulation/ha) gave 46.33 q / ha by reducing number of cyst/plant. Higher dosage (T2, T3, T4) of chemical was not able to increase yield of crop significantly. No Phyto-toxic effect was observed at higher dosage (T2, T3, T4) of chemical to any part of plant as reported in vegetable crop. Label claim dose of chemical (for vegetable) Fluensulfone 2% GR @0.5 Kg a.i./ha at sowing (25 Kg formulation/ha) (T1) gave higher yield in comparison to treated check, Carbofuran @2 kg a.i/ ha (Table 11.4).

Table 11.4: Effects of Fluensulfone on cereal cyst nematode in wheat under artificially created sick plot during crop season 2021-22

Treatments	Descriptions	Dose (kg a.i. per ha)	Mean number of cysts/plant	Yield q/ha
T_1	Fluensulfone 2% GR	0.5 Kg *a.i.*/ha at sowing	4.66	46.33
T_2	Fluensulfone 2% GR	1.0 Kg *a.i.*/ha at sowing	4.33	47.33
T_3	Fluensulfone 2% GR	1.5 Kg *a.i* /ha at sowing	4.33	47
T_4	Fluensulfone 2% GR	2.0 Kg *a.i.*/ha at sowing	4	46.66
T_5	Carbofuran	2 kg *a.i* ha at sowing	6	40.66
T_6	Untreated Check	No chemical	26	30.33
			1.33	4.66

Hisar

The experiment on evaluation of new chemical against cereal cyst nematode, *Heterodera avenae* was done in screen house in earthen pots to manage cereal cyst nematode using the chemical fluensulfone 2% GR in wheat. Nematode-infested soil was filled after diluting the soil with dune sand to make the initial inoculum 20 cysts per kg soil. There were six treatments with three replications in completely randomized design (CRD). Chemicals were mixed in soil at the time of sowing in their respective treatments. Observations were recorded after 110-120 days of sowing. The minimum reduction of cyst was observed in fluensulfone @ 2.0 kg *a.i.* per ha followed by carbofuran @ 2.0 kg *a.i.* per ha (Table 11.5).

Table 11.5. Effects of Fluensulfone on cereal cyst nematode, *Heterodera avenae*

Treatments	Descriptions	Dose (kg a.i. per ha)	Mean number of cysts/plant
T_1	Fluensulfone 2% GR	0.5 Kg *a.i.*/ha at sowing	18.9
T_2	Fluensulfone 2% GR	1.0 Kg *a.i.*/ha at sowing	14.7
T_3	Fluensulfone 2% GR	1.5 Kg *a.i* /ha at sowing	9.3
T_4	Fluensulfone 2% GR	2.0 Kg *a.i.*/ha at sowing	6.1
T_5	Carbofuran	2 kg *a.i* ha at sowing	8.3
T_6	Untreated Check	No chemical	26.8

Cooperators:

Name	**Center**
Priyanka Duggal	Hisar
S. P. Bisnoi	Durgapura
Sudheer Kumar, PL Kashyap, Ravindra Kumar	Karnal (Coordinating unit)

Annexure 1: Seedling response of AVT lines against the pathotypes of *Puccinia graminis* f. sp. *tritici* (black rust) during 2021-22 at ICAR-IIWBR, RS, Shimla

S. No.	Variety/line	Pathotype																				*Sr*-gene
		11	11A	15–1	21	21A–2	24A	34–1	40A	40–1	40–2	40–3	42B	117A	117A–1	117–1	117–2	117–3	117–6	122	184	295	
1.	VL2041	R	NG	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	*Sr 30+5+11+*
2.	VL2043	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
3.	VL2044	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr30+11+*
4.	HD3402	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	MR	R	R	R	*Sr9b+11+*
5.	HPW481	R	NG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
6.	HPW487	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
7.	HPW488	R	R	R	R	R	R	R	R	R	S	MS	R	R	R	R	MR	R	R	R	R	R	*Sr8a+9b+7b+*
8.	HS692	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
9.	HS693	MS	R	R	R	R	R	R	S	R	R	MS	R	R	R	R	R	R	MR	R	R	R	*Sr9b+11+7b+*
10.	HS694	S	R	R	R	R	MR	R	MS	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr11+7b+*
11.	UP3114	R	R	S	R	R	R	R	MR	R	R	MR	R	R	R	R	R	R	MS	R	R	R	*Sr8a+9b+7b+*
12.	VL3028	S	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr30+5+11+*
13.	VL3029	R	R	R	R	R	R	R	R	R	S	MS	R	R	R	R	R	R	R	R	R	R	*Sr8a+5+9e+*
14.	VL3030	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr30+8a+2+*
15.	HPW483	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	*Sr31+*
16.	HPW484	S	R	R	R	R	R	NG	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr30+5+11+*
17.	HPW485	R	R	S	R	R	R	R	R	R	MR	MS	R	R	R	R	R	R	R	R	R	R	*Sr8a+9b+7b+2+*
18.	HPW486	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	*Sr31+*
19.	HS688	R	R	R	R	R	R	R	R	R	S	S	R	R	R	R	R	R	R	R	R	R	*Sr8a+9b+*
20.	HS689	MS	R	R	R	R	R	R	R	R	S	S	R	R	R	R	R	R	R	R	R	R	*Sr5+9b+7b+*
21.	HS690	S	R	R	R	R	R	R	S	S	R	S	R	R	R	R	R	R	R	MS	R	R	*Sr5+9b+11+*
22.	HS691	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2+R*
23.	SKW362	S	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	MR	R	R	R	*Sr30+11+*
24.	UP3113	S	R	R	R	R	R	R	R	R	R	S	MR	R	R	R	R	R	MS	R	R	R	*Sr13+11+7b+2+*
25.	VL2047	R	R	R	R	R	R	R	R	R	R	S	R	R	NG	R	R	R	MS	R	R	R	*Sr13+11+9e+*
26.	VL2048	R	R	S	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr30+8a+5+*
27.	VL2049	R	R	S	R	R	R	R	R	R	R	S	R	R	R	R	R	R	MR	R	R	R	*Sr30+8a+5+*
28.	VL2050	R	R	S	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	MS	R	R	R	*Sr9e+7b+*
29.	HS507(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+5+*
30.	HS562(C)	S	R	S	R	R	R	R	S	R	S	S	R	R	R	R	R	R	R	R	R	R	*Sr8a+9b+11+*
31.	HS490(C)	S	MR	R	R	MR	R	R	R	R	S	R	R	R	R	R	MR	R	R	R	R	R	*Sr8a+9b+*
32.	HPW349(C)	S	R	MR	R	R	R	R	R	R	S	S	MR	R	R	R	R	R	R	MR	R	R	*Sr7b+2+*
33.	VL907(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	*Sr31+2+*

34.	VL892(C)	S	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr30+11+*
35.	DBW377	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
36.	PBW870	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*R*
37.	DBW372	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	*Sr28+*
38.	DBW318	R	R	MR	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	S	*R*
39.	DBW327 (C)	R	R	MS	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr5+13+*
40.	DBW332(C)	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr30+8a+*
41.	DBW370	S	S	S	R	R	R	R	MR	R	MR	S	R	R	R	R	R	R	MS	R	R	R	*Sr7b+*
42.	DBW371	S	S	MS	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr8a+5+*
43.	DBW373	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	MR	R	R	R	*Sr11+*
44.	PBW868	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
45.	PBW871	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr9b+11+2+*
46.	PBW872	MR	R	S	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	MS	*
47.	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+*
48.	HI1633(C)	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
49.	RAJ4083(C)	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	MR	R	R	R	*Sr11+*
50.	DBW320#*	R	R	S	R	R	R	R	R	R	S	S	R	R	R	R	R	R	MS	R	R	R	*Sr30+8a+*
51.	MP1380#	MR	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2+*R
52.	DBW407[B]	S	MS	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	MS	R	R	R	*Sr13+7b+*
53.	DDW48(d)(C)	R	R	R	R	R	S	R	R	R	R	R	S	R	R	R	R	R	S	MS	R	S	*Sr7b+2+*
54.	HI8826(d)*	R	R	R	R	R	S	R	R	R	R	R	MS	R	R	R	S	MR	MS	R	MR	R	*Sr7b+2+*
55.	MACS4100(d)*	R	R	MS	R	R	S	R	S	S	S	S	R	S	S	S	S	S	S	R	S	R	-
56.	MP1378	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
57.	MP3552	MS	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr30+5+11+*
58.	UAS3015	S	S	S	MS	R	R	R	MR	MR	S	S	R	R	R	R	S	MR	MR	MR	R	MS	*Sr7b+*
59.	HI8839(d)	R	R	MS	R	R	S	R	R	R	R	R	S	R	MR	R	S	R	MR	R	R	R	*Sr13+7b+*
60.	HI8840(d)	R	R	R	R	R	S	R	R	R	R	R	MR	S	R	MS	S	R	S	R	R	R	*Sr13+7b+*
61.	MP1358(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr11+*
62.	NIAW3922	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
63.	NIDW1149(d)(C)	NG	R	R	R	R	MR	R	R	R	R	R	S	MR	NG	R	R	NG	R	R	R	R	*Sr11+2+*
64.	UAS478(d)	R	R	MS	R	R	S	R	S	R	S	S	R	S	S	S	S	S	S	R	S	R	*Sr7b+2+*
65.	DBW352#	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	*Sr2+*R
66.	GW513(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+2+*
67.	GW547[B]	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2+*R
68.	HI1636(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	*Sr24+2+*
69.	HI1650*	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	*Sr31+*
70.	MACS6768*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
71.	MP3535*	S	S	S	MR	R	MR	R	R	R	MS	MS	S	R	R	R	R	R	S	MS	R	S	*
72.	NWS2194#	MR	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr30+11+*
73.	HI1665	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2+R*
74.	NIAW4028	S	R	R	R	R	S	R	R	R	R	R	S	R	R	R	MR	R	R	R	R	R	*Sr30+5+2+*

75.	CG1036*	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr7b+2+*
76.	CG1040	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R
77.	DDW47(d)(C)	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	S	S	MR	MS	R	MS	S	*Sr11+7b+2+*
78.	DDW55(d)^{Q}*	R	R	S	R	R	S	R	S	MS	S	S	R	S	S	S	S	S	MS	R	S	R	*Sr7b+2+*
79.	GW532	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2+R*
80.	HD3401	R	R	MS	S	R	S	R	S	S	S	MS	R	S	S	S	S	S	S	R	S	R	-
81.	HI1655^{Q}*	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2+R*
82.	HI1666	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	*Sr2+R*
83.	HI8823(d)(I)(C)	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	S	MR	S	R	S	R	*Sr11+2+*
84.	HI8830(d)*	R	R	R	R	R	R	R	R	S	R	MS	R	MR	R	S	S	MR	S	R	MR	R	*Sr7b+2+*
85.	MACS6795	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	*Sr2+R*
86.	MP1377	MS	R	R	R	R	MR	NG	R	R	R	S	MR	R	R	MR	R	R	R	R	R	R	*Sr13+11+7b+*
87.	MP3288(C)	S	R	R	R	R	S	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	*
88.	UAS3019	MR	R	MR	R	R	R	R	R	R	MR	S	R	R	R	R	R	R	R	R	R	R	*Sr9b+7b+*
89.	DBW316#*	S	S	S	MR	R	S	R	S	R	S	S	S	R	R	R	S	R	R	MR	R	S	*
90.	HD3118(C)	MR	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	MR	R	MR	R	R	R	*Sr9b+11+*
91.	HD3392	S	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	MS	R	R	R	*Sr13+11+7b+*
92.	HI1621(C)	R	R	MS	R	R	R	R	R	R	R	S	R	R	R	R	R	R	S	R	R	R	*Sr28+*
93.	PBW833*	S	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr7b+2+*
94.	PBW835^{Q}*	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr2+R*
95.	HD3249(C)	R	R	R	R	R	MR	R	R	R	R	MR	S	R	R	R	R	MR	S	MR	MS	R	*Sr11+2+*
96.	PBW826#*	MR	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr30+8a+2+*
97.	HD3388	S	R	MS	R	R	R	R	R	R	R	S	R	R	R	R	R	R	MR	R	R	R	*Sr13+7b+*
98.	PBW852	S	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	S	*Sr30+11+2+*
99.	DBW252(C)	MS	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr8a+5+11+2+*
100.	HD3171(C)	S	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	MS	MR	R	R	R	*Sr11+7b+2+*
101.	HD3293(C)	S	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	MR	R	R	R	MS	*Sr13+2+*
102.	DBW353	S	R	MS	R	R	R	R	R	R	R	S	R	R	R	R	R	R	MS	R	R	R	*Sr13+7b+*
103.	JKW261(I)(C)	S	S	S	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	S	*Sr11+*
104.	PBW771(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
105.	WH1124(C)	S	S	R	R	R	R	R	R	R	R	S	MS	R	R	R	R	R	R	MR	MR	MR	*Sr7b+2+*
106.	HD2967(C)	R	R	MR	R	R	R	R	R	R	R	S	R	R	R	R	MR	R	R	R	R	R	*Sr8a+11+2+*
107.	HD3386	R	R	MS	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr30+5+2+*
108.	DBW359	S	S	MS	R	R	R	R	R	R	MR	MS	R	R	R	R	R	R	MR	R	R	R	*Sr9b+7b+*
109.	DBW358	S	R	MR	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr30+5+*
110.	NIAW3170(C)	R	R	MS	R	R	R	R	MR	MR	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr8a+2+*
111.	HD3043(C)	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
112.	HD3369*	R	R	R	R	R	MR	R	R	R	R	MR	R	R	R	R	MR	R	R	R	R	R	*Sr13+*
113.	HD3397	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	-
114.	HD3400	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	*R*
115.	HD3418	MS	R	MR	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	MR	MR	R	R	*Sr30+*

116.	HI1628(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2*+R
117.	HI1653*	MS	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr7b+*
118.	HI1654*	S	R	MS	R	R	R	R	R	MR	R	S	R	R	R	R	S	R	R	R	R	R	*Sr13+*
119.	HUW838(I)(C)	S	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr8a+5+11+*
120.	UP3090	S	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	MS	*Sr30+11+*
121.	WH1402	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
122.	WH1403	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2*+R
123.	DBW365	R	R	S	R	R	R	R	R	MS	S	S	R	R	R	R	R	R	R	R	R	R	*Sr8a+2+*
124.	DBW366	MR	R	R	R	R	R	R	R	MR	R	MR	R	R	R	R	R	MS	R	R	R	R	*Sr30+8a+*
125.	DBW402	MR	R	R	R	R	R	R	R	MR	R	S	R	R	R	R	R	R	R	R	R	R	*Sr11+7b+2+*
126.	HD3415	MS	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr30+11+*
127.	Kharchia65(C)	S	S	MR	S	S	S	MS	S	MS	R	S	MS	S	S	S	S	S	S	S	S	S	*Sr7b+*
128.	KRL19(C)	R	R	S	R	R	R	R	R	R	MR	S	R	R	R	R	R	R	R	R	R	R	*Sr8b+9b+11+2+*
129.	KRL2006	S	R	MR	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr30+*
130.	UAS310	S	R	S	MR	MS	R	R	R	R	S	S	R	R	R	MR	S	MR	R	R	R	R	*Sr13+7b+*
131.	KRL2021	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr30+5+*
132.	KRL210(C)	S	S	S	R	R	R	R	MR	R	R	S	MS	R	MS	R	S	MS	R	MR	R	MR	*Sr7b+2+*
133.	RAJ4565	MR	R	R	R	R	R	R	MR	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr30+11+2+*
134.	HD3438	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
135.	HD3439	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
136.	CG1029(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+2+*
137.	HD3407*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
138.	HI1634(C)	R	R	R	R	R	R	R	R	MR	R	R	R	R	MR	R	R	R	R	R	R	R	*Sr31+*
139.	MP3336(C)	MS	R	R	R	R	R	R	R	R	R	S	R	R	R	MR	R	MS	MR	R	R	R	*Sr11+2+*
140.	HI8498(C)	S	R	MR	MR	R	S	R	R	R	R	S	S	R	R	MS	MS	S	S	R	MR	R	*Sr11+2+*
141.	HI8759(C)	MS	R	R	MR	R	MS	R	R	R	R	R	S	R	MR	R	MR	R	MR	R	R	R	*Sr11+2+*
142.	HI8846	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr30+*
143.	HI8847	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	MR	R	*Sr2*+R
144.	HD2733(C)	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr31+2+*
145.	HD3411*	S	MS	S	MR	S	R	R	S	MR	S	S	R	R	R	MR	MR	R	S	S	R	R	*Sr7b+*
146.	HD3440	S	S	MR	S	S	S	R	MS	S	S	MS	S	S	S	MR	S	MR	S	S	S	S	*Sr7b+*
147.	HD3406*	S	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	S	R	R	MS	*Sr13+*
148.	HD3436	R	R	MS	R	R	R	R	S	R	R	S	R	R	R	R	R	R	R	R	MR	R	*Sr8b+9b+9e+*
149.	HD3437	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr30+*
150.	PBW175(C)	MS	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	S	R	R	R	*Sr7a+2+*
151.	PBW677(C)	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	S	R	R	R	*Sr9b+11+2+*
152.	PBW901	S	MR	S	R	R	R	R	MS	R	S	R	R	R	R	MR	R	R	S	MR	R	S	*Sr9b+7b+2+*
153.	PBW902	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr2+R*

* Different seed lot to that of previous cropping season, - Gene not postulated, *R* resistant to all pathotypes

Annexure 2: Seedling response of AVT lines against the pathotypes of *Puccinia triticina* (brown rust) during 2021-22 at ICAR-IIWBR, RS, Shimla

S. No.	Variety/line	Pathotype																							*Lr*-gene
		11	12–2	12–3	12–5	12–7	16–1	77	77–1	77–2	77–5	77–7	77–8	77–9	77–10	77A–1	104–1	104–2	104–4	106	107–1	108–1	162A	162–1	
1	VL2041	R	R	R	S	S	R	S	S	S	S	R	R	S	NG	S	NG	S	S	R	R	R	R	S	*Lr13+*
2	VL2043	R	R	R	R	MS	R	R	MS	MS	S	R	MS	S	S	S	R	R	S	R	R	R	R	NG	*Lr13+*
3	VL2044	R	R	R	S	S	R	S	R	S	S	R	R	S	S	S	S	S	R	R	R	R	R	MS	*Lr13+3+*
4	HD3402	R	S	R	S	S	R	S	S	S	S	S	R	S	S	S	S	S	S	R	S	R	R	S	*Lr13+*
5	HPW481	R	NG	R	S	MR	R	S	S	S	S	R	MS	S	S	S	S	S	R	R	R	R	R	MS	*Lr13+3+*
6	HPW487	R	R	R	R	R	R	R	R	R	S	S	R	R	R	R	R	S	S	R	R	R	R	R	*Lr26+23+1+*
7	HPW488	R	R	R	S	S	R	S	S	S	S	S	R	S	S	S	S	S	R	R	R	R	R	R	*Lr13+3+*
8	HS692	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr26+R*
9	HS693	R	S	S	S	S	R	R	S	S	S	S	R	S	S	MR	S	S	S	R	R	R	R	S	*Lr13+*
10	HS694	R	R	R	R	S	R	S	S	S	S	R	R	S	S	S	MS	R	R	R	R	R	R	R	*Lr13+3+*
11	UP3114	R	S	R	S	S	R	S	S	S	S	S	S	S	S	S	S	S	R	R	R	R	R	R	*Lr3+*
12	VL3028	R	R	R	R	R	R	R	S	R	S	R	R	MS	S	S	R	R	R	NG	R	R	R	R	*Lr13+1+*
13	VL3029	R	R	R	R	R	R	S	S	S	S	S	R	S	S	S	R	R	MS	R	R	R	MS	R	*Lr13+*
14	VL3030	R	R	R	R	R	R	MS	S	R	S	R	R	S	MS	S	R	R	R	R	R	R	R	R	*Lr13+1+*
15	HPW483	NG	R	R	R	S	R	R	S	R	S	S	R	MS	R	R	NG	S	R	R	R	R	R	R	*Lr26+10+*
16	HPW484	R	R	R	R	R	R	MS	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	*Lr13+1+*
17	HPW485	R	R	R	S	S	R	R	S	S	S	R	S	S	R	MS	S	S	S	R	R	R	R	R	*Lr13+*
18	HPW486	R	R	R	R	S	R	R	S	R	S	S	R	R	R	R	R	R	MS	R	R	R	R	R	*Lr26+10+*
19	HS688	R	R	R	R	S	R	R	R	S	S	MS	R	S	S	R	R	R	R	R	R	R	R	R	*Lr23+10+*
20	HS689	R	R	R	R	R	R	S	S	S	S	MS	R	S	S	S	R	MS	S	R	R	R	R	R	*Lr13+1+*
21	HS690	R	S	S	S	S	MS	S	S	S	S	S	R	S	S	M	S	S	S	R	R	R	MS	S	-
22	HS691	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
23	SKW362	R	R	R	R	R	R	MS	S	MS	S	MS	R	S	S	S	R	R	R	R	R	R	R	R	*Lr13+1+*
24	UP3113	R	R	R	R	R	R	R	S	R	S	R	NG	S	R	R	R	R	MS	R	R	R	R	R	*Lr13+1+*
25	VL2047	R	R	R	R	MS	R	R	S	R	MR	R	NG	MS	R	R	R	R	R	R	R	R	R	NG	*Lr13+10+*
26	VL2048	R	R	R	R	S	R	R	S	MS	S	R	MS	S	MS	MS	R	MS	S	R	R	R	R	R	*Lr13+10+*
27	VL2049	R	R	R	R	R	R	S	S	S	S	MS	MS	S	S	S	R	R	R	R	R	R	R	R	*Lr13+1+*
28	VL2050	R	R	S	R	S	R	S	MS	R	S	R	R	S	S	MS	NG	MS	S	R	R	R	MS	S	*Lr13+10+*
29	HS507(C)	R	R	R	R	R	R	R	S	R	S	MS	R	R	R	R	R	MS	S	R	R	R	R	R	*Lr26+1+*
30	HS562(C)	R	R	R	R	S	R	R	R	S	S	S	R	S	S	R	S	S	R	R	R	R	R	R	*Lr23+10+3+*
31	HS490(C)	R	R	R	R	R	R	R	R	S	S	R	R	S	S	R	R	S	S	R	R	R	R	R	*Lr23+*
32	HPW349(C)	R	R	R	MS	S	R	MS	S	S	S	S	R	S	S	R	S	S	S	R	R	R	R	R	*Lr13+10+*
33	VL907(C)	R	R	R	R	S	R	R	S	R	S	R	R	R	R	R	R	MS	S	R	R	R	R	S	*Lr26+10+*
34	VL892(C)	R	R	R	R	S	R	R	S	S	S	S	R	S	S	R	R	MS	M	R	R	R	R	R	*Lr13+10+*
35	DBW377	R	R	R	R	R	R	R	R	R	R	R	R	MS	MS	R	R	R	R	R	R	R	R	R	*Lr23+1+*
36	PBW870	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
37	DBW372	R	R	R	R	MS	R	R	S	MS	R	R	R	S	S	R	R	MR	R	R	R	R	R	R	*Lr23+1+*
38	DBW318	R	S	R	S	S	R	S	S	S	S	R	R	S	S	R	R	S	S	R	R	R	R	R	*Lr 23+*
39	DBW327 (C)	R	R	R	R	R	R	R	R	R	S	S	R	S	MS	R	R	R	S	R	R	R	R	R	*Lr23+1+*
40	DBW332(C)	R	R	R	R	R	R	MS	MS	S	S	R	R	S	R	S	R	R	R	R	R	R	R	R	*Lr13+1+*

41	DBW370	R	R	R	R	R	R	MS	S	R	S	S	R	S	S	S	R	R	R	R	R	R	R	R	*Lr13+1+*
42	DBW371	R	R	R	R	R	R	R	R	R	S	R	R	S	S	R	R	R	R	R	R	R	R	R	*Lr23+1+*
43	DBW373	R	R	R	R	R	R	S	S	MS	S	R	MS	S	S	S	R	R	R	R	R	R	R	R	*Lr13+1+*
44	PBW868	R	R	R	R	R	R	R	S	R	S	R	R	S	S	R	R	R	S	R	R	R	R	M	*Lr13+10+*
45	PBW871	R	R	R	R	R	R	MS	S	R	S	S	MS	S	R	S	R	R	R	R	R	R	R	R	*Lr13+1+*
46	PBW872	R	R	R	R	MS	R	R	R	S	S	R	R	S	R	R	R	R	S	R	R	R	R	R	*Lr23+10+*
47	HD3090(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr26+R*
48	HI1633(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr26+R*
49	RAJ4083(C)	R	S	R	R	S	R	R	S	S	S	S	R	S	S	MS	MS	S	S	R	R	R	R	R	*Lr13+*
50	DBW320#*	R	R	R	R	R	R	R	S	R	S	S	R	S	S	R	R	R	R	R	R	R	R	R	*Lr10+1+*
51	MP1380#	R	R	R	R	R	R	R	MS	MS	R	R	R	S	S	S	R	R	S	R	R	R	R	R	*Lr13+*
52	DBW407[B]	R	R	R	R	S	R	S	S	S	S	M	MS	S	S	S	R	S	S	R	R	R	R	R	*Lr13+*
53	DDW48(d)(C)	NG	R	R	MX	MX	R	R	R	R	R	R	R	S	S	R	R	S	S	R	R	R	NG	R	*Lr23+*
54	HI8826(d)*	S	S	S	S	S	S	R	R	R	R	R	R	R	R	R	S	S	S	R	R	R	R	R	-
55	MACS4100(d)*	MS	R	R	R	R	R	R	R	R	MS	R	R	R	R	MS	MR	R	R	R	S	R	R	R	-
56	MP1378	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr26+10+*
57	MP3552	R	R	R	R	R	R	S	S	MS	S	R	MS	S	S	S	R	R	R	R	R	R	MX	R	*Lr13+1+*
58	UAS3015	R	R	R	R	S	R	R	R	S	S	MS	R	S	S	R	S	S	S	R	R	R	R	R	*Lr23+10+*
59	HI8839(d)	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-
60	HI8840(d)	S	MS	S	S	S	S	R	R	R	R	R	R	S	MR	R	S	S	S	R	R	R	S	S	-
61	MP1358(I)(C)	NG	R	R	R	R	R	R	MR	R	R	R	R	S	R	S	R	R	S	R	R	R	R	R	*Lr23+10+*
62	NIAW3922	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr26+R*
63	NIDW1149(d)(C)	NG	NG	MS	NG	MS	NG	NG	R	R	R	NG	R	MS	NG	R	R	NG	S	NG	R	R	R	R	*Lr23+10+*
64	UAS478(d)	R	R	R	S	S	R	R	R	R	R	R	R	S	MS	R	S	S	S	R	R	R	R	R	*Lr23+*
65	DBW352#	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
66	GW513(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr24+R*
67	GW547[B]	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
68	HI1636(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr24+R*
69	HI1650*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr26+R*
70	MACS6768*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr26+R*
71	MP3535*	R	R	R	R	S	R	R	S	S	S	S	R	S	S	R	S	S	R	R	R	R	R	R	*Lr13+10+3+**
72	NWS2194#	R	R	R	R	R	R	R	S	MS	S	S	MS	S	S	R	R	R	R	R	R	R	R	R	*Lr13+1+*
73	HI1665	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
74	NIAW4028	S	R	S	R	S	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	-
75	CG1036*	S	R	R	R	S	R	R	R	R	R	R	R	R	R	R	NG	R	R	R	R	R	R	R	-
76	CG1040	R	S	R	R	S	R	S	S	MS	S	MS	R	S	S	S	NG	S	S	R	R	R	R	R	*Lr13+*
77	DDW47(d)(C)	R	R	R	R	S	R	NG	R	R	R	R	R	S	S	MS	R	S	S	R	R	R	R	R	*Lr13+10+**
78	DDW55(d)[Q]*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	NG	R	R	R	R	R	R	R	*R*
79	GW532	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
80	HD3401	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	*Lr23+10+*
81	HI1655[Q]*	R	R	S	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-*
82	HI1666	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
83	HI8823(d)(I)(C)	R	R	R	S	S	S	R	R	R	R	R	R	S	MS	R	S	S	S	R	R	R	R	S	-
84	HI8830(d)*	R	MS	R	S	S	S	R	R	R	R	R	R	MS	R	R	S	S	S	R	R	R	R	R	-
85	MACS6795	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
86	MP1377	S	R	R	R	R	R	R	R	R	R	R	R	S	S	S	R	R	MS	R	R	R	R	R	-

87	MP3288(C)	R	R	R	R	R	R	R	MS	R	S	R	R	R	R	R	R	R	S	R	R	R	R	R	-*
88	UAS3019	R	R	R	S	MS	R	R	S	MR	S	R	R	S	S	S	R	MS	S	R	R	R	R	R	*Lr13+*
89	DBW316#*	R	R	R	R	S	R	R	S	S	S	S	R	S	S	S	R	S	S	R	R	R	R	S	*Lr13+10+3+**
90	HD3118(C)	R	MS	R	S	S	R	S	S	S	S	S	S	S	S	S	S	S	S	S	R	MR	M	R	MS	-
91	HD3392	R	R	R	MS	S	R	S	S	R	S	S	R	S	S	S	R	R	R	R	MS	R	R	S	*Lr13+*
92	HI1621(C)	R	R	R	S	S	R	S	S	S	S	MS	S	S	S	S	R	S	S	R	R	R	R	R	*Lr13+*
93	PBW833*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
94	PBW835^{Q}*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
95	HD3249(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**
96	PBW826#*	R	R	R	R	R	R	R	R	R	S	R	R	S	MS	R	R	R	R	R	R	R	R	R	*Lr23+*
97	HD3388	R	R	R	R	R	R	R	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr23+1+*
98	PBW852	R	R	R	R	R	R	R	R	S	S	R	R	S	MS	R	R	R	S	R	R	R	R	R	*Lr23+1+*
99	DBW252(C)	R	R	R	R	R	R	R	MS	R	S	R	R	S	MS	R	R	R	S	R	R	R	R	R	*Lr13+10+*
100	HD3171(C)	R	MS	R	R	S	R	R	R	S	S	S	R	S	S	R	R	S	S	R	NG	R	R	MS	*Lr23+13+10+*
101	HD3293(C)	R	R	R	R	S	R	R	MS	R	R	MR	R	S	S	S	R	MS	S	R	R	R	R	R	*Lr13+10+*
102	DBW353	R	R	R	R	R	R	S	S	R	S	R	R	S	MS	S	R	R	R	R	R	R	R	R	*Lr13+*
103	JKW261(I)(C)	R	R	R	S	S	R	R	R	R	R	R	R	S	MS	R	S	MS	S	R	R	R	R	R	*Lr23+13+*
104	PBW771(C)	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	*Lr26+23+1+*
105	WH1124(C)	R	R	R	R	S	R	R	S	S	S	S	R	S	S	R	S	S	R	R	R	R	R	MS	*Lr13+10+3+*
106	HD2967(C)	R	R	R	R	MS	R	R	R	R	S	S	R	S	S	R	R	R	S	R	R	R	R	R	*Lr23+*
107	HD3386	R	R	R	R	MS	R	R	MS	MS	S	R	R	S	MS	R	R	R	S	R	R	R	R	R	*Lr13+10+*
108	DBW359	R	R	R	S	S	R	S	S	MS	S	MS	S	S	S	S	S	S	R	R	R	R	MR	S	-
109	DBW358	R	R	R	S	MR	R	S	S	S	S	S	S	S	S	S	R	S	S	R	R	R	R	R	-
110	NIAW3170(C)	R	R	R	R	S	R	R	R	S	S	S	R	S	MR	R	R	R	S	R	R	R	R	R	*Lr13+10+*
111	HD3043(C)	R	R	R	R	S	R	R	S	R	S	S	R	S	R	R	R	S	S	R	R	R	R	S	*Lr26+10+*
112	HD3369*	S	S	R	S	S	R	S	R	S	S	S	R	S	R	S	S	S	S	R	R	R	R	R	*Lr13+*
113	HD3397	R	R	R	S	R	R	S	S	S	S	S	MS	S	S	S	R	R	R	R	R	R	R	R	*Lr13+*
114	HD3400	R	R	R	R	MS	R	R	R	MS	S	S	R	S	R	R	R	S	R	R	R	R	R	R	*Lr23+10+*
115	HD3418	R	R	R	R	R	R	MS	R	S	R	M	R	R	R	R	R	R	R	R	R	R	R	R	*Lr13+1+*
116	HI1628(C)	R	MS	R	R	S	R	S	S	S	S	S	S	S	S	S	R	S	S	R	R	R	R	R	*Lr13+10*
117	HI1653*	R	R	R	R	R	R	R	S	MS	S	R	S	S	S	S	R	R	R	R	R	R	R	S	*Lr13+3+*
118	HI1654*	R	R	R	M	M	R	S	S	S	S	MS	S	S	S	S	R	MS	S	R	R	R	R	R	*Lr13+*
119	HUW838(I)(C)	R	R	S	R	R	R	MS	S	S	S	R	R	S	MS	S	R	R	R	R	R	R	R	R	*Lr13+10+3+*
120	UP3090	R	R	R	R	R	R	R	R	R	R	R	R	S	MS	R	R	R	R	R	R	R	R	R	*Lr23+10+*
121	WH1402	R	S	R	R	R	R	S	S	S	S	R	R	R	R	S	R	S	S	R	R	R	R	R	*Lr13+*
122	WH1403	R	MS	R	R	R	R	S	S	S	S	MS	R	R	R	S	S	S	S	R	R	R	R	R	*Lr13+*
123	DBW365	R	R	R	R	S	R	R	R	R	R	R	R	S	R	R	S	S	S	R	R	R	R	S	*Lr13+10+*
124	DBW366	R	R	R	R	S	R	R	R	R	R	R	R	S	MS	R	R	MS	R	R	R	R	R	S	-*
125	DBW402	R	R	R	R	R	R	S	S	MS	S	S	R	S	S	MR	R	R	R	R	R	R	R	R	*Lr13+1+*
126	HD3415	R	S	MX	R	S	R	MX	S	MX	S	S	R	S	R	R	R	S	S	R	R	R	R	R	*Lr13+10+*
127	Kharchia65(C)	S	S	S	S	S	R	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	-
128	KRL19(C)	R	R	R	S	S	R	MS	S	R	S	S	R	S	MS	S	S	S	S	R	R	R	MS	R	*Lr13+*
129	KRL2006	R	R	R	R	R	R	R	R	MR	R	R	R	S	S	R	R	R	R	R	R	R	R	R	-
130	UAS310	R	R	R	R	S	R	R	S	S	S	R	R	S	MS	R	S	S	S	R	R	R	R	R	*Lr13+10+*
131	KRL2021	R	R	R	R	R	R	R	S	S	S	S	MS	S	MS	MR	R	R	R	R	R	R	R	R	*Lr13+1+*
132	KRL210(C)	R	R	R	R	S	R	R	S	S	S	S	R	S	S	MR	R	S	R	R	R	R	R	S	*Lr23+*

133	RAJ4565	R	R	R	R	R	R	R	R	R	R	S	R	S	MR	R	R	R	R	R	R	R	R	R	-
134	HD3438	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
135	HD3439	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
136	CG1029(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr24+R*
137	HD3407*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
138	HI1634(C)	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	*Lr26+R*
139	MP3336(C)	R	S	S	MR	S	MX	R	MS	S	S	S	R	S	MS	S	S	S	S	R	MR	R	R	MR	*Lr13+*
140	HI8498(C)	MR	R	MR	MR	S	S	R	R	R	R	R	R	MS	R	R	MS	R	MS	R	R	R	R	MS	*Lr23+*
141	HI8759(C)	S	MR	R	S	S	S	R	R	R	R	R	R	MR	R	R	S	S	S	R	R	R	R	R	-
142	HI8846	MR	R	R	MR	S	S	NG	R	R	R	R	R	S	R	R	R	R	R	NG	R	R	R	MS	-
143	HI8847	MR	R	MR	MS	S	S	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	MS	-
144	HD2733(C)	R	R	S	S	S	R	R	S	R	S	R	R	S	R	R	R	S	S	R	R	R	R	S	*Lr26+34+*
145	HD3411*	R	S	S	S	S	R	S	S	S	S	S	S	S	S	R	MX	S	S	R	R	S	MR	S	*Lr13+*
146	HD3440	R	R	R	MR	R	R	R	S	R	MR	R	S	MS	R	R	R	R	R	R	R	R	NG	R	-
147	HD3406*	R	R	R	MR	R	R	R	R	R	MR	R	R	S	S	R	R	R	R	R	R	R	R	R	*Lr23+10+1+*
148	HD3436	R	MS	MR	S	S	R	MX	R	S	S	R	R	S	S	R	S	S	S	R	R	R	MR	MR	*Lr23+*
149	HD3437	R	R	R	R	S	R	R	S	MS	S	R	R	S	S	R	R	S	S	R	R	R	R	S	*Lr13+10+*
150	PBW175(C)	R	R	R	R	R	R	S	R	R	S	S	R	S	S	R	MS	S	S	R	R	MR	R	R	*Lr23+34+*
151	PBW677(C)	R	R	R	R	R	R	R	S	S	S	S	R	S	MS	R	R	R	S	R	R	R	R	R	*Lr23+1+*
152	PBW901	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
153	PBW902	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*

* Different seed lot to that of previous cropping season, - Gene not postulated, *R* resistant to all pathotypes

Annexure 3: Seedling response of AVT lines against the pathotypes of *Puccinia striiformis* f. sp. *tritici* (yellow rust) during 2021-22 at ICAR-IIWBR, RS, Shimla

S. No.	Variety/line	Pathotype															*Yr*-gene
		46S119	110S119	238S119	78S84	110S84	P (46S103)	T (47S103)	111S68	79S68	79S4	K (47S102)	I (38S102)	6S0	7S0	N (46S102)	
1.	VL2041	S	S	S	R	MS	R	R	R	R	NG	R	R	R	R	R	*Yr2+*
2.	VL2043	S	S	S	R	S	R	S	R	R	R	S	S	R	R	R	*Yr2+*
3.	VL2044	S	S	MS	R	S	MS	S	R	R	R	S	S	R	R	S	*Yr2+*
4.	HD3402	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
5.	HPW481	MS	MS	S	R	MS	R	R	R	R	R	MR	MS	R	R	R	*Yr2+*
6.	HPW487	R	R	S	MS	MS	R	R	R	R	R	R	R	R	R	R	*Yr9+*
7.	HPW488	S	S	S	S	S	S	S	R	R	R	S	S	S	S	S	-
8.	HS692	R	MS	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
9.	HS693	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	-
10.	HS694	R	R	R	R	R	NG	R	R	R	NG	R	R	R	R	R	*R*
11.	UP3114	S	S	S	S	S	R	S	R	R	R	S	S	MS	R	S	-
12.	VL3028	S	MS	S	R	MS	R	S	R	R	R	S	R	R	R	R	*Yr2+*
13.	VL3029	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	-
14.	VL3030	S	S	S	S	MS	S	MS	R	R	R	S	MR	R	R	MS	*Yr2+*
15.	HPW483	MS	S	S	R	R	R	R	R	R	NG	R	R	R	R	R	*Yr9+*
16.	HPW484	S	S	S	MS	MS	MR	R	R	R	R	MS	R	R	R	R	*Yr2+*
17.	HPW485	MS	S	MS	R	R	R	MS	R	R	R	R	MR	R	R	R	*YrA+*
18.	HPW486	S	S	S	R	MS	R	R	R	R	R	R	R	R	R	R	*Yr9+*
19.	HS688	S	S	S	R	MR	MS	R	R	R	R	R	MR	R	R	R	*Yr2+*
20.	HS689	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	-
21.	HS690	S	S	S	R	R	R	R	R	R	R	S	R	R	R	R	*YrA+*
22.	HS691	R	S	R	R	MR	R	R	R	R	R	MS	R	R	R	R	-
23.	SKW362	S	S	S	S	MS	R	R	R	R	R	S	R	R	R	R	*Yr2+*
24.	UP3113	R	S	S	R	R	R	R	R	R	R	S	R	R	R	R	-
25.	VL2047	MS	S	S	R	S	S	MS	R	R	R	R	R	R	R	S	*Yr2+*

26.	VL2048	MS	MS	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr2+*
27.	VL2049	R	MR	MS	R	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
28.	VL2050	MS	MS	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
29.	HS507(C)	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
30.	HS562(C)	S	S	S	R	R	R	S	R	R	R	R	S	R	R	S	*YrA+*
31.	HS490(C)	MS	S	S	R	MS	R	R	R	R	R	R	R	R	R	R	*Yr2+*
32.	HPW349(C)	S	S	S	MS	S	S	S	R	R	R	R	S	R	R	S	*Yr2+*
33.	VL907(C)	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
34.	VL892(C)	S	S	S	S	MS	R	R	R	MS	R	MS	R	R	R	MR	*Yr2+*
35.	DBW377	R	S	S	R	R	S	R	S	R	R	MR	R	R	R	R	*Yr2+*
36.	PBW870	R	S	S	MS	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
37.	DBW372	S	S	S	MS	MS	R	S	S	MS	R	S	R	R	R	S	*Yr2+*
38.	DBW318	S	S	S	MS	MS	R	R	R	R	R	R	R	R	R	R	*Yr2+*
39.	DBW327 (C)	S	S	S	R	MS	R	MS	R	R	R	R	R	R	R	R	*Yr2+*
40.	DBW332(C)	S	S	S	MS	MS	R	MS	R	R	R	R	R	R	R	R	*Yr2+*
41.	DBW370	S	S	S	MS	MS	R	S	R	R	R	MS	R	MS	R	R	*Yr2+*
42.	DBW371	S	S	S	R	MS	R	MS	R	R	NG	MS	R	R	R	MS	*Yr2+*
43.	DBW373	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
44.	PBW868	S	S	S	R	S	R	MS	R	R	R	R	R	R	R	R	*Yr2+*
45.	PBW871	S	S	S	S	S	R	MS	R	R	R	R	R	R	R	MS	*Yr2+*
46.	PBW872	S	S	S	R	MS	R	MS	R	R	R	R	R	R	R	R	*Yr2+*
47.	HD3090(C)	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr9+*
48.	HI1633(C)	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr9+*
49.	RAJ4083(C)	S	S	S	S	S	S	MS	R	R	R	R	MR	R	R	R	*Yr2+*
50.	DBW320#*	S	S	S	R	MS	S	S	R	R	MS	S	S	R	R	S	*Yr2+*
51.	MP1380#	R	S	S	R	MS	R	R	R	R	R	R	R	R	R	R	-
52.	DBW407[B]	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
53.	DDW48(d)(C)	S	S	S	S	MS	R	MS	R	R	MS	S	R	S	R	R	-
54.	HI8826(d)*	S	S	S	S	S	S	MS	R	R	R	MR	NG	MS	S	R	-
55.	MACS4100(d)*	S	S	S	S	S	S	S	S	S	S	S	NG	S	S	S	-
56.	MP1378	S	S	S	S	S	R	R	R	R	R	R	NG	R	R	R	*Yr9+*
57.	MP3552	S	MS	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr2+*
58.	UAS3015	S	S	S	R	S	R	S	R	R	R	S	S	R	R	S	*Yr2+*
59.	HI8839(d)	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	-

60.	HI8840(d)	S	S	S	MS	MS	S	MS	R	R	NG	R	NG	R	R	R	*Yr2+*
61.	MP1358(I)(C)	MS	S	S	R	S	R	MS	R	R	R	MS	NG	R	R	R	*Yr2+*
62.	NIAW3922	S	S	S	R	S	R	R	R	R	R	R	R	R	R	R	*Yr9+*
63.	NIDW1149(d)(C)	MS	R	S	R	NG	S	MS	S	MR	NG	S	NG	R	R	S	*Yr2+*
64.	UAS478(d)	S	S	S	S	R	S	R	R	R	R	R	MS	MS	S	R	-
65.	DBW352#	S	S	S	S	S	S	S	S	S	MR	S	S	R	R	S	*Yr2+*
66.	GW513(I)(C)	S	S	S	S	S	MS	R	S	MS	S	R	MS	R	R	MR	*Yr2+*
67.	GW547^{B}	S	S	S	S	S	S	S	S	S	R	S	MS	R	R	S	*Yr2+*
68.	HI1636(I)(C)	S	S	S	S	S	S	S	MS	MS	R	S	S	MS	MS	S	-
69.	HI1650*	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr9+*
70.	MACS6768*	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr9+*
71.	MP3535*	S	S	S	R	R	R	S	R	R	R	S	MS	R	R	R	*Yr2+*
72.	NWS2194#	S	S	S	MS	S	R	MS	MR	R	R	MS	MS	MR	R	R	-
73.	HI1665	S	S	S	S	S	R	MS	S	R	S	R	S	S	R	R	-
74.	NIAW4028	S	S	S	R	S	R	R	R	R	R	R	R	S	R	R	-
75.	CG1036*	S	S	S	S	S	NG	S	S	S	NG	S	S	S	MS	MS	-
76.	CG1040	S	S	S	S	S	R	S	S	R	R	S	S	S	R	S	-
77.	DDW47(d)(C)	R	S	S	MS	S	R	S	R	R	R	R	R	R	R	R	*Yr2+*
78.	DDW55(d)^{Q}*	S	S	S	S	S	S	S	R	S	S	S	S	MS	S	S	-
79.	GW532	S	S	S	S	S	S	S	S	MS	MS	S	S	MS	R	S	-
80.	HD3401	R	S	S	S	S	S	S	S	S	R	S	S	R	S	S	-
81.	HI1655^{Q}*	S	S	S	S	S	S	S	S	S	S	S	S	R	S	S	-
82.	HI1666	S	S	S	S	S	S	S	S	S	MS	S	S	MS	MR	S	-
83.	HI8823(d)(I)(C)	S	S	S	MS	S	S	MS	S	MS	R	S	MR	R	S	R	-
84.	HI8830(d)*	S	S	S	MR	R	R	MR	R	MS	R	R	R	MS	S	R	-
85.	MACS6795	S	S	S	S	S	R	S	S	S	S	S	S	S	S	S	-
86.	MP1377	S	S	S	S	S	MS	R	S	MR	R	MS	R	R	MR	MS	-
87.	MP3288(C)	S	S	S	R	S	S	S	MS	R	R	R	S	S	MS	S	-
88.	UAS3019	S	S	S	MS	S	R	S	S	R	R	S	S	R	R	R	*Yr2+*
89.	DBW316#*	MS	S	S	R	MS	R	S	R	R	R	S	MS	MS	R	S	*
90.	HD3118(C)	S	S	S	MR	MS	R	S	R	MS	R	S	S	R	R	S	*Yr2+*
91.	HD3392	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
92.	HI1621(C)	S	S	S	MS	MS	R	S	S	MS	R	S	S	R	R	S	*Yr2+*
93.	PBW833*	MS	S	S	R	MR	R	R	MR	R	R	R	R	R	R	R	*Yr2+*

94.	PBW835^{Q}*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
95.	HD3249(C)	S	S	S	R	R	R	R	R	R	R	R	MR	S	S	R	-
96.	PBW826#*	S	S	S	S	S	R	S	R	R	R	R	MS	R	R	R	*Yr2+*
97.	HD3388	S	MS	S	R	R	R	S	R	R	R	R	R	R	R	R	*YrA+*
98.	PBW852	S	S	S	MS	S	R	MS	R	R	R	MR	S	MS	R	R	-
99.	DBW252(C)	S	S	S	R	MS	R	R	R	R	R	R	R	R	R	R	*Yr2+*
100.	HD3171(C)	R	MS	S	R	MS	R	S	R	R	R	R	R	R	R	R	*Yr2+*
101.	HD3293(C)	S	S	S	R	S	R	MR	R	R	R	R	S	R	R	R	*Yr2+*
102.	DBW353	S	S	S	R	S	MS	S	S	R	R	S	MS	R	R	MS	-
103.	JKW261(I)(C)	S	S	S	MS	S	S	S	R	R	R	MS	S	S	MR	R	-
104.	PBW771(C)	R	MS	S	R	MS	R	R	R	R	R	R	R	R	R	R	*Yr9+*
105.	WH1124(C)	MS	S	S	R	MS	R	S	R	R	R	S	S	R	R	S	*Yr2+*
106.	HD2967(C)	S	S	S	MS	S	R	S	R	R	R	S	S	R	R	S	*Yr2+*
107.	HD3386	S	S	S	R	S	S	MS	R	R	R	MS	MS	R	R	R	*Yr2+*
108.	DBW359	S	S	S	R	S	MS	MR	R	R	R	R	MS	R	R	R	*Yr2+*
109.	DBW358	S	S	S	R	S	R	S	R	R	R	MS	S	R	R	S	*Yr2+*
110.	NIAW3170(C)	S	S	S	S	S	S	S	R	MS	R	S	S	MS	R	S	-
111.	HD3043(C)	R	MS	MS	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+A+*
112.	HD3369*	S	S	S	R	MS	S	S	S	R	R	S	S	MS	R	S	-
113.	HD3397	S	S	S	R	MS	R	R	R	R	R	R	MR	R	R	R	*Yr2+*
114.	HD3400	S	S	S	R	S	R	MS	R	R	R	R	R	R	R	R	-
115.	HD3418	MS	MS	MS	R	R	R	R	R	R	NG	R	R	R	R	MS	*Yr2+*
116.	HI1628(C)	S	S	S	MR	S	R	S	R	R	R	S	S	R	R	S	*Yr2+*
117.	HI1653*	S	S	S	R	MS	R	S	R	R	R	S	MS	R	R	S	*Yr2+*
118.	HI1654*	S	S	S	R	S	R	MS	R	MS	R	S	S	R	R	S	*Yr2+*
119.	HUW838(I)(C)	S	S	S	R	MS	R	MS	R	MR	R	MS	MS	R	R	S	*Yr2+*
120.	UP3090	S	S	S	R	S	R	R	R	R	R	R	R	R	R	R	-
121.	WH1402	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
122.	WH1403	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
123.	DBW365	S	S	S	R	MS	R	S	R	R	R	S	S	R	R	S	*Yr2+*
124.	DBW366	S	S	S	S	MS	R	S	R	R	R	MS	MS	R	R	MS	*Yr2+*
125.	DBW402	S	S	S	R	S	R	S	R	R	R	S	MS	R	R	S	*Yr2+*
126.	HD3415	S	S	S	MS	S	S	S	R	R	R	MS	S	R	R	MS	*Yr2+*
127.	Kharchia65(C)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	-

128.	KRL19(C)	S	S	S	S	S	R	S	S	MS	MS	MS	S	S	S	R	-
129.	KRL2006	S	S	S	S	S	S	S	S	S	R	S	MS	R	MR	R	-
130.	UAS310	S	S	S	MS	S	MS	S	R	R	R	S	S	R	MS	S	-
131.	KRL2021	S	S	S	R	MS	R	R	R	R	R	R	R	R	R	R	*Yr2+*
132.	KRL210(C)	S	S	S	R	S	S	S	R	R	R	S	MS	R	R	S	*Yr2+*
133.	RAJ4565	S	S	S	S	S	S	S	S	MS	MS	S	S	S	S	R	-
134.	HD3438	S	S	S	S	S	R	S	S	S	S	S	MS	R	R	MS	-
135.	HD3439	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
136.	CG1029(C)	S	S	S	S	S	R	S	S	S	R	S	S	R	R	S	*Yr2+*
137.	HD3407*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
138.	HI1634(C)	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr9+*
139.	MP3336(C)	S	S	S	S	S	MS	S	MS	R	R	MS	MS	R	R	MS	*Yr2+*
140.	HI8498(C)	S	S	S	R	MR	S	S	R	R	R	R	NG	MS	S	R	-
141.	HI8759(C)	S	S	S	MS	S	MS	S	R	R	R	R	MR	MS	S	R	-
142.	HI8846	S	MS	MS	MS	R	S	MS	R	R	R	R	R	MS	S	R	-
143.	HI8847	S	S	MS	R	MS	R	MS	R	R	R	R	MR	MS	MS	R	-
144.	HD2733(C)	S	S	S	MS	S	R	R	R	R	R	R	R	R	R	R	*Yr9+18+*
145.	HD3411*	S	S	S	R	S	R	S	R	MS	R	S	R	R	R	R	*Yr2+*
146.	HD3440	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
147.	HD3406*	R	MR	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr2+*
148.	HD3436	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
149.	HD3437	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
150.	PBW175(C)	S	S	S	R	S	R	S	R	R	R	S	MR	R	R	S	*Yr2+18+*
151.	PBW677(C)	S	S	S	R	S	R	R	R	R	R	R	R	R	R	R	*Yr2+*
152.	PBW901	S	S	S	R	MR	R	R	R	R	R	S	R	R	R	R	*Yr2+*
153.	PBW902	R	S	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr2+*

* Different seed lot to that of previous cropping season, - Gene not postulated, *R* resistant to all pathotypes

Annexure 4: Seedling response of AVT lines against the pathotypes of *Puccinia graminis* f. sp. *tritici* (black rust) during 2021-22 at Mahabaleshwar

S. No.	Entry code	117-6	122	21A-2	117-5	117-4	117-2	42B	295	11A	21A-1	11	40A	34	117	24A
1	DBW377	R	R	R	R	R	S	S	S	R	R	R	R	S	R	R
2	PBW870	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
3	HD3090(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
4	HI1633(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
5	RAJ4083(C)	R	S	R	S	S	S	R	S	S	S	S	S	S	S	R
6	DBW320#*	R	S	R	S	S	S	S	R	S	S	S	R	S	S	R
7	MP1380#	R	NG	R	R	R	S	S	R	R	R	R	R	R	S	R
8	DBW407B	R	S	R	R	S	S	S	S	S	R	S	R	S	R	R
9	DDW48(d)(C)	R	S	R	R	R	R	R	R	R	R	R	R	S	R	R
10	HI8826(d)*	R	R	R	R	R	S	R	R	NG	R	R	R	S	R	R
11	MACS4100(d)*	R	S	R	S	S	S	S	S	S	R	S	S	S	S	R
12	MP1378	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R
13	MP3552	R	S	R	S	S	S	S	S	S	S	S	R	S	S	R
14	UAS3015	S	S	S	S	S	S	S	S	S	R	S	R	S	S	R
15	HI8839(d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
16	HI8840(d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
17	MP1358(I)(C)	R	R	R	R	R	NG	R	R	S	R	R	R	R	S	R
18	NIAW3922	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
19	NIDW1149(d)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
20	UAS478(d)	R	S	R	S	S	S	S	S	S	S	S	S	R	S	R
21	DBW352#	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
22	GW513(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
23	GW547B	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
24	HI1636(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
25	HI1650*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
26	MACS6768*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
27	MP3535*	R	S	R	S	S	S	R	R	S	R	R	R	S	S	R
28	NWS2194#	R	S	R	S	S	S	S	R	S	S	S	R	S	S	R
29	HI1665	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
30	NIAW4028	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
31	CG1036*	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R

32	CG1040	R	S	S	R	R	R	R	R	R	R	R	R	R	R	S
33	DDW47(d)(C)	R	S	R	R	R	R	R	R	NG	R	R	R	R	R	NG
34	DDW55(d)Q*	R	S	R	S	S	S	S	S	S	S	S	S	S	S	R
35	GW532	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R
36	HD3401	R	S	R	S	S	S	S	S	S	S	S	S	S	S	R
37	HI1655Q*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
38	HI1666	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
39	HI8823(d)(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
40	HI8830(d)*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
41	MACS6795	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
42	MP1377	R	S	R	R	R	R	S	S	S	S	R	R	S	S	R
43	MP3288(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
44	UAS3019	R	S	R	R	R	S	S	S	R	R	S	R	S	R	R
45	HD3438	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
46	HD3439	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
47	CG1029(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
48	HD3407*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
49	HI1634(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
50	MP3336(C)	R	R	R	S	S	S	S	R	R	R	R	R	S	R	R
51	HI8498(C)	R	S	R	R	S	S	S	S	R	S	R	R	S	R	R
52	HI8759(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
53	HI8846	S	R	R	R	S	S	S	S	S	R	R	R	R	R	R
54	HI8847	R	S	R	R	S	R	R	S	S	R	R	R	R	S	R
55	HI8713(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
56	HI8737(C)	R	R	R	R	S	S	S	S	R	R	R	R	R	R	R
57	MACS3949(C)	R	R	R	R	S	R	S	S	S	R	R	R	R	R	R
58	UAS428(C)	R	S	R	R	S	S	S	R	R	S	S	R	R	R	R
59	DDW59	R	S	R	R	S	R	R	S	S	S	R	R	R	R	R
60	DDW60	R	S	R	S	S	S	S	S	S	S	S	R	R	R	R
61	GW1360	R	R	R	R	R	R	S	S	S	S	S	R	S	R	R
62	GW1361	R	S	R	R	S	S	S	S	R	S	R	R	S	R	R
63	GW1363	R	R	R	R	R	R	R	S	R	R	R	R	S	R	R
64	GW1364	S	S	R	R	S	S	R	S	S	R	S	R	S	R	R
65	HI8841	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

66	HI8842	R	R	R	R	S	R	S	R	R	S	S	R	R	S	R
67	HI8843	S	R	R	R	R	R	R	R	R	R	S	R	R	R	R
68	MACS4120	R	S	R	S	S	NG	S	S	S	S	S	S	S	S	R
69	MACS4121	R	S	R	S	S	R	S	S	S	S	S	S	S	S	R
70	MACS4122	R	S	R	S	R	R	S	R	R	S	R	R	R	R	R
71	MPO1389	R	R	R	R	R	S	R	R	R	S	R	R	R	R	R
72	MPO1390	R	R	R	R	R	R	S	S	S	R	S	R	R	S	R
73	NIDW1485	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
74	PDW362	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
75	PDW363	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
76	PWU18	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
77	PWU19	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
78	UAS479	R	R	R	S	S	S	S	S	S	S	S	S	S	S	R
79	UAS480	R	R	R	R	S	S	S	R	S	S	S	R	S	R	R
80	AKDW4773	R	R	R	R	R	R	S	R	R	S	S	R	R	R	R

Annexure 5: Seedling response of AVT lines against the pathotypes of *Puccinia triticina* (brown rust) during 2021-22 at Mahabaleshwar

S. No.	Entry code	77-5	77-9	77-1	104-2	12-5	77-8	11	77-2	162A	77-3	12-2	104	12-3	77-4	104-1
1	DBW377	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R
2	PBW870	S	R	R	R	R	S	R	S	S	R	R	R	R	R	R
3	HD3090(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
4	HI1633(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
5	RAJ4083(C)	S	S	R	R	S	R	R	S	R	S	R	R	R	R	R
6	DBW320#*	S	R	S	R	R	R	R	R	R	S	R	R	R	R	R
7	MP1380#	S	R	R	R	NG	R	R	R	R	S	R	R	R	R	R
8	DBW407[B]	S	S	R	S	S	R	R	R	R	S	R	R	S	R	R
9	DDW48(d)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
10	HI8826(d)*	NG	R	R	R	S	R	R	R	R	R	R	S	R	R	R
11	MACS4100(d)*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
12	MP1378	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
13	MP3552	S	R	S	R	R	R	R	S	R	S	R	S	S	S	R
14	UAS3015	S	R	S	R	R	R	R	S	R	R	R	R	R	S	S
15	HI8839(d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
16	HI8840(d)	S	S	S	S	S	S	S	R	S	R	S	S	R	S	S
17	MP1358(I)(C)	S	R	R	S	R	R	R	R	R	R	R	R	R	S	R
18	NIAW3922	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
19	NIDW1149(d)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
20	UAS478(d)	S	R	R	R	S	R	R	R	R	R	S	S	R	R	S
21	DBW352#	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
22	GW513(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
23	GW547[B]	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
24	HI1636(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
25	HI1650*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
26	MACS6768*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
27	MP3535*	S	S	S	R	R	R	R	R	S	S	R	S	S	S	S
28	NWS2194#	S	R	S	R	R	R	R	R	R	S	R	R	S	R	R
29	HI1665	S	R	R	R	R	R	R	R	R	S	R	R	R	R	R
30	NIAW4028	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
31	CG1036*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
32	CG1040	S	S	S	R	R	S	R	S	R	S	S	S	R	R	S

33	DDW47(d)(C)	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R
34	DDW55(d)^{Q}*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
35	GW532	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
36	HD3401	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
37	HI1655^{Q}*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
38	HI1666	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
39	HI8823(d)(I)(C)	R	S	R	R	R	R	R	R	R	R	S	S	R	R	S
40	HI8830(d)*	S	R	R	R	R	R	R	R	R	R	S	S	R	S	R
41	MACS6795	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
42	MP1377	S	S	S	R	R	R	R	R	R	S	R	R	S	R	R
43	MP3288(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
44	UAS3019	S	S	S	S	R	R	R	R	R	S	R	S	S	S	S
45	HD3438	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
46	HD3439	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
47	CG1029(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
48	HD3407*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
49	HI1634(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
50	MP3336(C)	S	R	S	R	S	R	R	S	R	R	S	S	R	R	S
51	HI8498(C)	S	R	R	R	S	R	R	R	R	R	R	R	R	S	R
52	HI8759(C)	S	S	R	R	S	R	S	R	R	R	R	S	R	R	R
53	HI8846	S	R	R	S	S	R	S	R	R	R	R	R	R	R	R
54	HI8847	S	S	R	S	S	R	S	R	R	R	R	R	R	R	R
55	HI8713(C)	S	R	R	R	S	R	S	R	R	R	S	S	R	R	S
56	HI8737(C)	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R
57	MACS3949(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
58	UAS428(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
59	DDW59	S	S	R	R	R	S	R	S	R	S	R	R	S	S	R
60	DDW60	S	S	R	S	R	R	R	R	R	R	R	R	R	S	R
61	GW1360	S	S	R	R	R	R	S	R	R	R	R	R	R	R	R
62	GW1361	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R
63	GW1363	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
64	GW1364	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R
65	HI8841	R	R	S	NG	R	R	R	R	R	R	R	R	R	R	S
66	HI8842	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

67	HI8843	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
68	MACS4120	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
69	MACS4121	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
70	MACS4122	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
71	MPO1389	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
72	MPO1390	R	R	R	R	S	R	R	R	R	R	S	R	R	R	S
73	NIDW1485	R	S	R	R	R	R	R	R	R	R	S	R	R	R	R
74	PDW362	R	R	R	S	S	R	R	R	S	R	S	R	S	R	S
75	PDW363	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
76	PWU18	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
77	PWU19	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
78	UAS479	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R
79	UAS480	S	S	R	S	R	S	R	R	R	R	R	R	R	S	R
80	AKDW4773	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

Annexure 6: Disease response of IPPSN entries during 2021-22

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
RARI, Durgapura											
1	WR 2115	2	10MS	2.4	5MS	6.3	20S	11	40S	46	79
2	WR 2116	13.1	40S	10.4	20S	17.5	40S	32.6	60S	56	89
3	WR 2117	5.5	20MS	21.6	60S	20.0	40S	39.3	80S	46	89
4	WR 2118	12.6	50S	37.6	80S	11.3	40S	38.3	80S	46	68
5	WR 2119	1.9	10MS	3.3	10MS	10.0	20S	39	80S	46	68
6	WR 2120	6	40MR	9.2	20S	27.6	60S	0.8	5S	46	68
7	WR 2121	10.9	30S	17.6	40S	8.0	20S	3.1	10MS	46	78
8	WR 2122	10	50S	15.2	60S	11.3	40S	30.7	60S	57	89
9	WR 2123	32	70S	27.2	80S	12.5	40S	21.1	40S	57	79
10	WR 2124	1.3	5S	0.8	10MR	2.6	10S	24.1	60S	57	89
11	WR 2125	17.1	40S	0.9	10MR	6.3	20S	9.9	20S	46	89
12	WR 2126	16	40S	14.4	40MS	17.5	40S	9.9	40MS	56	89
13	WR 2127	20.3	50S	24	60S	31.3	60S	13	40MS	57	79
14	WR 2128	30	70S	48	80S	22.5	40S	33	60S	46	57
15	WR 2129	14	40S	4.6	10S	15.1	20S	31.1	60S	46	58
16	WR 2130	7.4	20MS	2.9	10MS	13.0	20S	12.9	40S	45	68
17	WR 2131	2.9	20MS	0	R	7.0	20S	4.3	20MS	46	79
18	WR 2132	14.4	50S	12	60S	1.1	5MS	16.5	40S	35	57
19	WR 2133	2.4	20MS	0.4	5MR	2.6	10S	25.3	60S	56	79
20	WR 2134	19	40S	12	60S	0.0	0	15.7	40S	56	77
20A	Infector	80	100S	80	100S	70.0	80S	71.4	80S	68	89
21	WR 2135	3.5	10MS	3.3	20MS	3.0	10MS	3.3	10MS	67	89
22	WR 2136	0.8	10MR	2.4	10MS	1.3	5S	18.9	60S	68	89
23	WR 2137	0.9	10MR	4.3	10MS	7.6	10S	11.7	40S	57	89
24	WR 2138	1.8	10MS	14.4	20S	26.3	60S	21	60S	57	99
25	WR 2139	2.9	20MS	18.8	20S	26.3	60S	16.9	60S	56	89
26	WR 2140	5.5	20S	7	30S	0.5	5MR	11.1	40S	45	79
27	WR 2141	2.5	20MS	0.6	5MR	20.0	40S	10.1	40S	56	68
28	WR 2142	0.7	5MR	0.2	5R	0.0	0	37.1	80S	57	79
29	WR 2143	3.5	10MS	0.5	5MR	2.5	10S	17.9	40S	57	89
30	WR 2144	11	40S	4	20MS	20.0	40S	29.1	60S	57	89
31	WR 2145	22.9	40S	10.8	20S	10.3	40S	16.1	40S	56	79
32	WR 2146	22.6	40S	13.6	40S	20.2	60S	10.3	20S	46	79
33	WR 2147	3.5	20MS	2.4	10MS	11.0	40S	24.7	60S	35	57
34	WR 2148	1.9	20MR	0	R	0.0	0	12.4	40S	46	68
35	WR 2149	0.3	TS	0	R	0.3	TS	32	60S	56	89
36	WR 2150	0.2	5R	0	R	5.0	20S	27	60S	46	89
37	WR 2151	6.4	20S	0.4	5MR	6.0	20S	10	20S	57	89
38	WR 2152	13	20S	0.4	5MR	7.3	20S	8.1	20S	56	89
39	WR 2153	10.3	20S	0.8	10MR	0.0	0	21.6	40S	56	79
40	WR 2154	24.6	70S	16.9	80S*	3.8	10S	14.6	40S	47	89
40A	Infector	81.4	100S	76	100S	70.0	100S	77.1	80S	78	89
MPUAT, Udaipur											
41	PWU 8	9.9	60S*	0.9	10MR	0.5	5MR	7	20S	46	89
42	PWU 9	1.2	10MS	1.7	20MR	1.0	10MR	7.2	20MS	56	79
43	PWU 11	4	20MS	3.3	20MS	1.0	10MR	39.7	80S	45	68
44	PWU 12	2.3	10S	0.9	5MS	10.5	5MR	10.2	40S	35	68
45	PWU 13	5.8	20MS	4.1	10MS	13.8	40S	34	60S	56	89
46	PWU 21	0.3	10R	0.8	5MR	0.0	0	43.3	60S	57	79
47	PWU 24	2.3	10MS	0.5	5MR	0.1	TR	6.3	20MS	47	69
48	PWU 37	2.9	10MS	0.9	10MR	5.0	20S	16.6	40S	46	58
49	PWU 39	1.2	10MS	6	20S	10.5	40S	7.6	20S	35	57
50	PWU 40	3.5	20MS	7.2	15MS	21.0	40S	10.3	20S	46	78
51	PWU 41	3.2	10S	10.9	20S	3.0	10S	10.7	20S	46	89

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
52	PWU 44	13.3	40MS	6	10S	5.5	10S	14.3	40S	47	68
NDUAT, Ayodhya											
53	NW-8053	1.9	5S	0.8	10MR	10.0	40S	19	40S	46	58
54	NW-8054	0.4	10R	1.3	5MS	5.1	20S	20.4	40S	46	57
55	NW-8055	20.1	40S	1.6	5MS	1.3	5S	12.3	40S	46	57
56	NW-8056	5	20S	2.4	10MS	0.0	0	21.4	40S	45	68
57	NW-8057	4.9	10S	3.6	10MS	7.3	20S	27.1	60S	45	68
58	NW-8058	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
59	NW-8059	5.6	20MS	2	10MS	2.5	10S	30.9	60S	35	57
60	NW-8060	6.3	20MS	1.6	10MS	0.1	TR	30.1	60S	45	78
60A	Infector	75.7	100S	76	100S	70.0	80S	71.4	80S	78	89
61	NW-8061	1.2	10MS	0	R	0.0	0	25.4	60S	35	56
62	NW-8062	2.1	10S	0	R	0.0	0	34	60S	35	68
63	NW-8063	5.7	20MS	1.6	5MS	0.0	0	29.7	40S	45	68
64	NW-8064	3.5	10MS	0	0	3.8	10S	35.9	60S	46	68
65	NW-8065	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
66	NW-8066	9	20S	0	R	2.5	10S	32.1	60S	34	57
67	NW-8067	7	20S	1.9	5S	0.0	0	27.9	40S	25	36
68	NW-8068	5.7	20MS	0.8	10MR	0.0	0	37.1	80S	46	89
69	NW-8069	6.9	20S	0.8	10MR	0.0	0	30	60S	46	58
70	NW-8070	4	20MS	0.8	10MR	1.0	5MS	22.3	40S	46	89
71	NW-8071	6.5	20S	0.4	5MR	2.6	10S	10.1	20S	46	79
72	NW-8072	20	40S	2.4	10MS	5.0	20S	11.3	20S	46	79
73	NW-8073	10.3	40MS	2.4	10MS	11.3	20S	9.9	40S	34	35
74	NW-8074	11.4	20MS	0	R	0.0	0	22.9	40S	35	56
75	NW-8075	5	20S	1.6	5MS	15.0	40S	13.4	40S	46	57
76	NW-8076	7.6	40MS	20	60S	25.0	60S	47.4	60S	56	67
77	NW-8077	13.7	40S	10.8	20S	20.0	60S	23.4	40S	57	78
JNKV, Sagar											
78	JWS- 920 (d)	4	40MR	2.8	10MS	2.8	10S	7.9	40S	67	78
79	JWS- 948	5.3	30S	15.2	40S	11.3	40S	31.4	60S	68	79
80	JWS-1013	8.9	50S*	14	60S*	22.5	40S	35.4	60S	57	68
80A	Infector	75.7	100S	80	100S	70.0	80S	77.1	80S	78	89
81	JWS-1027	3.5	20MS	16.4	40MS	27.5	60S	45.7	80S	57	89
82	JWS-1122	6.9	30MS	20	40S	45.0	60S	54.3	80S	57	79
83	JWS-1216	2.9	10MS	14.6	20S	15.0	20S	39.4	60S	57	78
84	JWS-1220	14.6	40S	12.2	20S	22.5	60S	50.9	80S	45	77
85	JWS-1226	10.6	40S	12.2	30MS	32.5	60S	53.7	80S	46	57
86	JWS-1318	6.6	30S	17	40S	32.5	60S	42.3	60S	35	37
87	JWS-1333	2.1	20MR	2.8	10S	10.0	20S	37.1	60S	34	56
88	JWS-1339	2.9	20MS	9.8	20S	15.0	20S	45.1	60S	25	46
BARC (SB), Mumbai											
89	TAW221	12.7	40S	3.2	10MS	5.3	20S	12.6	20S	56	78
90	TAW222	6.9	20S	4	20MS	15.0	40S	18.4	40S	57	68
91	TAW223	5.9	20S	2.4	10MS	4.0	20MS	16.3	40S	57	89
92	TAW224	10	30S	6.4	20MS	5.0	20S	14	20S	56	89
93	TAW225	6.6	20MS	0.9	10MR	0.1	TR	26.9	40S	57	89
94	TAW226	5.5	10MS	3.6	20MS	1.0	5MS	15	40S	57	79
95	TAW227	3.2	10MS	0.1	TMR	0.0	0	20.4	40S	46	78
96	TAW228	12	30S	0.6	5MR	0.0	0	29.4	60S	46	79
97	TAW229	17.1	40S	0.8	10MR	15.0	60S*	22.9	60S	35	46
98	TAW230	8	30S	4.8	20MS	30.5	40S	23.7	60S	35	68
BARC (BKB), Mumbai											
99	TW-177-14	4.6	20MS	4.2	20MS	5.0	20S	35	80S	57	78
100	TW-177-18	6.9	20MS	3.7	20MS	0.0	0	49.7	80S	68	79
100A	Infector	81.4	100S	80	100S	75.0	100S	65.7	80S	78	89

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
101	TAW159	19.7	40S	5	10MS	5.5	20S	16.9	60S	57	89
102	TW181	2.9	10MS	0.1	R	2.5	10S	45.7	60S	56	89
103	TW197	10	20S	18.4	60S	20.5	40S	31.9	60S	46	68
ARI, Pune											
104	MACS 6825	6	20S	6.1	30S	0.0	0	3.2	10MS	57	79
105	MACS 6826	0.2	5R	1.6	20MR	1.3	5S	5.9	20S	57	79
106	MACS 6827	1.7	10MS	1.7	20MR	0.0	0	23.1	60S	57	89
107	MACS 6828	24.3	40S	3.6	20MS	7.6	20S	48.6	60S	35	67
108	MACS 6829	0.7	10MR	0.4	5MR	0.0	0	50	80S	46	78
109	MACS 6830	0.9	10MR	0	R	0.0	0	54.3	80S	46	67
110	MACS 6831	1.8	10S	12.6	40S	20.0	40S	15.4	60S	57	79
111	MACS 6832	12.3	40S	9.6	20S	12.5	40S	45.1	80S	56	78
112	MACS 6833	3.5	10S	4.1	20S	3.8	10S	54.3	80S	57	89
113	MACS 6834	2	10MS	0.4	5MR	0.5	5MR	57.1	80S	57	89
114	MACS 6835	24.3	40S	3.6	10MS	1.0	5MS	49.7	80S	47	57
115	MACS 6836	3.8	10MS	2.5	15MS	0.0	0	15.7	60S	56	89
116	MACS 6837	6.6	20MS	0.4	5MR	1.3	5S	18.4	40S	56	89
117	MACS 6838	24.3	60S	1.6	20MR	2.5	10S	15	60S	67	79
118	MACS 6839	23.6	40S	0.8	5MS	7.5	20S	28.6	60S	46	68
119	MACS 6840	17.7	40S	8.3	20MS	6.6	20MS	40.6	60S	57	89
120	MACS 6841	8.6	20S	1.2	15MR	0.0	0	36	60S	45	58
120A	Infector	75.7	100S	80	100S	75.0	80S	80	100S	78	78
121	MACS 6842	8.6	20MS	1.8	5S	1.0	5MS	27.1	80S	46	78
122	MACS 6843	23.4	60MS	2.5	15MS	1.3	5S	15.6	60S	57	79
123	MACS 6844	13.1	40MS	1.6	10MS	2.5	10S	46.6	80S	57	89
124	MACS 4125	2.2	10MR	0.5	5MR	0.0	0	1.7	5S	56	89
125	MACS 4126	5.4	40MS	0.1	TMR	0.0	0	1.8	5S	67	89
126	MACS 4127	6.9	40MS	1.9	10MS	0.5	5MR	13	40S	57	89
127	MACS 4128	20	40S	1.3	10MR	0.5	5MR	8.4	20S	57	79
128	MACS 4129	7.4	40MS	0.5	5MR	0.0	0	0.6	5MR	57	79
129	MACS 4130	6.6	40MS	4.1	20S	0.1	TR	1.3	5S	67	79
130	MACS 4131	6.9	40MS	0.5	5MR	0.0	0	0.1	TS	67	89
131	MACS 4132	4	20S	1.7	5MS	1.0	5MS	3.5	10S	67	89
132	MACS 4133	6.9	40S	4.1	20MS	2.0	10MS	16.1	60S	56	89
133	MACS 4134	12.9	60S	0.5	5MR	0.0	0	3.9	10S	57	79
134	MACS 4135	8.9	60MS	4.1	20S	0.1	TR	3.3	10MS	57	79
135	MACS 4136	16.3	40S	4.1	20S	0.0	0	3.9	20S	57	89
136	MACS 4137	9.5	40MS	4.9	20S	0.6	5MR	3.6	10MS	57	79
137	MACS 5062	1.4	20MR	0.1	R	0.0	0	17.7	40S	56	89
138	MACS 5063	1.2	20MR	0.1	R	0.0	0	8.1	20S	56	89
SKUAST, Jammu											
139	JAUW 705	16.4	40S	0	R	4.3	20MS	8.9	20S	56	89
140	JAUW 706	25.1	40S	0.2	TMR	0.0	0	17	40S	56	89
140A	Infector	75.7	100S	76	100S	75.0	80S	74.3	80S	78	89
141	JAUW 707	15.7	60MS	1.6	10MS	5.0	20S	5	20S	46	79
142	JAUW 708	1	5MS	6.1	15MS	12.6	40S	23.1	40S	67	89
143	JAUW 709	10	40MS	0.4	5MR	2.5	10S	15.6	40S	57	79
144	JAUW 710	23.4	60S	0.9	10MR	5.0	10S	4.4	10S	57	89
145	JAUW 711	10.2	20S	1.7	5MS	3.8	10S	9.1	20MS	46	68
146	JAUW 712	16	60MS	0.8	10MR	2.5	10S	10.3	40S	46	68
147	JAUW 713	12.3	40MS	7.6	20MS	10.0	20S	14.3	40S	57	78
148	JAUW 714	17	40MS	1.6	10MS	5.0	20S	7.2	40S	57	79
PDKV, Akola											
149	AKAW-4764	2.7	20MR	1.7	10MS	5.0	20S	55.7	80S	57	89
150	AKAW-5347	2.4	10MS	3.5	10MS	0.0	0	37.1	60S	67	89
151	AKDW-5348	3.9	10MS	1.9	5S	0.5	5MR	9.9	40S	57	89

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
152	AKAW-5440	4.9	20S	16.8	20S	2.0	10MS	40	80S	67	89
153	AKDW-5442	13.5	40S	9	20S	3.5	10S	16.9	60S	57	89
154	AKAW-5446	35.7	60S	42	80S	22.5	40S	47.9	80S	57	89
155	AKAW-5447	14.6	50S	40	80S	22.5	40S	34.1	60S	68	89
156	AKAW-5448	2.8	10S	8.1	20S	10.5	20S	40.6	60S	57	79
157	AKAW-5449	14.4	40MS	24	60S	11.3	40S	39.6	60S	67	89
158	AKAW-5512	2.6	20MR	0.9	10MR	0.1	TR	40.9	80S	45	77
159	AKAW-5514	19.7	80MS	3.6	20MS	12.0	40S	48	80S	45	57
160	AKDW-5516	7.1	20MS	2.1	20MR	7.0	20S	6.9	20MS	56	89
160A	Infector	75.7	100S	76	100S	70.0	80S	77.1	80S	78	79
161	AKAW-5517	20.3	40S	48	80S	30.0	60S	54.3	80S	67	78
162	WSM-131-2-1	2.6	20MR	0.9	10MR	0.0	0	54.3	80S	46	69
163	WSM-138	0.3	10R	0.8	10MR	0.0	0	33.4	60S	46	68
BAU, Ranchi											
164	JKW 300	14.7	40S	2.1	5MS	10.0	40S	49.7	80S	46	68
165	JKW 301	21.1	60MS	4	20S	2.5	10S	32.7	60S	45	77
166	JKW 302	12.3	20S	0.8	10MR	0.0	0	40.6	60S	45	77
167	JKW 303	7.7	20S	4.4	10S	5.0	20S	2.9	10S	57	79
168	JKW 304	18.9	40S	1.1	5MS	0.0	0	1.2	5MS	46	79
169	JKW 305	8.9	40MS	10.1	40S	7.5	20S	15.7	40MS	57	68
170	JKW 306	7.7	20S	0.8	10MR	0.1	TMR	11.1	20S	57	79
171	JKW 307	7.7	20S	0.8	10MR	0.0	0	3.9	10MS	67	89
172	JKW 308	9	40MS	3.6	10S	1.3	5S	22.1	40S	57	89
173	JKW 309	5.5	20MS	1.2	5MS	10.0	40S	32.3	60S	68	89
SKAUST, Kashmir											
174	SKW-367	1.6	5S	1.6	10MS	0.0	0	5.6	20MS	57	89
175	SKW-368	4.1	20MS	0.4	5MR	2.5	10S	3.3	10S	67	89
176	SKW-369	2.9	10MS	2.1	10S	2.5	10S	4.3	10S	56	79
177	SKW-370	0.3	5MR	0.9	10MR	0.0	0	0	TR	67	79
178	SKW-371	3.3	10MS	3.4	10MS	0.0	0	4.2	10S	57	89
179	SKW-372	2.9	10MS	1.6	10MS	0.0	0	3.6	10S	56	89
180	SKW-373	8.9	20S	4.1	20S	0.0	0	7.1	10S	46	67
180A	Infector	75.7	100S	80	100S	75.0	100S	77.1	80S	78	89
181	SKW-374	7.7	20MS	6.8	20S	3.8	10S	10.2	40S	46	89
182	SKW-375	2.2	10MR	2.1	10S	11.0	40S	5.5	20S	56	78
183	SKW-376	5.4	10MS	3.2	10MS	0.0	0	6.3	20MS	57	78
184	SKUA-WW-101	8	20MS	9.2	20S	0.0	0	4.7	10S	57	68
185	SKUA-WW-102	11.3	40MS	14	40S	0.0	0	9.1	20S	57	68
186	SKUA-WW-103	0.2	5R	0.4	5MR	0.0	0	1.5	5S	57	89
187	SKUA-WW-104	0.7	5MS	0.1	R	2.5	10S	2.1	10MS	57	89
188	SKUA-WW-105	1.6	10MR	4.4	20MS	1.0	5MS	7.1	40S	46	57
SHUATS, Prayagraj											
189	SHUATS-W58	16.2	80MS	15.2	20S	25.0	60S	47.1	60S	56	68
190	SHUATS-W63	23.4	60S	6.5	20MS	9.0	20S	42.6	80S	56	89
191	SHUATS-W86	26.3	60S	24.8	80S	27.0	60S	37.1	60S	57	89
192	SHUATS-W69	6	20MS	3.8	20MS	2.0	10MS	16.1	40S	57	78
193	SHUATS-W74	30.3	60S	35.6	80S	35.0	60S	23.6	40S	67	77
Lok Bharti, Sanosara											
194	Lok-2021-1	11.5	40S	12.4	20S	10.0	20S	28	60S	67	89
195	Lok-2021-2	2.3	10MS	1.8	10MS	0.5	5MR	32	80S	68	89
196	Lok-2021-3	9.5	40S	17.6	20S	12.5	40S	49.7	80S	78	89
197	Lok-2021-4	8.8	40S	15.6	40S	12.5	40S	44.3	80S	68	89
198	Lok-2021-5	6.3	20S	17.6	40S	7.5	20S	50.9	80S	57	89
VNMKV, Prabhani											
199	DSS-15-1737	18	40S	0	R	10.0	40S	35.1	60S	45	56
200	DSS-16-1762-1	9.7	40S	0.4	5MR	0.0	0	46.9	60S	45	58

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
200A	Infector	78.6	100S	76	100S	75.0	100S	74.3	80S	67	78
201	DSS-16-1766-1	6.3	20S	0	R	0.0	0	45.1	60S	35	58
202	DSS-16-1792-1	4	20S	2	10S	0.0	0	37.4	60S	46	68
203	DSS-16-1826-1	8	20S	13.6	20S	25.0	40S	39.1	60S	35	68
RPCAU, Pusa											
204	RAUW 107	2.3	10S	0.1	R	0.0	0	5	10MS	45	89
205	RAUW 108	18.3	60S	0.5	5MR	10.0	40S	23	40S	46	79
206	RAUW 109	12.9	40S	4.1	10MS	12.5	40S	25.1	40S	57	78
207	RAUW 110	2.3	10MS	0.8	5MR	5.0	20S	42.3	60S	46	68
208	RAUW 111	1.8	10S	0.4	5MR	0.0	0	20.6	40S	36	47
209	RAUW 112	25.7	40S	2	10S	5.0	20S	34.7	60S	46	68
VPKAS, Almora											
210	VW 2102	9.3	60S*	0.5	5MR	0.0	0	18	40S	35	57
211	VW 2106	3	20S	0.9	10MR	0.0	0	14.3	40S	46	57
212	VW 2107	1.7	5MS	0.8	10MR	12.5	40S	2.6	10MS	46	68
213	VW 2109	25.7	40S	0.5	5MR	10.0	20S	28	60S	35	56
214	VW 2111	15.9	20S	0.8	5MS	0.0	0	6.5	20S	46	78
215	VW 2113	13.9	60S*	0.8	5MS	2.5	10S	12.1	40S	24	37
216	VW 2115	6.3	40MS	1.8	5S	3.8	10S	3.3	10MS	46	78
217	VW 2117	8.2	40MS	1.8	10MR	2.5	10S	20.3	40S	68	89
218	VW 2118	3.5	40MR	7.6	20S	0.0	0	22	40S	68	89
219	VW 2120	16.6	80MS	2.6	10MS	1.3	5S	28.4	60S	57	89
220	VW 2121	12.6	20S	0.5	5MR	0.0	0	9.6	40S	67	79
220A	Infector	78.6	100S	80	100S	70.0	80S	74.3	80S	78	89
221	VW 2123	12.4	40MS	14.4	40S	10.0	40S	8.4	20MS	67	89
222	VW 2127	1.7	5S	0.1	TMR	2.5	10S	5.2	20MS	45	57
223	VW 2128	24.3	60S	25.6	40S	3.8	10S	6.1	20S	57	78
224	VW 2131	22.9	60S	4.5	20S	1.3	5S	8	30S	46	57
225	VW 2132	6	10S	0	R	1.3	5S	0.6	5MS	35	57
226	VW 2134	2.3	10MS	1.6	10MS	0.0	0	17.9	60S	46	68
227	VW 2138	2.4	20MR	4.6	20S	10.0	20S	2.7	10S	68	79
228	VW 2141	10.6	20S	4	10S	11.3	40S	26.3	40S	57	77
229	VW 2143	2.9	10MS	15.2	30S	12.5	20S	13	40S	67	89
230	VW 2144	13	40S	2.4	10MS	2.6	10S	17.9	40S	46	78
231	VW 2145	2.1	10S	0	R	0.0	0	7.4	20S	56	67
232	VW 2146	1.7	10MR	0.8	5MS	1.3	5S	14.9	40S	57	69
233	VW 2147	0.9	10MR	8	20S	15.0	40S	10.1	40S	57	89
234	VW 2149	14.7	40S	0.5	5MR	1.3	5S	8.4	20S	35	68
HAU, Hisar											
235	P 13820	3.5	20MS	4	10MS	12.5	40S	2.9	10S	56	89
236	P13841	6.2	20MS	6.6	20S	15.0	40S	13.6	40S	45	89
237	P13851	0.5	5MR	0.8	10MR	2.5	10S	13.6	40S	46	79
238	P13854	20	60MS	1	10MR	5.0	20S	17.7	40S	67	89
239	P13855	12.1	80MS*	1.7	10MS	1.3	5S	18.9	40S	57	77
240	P14161	21.6	60S	3.7	10MS	12.5	40S	9.9	40S	67	89
240A	Infector	81.4	100S	76	100S	70.0	80S	74.3	80S	78	89
241	P13819	4.9	20MS	4	10S	1.3	5S	9	30S	56	89
242	P13653	9.6	60S*	2	10S	0.0	0	8.9	40MS	57	79
243	P13935	4.9	20MS	6.5	20S	2.5	10S	22.9	40S	67	89
244	P13978	7.8	40MS	0.8	10MR	0.0	0	16.9	40S	57	78
245	P13983	1.7	5S	2	10S	5.0	20S	7.1	20S	47	58
246	P13987	6	20S	5	20MS	0.0	0	16	40S	46	68
247	P13989	12.9	60S	0	R	0.0	0	19.1	40S	56	78
248	P13861	6.5	20S	0.8	5MS	10.0	40S	18	40S	46	68
249	P14029	11.4	40MS	12	20S	0.0	0	30.2	60S	57	77
250	P13741	24.6	60S	8.1	40S	10.0	40S	11.2	20S	57	79

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
251	P13679	16.1	60S	1.1	10MR	5.0	20S	17	40S	57	79
252	P14283	8.2	40S	1	5MS	0.0	0	13.4	40S	57	79
253	P14284	13.4	40S	0.8	5MR	15.0	60S*	3.9	10MS	57	79
254	P14285	3.5	20MS	1.6	10MS	0.0	0	9.6	40S	46	57
255	P14286	14.9	60S	1.6	10MS	0.0	0	13.5	40S	57	79
256	P14287	16.1	40S	0.9	10MR	7.5	20S	10.6	40S	46	58
257	P14288	21.4	40S	0.6	5MR	10.0	40S	7.8	20S	56	89
258	P14291	29.7	80S	7.7	20S	15.0	40S	21.7	40S	57	78
259	P14292	10.3	40S	9.6	20S	0.0	0	22.6	60S	68	89
260	P14123	7.5	40MS	0.9	10MR	25.0	60S	14.4	40MS	46	58
260A	Infector	75.7	100S	80	100S	75.0	100S	78.6	90S	68	78
261	P14124	7.8	20MS	3.3	10MS	0.0	0	15.7	40S	45	56
262	P14126	1.2	5MS	0.9	10MR	3.8	10S	19.9	40S	46	58
263	P14154	19.6	40S	3.4	15S	0.8	5MR	6.1	20MS	57	69
264	P 13634	1.6	10MS	0.1	TMR	1.3	5S	28	60S	56	89
265	P 13833	7.1	20MS	3.4	20MR	2.3	5S	26.6	60S	56	57
266	P 13909	5	20MS	1.7	10MS	0.0	0	10.7	20S	56	68
267	P 14091	7.2	40MS	0.9	5MS	1.0	5MS	10.3	40S	56	68
268	P 14092	18.7	40S	1.1	5S	0.0	0	3.7	20MR	46	58
269	P 14100	16.3	40S	0.4	5MR	0.0	0	17.8	40S	56	89
270	P 14230	21.7	60S	11.4	40S	20.0	40S	17	60S	46	58
271	P 14232	4	20MS	10	20S	25.0	60S	16.6	60S	46	68
272	P 14234	13.1	60MS	1	5S	10.0	20S	8.7	40MS	46	68
273	P 14235	16.7	60S	4.9	10S	13.0	40MS	3.7	10MS	57	79
274	P 14239	16	60S	3.5	10MS	15.0	40S	14.5	60S	57	89
275	P 14240	22	60S	10	30S	15.5	40S	11.6	40S	57	89
276	P 12368	21.4	40S	9.9	20S	20.1	40S	9.7	40MS	67	89
277	P 13787	8.6	20S	0.4	5MR	5.0	20S	17.2	40S	35	57
278	P 13793	13.4	40S	1.7	10MS	0.0	0	7.6	20S	45	89
279	P 13839	18.7	40S	1.1	5MS	6.3	20S	10.5	20S	57	89
280	P 13974	11.9	40MS	4.3	20MS	5.0	20S	5.9	10S	56	89
280A	Infector	78.6	100S	72	100S	75.0	100S	77.1	80S	78	89
281	P 14271	9.3	40MS	0.9	5MS	0.0	0	4.5	10MS	46	89
282	P 14272	12.6	40S	0.8	10MR	1.3	5S	6.6	20S	45	78
283	P9004	22.4	80S	2.5	5MS	0.5	5MR	2.9	10S	45	89
284	P9010	17.2	100S	3.7	20MS	2.0	10MS	3.6	10MS	57	69
SDAU, Vijapur											
285	VA 2020-16	0.9	10MR	0.4	5MR	0.0	0	33.1	60S	57	89
286	VA 2018-01	0.6	5MR	0.4	5MR	0.0	0	10.2	20S	57	89
287	VA 2020-02	1.7	30MR	1.6	10MS	10.0	40S	17.9	60S	56	89
288	VA 2020-19	1.6	20MR	10.8	20S	12.6	40S	36.3	60S	57	89
289	VA 2020-06	1	5MS	3.8	15MS	0.5	5MR	29.9	60S	56	89
290	VA 2020-17	0.2	5R	1.6	10MS	0.3	TS	45.7	80S	67	89
291	VA 2020-18	1.3	5S	0.8	5MS	0.3	TS	47.1	80S	67	89
292	VA 2020-13	0.9	10MR	0.4	5MR	1.0	5MS	51.4	80S	56	89
293	VA 2020-14	0.3	5MR	0.5	5MR	0.3	TS	44.3	80S	56	89
294	VA 2020-11	0.6	10MR	0.8	5MR	1.0	5MS	23.4	40S	56	79
295	VA 2020-08	1.8	20MR	0.9	10MR	10.0	40S	15	60S	57	79
296	VA 2020-10	2.5	10S	12.8	20S	7.3	20S	53.6	80S	68	89
297	VA 2020-15	0.6	10MR	0.9	10MR	15.0	60S*	31.9	60S	57	89
298	VA 2020-34	9.7	40MS	10.2	20S	22.5	60S	43.7	80S	46	89
299	VA 2020-35	7.7	20MS	11.8	20S	30.0	60S	46.6	80S	57	79
300	VA 2020-04	3.5	10S	7.7	20S	22.5	40S	40.6	60S	57	89
300A	Infector	78.6	100S	76	100S	70.0	80S	74.3	80S	78	89
301	VA 2020-28	0.6	10MR	0.5	5MR	1.1	5MS	32.9	60S	57	79
302	VA 2020-26	1.5	10MR	0.5	5MR	0.0	0	41.6	80S	56	89

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
303	VA 2020-24	0.9	10MR	0.8	10MR	5.1	20S	33.1	60S	56	99
304	VA 2020-32	0.9	10MR	0.9	10MR	0.0	0	44.4	80S	67	89
305	VA 2020-25	3.5	20MS	3.3	10MS	3.5	10S	40.4	80S	67	89
306	VA 2020-30	0.6	5MR	0.4	5MR	0.3	TS	21.1	60S	67	89
307	VA 2020-31	0.2	5R	1.7	10MS	0.3	5R	36.9	60S	67	89
308	VA 2020-33	0.3	5MR	0.8	10MR	0.0	0	25.3	60S	67	99
309	VA 2020-21	2	10MR	1.1	5MS	3.3	10MS	42.6	80S	57	89
310	VD 2020-3	1.7	10S	0.4	5MR	0.0	0	18.6	60S	56	89
311	VD 2020-4	3.2	20S	3.7	20MS	2.3	10MS	1.3	10MS	57	78
312	VD 2020-5	0.8	10MR	3.2	20MS	4.0	20MS	1.7	5MS	56	89
313	VD 2020-6	3.8	20S	0.8	10MR	0.1	TR	13.9	40S	57	89
314	VD 2020-7	0.6	10MR	3.6	20MS	2.0	10MS	13.6	40S	58	89
315	VD 2020-12	2.4	10MS	3.7	20MS	2.0	10MS	20.7	60S	57	89
316	VD 2020-14	1.7	10MS	0.5	5MR	0.1	TR	23	60S	67	99
317	VD 2020-1	5.3	20MS	3.6	10MS	2.5	10S	8.7	20S	57	99
318	VD 2020-11	4	20S	4.8	30MS	7.0	20S	6.7	20S	57	89
319	VD 2020-9	1	5S	4.4	20S	5.0	20S	9.2	40MS	56	78
320	VD 2020-2	1.5	10MS	2.9	10S	1.3	5S	7.2	20S	56	77
320A	Infector	81.4	100S	76	100S	75.0	100S	77.1	80S	68	78
321	VD 2020-8	2.6	5S	9.3	20S	17.0	40S	10.2	40S	45	79
322	DR-19-47	1.8	10MS	0.9	5MS	0.1	TR	28.4	80S	57	99
323	DR-19-53	5.3	20S	10.5	40S	10.1	40S	27	60S	57	99
324	DR-20-08	16.8	80S	9.6	40S	5.1	20S	28.3	60S	57	99
UBKV, Coochbehar											
325	UBKV-2021-1	1.9	10MS	4	10S	7.5	20S	15.7	60S	57	77
326	UBKV-2021-2	8.4	20S	0.8	10MR	15.0	40S	17.6	40S	46	68
327	UBKV-2021-3	11.1	20S	5	15S	5.0	10S	19.7	60S	46	57
328	UBKV-2021-4	13.5	40S	2.7	10MS	0.8	5MR	30	60S	46	68
329	UBKV-2021-5	10.4	20S	0.3	5R	1.3	5S	25.7	60S	45	74
BCKV, Kalyani											
330	BCW 26	1	5MS	2.4	10MS	11.8	40S	18	60S	46	78
331	BCW 27	3.9	10S	2.4	15MS	2.6	10S	8.9	40MS	46	78
332	BCW 28	11.3	20S	2.6	10MS	3.0	10S	3.7	20MS	36	58
333	BCW 29	1.2	10MR	0.8	10MR	10.0	40S	2.9	10S	35	47
334	BCW 30	8.6	20S	1.7	10MS	6.3	20S	8	20S	35	57
HPKV, Malan											
335	PW 2101	14.1	40S	6	15S	5.0	10S	29	40S	46	77
336	PW 2102	6	40MS	9.6	20S	10.0	20S	22.1	60S	56	68
337	PW 2103	4.7	20S	0.8	10MR	0.0	0	10.5	60S*	46	68
338	PW 2104	14.6	40S	6.2	20S	22.5	60S	19.4	60S	45	55
339	PW 2105	0.7	5S	11	20S	2.5	10S	25	60S	34	56
340	PW 2106	11.1	60S*	4.6	10S	0.0	0	20.1	60S	46	89
340A	Infector	78.6	100S	84	100S	75.0	100S	74.3	80S	78	89
341	PW 2107	3.9	20S	1.7	10MS	0.0	0	0.2	TS	46	89
342	PW 2108	6.9	20S	15.2	40S	7.5	20S	23.6	60S	56	89
343	PW 2109	1.2	10MR	1.6	5MS	15.0	40S	9.4	20S	46	57
344	PW 2110	0.5	5MR	2.1	10MS	0.0	0	8.9	40MS	46	89
345	PW 2111	4.4	20S	3.8	15S	7.5	10S	5.3	20MS	45	68
346	PW 2112	7.8	40S	1.7	10MS	0.0	0	10.6	40MS	46	79
347	PW 2113	5.5	20MS	0.1	R	0.0	0	11.1	40S	57	79
348	PW 2114	2.3	10MS	1.6	10MS	1.3	5S	18.9	60S	45	89
349	PW 2115	7.5	20MS	5	20S	1.0	5MS	20.3	60S	56	89
350	PW 2116	5.6	20S	2	10S	1.3	5S	11.5	60S	56	89
351	DW 281	14.6	40S	4.6	10S	15.5	40S	22	40S	45	56
352	DW 284	4.9	20S	0.4	5MR	1.0	5MS	35.7	60S	46	68
353	DW 288	7.3	30S	4.1	20S	1.3	5S	10.1	40MS	57	78

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
354	DW 289	1.6	5S	8.6	20S	13.5	40S	2	5S	56	57
355	DW 290	4.6	30S	8	40S	0.0	0	40	80S	45	57
HPKV, Bilaspur											
356	CG2101	7.1	20S	14.4	40S	12.5	40S	41.4	80S	56	78
357	CG2102	15.7	40S	2	10S	0.0	0	10.6	40S	46	68
358	CG2103	5.5	20MS	4.1	20S	2.5	10S	47.4	80S	56	79
359	CG2104	2.7	10S	8.4	20S	21.0	40S	44	80S	57	68
360	CG2105	7.2	20MS	17.6	40S	16.0	40S	48.9	80S	56	77
360A	Infector	78.6	100S	80	100S	70.0	80S	74.3	80S	68	78
361	CG2106	1.2	10MR	1.6	10MS	0.0	0	42.3	60S	46	89
362	CG2107	1.3	5S	2	10S	0.0	0	40	80S	56	89
363	CG2108	12.9	30S	15.2	40S	15.0	40S	27.9	60S	46	89
364	CG2109	10.6	40MS	13.2	20S	10.0	40S	34.3	60S	56	89
365	CG2110	10.9	40S	3.2	10MS	2.5	10S	5.6	20MS	57	89
366	CG2111	15.3	50S	18.2	60S	16.3	40S	20.6	60S	56	79
367	CG2112	4.3	20MS	10.2	20S	15.0	40S	41.1	80S	67	89
368	CG2113	8.3	40S	2.8	10S	1.8	5S	17.7	40MS	56	79
369	CG2114	9.4	30S	16.4	40S	8.5	20S	23.7	60S	56	79
370	CG2115	32.9	60S	11.6	20S	16.0	40S	42.3	60S	56	79
BARC, Indore											
371	THI-3	0.1	TMR	0.8	10MR	0.0	0	35.7	80S	46	58
372	THI-4	0.1	TMR	0.4	5MR	0.0	0	36.6	80S	46	57
373	THI-5	0.1	TR	1.6	10MS	0.0	0	33.1	80S	45	57
374	THI-6	0.1	TR	0.4	5MR	0.0	0	32	80S	46	68
375	THI-7	0.1	TR	0.4	5MR	2.5	10S	33.1	80S	46	68
BAU, Sabour											
376	BRW 3928	6.3	20S	8.4	20S	10.0	20S	25.7	60S	45	77
377	BWR 3929	13.4	60S	0.5	5MR	13.0	40S	33.7	60S	35	57
378	BRW 3930	8	20S	2.5	10MS	13.5	40S	33.7	60S	45	57
379	BRW 3931	9	40MS	3.8	10MS	12.0	40S	34.3	60S	46	89
380	BRW 3932	12.3	40S	10.8	20S	12.5	40S	30	40S	46	57
380A	Infector	78.6	100S	76	100S	75.0	100S	77.1	80S	67	78
381	BRW 3933	3.8	20MS	0	R	0.0	0	41.6	80S	45	57
382	BRW 3934	22.1	40S	0	R	2.5	10S	38	60S	46	57
383	BRW 3935	5.1	20MS	0.4	5MR	0.0	0	19.3	40S	56	68
384	BRW 3936	5.1	20MS	0.4	5MR	0.0	0	20.9	40S	46	77
385	BRW 3937	2.3	10MS	0	R	1.3	5S	30.6	40S	56	68
386	BRW 3938	6.7	40S	0.1	TMR	0.1	TR	19.7	40S	46	68
387	BRW 3939	5	20S	0.8	5MS	0.0	0	26.9	40S	56	78
388	BRW 3940	4.5	20MS	7	20S	0.1	TR	10.6	40S	46	58
389	BRW 3941	2.9	20MS	0.5	5MR	0.0	0	14.6	40S	46	57
390	BRW 3942	4.5	20S	4.8	10S	2.5	10S	12.9	40S	56	68
391	BRW 3943	12.2	40S	7.2	20MS	10.0	20S	12	30S	57	68
392	BRW 3944	7.8	20S	0.1	TMR	5.0	10S	13.7	40S	46	77
393	BRW 3945	7.3	20S	1.2	5S	7.5	20S	21.7	40S	56	89
394	BRW 3946	15.7	60S	8.2	20MS	1.8	5S	19.7	40S	46	89
395	BRW 3947	10.7	40S	4.6	10S	8.5	20S	24	40S	46	68
BHU, Varanasi											
396	HUWL2101	15.4	40S	6	20MS	26.0	60S	35.9	60S	46	68
397	HUWL2102	15.4	40S	16.4	40S	15.5	40S	36.3	80S	56	68
398	HUWL2103	13.1	40S	11.6	20S	22.5	60S	33.7	60S	56	68
399	HUWL2104	17.3	40S	21.2	40S	27.5	40S	31.3	80S	46	67
400	HUWL2105	18	40S	14.6	40S	25.5	40S	36.3	80S	35	57
400A	Infector	78.6	100S	80	100S	80.0	100S	77.1	80S	78	89
401	HUWL2106	0.6	5MS	2.8	10MS	5.0	20S	31.9	60S	57	79
402	HUWL2107	6.8	40S	3.8	10S	0.0	0	27.9	60S	56	79

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
403	HUWL2108	5.5	20MS	18.4	20S	20.0	40S	36.3	80S	57	79
404	HUWL2109	4.3	20MS	4.8	20S	12.5	40S	28.7	60S	67	89
405	HUWL2110	4	10S	22.4	40S	25.0	60S	28.6	60S	67	89
406	HUWL2111	8.5	30S	26.2	60S	25.0	40S	34.3	60S	57	89
407	HUWL2112	24.4	60S	23.4	40S	30.0	40S	35.7	60S	56	68
408	HUWL2113	2.7	20MS	1.6	10MS	1.3	5S	24.3	40S	46	68
409	HUWL2114	27.1	40S	4	10S	2.5	10S	19.3	40S	35	57
410	HUWL2115	21	40S	1.6	5MS	0.6	5MR	27.1	40S	56	67
411	HUWL2116	3.8	20MS	4	20MS	1.0	5MS	25.9	40S	57	89
412	HUWL2117	3.2	10MS	1.9	10MS	0.0	0	20	40S	56	78
413	HUWL2118	32.9	60S	2.2	10MS	2.5	10S	38.6	80S	56	79
414	HUWL2119	17.1	40S	7.2	20S	2.6	10S	20.1	40S	35	57
415	HUWL2120	16.6	40S	5.2	20MS	2.5	10S	26.4	60S	56	89
JNKVV, Jabalpur											
416	MP 3568	1.9	10MS	5.9	20MS	5.0	20S	29.9	60S	56	89
417	MP 3569	3.2	20MS	10.2	30S	17.5	40S	46.3	80S	56	89
418	MP 3570	3.7	20MS	1.7	10MS	10.0	40S	16.6	40S	57	89
419	MP 3571	3.5	40MR	3.7	20MS	5.0	10S	42.3	60S	57	89
420	MP 3572	3.2	10S	4	20S	0.0	0	37.3	60S	57	79
420A	Infector	78.6	100S	72	100S	60.0	80S	77.1	80S	78	89
421	MP 3573	3.3	10MS	3.2	10S	2.5	10S	8.8	20MS	56	89
422	MP 3574	6.9	20S	0.9	5MS	10.0	40S	10	40MS	67	89
423	MP 3575	1.7	10MS	6.8	20S	17.5	40S	28.3	60S	57	89
424	MP 3576	1.7	10S	8.5	20S	10.0	20S	8.9	20S	46	89
425	MP 3577	7.3	20S	4.2	20S	3.8	10S	12.7	20S	47	79
426	MP 3578	8.5	20MS	6.8	20MS	20.0	40S	33.3	60S	56	99
427	MP 3579	3.8	10S	4.2	10MS	5.0	20S	32	60S	45	79
428	MP 3580	2.6	20MS	2.2	5S	1.3	5S	36.9	60S	46	57
429	MP 3581	4.4	20S	4	10MS	1.3	5S	6.2	20MS	46	89
430	MP 3582	1.6	10S	4	20S	2.5	10S	38	60S	56	99
UAS, Dharwad											
431	UASD-2101	16.6	40S	5.9	20MS	3.8	10S	20.9	40S	46	57
432	UASD-2102	14.3	40S	0.4	5MR	0.0	0	12	20S	56	68
433	UASD-2103	3.5	20S	0.4	5MR	0.0	0	19.9	60S	56	78
434	UASD-2104	1.1	10MR	1	5S	0.0	0	25	40S	56	89
435	UASD-2105	3.2	10S	0.8	5MS	0.5	5MR	13.9	40S	46	78
436	UASD-2106	16.6	40S	0.4	5MR	5.0	20S	4.4	10S	56	89
437	UASD-2107	12.1	80S*	1.8	5S	0.0	0	1	5S	56	89
438	UASD-2108	6	20S	0.9	10MR	0.0	0	38.6	80S	46	89
439	UASD-2109	8.9	40MS	0.5	5MR	5.0	20S	32.6	80S	46	89
440	UASD-2110	6.7	40S	0.5	5MR	0.0	0	35.4	60S	46	68
440A	Infector	78.6	100S	76	100S	75.0	100S	77.1	80S	78	79
441	UASD-2111	14.3	80S	0.5	5MR	0.5	5MR	5.6	20MS	55	99
442	UASD-2112	12.6	80S*	1.7	10MS	1.0	10MR	8.3	20S	56	99
443	UASD-2113	12.9	80S	0.5	5MR	0.5	5MR	6.2	20MS	56	99
444	UASD-2114	19.1	100S	2.1	10MS	2.0	10MS	5.3	20S	46	89
445	UASD-2115	8.9	60MS*	1.6	5MS	0.5	5MR	4	20MS	46	79
446	UASD-2116	12.7	80S*	2.5	10MS	1.0	5MS	1.9	10MS	45	89
447	UASD-2117	21.4	80S	8.4	40S	0.5	5MR	3	20MS	57	79
448	UASD-2118	24.6	80S	0.8	10MR	0.1	TR	7.7	20S	56	57
449	UASD-2119	5.2	20S	0.9	10MR	1.3	5S	33	60S	46	69
450	UASD-2120	30.3	80S	0.5	5MR	0.0	0	27.7	60S	46	68
451	UASD-2121	11.6	40MS	0.8	10MR	0.0	0	37.1	60S	46	89
452	UASD-2122	14.5	60S	1.6	5MS	0.0	0	10.7	20S	56	79
453	UASD-2123	21	40S	8.1	40S	5.0	20S	7	20S	57	79
454	UASD-2124	12.6	40S	1.6	10MS	3.5	10S	3	10S	56	77

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
455	UASD-2125	15.3	50S	12.4	60S*	2.5	10S	30	60S	36	57
456	UASD-2126	30.3	80S	9.1	40S	2.5	10S	10.7	30S	46	57
457	UASD-2127	14.1	80S	0.9	10MR	0.0	0	2.5	10MS	46	68
458	UASD-2128	12.9	80S*	0.8	5MS	0.1	TR	2.4	10MS	56	89
459	UASD-2129	4.3	20S	3.3	20MS	1.0	10MR	1.9	5S	57	57
460	UASD-2130	21.8	60S	0.5	5MR	0.0	0	2.3	10S	45	57
460A	Infector	75.7	100S	76	100S	75.0	80S	74.3	80S	78	79
461	UASD-2131	9.3	60S*	1.7	10MS	1.0	5MS	5.9	20MS	57	99
462	UASD-2132	3.5	40MR	0.1	R	0.0	0	22	40S	46	79
463	UASD-2133	3.8	20MS	0.1	R	0.0	0	22	40S	56	79
464	UASD-2134	2.4	20MR	0.1	R	0.1	TR	23.3	40S	46	79
465	UASD-2135	1.7	20MR	0.1	R	0.0	0	28	60S	56	89
Nuziveedu seeds											
466	NWS2442	1.3	10MS	1.6	10MS	2.5	10S	6.2	20MS	56	89
467	NWS2216	13.4	40S	0.1	R	0.0	0	16.7	40MS	56	89
468	NWS2170	9.5	40S	0.1	TMR	0.0	0	22.6	40S	46	79
CSAUAT, Kanpur											
469	KA 2101	9.8	60S*	0.2	TMS	0.5	5MR	28.3	40S	46	68
470	KA 2102	1.8	10MS	2	10S	2.5	10S	36.9	60S	46	68
471	KA 2103	6.3	20S	0	R	0.0	0	36.6	60S	46	57
472	KA 2104	16.3	80S	7.8	20S	15.0	20S	45.7	60S	56	89
473	KA 2105	6	20S	0.5	5MR	1.3	5S	39.3	60S	56	89
474	KA 2106	17.1	60S	0.4	TMS	3.5	10S	13.4	40MS	46	57
475	KA 2107	20.9	40S	0.4	5MR	0.5	5MR	6	20MS	46	68
476	KA 2108	12	40S	1.2	10MR	0.5	5MR	16.3	40S	46	78
477	KA 2109	7.3	40MS	0.4	5MR	0.0	0	7	20MS	46	69
478	KA 2110	6.6	20MS	0	R	5.0	20S	20.3	40S	57	79
479	KA 2111	1.8	10MS	0.4	5MR	0.1	TR	11.4	20S	67	79
480	KA 2112	6.9	20S	0.8	10MR	0.0	0	13.4	40S	46	57
480A	Infector	81.4	100S	68	100S	70.0	80S	84.3	100S	68	78
481	KA 2113	13.1	20S	0.4	5MR	1.3	5S	32.6	40S	46	79
482	KA 2114	2	10MS	0.8	10MR	0.0	0	21.1	40S	47	79
483	KA 2115	1.2	10MS	4	20S	0.0	0	22.3	40S	46	79
484	KA 2116	9	40S	1.1	5S	5.0	20S	42.1	60S	46	68
485	KA 2117	11.7	40S	5.7	20S	5.0	20S	38.3	60S	67	89
486	KA 2118	13.2	40S	16.8	40S	16.3	40S	31.4	60S	57	79
487	KA 2119	16.4	60S	8.6	20MS	12.8	20S	48.6	80S	47	79
488	KA 2120	8.6	20S	10.6	20S	5.3	20S	48.6	80S	57	89
489	KA 2121	3.7	10MS	2.9	10S	3.8	10S	50	60S	46	69
490	KA 2122	3.2	10S	0.8	10MR	1.3	5S	47.1	80S	46	69
491	KA 2123	12.1	40S	0.1	R	0.0	0	5.5	40MS	46	79
492	KA 2124	11.4	40S	0	R	0.0	0	26.9	60S	35	58
493	KA 2125	3.1	10S	2.1	10S	3.5	10S	32.9	40S	35	57
494	KA 2126	7.4	20S	0.1	R	0.0	0	8.9	20S	35	57
495	KA 2127	3.2	20S	0	R	0.0	0	37.1	60S	46	57
496	KA 2128	6.7	40S	1.8	10MS	2.6	10S	29.4	60S	36	58
497	KA 2129	8.3	40S	1	10MR	3.8	10S	38.3	60S	47	69
498	KA 2130	4.4	20S	1	10MR	0.0	0	34.7	60S	56	89
499	KA 2131	3.9	20MS	0	R	1.3	5S	28.3	40S	46	79
500	KA 2132	6.4	20MS	5.1	20S	5.0	10S	15	30S	45	68
500A	Infector	75.7	100S	80	100S	75.0	80S	74.3	80S	78	79
501	KA 2133	2.5	10MS	1.2	5MS	2.5	10S	37.1	60S	46	79
502	KA 2134	17	80S	3.6	10MS	1.0	10MR	44.3	60S	46	68
503	KA 2135	8.7	40S	0.8	10MR	1.0	10MR	7.9	20MS	56	89
GBPUAT, Pantnagar											
504	UPW-1	20.6	60S	1	5MS	2.5	10S	15.1	30S	46	89

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
505	UPW-2	24.4	80S	0.4	5MR	0.0	0	10.4	20MS	35	47
506	UPW-3	21	60S	2.9	10S	2.5	10S	19.4	40S	35	68
507	UPW-4	28.1	80S	1.9	10MS	5.0	10S	10.3	30S	35	57
508	UPW-5	28.7	80S	1.8	10MS	2.5	10S	12	20S	35	68
509	UPW-6	13.5	40S	0	R	1.3	5S	3.3	10S	35	68
510	UPW-7	0.9	10MR	0.8	10MR	0.0	0	15.6	40S	45	57
511	UPW-8	10.3	60S*	2.4	10MS	1.3	5S	18	40S	45	57
512	UPW-9	3.5	20MS	0	R	0.0	0	14.5	60S	46	67
513	UPW-10	7.7	20S	0.8	10MR	0.0	0	3.6	10MS	35	47
514	UPW-11	6.3	20MS	2.2	10MS	1.3	5S	21.4	60S	46	57
515	UPW-12	5.2	20MS	0.8	10MR	1.3	5S	22.7	60S	57	67
516	UPW-13	21.1	60S	0.4	5MR	0.0	0	20.9	60S	46	68
517	UPW-14	15.9	40S	0.4	5MR	0.0	0	19.1	60S	46	58
518	UPW-15	17.3	40S	4	20S	0.0	0	3	10MS	56	68
519	UPW-16	17.1	60S	3.7	10MS	7.5	20S	20.6	40S	35	58
520	UPW-17	6.6	20S	4	20S	0.0	0	24.3	60S	45	68
520A	Infector	81.4	100S	76	100S	80.0	100S	77.1	80S	78	78
521	UPW-18	4.3	10S	0.9	10MR	0.0	0	33.3	60S	57	68
522	UPW-19	11.1	40S	1.2	5MS	1.5	5S	21.1	60S	46	57
523	UPW-20	10.3	20S	3.3	10MS	5.0	20S	12	40S	45	68
524	UPW-21	12.7	60S	1.7	10MS	0.0	0	6.1	20MS	45	57
525	UPW-22	16.6	60S	4.8	20MS	0.0	0	11.7	40MS	46	57
526	UPW-23	17.6	40S	0.5	5MR	1.3	5S	26.6	60S	56	89
527	UPW-24	6.3	20S	1.9	5S	0.0	0	20.7	40S	46	57
528	UPW-25	8.3	40S	4.2	10MS	2.5	10S	24.6	60S	46	69
529	UPW-26	13.3	40S	2	10MS	0.1	TR	25.7	60S	46	57
530	UPW-27	8.2	60MS*	6.4	20MS	2.5	10S	31.4	60S	46	69
531	UPW-28	19.7	80S	11	20S	3.3	10MS	8.7	20S	46	57
532	UPW-29	7.3	20S	1.6	5MS	1.3	5S	20.4	40S	46	56
533	UPW-30	15.9	40S	8.9	40S	0.0	0	10.6	40MS	46	56
534	UPW-31	6	20MS	1.4	10MR	0.0	0	25.8	60S	45	58
535	UPW-32	31.4	60S	1.4	5S	0.0	0	12.3	40MS	56	57
536	UPW-33	9.6	20S	0.5	5MR	1.3	5S	36.9	60S	46	69
537	UPW-34	6.6	20S	2.7	10MS	0.0	0	16.4	40S	46	68
538	UPW-35	4.3	20S	1.7	10MS	0.0	0	11.2	40S	46	69
539	UPW-36	0.3	5MR	0.4	5MR	2.5	10S	16.3	40S	36	68
540	UPW-37	1.3	5MS	1.6	10MS	0.0	0	6.4	20MS	46	89
540A	Infector	81.4	100S	76	100S	80.0	100S	74.3	80S	78	79
541	UPW-38	28	80S	6.5	20S	11.3	40S	17.4	60S	56	67
542	UPW-39	0.6	5MR	5.6	20S	3.8	10S	18.3	60S	46	79
543	UPW-40	10	20S	5.8	20S	2.6	10S	27.7	60S	35	46
544	UPW-41	3.7	10S	5.6	20S	0.0	0	10.9	20S	46	57
545	UPW-42	13.1	40S	0.8	5MR	0.1	TR	16.1	40S	35	47
546	UPW-43	9.7	40MS	5	20S	0.0	0	8.2	20S	46	58
547	UPW-44	16	40S	4.2	20S	5.0	20S	31	60S	46	58
548	UPW-45	7.5	20S	0.8	10MR	2.5	10S	12.3	20S	57	69
549	UPW-46	5.8	20S	4.2	20S	1.3	5S	8	20S	56	69
550	UPW-47	13.6	40S	1.2	10MR	6.3	20S	11.7	40MS	56	68
551	UPW-48	7.3	20MS	2.1	10S	0.0	0	5.5	20MS	46	68
552	UPW-49	7.8	20S	0.4	5MR	0.0	0	5.6	20S	56	89
553	UPW-50	19.4	40S	0.5	5MR	0.0	0	4.4	20S	45	89
JNKVV, Powarkheda											
554	MPO-22-01	10.9	40S	3.3	20MS	2.5	10S	6.9	30S	56	89
555	MPO-22-02	0.9	10MR	8.1	20S	1.3	5S	49.4	80S	56	89
556	MP-22-03	21.5	40S	4.3	20S	5.0	10S	42.1	80S	56	89
557	MP-22-04	9.8	40MS	1.2	10MR	10.0	40S	41.4	80S	68	79

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
558	MP-22-05	8.7	40MS	10.6	20S	10.0	20S	48.3	80S	57	89
559	MP-22-06	13.3	40S	4.9	20MS	10.0	40S	8.7	20S	57	89
560	MP-22-07	2.1	5S	2	10S	0.0	0	10.9	40MS	57	89
560A	Infector	78.6	100S	76	100S	70.0	80S	77.1	80S	78	79
561	MP-22-08	3.8	10S	6.6	10S	5.1	10S	20	40S	57	89
562	MP-22-09	2.4	10MS	0.9	10MR	0.0	0	37.4	60S	57	89
563	MP-22-10	0.3	5MR	0.9	10MR	0.0	0	25.9	60S	56	89
564	MP-22-11	13.7	20S	1.2	15MR	0.0	0	45.1	60S	56	99
565	MP-22-12	2.6	10MS	3.2	20MS	0.0	0	49.4	80S	67	99
566	MP-22-13	7.1	20S	1.5	5S	10.0	40S	27.1	40S	47	79
567	MP-22-14	1.5	10MS	1.6	10MS	0.0	0	43.4	60S	57	79
568	MPO-22-15	1.8	10S	9.2	20S	0.0	0	40.6	60S	67	99
569	MP-22-16	9.9	20S	2.8	10S	0.0	0	35.6	60S	56	99
570	MPO-22-17	4.6	20S	0.6	5MR	0.0	0	5.4	20S	35	57
571	MPO-22-18	1.4	5S	0.1	R	0.0	0	1.8	5MS	57	89
572	MP-22-19	3.5	20MS	4.8	10MS	7.3	20S	6.7	20S	67	99
573	MPO-22-20	1.4	10MS	0.8	10MR	0.0	0	3.4	10MS	46	68
574	MP-22-21	1.9	10S	4.5	10S	3.8	10S	17.6	40S	57	89
575	MP-22-22	5.6	10S	1.7	10MS	1.3	5S	31.6	80S	56	89
576	MPO-22-23	19.5	100S	3.8	20MS	1.3	5S	6.7	40S	67	99
577	MP-22-24	2.8	10S	1.6	10MS	0.0	0	36.6	60S	46	79
578	MP-22-25	11.1	20S	1.6	10MS	0.0	0	42.3	60S	46	79
579	MPO-22-26	2.9	20MS	1.7	10MR	0.1	TR	4.2	10MS	67	89
580	MP-22-27	5.4	40MS	2.8	5MS	5.5	10S	27.1	60S	56	89
580A	Infector	81.4	100S	68	100S	70.0	80S	77.1	80S	78	89
581	MP-22-28	4.1	10S	2.8	10MS	5.0	20S	29.9	60S	57	79
582	MPO-22-29	21.1	80S	4	20S	2.5	10S	4.2	20S	45	78
583	MP-22-30	15.9	40S	0.8	10MR	2.5	10S	25	60S	56	69
Niphad											
584	NIAW 4267	2.9	20MR	0.6	5MR	1.0	5MS	44.3	60S	56	89
585	NIAW 4273	6.1	20MS	3.3	10MS	0.0	0	36.6	60S	56	77
586	NIAW 4280	9.8	40MS	9.9	20S	3.5	10S	38	60S	57	79
587	NIAW 4284	3.7	10S	8.2	20S	1.3	5S	39.4	80S	56	89
588	NIAW 4297	1.3	10MR	0.4	5MR	0.0	0	17.3	40S	56	79
589	NIAW 4300	1.2	10MR	0.6	5MR	0.1	TR	27	60S	56	68
590	NIAW 4311	1.3	10MR	0.8	10MR	1.3	5S	43.7	80S	45	68
591	NIAW 4312	2.9	20MR	0.4	5MR	0.0	0	40.9	80S	56	78
592	NIAW 4323	1.5	20MR	2	10MS	1.0	5MS	44.3	80S	67	89
593	NIAW 4324	0.9	10MR	5.8	20MS	0.0	0	50	80S	56	79
594	NIAW 4330	2.3	20MR	1.7	10MS	0.0	0	32	60S	46	57
595	NIAW 4332	1.4	5S	11.2	20S	5.0	20S	29.9	60S	56	69
596	NIAW 4338	1	5S	2	10S	0.0	0	16.3	40S	46	69
597	NIAW 4349	1.2	10MS	0.4	5MR	0.0	0	39.4	80S	56	99
598	NIAW 4357	9.4	40S	7.2	20S	6.0	20S	43.7	80S	46	79
599	NIAW 4359	2.9	10S	13	20S	13.3	40S	38.9	80S	56	99
600	NIAW 4364	12.6	40S	1.2	10MR	5.0	20S	42.3	60S	35	57
600A	Infector	78.6	100S	72	100S	75.0	80S	77.1	80S	78	89
601	NIAW 4387	9.5	40MS	7	20S	2.3	5S	46.8	80S	46	68
602	NIAW 4403	20	80S	7.6	30S	5.0	20S	43.3	80S	46	68
603	NIAW 4412	5.2	20S	1.9	10MS	7.5	20S	20.9	40S	46	69
604	NIAW 4424	4.6	20S	0	R	2.5	10S	33.6	60S	45	77
605	NIAW 4432	0.7	10MR	0.8	10MR	0.0	0	32.9	60S	57	79
606	NIAW 4437	6.9	20S	0.5	5MR	2.5	10S	21.3	60S	46	89
607	NIAW 4440	4.3	10MS	5.3	20MS	0.0	0	24.9	60S	45	58
608	NIAW 4454	22.1	80S	1.6	5MS	1.3	5S	29.6	60S	46	69
609	NIDW 1499	10.3	40S	3.3	20MS	2.5	10S	2	5S	45	57

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
610	NIDW 1507	10.3	40S	3.2	20MS	2.0	10MS	5	20MS	35	47
611	NIDW 1520	9.2	60S*	0	R	0.0	0	2	5MS	35	69
612	NIDW 1521	10.3	60S*	3.7	20MS	2.5	10S	1.7	5MS	35	89
613	NIDW 1534	8.1	40S	0.9	5MS	1.0	5MS	1.8	5MS	45	89
Bioseed research											
614	BW18R1009	6.6	20MS	0	R	0.0	0	24.4	60S	35	58
615	BW18R6060	11	20S	0.9	5MS	2.5	10S	54.3	80S	56	78
616	BW18R6016	3.5	20MS	3.2	10MS	5.2	20S	38.6	60S	57	79
CSSRI, Karnal											
617	KRL2101	0.5	5MR	12.4	60S	0.0	0	16.6	40S	46	78
618	KRL2102	4	20S	9.6	20S	17.5	40S	41.4	80S	46	79
619	KRL2103	5.8	40S	0.4	5MR	0.0	0	35.4	80S	46	78
620	KRL2104	2.5	20MR	2.9	10S	2.5	5S	55.7	80S	46	57
620A	Infector	78.6	100S	76	100S	75.0	80S	77.1	80S	78	89
621	KRL2105	0.3	5MR	0.5	5MR	0.0	0	13.7	40S	57	68
622	KRL2106	6.7	20S	2	10S	0.0	0	16.9	40S	34	78
623	KRL2107	10.7	40S	7.3	20S	2.5	10S	51.4	80S	56	77
624	KRL2108	1.9	10MS	2	10S	0.0	0	50	80S	57	79
625	KRL2109	1.3	5S	2	10S	0.0	0	27.6	40S	57	89
626	KRL2110	1.9	5S	2	10S	0.0	0	34.9	80S	56	89
627	KRL2111	14	60S	9.4	20S	11.3	40S	27.7	60S	56	89
628	KRL2112	9.8	40S	2	5S	0.1	TR	13.6	40S	46	89
629	KRL2113	7.9	20S	0.5	5MR	0.0	0	49.4	80S	46	57
630	KRL2114	13.7	60S	0.4	5MR	0.0	0	19.6	60S	46	77
631	KRL2115	1.7	20MR	0.5	5MR	0.0	0	35.7	80S	56	89
632	KRL2116	0.6	10MR	0.4	5MR	5.0	20S	27.4	60S	46	89
633	KRL2117	2	20MR	20	60S	5.0	20S	29.7	60S	46	57
634	KRL2118	2.9	10S	4	20S	0.0	0	50.3	80S	46	58
635	KRL2029	0.6	5MR	0.8	10MR	2.5	10S	45.3	80S	57	89
636	KRL2025	12.1	40S	0.5	5MR	0.0	0	21.7	60S	46	79
IIFSR, Modipuram											
637	SVPWL21-01	5.7	20S	0.1	R	2.5	10S	1	5S	35	78
638	SVPWL21-02	11	20S	0.1	R	0.0	0	5.4	20S	46	57
639	SVPWL21-03	5.9	20S	2.4	10MS	5.0	20S	4.6	20MS	57	77
640	SVPWL21-04	3.5	20S	0.9	10MR	0.0	0	14.9	40S	56	77
640A	Infector	78.6	100S	80	100S	70.0	80S	77.1	80S	78	79
641	SVPWL21-05	2	10S	0.4	5MR	0.0	0	7.6	20S	46	68
642	SVPWL21-06	8	20S	1	10MR	0.0	0	7.9	20S	56	77
643	SVPWL21-07	9.9	20S	0.1	TMR	0.0	0	4.3	20MS	46	79
644	SVPWL21-08	16	80S	2.6	10MS	1.3	5S	4.2	20MS	35	57
645	SVPWL21-09	2.5	20MR	2	10S	2.5	10S	12.2	40S	46	57
646	SVPWL21-10	11.4	40S	2.4	10S	1.3	5S	6.5	20S	46	57
647	SVPWL21-11	3.6	10S	1.2	5MS	1.3	5S	1.5	5S	46	57
648	SVPWL21-12	11.1	40MS	3.4	10MS	2.5	10S	6.4	20MS	45	79
649	SVPWL21-13	2.5	10S	1	5S	0.0	0	16.3	40S	46	57
650	SVPWL21-14	15.9	40S	3.3	10S	1.3	5S	9.9	40MS	56	89
651	SVPWL21-15	13.8	60S	13.5	40S	10.3	40S	3.7	20MS	57	89
PAU, Ludhiana											
652	BWL5410	6.1	20MS	2	10MS	0.2	TMS	5	30S	46	68
653	BWL 8878	15.7	70S	31.2	80S	15.8	40S	39.4	80S	46	68
654	BWL 9107	13	40S	3.8	10S	6.0	10S	5.1	20S	56	89
655	BWL 9244	6.9	20MS	16.2	40S	7.0	20S	42.3	80S	56	79
656	BWL 9264	17.9	40S	2.6	10MS	0.0	0	0.2	TS	57	79
657	BWL 9330	6	20S	1.2	5MS	0.0	0	5.1	30S	56	79
658	BWL 9344	4.2	20MS	0.8	10MR	0.0	0	0.4	5MR	46	68
659	BWL 9440	8.7	40S	2.6	5S	1.3	5S	0	0	56	79

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
660	BWL 9758	11.3	50S	15.4	60S*	11.8	40S	50	80S	45	79
660A	Infector	78.6	100S	76	100S	80.0	80S	77.1	80S	78	79
661	BWL 9851	8.1	20MS	3.7	20MS	2.0	10MS	2.2	5S	46	89
662	BWL 9869	4.9	20MS	4	20S	0.0	0	17.3	40S	57	89
663	BWL 9923	1.5	20MR	0.8	5MS	1.0	5MS	7.3	20MS	67	89
664	BWL 9928	10.9	40MS	0.4	5MR	0.0	0	6.3	20MS	46	57
665	BWL 9937	0.6	10MR	0.8	5MR	1.0	5MS	2.9	20MS	56	68
666	BWL 9945	4	20MS	14	40S	17.5	40S	45.7	80S	46	68
667	BWL 9951	4.7	20MS	2	10S	1.3	5S	17.3	40S	57	79
668	BWL 9995	6.9	20S	12.5	30S	16.8	40S	38.3	80S	35	57
669	BWL9984	1.8	10S	2	10MS	2.0	10MS	4.9	20MS	45	68
670	BWL9985	2.6	20MR	1.2	5MS	0.5	5MR	8.5	20S	56	78
671	BWL9986	1.7	10MS	0.8	5MR	10.5	40S	12.7	40S	56	68
672	WBL0002	4.6	20MS	5.7	10S	2.6	10S	0.3	5MR	46	57
673	WBL0003	15	40S	0.9	5MS	0.5	5MR	0.1	TMS	47	69
674	WBL0006	4.9	20S	10.1	40S	10.0	40S	36.6	60S	56	79
675	WBL0009	2.3	10MS	2.5	10MS	1.0	5MS	4.7	10S	46	89
676	WBL0014	2.9	10MS	0.5	5MR	0.0	0	2.4	10MS	46	56
677	WBL0016	1.5	10MS	0.1	R	5.0	20S	11.3	40S	46	58
678	WBL0018	1.7	10MS	2.4	10MS	2.5	10S	9.7	20S	56	68
679	WBL0023	7.9	20S	2.4	10MS	0.0	0	1.3	5S	56	99
680	WBL0026	2	10S	0.7	5MR	0.0	0	10.4	40S	46	89
680A	Infector	84.3	100S	80	100S	70.0	80S	77.1	80S	78	89
681	WBL0028	0.2	5R	0	R	0.0	0	0.7	5S	46	79
682	WBL0030	1.1	5S	1	5MS	0.0	0	1.4	10S	46	79
683	WBL0031	4.9	20S	6.1	30S	1.3	5S	2.1	10S	46	68
684	WBL0032	2.9	10MS	2.8	10MS	16.3	60S*	1.3	5S	46	68
685	WBL0042	11.6	40S	4.5	10S	5.0	10S	0.6	5MS	46	57
686	WBL0043	12.1	40S	24.7	80S	20.0	40S	39.4	60S	46	79
687	WBL0047	1.8	5MS	0.1	R	0.0	0	5.4	10S	56	77
688	WBL0051	1.5	10S	0.5	5MR	0.0	0	5.1	10S	46	67
689	WBL0053	8.4	20S	0	R	2.5	10S	1.5	10MS	56	78
690	WBL0060	3.8	20MS	0	R	0.0	0	1.3	10MS	45	57
691	WBL0061	5.7	20S	0.1	TMR	1.3	5S	2.6	10MS	57	67
692	WBL0062	9.7	40S	0.1	R	0.0	0	0	0	57	68
693	WBL0064	13.4	40MS	0.8	10MR	0.0	0	0	0	46	68
694	WBL0067	3.8	10S	4.1	20S	2.5	5S	0	0	45	68
695	WBL0068	3	10S	1.6	10MS	0.5	5MR	2.5	20MR	46	79
696	WBL0080	8	20S	2	10S	17.5	60S	19.1	40S	46	78
697	WBL0081	12.8	40S	13.8	60S*	25.0	60S	39.4	60S	46	68
698	WBL0090	22.9	100S	27.3	80S	20.3	40S	2.9	20MS	46	68
699	WBL0091	5.7	20S	0.4	5MR	0.1	TR	3.9	20MS	45	57
700	WBL0092	4.3	20S	0.8	10MR	5.0	20S	6.7	20MS	46	68
700A	Infector	81.4	100S	80	100S	70.0	80S	77.1	80S	78	79
701	WBL0093	7.4	20S	1.6	5MS	0.0	0	0.6	5MS	46	79
702	WBL0094	3.5	20MS	0	R	0.0	0	3.3	10MS	46	56
703	WBL0095	23.3	80S	0.8	10MR	0.0	0	4.9	20MS	46	58
704	WBL0096	2.7	10MS	1.7	10MS	0.0	0	18.3	40S	67	99
705	WBL0097	11	30S	12.1	40S	20.0	40S	52.9	60S	46	57
706	WBL0174	7.5	20S	2.8	10S	12.5	40S	0.7	5S	57	79
707	WBL0227	9.4	40MS	2.8	10S	3.8	10S	0.6	5MS	46	68
708	WBL0231	23	60S	11	20S	12.5	40S	0.6	5MS	45	89
709	WBL0239	30	80S	0	R	0.0	0	0.4	5MR	57	99
710	WBL0281	34.4	80S	3.6	10S	2.5	10S	0.1	TS	45	68
711	WBL0311	18.7	60S	6.4	20S	15.0	40S	4.1	10S	45	57
712	WBL0332	9.9	30S	11.4	40S	12.5	40S	45.1	60S	46	68

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
713	WBL0338	5.5	30S	8.8	40S	6.3	20S	13.7	40S	56	78
714	WBL0413	3.5	10S	2	10S	10.0	40S	26.3	60S	46	68
715	WBL0415	6.4	20MS	0.1	R	5.0	20S	27	60S	56	68
716	WBL0425	2.6	10MS	2.9	10S	6.0	20S	26.3	40S	46	68
717	WBL0428	10	40S	6.6	20S	11.0	40S	43.7	60S	56	68
718	WBL0431	4	10MS	4.8	20MS	0.0	0	8.1	20MS	46	57
719	WBL0435	3.5	20MS	2.3	10S	0.0	0	13.6	20S	56	79
720	WBL0438	7.7	20S	9.8	20MS	7.8	20S	38	60S	46	77
720A	Infector	78.6	100S	68	80S	70.0	80S	80	80S	78	89
721	WBL0517	4.3	20MS	5.4	10S	10.0	40S	7.4	20MS	56	89
722	WBL0530	4.6	20S	1.7	10MS	0.0	0	0.1	TR	46	79
723	WBL0588	6.7	20S	2.6	10MS	16.5	60S*	41.6	60S	46	68
724	WBL1601	3.2	10MS	3.6	10S	5.0	20S	9.7	20S	35	58
725	WBL1602	3.8	20MS	4.1	20S	0.0	0	28.6	40S	56	58
726	WBL1603	5.2	20S	6.4	20S	3.5	10S	37.1	60S	45	57
727	WBL1604	15.1	40S	4	20S	0.0	0	25.7	40S	46	68
728	WBL1605	6.9	20S	8.2	20S	21.0	60S	35	60S	46	68
729	WBL1606	6	20MS	0.1	TMR	0.0	0	24.4	40MS	35	68
730	WBL1607	21.3	60S	2.1	10MS	0.5	5MR	6.4	20S	46	68
731	WBL1608	12.6	40S	8.6	15S	22.0	40S	40.9	60S	45	78
732	WBL1609	18.3	40S	1.6	10MS	1.3	5S	0.1	TS	35	56
733	WBL1610	17.9	40S	3.2	10S	1.3	5S	0	0	46	57
734	WBL1611	8	20S	10.6	40S	2.5	10S	40	60S	45	57
735	WBL1612	1.6	10MS	0.2	TMS	0.0	0	0	0	46	78
736	WBL1613	4.1	20S	0	R	0.0	0	0.6	5MS	46	79
737	WBL1614	8.9	40MS	0.4	5MR	0.0	0	5.5	10S	35	57
738	WBL1615	30	60S	0	R	7.5	20S	27.9	40S	46	79
739	WBL1616	0.9	10MR	0	R	0.0	0	4.1	10MS	57	79
740	WBL1617	12	40S	18.6	40S	1.3	5S	42.9	60S	46	79
740A	Infector	81.4	100S	76	100S	70.0	80S	77.1	80S	78	78
741	WBL1618	4.4	20MS	2.1	10S	5.0	10S	10.9	20S	56	77
742	WBL1619	6.5	20MS	2.4	10MS	1.3	5S	0.7	5MS	56	79
743	WBL1620	2.9	20MS	3.2	10MS	0.0	0	0.1	TMR	55	78
744	WG 2395	3.5	20S	7.2	20S	6.0	20S	37.1	60S	46	68
745	WG 2396	4.1	10MS	2	10S	2.5	10S	4.6	20S	46	57
746	WG 2399	13.1	40S	3.6	20MS	2.0	10MS	2.6	10MS	45	56
747	WG 2429	4.8	20MS	4.5	10S	2.6	10S	7.9	20S	46	68
748	WG 2432	16.8	40S	4.1	10S	1.3	5S	0.9	5MS	45	57
749	WG 2434	11	40S	3.6	20MS	2.5	10S	1.1	5S	46	47
750	WG 2435	2.4	20MS	0.8	10MR	0.0	0	5.6	20S	35	68
751	WG 2437	13.7	40S	5.8	20S	0.0	0	1.7	5S	35	47
752	WG 2457	9.1	20S	1.6	10MS	2.6	10S	5.1	10S	24	46
753	WG 2467	13.9	40S	2	10S	0.0	0	16.6	40S	34	68
754	WG 2469	11.5	40S	4	20S	2.5	10S	20	40S	35	68
755	WG 2474	7.4	20S	0.2	TMR	1.3	5S	26.3	40S	35	57
756	WG 2496	0.6	5MR	0	R	0.0	0	4.7	20S	46	68
757	WG 2499	6.3	20S	0	R	0.5	5MR	9.1	40S	35	68
758	WG 2526	8	40S	1.8	5S	1.0	5MS	17.7	40S	45	56
759	WG 2540	0.6	10MR	0	R	0.0	0	17.3	40S	35	57
760	WG 2541	1.5	20MR	0.4	5MR	0.5	5MR	1.1	10MS	46	58
760A	Infector	81.4	100S	80	100S	70.0	80S	77.1	80S	78	79
761	WG 2542	7.7	20S	16.6	40S	26.3	60S	1.1	10MS	56	68
762	WG 2543	19.9	80S	1	5S	0.0	0	3	5S	46	57
763	DW582	21.7	80S	4.1	20S	2.5	10S	4.7	20MS	56	89
764	DW583	21.7	60S	1.7	10MS	2.0	10MS	2.9	10MS	45	89
765	DW584	17.8	100S	2	10S	2.5	10S	4.9	20S	35	57

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
766	DW585	29.1	100S	4	20S	2.5	10S	4.4	10MS	45	79
767	DW586	16.6	100S*	2	10S	2.5	10S	3.1	10MS	35	58
768	DW587	25.2	100S	5	20S	2.5	10S	4.9	20MS	56	89
769	DW588	20.7	100S	2.1	5S	5.0	20S	2.7	10S	45	89
770	DW589	14.5	60S	1.1	5S	0.0	0	6	40MS	46	89
771	DWG 2601	19.4	40S	2.4	10S	2.5	10S	0.7	5S	35	56
772	WBL1621	13.8	60MS	3.2	20MS	1.0	10MR	0.7	5S	46	57
773	WBL1622	17.7	80S	0.8	10MR	0.0	0	0.6	5MS	45	68
774	WBL1623	6.1	60MR	0.4	5MR	0.0	0	1.1	10MS	46	79
775	WBL1624	9.3	30S	11.2	20S	12.5	40S	36.6	60S	56	68
776	WBL1625	3.6	40MR	0.4	5MR	0.0	0	5.1	20MS	67	89
777	WBL0441	3.3	10S	2.4	10MS	0.0	0	25.9	40S	56	79
778	WBL0493	2.9	20MS	0.5	5MR	0.1	TR	12	40S	57	69
779	WBL0536	1.6	10MS	1.2	10MR	0.0	0	2.1	10MS	45	68
780	WBL0567	3.4	10MS	0.5	5MR	17.5	40S	1.9	10MS	45	57
780A	Infector	78.6	100S	76	100S	75.0	100S	77.1	80S	78	79
781	WBL0577	8.6	20MS	0.8	10MR	0.0	0	0.7	5S	46	79
IARI, New Delhi											
782	IARI-21-1	6.7	20S	9	20S	25.0	60S	16	40S	56	77
783	IARI-21-2	5.3	20S	3	10MS	2.5	10S	39.4	60S	46	77
784	IARI-21-3	12.7	40MS	2.4	10S	2.5	10S	4.5	20MS	46	77
785	IARI-21-4	15.1	40S	4.7	10S	7.5	20S	5.6	20MS	46	77
786	IARI-21-5	11.5	40S	4.6	10MS	16.3	40S	20.7	40S	46	58
787	IARI-21-6	6.3	20S	1.3	5MS	15.0	40S	4.4	10S	57	77
788	IARI-21-7	3.1	10MS	6.2	10S	21.3	40S	10.7	40S	46	77
789	IARI-21-8	10.5	40S	0.8	5MS	0.0	0	24.1	40S	57	79
790	IARI-21-9	5.3	20MS	13.8	40S	20.0	40S	7.7	20S	57	79
791	IARI-21-10	16.4	40S	1	5S	1.0	5MS	7.3	20S	35	57
792	IARI-21-11	16.6	80S	8.4	20MS	1.0	5MS	35	60S	56	67
793	IARI-21-12	23.7	60S	5.2	20MS	1.3	5S	16.6	40MS	57	77
794	IARI-21-13	16	40S	5.2	10S	12.5	40S	20.6	40S	46	89
795	IARI-21-14	13.4	40S	0.5	5MR	7.5	20S	25.1	60S	46	89
796	IARI-21-15	6.6	20S	2	10S	5.0	20S	2.8	10S	46	79
797	IARI-21-16	18.6	40S	1	5S	0.0	0	34.3	60S	46	68
798	IARI-21-17	12.4	60S*	1.3	15MR	0.0	0	4.3	20MS	35	58
799	IARI-21-18	8.1	40S	7.6	20S	17.5	60S	33.7	60S	56	68
800	IARI-21-19	1.2	10MS	0	R	0.0	0	4.7	20MS	46	79
800A	Infector	81.4	100S	84	100S	70.0	80S	68.6	80S	78	89
801	IARI-21-20	10.6	20S	3.6	10S	5.0	20S	9	40MS	56	89
802	IARI-21-21	3.6	20MS	0.9	10MR	0.0	0	44.3	60S	57	79
803	IARI-21-22	0.4	5MR	0.6	5MR	1.3	5S	37.1	60S	56	77
804	IARI-21-23	24.3	60S	27	40S	20.0	60S	0.1	TS	56	67
805	IARI-21-24	14.6	60S*	10.8	20S	6.0	20S	29.3	60S	57	78
806	IARI-21-25	12.8	60S*	11.2	40S	11.0	40S	35.7	60S	57	68
807	IARI-21-26	0.6	5MS	0	R	0.0	0	7.9	20S	35	68
808	IARI-21-27	23.4	60S	1	5S	0.0	0	1.9	5S	56	68
809	IARI-21-28	9.4	20S	0.9	10MR	0.0	0	7.6	20S	45	68
810	IARI-21-29	7.4	20MS	2.1	20MR	0.0	0	17.4	60S	46	77
811	IARI-21-30	3.8	20S	0.5	5MR	0.0	0	36.3	60S	56	78
812	IARI-21-31	12.9	30S	26	40S	30.1	40S	30.1	60S	47	79
813	IARI-21-32	3	20MR	4.1	10MS	2.5	5S	31.4	60S	56	78
814	IARI-21-33	5.3	20S	0.5	5MR	0.0	0	9.7	40MS	46	79
815	IARI-21-34	4.4	20S	6.1	20MS	2.5	10S	32.9	60S	46	79
816	IARI-21-35	0.5	5MR	0.5	5MR	0.0	0	56.6	80S	46	89
817	IARI-21-36	0.5	5MR	0	R	0.0	0	65.1	80S	57	79
818	IARI-21-37	0.6	5MR	1.2	10MR	0.0	0	60	80S	56	79

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
819	IARI-21-38	0.3	5MR	0.5	5MR	0.0	0	40.7	80S	46	58
820	IARI-21-39	4.7	30S	8.1	40S	0.0	0	46.4	80S	46	77
820A	Infector	78.6	100S	76	100S	80.0	100S	77.1	80S	68	78
821	IARI-21-40	0.1	TR	1	10MR	0.0	0	42.3	60S	56	99
822	IARI-21-41	0.6	5MR	8	20S	3.5	10S	39.4	60S	67	79
823	IARI-21-42	9.8	20S	11.2	40S	20.5	40S	5.9	20MS	56	99
824	IARI-21-43	11	40S	9.3	20S	2.5	5S	34.9	60S	56	79
825	IARI-21-44	13.9	30S	8	40S	0.0	0	4.7	10S	57	79
826	IARI-21-45	8.2	20S	0	R	0.0	0	3.5	5S	57	89
827	IARI-21-46	5.5	20S	1.6	10MS	0.0	0	5.1	20MS	45	68
828	IARI-21-47	0.4	5MR	3.6	10MS	1.3	5S	26.9	60S	56	84
829	IARI-21-48	18.9	60S	3.4	20MS	0.1	TR	5.6	20S	46	68
830	IARI-21-49	7.1	20S	0	R	0.0	0	6.2	20S	46	89
831	IARI-21-50	7.2	40S	5.8	20MS	2.5	10S	0	0	46	79
832	IARI-21-51	8.1	40S	8.8	20S	0.5	5MR	40.6	60S	56	58
833	IARI-21-52	16.1	60MS	21.2	40S	20.5	40S	0.6	5MS	46	58
834	IARI-21-53	44.3	80S	8.8	20S	20.0	60S	4.5	20MS	45	56
835	IARI-21-54	8.9	20MS	4.2	20S	7.5	20S	27.6	40S	57	89
836	IARI-21-55	3.5	10MS	4.9	20S	0.0	0	36.4	60S	45	78
837	IARI-21-56	4.7	20S	6.6	20S	1.3	5S	41.6	60S	36	68
838	IARI-21-57	32.1	80S	10.8	40S	25.0	60S	23.4	60S	46	68
839	IARI-21-58	24	80S	24	40S	37.5	80S	31.4	60S	56	78
840	IARI-21-59	17.6	40S	3.2	10MS	30.0	60S	33.7	60S	67	79
840A	Infector	81.4	100S	76	100S	80.0	100S	77.1	80S	68	79
841	IARI-21-60	11.3	40MS	3.3	10MS	20.0	60S	11.5	40S	46	79
842	IARI-21-61	12.7	40S	4	15MS	2.5	10S	3.3	10S	46	79
843	IARI-21-62	4	10S	1.6	10MS	2.5	10S	26.7	60S	56	89
844	IARI-21-63	4.2	20S	2.6	10MS	0.0	0	23.6	40S	46	69
845	IARI-21-64	20	50S	28.2	60S	20.3	80S*	32.7	60S	57	78
846	IARI-21-65	5.1	10S	6.5	20S	0.5	5MR	44.3	80S	46	69
847	IARI-21-66	0.5	5MR	1.2	15MR	0.0	0	38.6	80S	57	79
848	IARI-21-67	1.3	5S	2	10S	5.0	20S	53.7	80S	56	89
849	IARI-21-68	1.2	5S	3	15S	0.0	0	46.9	80S	56	89
850	IARI-21-69	0.6	5MR	0.8	10MR	0.0	0	44.3	60S	56	89
851	IARI-21-70	0.1	TR	1.6	10MS	0.0	0	57.1	80S	46	89
852	IARI-21-71	0.3	5MR	1.2	15MR	0.0	0	50	80S	45	89
853	IARI-21-72	0.7	5MR	15.6	60S*	17.5	40S	33.7	60S	46	89
854	IARI-21-73	6.6	20S	12	20S	2.5	5S	43.7	60S	56	79
855	IARI-21-74	19.4	40S	6.1	20S	3.8	10S	13.1	40S	56	68
856	IARI-21-75	12.3	40S	1.2	10MR	0.0	0	12.9	40S	45	79
857	IARI-21-76	7.7	20S	9.4	20S	0.0	0	12.1	40S	57	99
858	IARI-21-77	13.6	20S	8.8	30S	15.0	40S	14.6	60S	67	99
859	IARI-21-78	2.8	20MS	2	10MS	0.0	0	9	40S	45	89
860	IARI-21-79	6.5	40S	1.2	10MR	0.0	0	7.4	40S	46	99
860A	Infector	81.4	100S	80	100S	75.0	80S	74.3	80S	78	89
861	IARI-21-80	5.9	40S	2	5MS	0.0	0	1.6	5MS	46	79
862	IARI-21-81	5.9	40S	0.5	5MR	0.0	0	1.6	5MS	46	69
863	IARI-21-82	3.2	20S	4	20MS	2.5	10S	8	40MS	46	69
864	IARI-21-83	2.9	10S	0.9	10MR	0.0	0	3.6	10S	45	69
865	IARI-21-84	7.8	20S	1.6	5MS	1.0	5MS	3.6	10MS	46	68
866	IARI-21-85	4.7	20S	1	10MR	0.0	0	4.3	10MS	45	68
867	IARI-21-86	3.6	20S	1.6	5MS	0.0	0	4.9	40MR	46	68
868	IARI-21-87	2	10S	1.2	5MS	0.0	0	2.1	5S	46	68
869	IARI-21-88	2	10S	2	10S	3.8	10S	2.8	5S	35	57
870	IARI-21-89	17.5	50S	36	60S	27.5	60S	3.4	20MS	56	79
871	IARI-21-90	0.6	10MR	0.5	5MR	0.0	0	22.3	60S	56	68

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
872	IARI-21-91	0.7	10MR	1.2	10MR	0.0	0	23.6	60S	56	78
873	IARI-21-92	0.1	TR	1.6	10MS	0.0	0	37.1	60S	46	57
874	IARI-21-93	10.3	40MS	19	20S	17.5	40S	0.1	TS	46	56
875	IARI-21-94	12.6	40S	3.2	10S	2.5	10S	3	20S	46	68
876	IARI-21-95	16.1	40S	28.4	80S	21.3	40S	27.1	60S	35	68
877	IARI-21-96	5	20MS	3.6	10MS	1.3	5S	15.6	40S	45	57
878	IARI-21-97	4.1	10S	9.4	20S	10.0	40S	37.1	60S	46	68
879	IARI-21-98	6.7	20MS	6.5	20S	15.0	40S	6.6	20S	57	89
880	IARI-21-99	22	60S	3.8	10MS	2.5	10S	18.3	80S	56	89
880A	Infector	81.4	100S	76	100S	75.0	80S	74.3	80S	78	79
881	IARI-21-100	20	80S	5.4	20MS	12.5	40S	7.6	20MS	56	89
882	IARI-21-101	16.3	80S*	2.8	15MS	0.0	0	11.5	40MS	45	57
883	IARI-21-102	3.4	10MS	1.6	10MS	0.0	0	2.7	20MR	57	89
884	IARI-21-103	7.3	20S	1.3	10MR	0.0	0	7	20S	56	89
885	IARI-21-104	1.6	10MS	1.6	10MS	0.0	0	38.3	80S	45	68
886	IARI-21-105	1.5	10MS	1.7	10MS	0.0	0	42.9	80S	46	78
887	IARI-21-106	0.7	5MS	1.6	10MS	0.0	0	28.6	60S	46	69
888	IARI-21-107	3.5	20S	15.2	30S	25.0	60S	39.4	60S	56	78
889	IARI-21-108	0.9	10MR	1.3	10MR	0.5	5MR	3.7	10MS	46	67
890	IARI-21-109	1	10MR	0.5	5MR	0.0	0	3.6	20MS	46	67
891	IARI-21-110	0.3	TS	0.4	5MR	0.0	0	17.7	40S	57	69
892	IARI-21-111	0.1	TMR	1.7	5MS	0.5	5MR	3.6	20S	46	79
893	IARI-21-112	5.1	20S	9.6	20S	10.0	20S	12.4	60S	45	57
894	IARI-21-113	22.3	60S	17.6	40S	20.0	40S	24.9	60S	56	79
895	IARI-21-114	14.3	40S	16.2	40S	25.5	60S	3.2	20MR	56	78
896	IARI-21-115	2.1	10MS	13.2	40S	12.5	40S	13.5	60S	57	69
897	IARI-21-116	5.1	20MS	12	20S	7.5	10S	37.3	80S	46	56
898	IARI-21-117	11.5	60S	6.8	20MS	17.5	40S	23.6	80S	46	78
899	IARI-21-118	7	40S	0.9	10MR	0.0	0	10.6	40S	46	79
900	IARI-21-119	0.8	5S	0	R	2.5	10S	13.3	60S	45	79
900A	Infector	81.4	100S	80	100S	80.0	100S	74.3	80S	78	89
901	IARI-21-120	14.1	60S	5.8	20MS	0.1	TR	3.5	20S	45	58
902	IARI-21-121	2.3	5S	2	10S	10.0	40S	7.5	40S	46	89
903	IARI-21-122	10.3	40S	0.8	10MR	6.3	20S	24	60S	46	89
904	IARI-21-123	26.9	60S	24.2	40S	21.3	40S	33.7	60S	46	89
905	IARI-21-124	4.9	20S	13.2	20S	17.5	40S	39.4	60S	45	89
906	IARI-21-125	9.2	40S	9	20S	23.0	40S	45.1	60S	46	77
907	IARI-21-126	21.3	60S	7.6	20S	3.8	10S	17.3	40S	45	58
908	IARI-21-127	0.1	TR	0.8	10MR	0.0	0	41.7	80S	46	56
909	IARI-21-128	0.3	5MR	1.6	10MS	0.0	0	55.1	80S	46	89
910	IARI-21-129	1	5S	1.6	10MS	0.0	0	30.3	80S	56	89
911	IARI-21-130	1	5S	0.9	10MR	0.0	0	46.3	80S	46	89
912	IARI-21-131	0.9	10MR	0	R	0.0	0	5.7	20MS	45	58
913	IARI-21-132	2.9	10S	0.4	5MR	0.0	0	7.4	30MS	46	69
914	IARI-21-133	13	60S	3.4	15S	0.0	0	16.6	60S	46	68
915	IARI-21-134	17.4	40S	3	20MR	2.5	5S	11.6	60S	46	79
916	IARI-21-135	20.6	80S	5.2	20MS	12.5	40S	13.6	60S	45	79
917	IARI-21-136	10.7	40S	8.4	20S	3.8	10S	43.6	80S	57	68
918	IARI-21-137	19	80S	12	40S	1.8	5S	48.3	80S	46	69
919	IARI-21-138	26.4	60S	2.8	10MS	3.0	10S	3.7	20S	46	89
920	IARI-21-139	0.5	5MR	1.2	15MR	5.0	20S	35.1	80S	56	89
920A	Infector	75.7	100S	72	100S	70.0	80S	77.1	80S	78	89
921	IARI-21-140	8.6	40S	2.7	10MS	10.0	40S	1.4	10S	46	89
922	IARI-21-141	14.2	80S	5.8	10S	22.5	40S	16.6	40S	35	57
923	IARI-21-142	5.1	10MS	5	20MS	16.3	40S	24.1	60S	46	78
924	IARI-21-143	8.9	40S	8	20MS	10.0	20S	41.4	60S	46	78

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
925	IARI-21-144	17.8	40S	12.8	40S	20.0	40S	17.1	40S	57	79
926	IARI-21-145	27.6	60S	5.6	20MS	6.3	20S	2.4	10S	46	79
927	IARI-21-146	11.5	40S	0.9	5MR	0.0	0	4.7	20S	45	58
928	IARI-21-147	1.5	20MR	0.4	5MR	0.0	0	3.8	20S	46	56
929	IARI-21-148	0.3	5MR	2.4	20MR	2.0	10MS	21.3	40S	46	58
930	IARI-21-149	0.3	5MR	0.5	5MR	0.0	0	39.1	60S	35	57
931	IARI-21-150	7.2	20MS	13.6	30MS	2.5	10S	43.7	60S	46	68
932	IARI-21-151	5.9	40S	1.2	5S	0.0	0	3.3	20MR	57	69
933	IARI-21-152	4	20S	1.2	5S	0.0	0	5.6	20MS	46	68
934	IARI-21-153	4.6	20S	0.2	TMS	2.5	10S	14.4	40S	46	68
935	IARI-21-154	0.9	5MS	3.6	20MS	10.0	40S	48	60S	46	68
936	IARI-21-155	0.3	5MR	4.1	20MS	2.5	10S	44.3	60S	35	69
937	IARI-21-156	4.9	20S	5.5	20S	16.7	40S	42.3	60S	46	77
938	IARI-21-157	3.9	20MS	1.8	10MS	1.3	5S	22.9	40S	46	68
939	IARI-21-158	4	20MS	4.8	20MS	0.0	0	10.6	20S	56	77
940	IARI-21-159	1.5	10MS	0.4	5MR	0.0	0	2.7	10S	35	47
940A	Infector	81.4	100S	84	100S	80.0	100S	77.1	80S	78	78
941	IARI-21-160	14.3	60MS	12.6	40S	20.0	40S	20.8	40S	57	79
942	IARI-21-161	9.2	60MS*	6.8	10S	12.5	40S	26.6	60S	57	69
943	IARI-21-162	0.3	5MR	0.1	TMR	2.5	10S	17.7	40S	45	57
944	IARI-21-163	6	20S	12	40S	17.5	40S	36.6	60S	45	57
945	IARI-21-164	14.1	40MS	18.8	40S	12.5	40S	9.6	40S	46	57
946	IARI-21-165	16.1	40S	14	40S	27.5	40S	23	60S	57	67
947	IARI-21-166	0.9	10MR	0.8	10MR	0.5	5MR	8.4	20S	46	58
948	IARI-21-167	12.9	60S	0.4	5MR	2.5	10S	18.9	60S	46	67
IIWBR (Hanif Khan)											
949	RWP1170	9.5	30S	20.4	40S	26.3	60S	33.7	60S	57	89
950	RWP1365	15.2	50S	25.2	60S	17.5	40S	36.6	60S	56	89
951	RWP1375	12	50S	20.8	60S	25.0	40S	39.4	60S	46	79
952	RWP1397	14	50S	35.2	60S	17.5	40S	43.7	60S	46	79
953	RWP1403	15.2	50S	22.4	60S	7.5	10S	46.6	60S	46	79
954	RWP1407	15.5	60S	9.6	20MS	13.8	40S	43.7	60S	45	68
RVSKVV, Gwalior											
955	RVW 4360	31.7	60S	37.2	80S	20.0	60S	45.1	60S	46	79
956	RVW 4361	11.4	20S	20.8	30MS	27.5	60S	43.7	80S	56	77
957	RVW 4362	8.6	30S	8.4	20MS	17.5	40S	38.3	60S	46	68
958	RVW 4363	3.7	10MS	6.4	20MS	5.0	10S	26.3	40S	46	79
959	RVW 4364	22.9	80S	18.4	40S	26.3	60S	28.6	60S	46	69
960	RVW 4365	3.5	40MR	10.2	40S	12.5	40S	42.3	80S	57	69
960A	Infector	78.6	100S	80	100S	80.0	100S	77.1	80S	68	78
961	RVW 4366	1.2	5MS	8.8	20S	15.0	40S	40.1	80S	56	79
962	RVW 4367	11.9	40MS	0.5	5MR	0.0	0	50.9	60S	46	79
963	RVW 4368	1.1	5S	5.6	20MS	1.3	5S	48.9	60S	35	57
964	RVW 4369	2.6	10MS	4.8	20MS	13.5	40S	46	60S	46	77
965	RVW 4370	6.6	20MS	2.8	5S	3.8	10S	25.7	40S	45	77
966	RVW 4371	1.9	5S	4.2	20MS	3.8	10S	20.6	40S	56	68
967	RVW 4372	2.3	10MS	5.2	20MS	0.0	0	45.1	60S	46	69
968	RVW 4373	2.9	10S	0.8	5MS	0.0	0	23.7	40S	46	77
969	RVW 4374	8.1	20S	0	R	0.0	0	28	40S	46	68
970	RVW 4375	1.3	5MR	0.1	TMR	0.0	0	22.9	40S	45	57
971	RVW 4376	0.7	5MR	0.5	5MR	0.0	0	26.3	60S	57	68
972	RVW 4377	2.7	20MS	1.6	10MS	0.0	0	15.1	40S	57	89
JAU, Junagarh											
973	J 20-01	0.5	5MR	1.8	10MS	0.0	0	58.6	80S	56	79
974	J 20-03	0.5	5MR	1.2	15MR	2.5	10S	48	80S	47	89
975	J 20-05	2.1	10S	6.8	20S	0.0	0	56.6	80S	57	89

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
976	J 20-06	1.2	15MR	1.6	10MS	1.3	5S	60	80S	56	89
977	J 20-07	0.3	5R	0.8	10MR	0.0	0	57.1	80S	46	69
978	J 20-12	2.6	10S	9.2	20S	0.0	0	49.7	80S	46	79
979	J 20-13	0.7	10MR	0.4	5MR	0.0	0	54	80S	56	89
980	J 20-14	1.5	10MR	1.2	15MR	1.3	5S	46.9	80S	56	89
980A	Infector	78.6	100S	68	100S	70.0	80S	68.6	80S	78	89
981	J 20-16	1.2	10MR	11.2	40S	2.5	10S	53.7	80S	45	99
982	J 20-17	2	10S	14	40S	5.0	20S	50.9	80S	45	99
983	J 20-18	1.3	10MS	0.1	R	10.0	40S	43.7	80S	56	99
984	J 20-19	1.7	10MR	4.2	20MS	0.0	0	38.6	80S	57	99
985	J 20-25	3.2	10S	1.6	10MS	0.0	0	50.9	80S	56	99
986	J 20-26	0.3	5MR	0.4	5MR	0.0	0	51.4	80S	57	99
987	J 20-30	0.3	5MR	0.8	10MR	2.5	10S	61.4	80S	67	99
988	J 20-31	1.1	5MR	0.8	10MR	1.3	5S	62.9	80S	67	99
989	J 20-32	0.6	5MR	0.5	5MR	0.0	0	48.6	60S	67	99
990	JD 20-10	2.1	10S	1	10MR	0.0	0	10.5	40S	46	77
991	JD 20-12	1.7	5S	0.5	5MR	0.0	0	4	20S	46	57
992	JD 20-13	3.3	20S	0.5	5MR	0.0	0	3.8	20MS	47	68
IIWBR (Vishnu Kumar)											
993	IC640204	4.4	20S	2	20MR	0.0	0	3.9	10S	46	78
NABI, Mohali											
994	NABI 21-1	8.3	20S	1.6	5S	15.0	60S*	33.6	80S	35	57
995	NABI 21-2	9.7	20S	0.6	5MR	15.0	60S*	28.6	60S	46	77
IIWBR											
996	RWP1055	7.5	20S	0	R	0.0	0	11.4	40S	56	79
997	RWP1056	7.9	40MS	3.2	20MS	5.0	20S	6.1	20MS	46	79
998	RWP1157	14	40S	4.6	20MS	1.3	5S	2.8	10S	56	79
999	RWP1058	14.4	60S	4	20MS	0.0	0	7	20S	56	79
1000	RWP1060	3.3	10MS	0.9	10MR	0.0	0	17.7	40S	35	56
1000A	Infector	81.4	100S	76	80S	80.0	100S	77.1	80S	78	79
1001	RWP1091	15.4	40S	4.8	10S	6.3	20S	13.9	40S	45	68
1002	RWP1099	2.2	10S	2.4	20MR	1.3	5S	9.5	40S	45	68
1003	LBP2020-8	3.5	20MS	4	15MS	1.3	5S	1.4	5S	35	57
1004	LBP2020-10	5.9	20MS	6.4	20MS	2.6	10S	3.9	10S	46	68
1005	LBP2020-22	17	40S	1.4	15MR	1.3	5S	11.4	40S	45	77
1006	LBP2020-25	22.9	80S	0.8	5MS	0.0	0	13.9	40S	45	77
1007	DWAP2020-26	13.7	40S	1.6	10MS	0.0	0	5.6	20S	46	79
1008	DWAP2020-28	29.3	60S	8	40S	0.0	0	3.8	20MS	35	57
1009	DWAP2020-29	14.6	40S	2.8	10MS	0.5	5MR	9.6	40S	46	69
1010	DWAP2020-30	2.3	10MS	0	R	0.0	0	19.4	40S	45	56
1011	PBS-PYT-IR-2020-21	26.6	60S	2.6	10MS	0.0	0	40.7	60S	45	68
1012	PBS-PYT-IR-2020-30	2.6	10MS	4	20MS	1.0	10MR	1.6	5S	45	68
1013	QYT-2030	4.3	40MS	0.8	10MR	0.3	TS	5	20MS	56	69
1014	QYT-2031	3.3	20MR	3.6	20MS	1.3	5S	4.1	20MS	46	68
1015	QYT-2032	2.7	10MS	0.8	10MR	1.3	5S	4.4	20S	45	69
1016	QYT-2047	5.4	20MS	0.8	5MR	0.0	0	7.9	40S	46	69
1017	QYT-2049	2.3	5MS	5	10S	5.0	20S	24.3	60S	35	69
1018	QYT-2050	6.6	20MS	0	R	0.0	0	6.2	20MS	35	78
1019	RWP1057	11.3	40MS	2	10S	1.3	5S	7.7	30MS	46	78
1020	RWP1097	20.9	60S	8.1	40S	0.0	0	10.9	20S	45	89
1020A	Infector	78.6	100S	76	100S	80.0	100S	74.3	80S	78	89
1021	RWP1104	7.6	20S	2.4	10MS	11.3	40S	10.8	40S	46	79
1022	RWP1148	1.7	10MR	0.8	10MR	2.5	10S	8.3	20S	56	78
1023	RWP1155	0.7	10MR	0.9	10MR	2.5	10S	11.6	20S	56	79

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
1024	LBP2020-11	7.1	20S	2.6	15MS	2.5	10S	5.7	20S	45	77
1025	LBP2020-20	0.4	5MR	1.7	10MS	3.8	10S	17.1	40S	45	68
1026	LBP2020-21	4.6	20S	6.2	30S	2.5	10S	11.4	40S	46	68
1027	DWAP2020-10	7.4	20MS	8.6	20S	1.3	5S	13.6	40S	45	69
1028	DWAP2020-15	13.9	40S	1.3	15MR	0.0	0	21.7	60S	35	46
1029	DWAP2020-22	5.4	20MS	2.8	20MR	0.0	0	6.5	20S	46	69
1030	DWAP2020-27	6	20S	0.8	10MR	6.3	20S	4.5	20MS	45	77
1031	PBS-PYT-IR-2020-01	0.3	5MR	5.4	10S	5.0	20S	12.5	30MS	46	69
1032	PBS-PYT-IR-2020-12	7.5	30S	9.7	40S	1.3	5S	32.3	60S	45	69
1033	PBS-PYT-IR-2020-13	6.6	20MS	3.7	10S	5.0	20S	7.3	20S	45	68
1034	PBS-PYT-IR-2020-32	20.9	80S	13.2	40S	10.0	20S	7.9	20S	46	68
1035	PBS-PYT-IR-2020-35	14.6	40S	7.2	20S	0.0	0	7.7	20S	46	69
1036	QYT-2034	13.1	20S	7.2	20S	1.3	5S	6.9	20S	46	57
1037	QYT-2036	4.7	20MS	0.4	5MR	0.0	0	2.6	10MS	34	47
1038	QYT-2038	7.9	20S	4	20MS	12.5	40S	7.1	20MS	34	78
1039	QYT-2041	6.9	20MS	2.4	10S	2.5	10S	18.3	40S	34	57
1040	QYT-2048	8	20MS	4.4	20S	2.5	10S	12.4	60S	34	57
1040A	Infector	78.6	100S	76	100S	80.0	100S	74.3	80S	78	79
1041	QYT-2073	3.4	10MS	2.4	10MS	5.0	20S	29.4	60S	35	57
1042	RWP1008	5.1	10MS	4.8	20MS	10.0	40S	6.9	20S	46	69
1043	RWP1103	17.1	40S	3.7	15MS	2.5	10S	10.1	40MS	46	69
1044	RWP1109	8.1	20MS	2.6	10MS	0.0	0	14.6	40S	46	79
1045	RWP1123	6.3	20S	1.2	10MR	0.0	0	8.3	20S	46	67
1046	LBP2020-28	4.6	20MS	2	5MS	2.5	10S	4.1	10S	34	57
1047	LBP2020-37	34.3	80S	0.2	TMS	0.0	0	16.7	40MS	36	69
1048	LBP2020-40	18.9	40S	1.2	5MS	1.3	5S	1.3	5S	35	58
1049	LBP2020-50	5.7	20MS	0	R	0.0	0	7.7	20MS	56	78
1050	LBP2020-51	12	40MS	1.6	5MS	1.3	5S	6.2	20S	45	79
1051	LBP2020-52	23.3	60S	4	20MS	0.1	TR	14.3	40MS	46	79
1052	DWAP2020-40	18.3	40S	1.4	15MR	6.3	20S	25	60S	45	79
1053	DWAP2020-42	30	60S	0.8	10MR	0.0	0	14.7	40S	45	78
1054	DWAP2020-49	10	40S	1.7	10MS	1.0	5MS	4.5	20MS	46	78
1055	DWAP2020-50	19.3	40S	1.8	5MS	0.0	0	8.9	20S	35	69
1056	DWAP2020-51	7.5	20S	2.8	15MR	0.0	0	4	10S	35	58
1057	DWAP2020-52	3.7	10S	2.4	10MS	0.0	0	3.8	20MS	45	57
1058	PBS-PYT-LS-2020-01	12.1	20S	2.6	15MS	0.0	0	16.1	40S	47	69
1059	PBS-PYT-LS-2020-03	4.9	10MS	3.2	20MS	0.0	0	6.7	20MS	56	89
1060	PBS-PYT-LS-2020-06	4	20MR	0.4	5MR	0.0	0	24.6	60S	46	79
1060A	Infector	81.4	100S	68	100S	75.0	80S	75.7	80S	78	79
1061	PBS-PYT-LS-2020-10	8	40S	11.2	20S	16.0	60S*	30	60S	45	78
1062	PBS-PYT-LS-2020-12	1	10MR	2.4	10MS	1.0	5MS	0.6	5MS	46	79
1063	QYT-2051	5.8	20MS	13.6	20S	14.0	40S	21.1	40S	45	79
1064	QYT-2061	4.9	20MS	9.4	20S	28.0	40S	8.7	20S	45	89
1065	RWP1063	12.9	40S	1.7	10MS	5.0	20S	21.4	40S	46	79
1066	RWP1067	5.9	20S	1.7	5MS	0.0	0	6.8	20MS	56	89
1067	RWP1071	8.7	40S	0.9	10MR	1.3	5S	13	40S	46	79

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
1068	RWP1076	9.7	40S	4.4	15MS	0.0	0	10.7	20S	45	79
1069	RWP1078	11.6	20S	3.3	20MS	1.3	5S	6.7	30S	56	68
1070	RWP1090	7.9	20S	3.3	15MS	0.0	0	18.3	40S	57	79
1071	RWP1107	12	40S	2.4	15MS	1.3	5S	2.6	5S	45	68
1072	RWP1131	7.3	20S	3.4	10MS	7.5	20S	3.4	10S	46	68
1073	LBP2020-55	6.5	40MS	4.4	10S	10.0	20S	9.1	20S	35	47
1074	LBP2020-56	10	40MS	0.8	5MS	0.0	0	3.9	10S	46	58
1075	LBP2020-57	14.4	40S	8.4	20MS	20.0	40S	1.9	10MS	46	58
1076	LBP2020-61	6.4	20S	1.2	15MR	16.3	60S*	1.3	5S	46	56
1077	LBP2020-63	5.9	20S	0.8	10MR	0.0	0	0.6	5MS	46	68
1078	DWAP2020-60	3	20S	8.4	30S	5.0	20S	10.6	20S	56	69
1079	DWAP2020-63	2.9	10MS	3.4	15MS	0.0	0	19.4	40S	46	68
1080	DWAP2020-73	9	20S	1.6	10MS	1.3	5S	7	20MS	56	79
1080A	Infector	81.4	100S	76	100S	75.0	100S	77.1	80S	78	79
1081	PBS-PYT-RI-2020-02	1.4	10MR	2.1	5MS	0.0	0	41.4	60S	45	78
1082	PBS-PYT-RI-2020-09	11.4	20S	6.9	30S	5.0	20S	16.4	40S	46	78
1083	PBS-PYT-RI-2020-18	6.1	40MS	0.8	5MR	0.0	0	7.6	40S	45	78
1084	QYT-2004	8.9	20S	10.9	30S	5.0	20S	29.3	60S	46	99
1085	QYT2008	1	5S	0.4	5MR	0.0	0	4.5	10S	45	57
1086	QYT-2009	2.3	5S	1.3	15MR	5.0	20S	32.9	60S	45	57
1087	QYT-2011	15.4	60S	0.4	5MR	0.0	0	7.8	20S	46	79
IIWBR (C N Mishra)											
1088	CRP 2	3.3	10MS	2.4	10MS	0.0	0	20.6	40S	46	68
1089	CRP 3	3	10MS	2.4	15MS	0.0	0	23.1	40S	45	68
1090	CRP 7	6	20S	1.6	10MS	2.5	10S	17.6	40S	35	68
1091	CRP 8	6.9	20MS	4.8	20S	2.5	10S	9.4	20S	35	69
1092	CRP 9	3.8	20MS	2.5	15MS	2.5	10S	16	40S	45	69
1093	CRP 11	12	20S	2	10MS	2.5	10S	12.3	40S	46	69
1094	CRP 14	22	80S	13.2	40S	25.0	40S	10.1	20S	46	79
1095	CRP 16	22.9	80S	10.8	20S	12.5	40S	26.9	60S	46	57
1096	CRP 18	11	40MS	20	40S	1.3	5S	40	60S	45	68
1097	CRP 19	5.4	20MS	2.8	10S	0.0	0	32.6	60S	46	78
1098	CRP 28	4.5	20MS	7.2	20MS	2.5	10S	10.9	20S	56	78
1099	CRP 30	11.4	20S	30.8	80S	12.5	40S	15.9	40S	56	89
1100	CRP 33	4.7	20MS	6.4	20S	5.0	10S	26.9	40S	35	57
1100A	Infector	75.7	100S	72	100S	80.0	100S	68.6	80S	68	78
1101	CRP 37	12.7	20S	12.4	20S	10.0	40S	20	40S	56	68
1102	CRP 41	11.7	20S	14.8	20S	25.0	60S	29.7	60S	46	68
1103	CRP 45	7.5	20MS	3.4	15MS	10.0	40S	36.6	60S	56	68
1104	CRP 47	12	60MS	4	10MS	10.0	40S	32.6	60S	46	68
IIWBR (Satish Kumar)											
1105	BRNS 1	4.3	10S	0.8	5MS	0.0	0	13.7	40S	46	79
1106	BRNS 2	7.7	40S	5.8	10MS	10.0	40S	24.9	60S	45	57
1107	BRNS 3	19.7	40S	3.2	20MS	1.3	5S	30.6	60S	35	57
1108	BRNS 4	14.3	40MS	9.2	20S	12.3	40S	17.1	40S	46	79
1109	BRNS 5	8.9	40S	0.8	5MR	1.3	5S	7.4	20MS	46	79
1110	BRNS 6	4.6	20MS	0.4	5MR	5.0	20S	7.5	20MS	46	77
1111	BRNS 7	14.6	40S	9.2	20MS	10.0	40S	16.3	40S	56	79
1112	BRNS 8	9.3	40MS	3.2	15MS	5.0	20S	16.4	40S	56	68
1113	BRNS 9	13.3	40S	1.6	20MR	5.3	20S	10.3	40MS	56	77
1114	BRNS 10	9.2	40S	0.4	5MR	0.0	0	11.3	20S	56	68
1115	BRNS 11	15.4	60S	0.4	5MR	1.3	5S	12.4	20S	45	68
1116	BRNS 12	10.3	20S	4.1	20MS	7.5	20S	10.9	20S	56	68

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
1117	BRNS 13	11.1	20S	7.1	30S	5.0	10S	42.9	80S	34	57
1118	BRNS 14	13.4	40S	6	15MS	12.5	40S	17.2	40S	46	79
1119	BRNS 15	11.3	40MS	2.5	10MS	3.8	10S	26.6	60S	56	79
1120	BRNS 16	14	40S	2.6	10MS	11.3	40S	18.9	60S	56	89
1120A	Infector	78.6	100S	72	100S	75.0	80S	74.3	80S	78	79
1121	BRNS 17	18.3	60S	2	5S	10.3	40S	20.7	40S	56	68
1122	BRNS 18	14.3	20S	6.4	30MS	10.0	40S	19.3	40S	45	79
1123	BRNS 19	13.7	20S	6.6	20MS	10.0	40S	25.1	40S	56	79
1124	BRNS 20	8.6	40S	3.4	10MS	1.0	5MS	36.1	60S	34	56
1125	BRNS 21	12.6	40S	2.3	15MR	11.3	40S	20.1	40S	46	57
1126	BRNS 22	12.6	20S	6.4	20MS	2.5	10S	18.7	60S	45	68
1127	BRNS 23	15.7	40S	9.4	20S	6.3	20S	17.7	60S	46	79
1128	BRNS 24	16.9	60S	6.1	20S	9.0	20S	18.6	60S	45	78
1129	BRNS 25	16.6	40MS	4.8	15MS	2.3	5S	20.6	40S	45	78
1130	BRNS 26	7.3	20S	3.6	10S	1.3	5S	12	20S	46	78
1131	BRNS 27	10.3	30S	2.7	20MR	0.0	0	26	40S	56	78
1132	BRNS 28	0.9	10MR	0.8	5MS	0.0	0	43.7	60S	34	68
1133	BRNS 29	21.4	60S	0.1	R	0.0	0	24.7	60S	35	47
1134	BRNS 30	5	20MS	4.8	20MS	0.0	0	11.7	40MS	46	78
1135	BRNS 31	7.1	20S	4.4	20MS	0.0	0	18.6	60S	46	79
1136	BRNS 32	10.1	20MS	2.2	5S	2.5	10S	24.3	60S	46	79
1137	BRNS 33	9.1	20S	6.2	20MS	1.3	5S	23.6	60S	57	79
1138	BRNS 34	11.8	20S	5.1	20MS	0.0	0	25	60S	56	89
1139	BRNS 35	7.8	20S	1.8	5S	0.0	0	21.9	60S	56	89
1140	BRNS 36	12.7	40MS	4.5	20MS	0.0	0	13.1	40MS	56	89
1140A	Infector	75.7	100S	76	100S	80.0	100S	77.1	80S	68	78
1141	BRNS 37	15.5	40MS	4	20S	2.5	10S	24.3	60S	45	89
1142	BRNS 38	11.4	30MS	4.9	20MS	1.3	5S	22.9	40S	56	89
Supreme breeders											
1143	Supreme 1122	16.3	40S	8.9	40S	0.0	0	7	20MS	46	58
QCWBN											
1144	PBS 01	6.6	20S	1.2	10MR	0.0	0	5.1	20MS	46	69
1145	PBS 02	1.5	15MR	1.7	10MS	0.0	0	2.1	10MS	46	79
1146	PBS 03	23	80S	0.9	10MR	0.0	0	16.6	60S	46	69
1147	PBS 04	2.7	10MS	10.6	20MS	15.5	60S*	6.3	20S	36	69
1148	BNSR 8	9.5	40S	2	15MR	2.5	10S	35.4	60S	46	68
1149	BNSR 9	6.3	20S	4.2	20S	5.0	20S	29	60S	46	89
1150	NEQ 2021-1	2.4	10MS	0.9	5MR	1.8	5S	22.3	40S	46	57
1151	NEQ 2021-2	6.9	40S	0.5	5MR	0.0	0	26.6	40S	46	57
1152	RWP 1216	3.3	20MS	0.1	TMR	5.0	20S	0.7	5MS	45	57
1153	RWP 1174	6	40S	0	R	0.1	TR	2.6	5S	46	58
1154	QLD 124	12	20S	0.2	TMR	5.0	20S	11.7	30S	46	68
1155	QLD 125	6.2	20S	2.4	15MS	0.0	0	27.1	40S	57	77
1156	RAJ 4238	1.1	5S	2.4	10S	0.0	0	57.1	80S	56	77
1157	RAJ 4083	2.3	10S	8.4	20S	7.5	20S	41.1	80S	57	78
1158	MACS 6847	11.3	40S	3.7	10S	1.3	5S	53.7	80S	57	78
1159	MACS 6846	0.7	5MR	0.9	10MR	0.0	0	16.9	40S	56	78
1160	MACS 6849	11.4	40MS	2.4	15MS	0.0	0	6.3	20MS	45	57
1160A	Infector	81.4	100S	76	100S	75.0	80S	74.3	80S	78	78
1161	MACS 6848	11.7	60S*	4.8	20MS	0.0	0	11.4	40S	46	68
1162	MACS 6845	18.1	60S	4.5	20MS	0.0	0	47.6	80S	45	68
1163	AKDW 4773	6.9	40S	0.6	5MR	0.0	0	0.9	5MS	46	89
1164	AKDW 4781	14.6	40S	31.2	60S	25.0	40S	37.7	80S	46	57
1165	UASQ 332	0.6	5MS	8.8	20MS	6.5	20MS	47.3	80S	46	99
1166	MP 3564	3.6	20MS	3.6	10MS	12.5	40S	40.9	80S	57	79
1167	MP 3562	9.8	30S	21.6	40S	20.5	40S	54.3	80S	46	58

IPPSN No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Yellow rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	Avg	HS
1168	MP 3340	0.9	5S	8.4	20MS	8.0	20S	37.6	80S	67	89
1169	GW 2021-1017	0.8	5S	0.5	5MR	2.5	5S	41.7	80S	45	57
1170	GW 2021-1026	1	5S	2.4	20MR	0.0	0	16.9	60S	57	89
1171	GW 2021-1020	0.1	TMR	21.6	60S	7.5	20S	40.9	80S	57	89
1172	GW 2021-1018	0.6	10MR	0.1	TMR	1.3	5S	48.6	80S	56	89
1173	GW 2021-1022	0.1	TMR	0.1	TMR	0.0	0	48.6	80S	57	79
1174	CG 2116	1.3	5S	0.9	5MS	2.5	10S	45.1	80S	57	78
1175	CG 2118	14.9	30S	33	100S	5.0	20S	30.9	80S	46	79
1176	CG 2117	4.6	20S	13.6	30S	10.0	20S	31.1	60S	46	79
1177	UP 3083	3.5	10MS	2.5	15MS	0.0	0	9.3	20S	45	57
1178	UP 3086	10	20S	1.6	5MS	1.3	5S	20	60S	45	57
1179	UP 3088	7.4	20S	0.1	TMR	0.0	0	23.7	60S	45	57
1180	WBL 1626	10.9	60S*	2.4	20MR	5.0	20S	33	60S	46	79
1180A	Infector	81.4	100S	72	80S	62.5	80S	74.3	80S	68	78
1181	WBL 1628	6.3	20MS	1.7	10MS	1.3	5S	28.7	60S	56	78
1182	WBL 1627	6.5	20MS	0.6	5MR	2.5	10S	26.4	60S	56	89
1183	WBL 1630	5.9	10S	4.9	20S	5.0	10S	15	40S	35	89
1184	WBL 1629	9.6	30S	1.6	10MS	0.0	0	13.7	40S	56	79
1185	QBI 21-1	4.4	20MS	1.6	5MS	1.3	5S	21.4	60S	35	58
1186	QBI 21-5	13.2	40S	4.9	20S	6.3	20S	28.6	60S	35	57
1187	QBI 21-2	4.6	10S	3.2	20MR	1.3	5S	37.1	60S	35	58
1188	QBI 21-3	13.3	40S	0.6	5MR	3.8	10S	40.7	60S	46	58
1189	QBI 21-4	13.6	40S	16	20S	12.5	40S	29.1	60S	46	77
1190	INDB 2121	0.6	10MR	0.5	5MR	0.0	0	46.1	80S	57	79
1191	IDW 2116 (d)	2	10MS	0.9	5MR	1.0	5MS	11.6	40S	46	79
1192	INDB 2120	0.3	5MR	0.8	10MR	0.0	0	51.4	80S	57	89
1193	INDB 2119	0.6	10MR	1.6	10MS	0.0	0	31.1	80S	67	89
IIWBR											
1194	RWP-1004	3.3	20MS	4.4	20MS	0.0	0	9.9	30S	57	79
1195	RWP-1005	7.3	40MS	10.4	20S	12.5	40S	15.7	40S	56	89
1196	RWP-1175	7.6	40S	4.8	10S	2.5	10S	5.6	20MS	56	79
1197	RWP-1181	12.6	40S	0.1	R	0.1	TR	15.7	40S	46	68
1198	NEST-21-1	14.7	40S	0.1	TMR	0.0	0	12.3	30S	46	68
1199	NEST-21-2	13.8	40S	1.6	10MS	0.0	0	9.1	20S	35	57
1200	NEST-21-3	0.7	10MR	2.6	20MR	12.5	40S	15.7	60S	45	68
1200A	Infector	75.7	100S	72	80S	75.0	80S	74.3	80S	68	78
1201	NEST-21-4	4.1	10S	0.4	5MR	0.0	0	28	60S	46	79
1202	QYT 2101	6.6	20MS	0.8	5MS	12.6	40S	10.7	40MS	46	77
1203	QYT 2102	13	40S	2.4	5MS	5.0	20S	9.9	20S	57	79
1204	QYT 2103	6	20MS	2.4	10MS	0.0	0	7	20MS	56	79
1205	DWAP-2162	12	40MS	1.3	10MR	2.5	5S	23.4	60S	35	79
1206	DWAP-2163	2.7	20MS	0.5	5MR	15.0	60S*	10.1	40S	45	57
1207	DWAP-2164	2.7	20MR	16	40S	17.5	40S	34.3	60S	56	67
1208	DWAP-2165	14.1	40S	2.4	15MS	1.3	5S	28.6	60S	35	58
1209	PBS-ST-5-21-1	4.9	10S	3.3	20MS	1.3	5S	13.6	60S	46	69
1210	PBS-ST-5-21-2	3.8	20MS	2.8	10MS	6.3	20S	20.9	60S	46	68
1211	PBS-ST-5-21-3	12.1	30S	27.2	40S	12.5	40S	28	60S	46	79
1212	PBS-ST-5-21-4	4.7	10S	2.2	15MR	5.0	10S	9.1	40S	46	57
1213	BSP 2001	7	20MS	0.8	5MS	0.0	0	27.1	60S	46	56
1214	BSP2002	6.4	20MS	0.9	5MS	0.0	0	23.7	40S	36	69
1215	BSP2003	16.1	40S	3.5	15MS	0.3	TS	7.9	20MS	46	69
1215A	Infector	80	100S	80	100S	75.0	80S	77.1	80S	78	79

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

Annexure 7: Performance of the entries screened against wheat blast at Jashore, Bangladesh during 2020-21 and 2021-22.

S. No.	Entries	Avg	HS
1.	DBW342	0.0	0
2.	DBW343	3.3	10
3.	DBW344	7.5	20
4.	DBW345	5.0	10
5.	DBW346	8.3	10
6.	DBW362	14.2	35.3
7.	HD3385	4.9	10
8.	HD3386	5.0	10
9.	HD3387	83.5	100
10.	HD3388	29.3	71.6
11.	HD3389	89.1	96.3
12.	HUW844	7.5	20
13.	JAUW691	47.1	69.6
14.	K2001	32.5	70
15.	PBW849	12.5	40
16.	PBW851	82.2	100
17.	PBW853	16.6	56.3
18.	RAJ4555	5.0	10
19.	RAJ4556	82.5	100
20.	RAJ4557	76.6	90
21.	TAW123	5.8	10
22.	UP3080	2.4	9.5
23.	UP3081	77.9	94.9
24.	UP3082	8.9	10
25.	UP3083	13.0	18.1
26.	WH1292	4.7	10
27.	WH1293	5.0	10
28.	WH1294	55.5	92
29.	AAI-W70	82.5	100
30.	BRW3895	5.9	10
31.	BRW3902	2.2	8.9
32.	DBW347	7.2	10
33.	DBW349	7.5	10
34.	HD3390	85.2	90
35.	HD3391	7.5	10
36.	HP1971	5.9	10
37.	HP1972	92.5	100
38.	HUW845	5.0	10
39.	HUW846	7.5	10
40.	JKW282	13.1	30
41.	JKW287	5.0	10
42.	K2003	56.8	100
43.	K2004	90.0	100
44.	K2005	80.0	96.5
45.	KRL1912	7.1	20
46.	PBW854	85.5	90
47.	PBW856	17.5	60
48.	RAJ4558	35.0	60
49.	RAJ4559	6.8	10
50.	TAW119	6.4	10

S. No.	Entries	Avg	HS
51.	WH1295	7.5	10
52.	WH1296	6.3	10
53.	CG1038	56.3	80
54.	GW529	72.6	95.3
55.	GW530	73.0	82
56.	GW533	75.0	100
57.	HI1656	73.3	95.4
58.	HI1657	83.6	100
59.	HI1658	71.5	100
60.	HI1659	78.7	100
61.	HI1660	70.0	100
62.	MACS6785	82.5	100
63.	MACS6786	80.0	100
64.	MACS6789	87.5	100
65.	MACS6792	75.0	100
66.	MP1378	94.6	100
67.	MP1379	4.9	10
68.	MP3545	5.0	10
69.	MP3552	6.6	10
70.	NIAW3924	64.8	99
71.	NIAW3950	60.6	100
72.	NWS2194	5.0	10
73.	PBW857	32.5	60
74.	PWU6	47.5	100
75.	RAJ4560	43.4	70
76.	RVW4343	62.5	100
77.	RVW4348	35.0	80
78.	UAS3015	10.0	20
79.	UAS3016	71.4	80
80.	UP3086	6.6	10
81.	WH1297	49.0	66
82.	WSM109-4	85.0	100
83.	BRW3897	7.5	10
84.	DBW353	5.0	10
85.	DBW354	4.7	10
86.	DBW355	13.3	30
87.	DBW356	2.1	8.6
88.	DBW357	0.0	0
89.	HD3392	21.0	53.9
90.	HD3393	8.6	10
91.	HD3394	9.3	10
92.	HD3395	7.4	10
93.	HD3396	34.3	70
94.	HUW847	4.5	10
95.	JKW285	11.9	40
96.	K2007	59.9	80
97.	NW8004	5.7	10
98.	NW8022	5.0	10
99.	PBW858	84.5	88
100.	PBW859	4.5	10

S. No.	Entries	Avg	HS
101.	PBW860	9.6	28.5
102.	PBW861	50.0	100
103.	PBW862	5.3	10
104.	PBW875	0.0	0
105.	RAJ4561	93.0	100
106.	RAJ4562	59.9	80
107.	RAJ4563	60.4	81.5
108.	UP3087	69.0	80
109.	UP3088	4.3	10
110.	UP3089	47.4	70
111.	UP3094	20.0	60
112.	WH1298	29.6	68.3
113.	WH1299	7.5	10
114.	WH1300	49.1	70.5
115.	AKAW5349	65.0	80
116.	CG1039	50.0	70
117.	GW531	82.5	100
118.	GW534	45.0	90
119.	GW535	60.0	100
120.	HI1661	45.0	100
121.	HI1662	62.5	100
122.	HI1663	45.0	100
123.	HI1664	53.8	100
124.	LOK78	37.5	100
125.	MACS6779	53.7	90
126.	MACS6784	61.5	90
127.	MACS6793	58.9	90
128.	MP1380	2.5	10
129.	MP3541	10.0	20
130.	MP3542	17.5	60
131.	NIAW3923	7.0	10
132.	NIAW4028	5.0	10
133.	PBW863	86.4	100
134.	UAS3017	27.5	40
135.	UAS3018	34.9	59.5
136.	WH1401	29.7	70
137.	DDW56(d)	81.3	100
138.	DDW57(d)	81.0	90
139.	GW1357(d)	91.6	100
140.	GW1358(d)	92.8	100
141.	HI8834(d)	80.0	100
142.	HI8835(d)	37.5	70
143.	HI8836(d)	86.0	100
144.	HI8837(d)	87.5	100
145.	HI8838(d)	52.5	80
146.	MACS4110(d)	67.5	100
147.	MACS4111(d)	87.5	100
148.	MPO1381(d)	80.0	100
149.	MPO1382(d)	80.0	100
150.	MPO1383(d)	79.9	90
151.	NIDW1399(d)	82.8	100
152.	NIDW1405(d)	91.2	100

S. No.	Entries	Avg	HS
153.	PBND1625-01(d)	71.5	90
154.	PDW361(d)	82.5	100
155.	PWU10(d)	67.5	80
156.	UAS476(d)	52.6	70
157.	UAS477(d)	74.7	100
158.	WHD966(d)	97.5	100
159.	BRW3901	10.0	20
160.	DBW358	10.0	20
161.	DBW359	9.0	16
162.	DBW360	7.5	10
163.	DBW361	7.2	10
164.	HD3397	17.5	40
165.	HD3398	10.0	10
166.	HD3399	7.5	10
167.	HD3400	5.0	10
168.	HP1973	10.0	10
169.	HUW848	10.0	10
170.	JAUW694	73.1	80
171.	K2010	22.1	40
172.	NW8010	5.0	10
173.	PBW864	61.0	80
174.	PBW865	85.0	100
175.	PBW866	3.7	10
176.	UP3090	7.1	10
177.	UP3091	5.0	10
178.	WH1403	85.8	93.2
179.	AKAW5351	62.2	69.8
180.	CG1040	70.9	80
181.	DDW58(d)	85.0	100
182.	GW1359(d)	82.8	100
183.	GW532	47.1	70
184.	HD3401	5.0	10
185.	HI1665	83.4	100
186.	HI1666	77.5	100
187.	HI8839(d)	84.7	100
188.	HI8840(d)	64.4	100
189.	MACS4107(d)	52.5	70
190.	MACS6795	90.0	100
191.	MP1377	19.4	57.8
192.	MP3544	79.6	100
193.	MPO1376(d)	80.0	100
194.	NIAW3922	72.5	100
195.	UAS3019	37.5	70
196.	UAS478(d)	85.0	100
197.	HD3406	5.2	10
198.	PBW876	12.5	20
199.	HD3411	75.0	90
200.	HI1667	80.1	100
201.	HI8832(d)	48.9	97.4
202.	HI8833(d)	55.0	100
203.	HD3407	80.4	100

S. No.	Entries	Avg	HS
204.	DBW363	5.7	10
205.	DBW364	10.0	20
206.	DBW365	53.7	80
207.	DBW366	15.8	56.9
208.	DBW367	75.0	100
209.	DBW368	77.2	80
210.	DBW369	42.5	52.1
211.	K1805	68.7	80
212.	DBW370	8.6	10
213.	DBW371	5.0	10
214.	DBW372	7.5	20
215.	PBW872	7.5	10
216.	DBW374	17.5	60
217.	DBW375	4.0	10
218.	DBW377	10.0	20
219.	DBW378	12.4	39.5
220.	HD3403	14.9	39.5
221.	HD3404	14.2	40
222.	HD3405	4.5	10
223.	PBW871	3.2	10
224.	UP3095	90.3	100
225.	UP3096	10.0	20
226.	WH1404	12.5	20
227.	WH1405	22.8	38.5
228.	WH1406	7.5	10
229.	WH1407	5.0	10
230.	DWAP-B-2001	2.5	10
231.	DWAP-B-2002	2.5	10
232.	DWAP-B-2003	2.5	10
233.	DWAP-B-2004	39.5	67.9
234.	DWAP-B-2005	6.7	19
235.	DWAP-B-2006	27.5	50
236.	DWAP-B-2007	50.4	91.7
237.	DWAP-B-2008	55.9	68
238.	DWAP-B-2009	25.0	60
239.	DWAP-B-2014	12.8	38.5
240.	RWP1	12.2	38.9
241.	RWP13	3.4	10
242.	RWP14	67.5	80
243.	RWP15	7.5	10
244.	QYB-2001	40.0	80
245.	QYB-2002	5.6	20
246.	QYB-2003	10.0	10
247.	QYB-2004	5.0	10
248.	QYB-2005	2.5	10
249.	QYB-2006	5.0	10
250.	QYB-2007	37.5	70
251.	QYB-2008	54.0	80
252.	QYB-2009	5.0	10
253.	QYB-2010	7.5	10
254.	QYB-2011	4.2	10
255.	QYB-2012	7.5	10
256.	QYB-2013	7.5	10
257.	QYB-2014	20.0	60
258.	QYB-2015	11.4	40
259.	LBP-2019-1	5.0	10
260.	LBP-2019-2	5.6	20
261.	PBS 1011(d)	91.4	100
262.	CB2001	75.2	80
263.	CB2003	84.4	100
264.	CB2004	90.0	100
265.	CB2005	33.7	75
266.	CB2006	47.1	98.4
267.	CB2007	40.0	80
268.	WH1215	33.4	73.6
269.	EC609396	12.5	30
270.	HI1562	10.0	20
271.	BH 1146	74.6	100
272.	RWP 2014-18	67.0	74.6
273.	DCMS1A&1B	88.8	100
274.	DCMS2A&2B	91.8	100
275.	DCMS4A&4B	83.8	100
276.	DCMS5A&5B	81.3	100
277.	DCMS6A&6B	78.6	90
278.	QLD 112	50.0	100
279.	QLD 102	82.7	90
280.	IIWBR Phy-1	86.7	96.9
281.	IC 427824	30.3	72.3
282.	R check	1.1	4.5
283.	S check	86.0	100

(Total 350 entries sent in 2020 were screened against blast at Jashore, Bangladesh at two different dates of sowing during 2020-21 and out that 283 again tested at Jashore, Bangladesh at two different dates of sowing during 2021-22.)

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

Azadi Ka Amrit Mahotsav

बेटी बचाओ बेटी पढाओ

150 YEARS OF CELEBRATING THE MAHATMA

स्वच्छ भारत
एक कदम स्वच्छता की ओर

भाकृअनुप
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61st All India Wheat and Barley Research Workers' Meet

(August 29-31, 2022)

Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior (MP)

61वीं अखिल भारतीय गेहूँ एवं जौ अनुसंधान कार्यकर्ता गोष्ठी

(29-31 अगस्त, 2022)

राजमाता विजयाराजे सिंधिया कृषि विश्वविद्यालय, ग्वालियर (मध्य प्रदेश)