प्रगति प्रतिवेदन
PROGRESS REPORT
2022-23
फसल सुरक्षा
CROP PROTECTION

अखिल भारतीय समन्वित गेहूँ एवं जौ अनुसंधान परियोजना

AICRP on Wheat and Barley

भा.कृ.अनु.प.–भारतीय गेहूँ एवं जौ अनुसंधान संस्थान, करनाल

ICAR-Indian Institute of Wheat and Barley Research, Karnal

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AlCRP ON WHEAT AND BARLEY

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(Poonam Jasrotia)
Principal Investigator
(Crop Protection Programme)

ICAR-IIWBR, Karnal
Dated: 14th August2023

C O N T E N T S

PROGRAMME OF WORK, 2022-23

The work plan for the crop year 2022-23 which is finalized in the 61st All India Wheat and Barley Research Workers Meet to be held in August 29-31, 2022 at RVSKV, Gwalior, Madhya Pradesh. The various activities to be executed at respective centres are given below:

PROGRAMME 1: Host resistance -IPPSN and PPSN

Adult Plant Resistance for rusts & other diseases

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:**
Stripe rust: Malan, Dhaulakuan, Jammu, Gurdaspur, Ludhiana, Karnal, Hisar and Durgapura.
Leaf rust (North): Ludhiana, Karnal, Delhi, Durgapura, Ayodhya, Kanpur, Sabour and Coochbehar.
Leaf rust (South) + 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:**
Stripe rust: Khudwani, Malan, Bajaura, Dhaulakuan, Almora, Jammu, Gurdaspur, Ludhiana, Karnal, Hisar, Delhi, Durgapura and Pantnagar.
Leaf rust (North): Jammu, Ludhiana, Karnal, Hisar, Delhi, Durgapura, Pantnagar, Kanpur, Ayodhya and Kalyani.
Leaf rust (South) 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	*Pucciniagraministritici*	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 –** 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. graministritici*	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. Flowerdalecentre 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, Kalyani, Coochbehar and Shillongani.
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, Shimla, 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 conduct the surveys on regular interval during crop season and will send the information after every survey. During survey, if found any disease, in case of rusts samples should be sent to Incharge, ICAR-IIWBR, RS, Flowerdale, Shimla and other disease P.I. Crop Protection.
   - 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 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 DalangMaidan, 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 Multiple Disease Screening Nursery (EMDSN):** 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, Hisar, 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, 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 and Delhi
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.

2. Management of diseases

(a) 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.

(b) 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.

(c) 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.

(d) 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%,	0.06%
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%	0.1%
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.

PROGRAMME 10. ENTOMOLOGY

1. **Host plant resistance:** Entomological screening nurseries (ESN), multiple pest screening nurseries (MPSN) and special screening nurseries of promising entries identified during previous season will be evaluated as per following plan.

(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, RAU Pusa, Vijapur, and Kharibari)
- **(iv)** Root aphid (Centres: Karnal and Ludhiana)

(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, RAU Pusa, Vijapurand 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 four different dates of sowing i.e. early (first fortnight of November), timely (second fortnight of November), late (first fortnight of December) and very late (second fortnight of December) will be evaluated on the population build-up of major insect-pests of wheat to better understand the insect-pest behaviour under different climatic conditions. At Kharibari, as the wheat sowing is done late, the four different dates of sowing that will be tested are early (first fortnight of December), timely (second fortnight of December), late (first fortnight of January) and very late (second fortnight of January) will be evaluated.

(c) Population dynamics of insect-pests and natural enemies under different residue management scenarios in rice-wheat cropping system (Centres: Karnal, Ludhiana)

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)

Following treatments of Monosilicic acid (MSA) will be evaluated against major insect-pests and natural enemies of wheat.

Treatment ID	Treatment Details
T1	One spray of sodium meta-silicate @ 10g/litre at booting stage
T2	Two sprays of sodium meta-silicate @ 10g/litrefirst at booting stage and second 10 days after first spray
T3	One spray of sodium meta-silicate @ 30g/litre at booting stage
T4	Two sprays of sodium meta-silicate @ 30g/litrefirst at booting stage and second 10 days after first spray
T5	One spray of sodium meta-silicate @ 50g/litre at booting stage
T6	Two sprays of sodium meta-silicate @ 50g/litrefirst at booting stage and second 10 days after first spray
T7	One spray of Actara (thiamethoxam 25 WG) @ 50g/ha at booting stage
T8	Two sprays of Actara (thiamethoxam 25 WG) @ 50g/ha first at booting stage and second 10 days after first spray
T9	Untreated Check

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

Following treatments will be evaluated against termites in wheat.

Treatment ID	Treatment and dosages	Method of application
T1	GoondKatira (100 g/kg) + Jaggery (250 g/litre)+ Thiamethoxam 70WS @ 1 g/kg of seed)	Seed treatment
T2	GoondKatira(100 g/kg) + Jaggery (250 g/litre)+ chlorpyriphos @ 4 ml/kg of seed)	Seed treatment

T3	GoondKatira (100 g/kg) + Jaggery (250 g/litre)+ Neonix @ 2 ml/kg of seed)	Seed treatment
T4	Thiamethoxam 70WS @ 1 g/kg of seed	Seed treatment
T5	Chlorpyriphos @ 4 ml/kg of seed	Seed treatment
T6	Neonix @ 2 ml/kg of seed	Seed treatment
T7	GoondKatira (5kg/ha)+ Fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation	Soil application
T8	GoondKatira (5kg/ha)+ Chlorpyriphos 20 EC(2.5 litres/ha) before Ist irrigation	Soil application
T9	Fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation	Soil application
T10	Chlorpyriphos 20 EC(2.5 litres/ha) before Ist irrigation	Soil application
T11	Untreated seed+ no application of chemical (Control)	-

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

Following chemicals 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.

Treatment ID	Treatments	Dosage g ai/ha
T1	Pymetrozine 50% WG	80 g
T2	Pymetrozine 50% WG	100 g
T3	Pymetrozine 50% WG	120 g
T4	Thiamethoxam 25% WG	12.5 g
T5	Imidacloprid 17.8 SL	100 ml
T6	Acetamiprid 20SP	100 g
T7	Untreated Check	-

(h) Management of lepidoterous pests (pink stem borer, army worm & cutworms) of wheat: (Centres: Karnal and Ludhiana)

Following chemicals will be evaluated againstlepidopterous insect-pests in wheat

Treatment ID.	Treatments	Dosages/ha
T1	Foliar spray of Coragen 18.5 SC (chlorantraniliprole)	100 ml
T2	Foliar spray of Coragen 18.5 SC (chlorantraniliprole)	125 ml
T3	Foliar spray of Coragen 18.5 SC (chlorantraniliprole)	150 ml
T4	Soil application of fipronil 0.6 GR	6.0 Kg
T5	Soil application of fipronil 0.6 GR	7.0 Kg
T6	Soil application of fipronil 0.6 GR	8.0 Kg
T7	Soil application of chlorpyriphos 20EC	2.0 litre
T8	Soil application of chlorpyriphos 20EC	2.5 litre
T9	Soil application of chlorpyriphos 20EC	3.0 litre
T10	Untreated Check	-

(i) Management of termites through seed treatment of chemical molecules combinations (**Centres:**Durgapura, Kanpur, Ludhiana and Vijapur)

Following insecticides will be tested as seed treatment /soil application against termites.

Tr.No.	Treatment	Dosage
T1	Seed treatment with Neonix (Imidacloprid 18.5%+ Hexaconazole 1.5% FS)	1.5 ml/kg of seed
T2	Seed treatment with Neonix (Imidacloprid 18.5%+ Hexaconazole 1.5% FS)	2 ml/kg of seed
T3	Cruiser 70 WS (thiamethoxam)	1 ml/kg of seed
T4	Cruiser 70 WS (thiamethoxam)	1.5 ml/kg of seed
T5	Soil application of fipronil 0.3 GR	15 Kg
T6	Soil application of fipronil 0.3 GR	17.5 Kg

T7	Soil application of fipronil 0.6 GR	20 Kg
T8	Soil application of chlorpyriphos 20EC	2.0 l
T9	Soil application of chlorpyriphos 20EC	2.5 l
T10	Soil application of chlorpyriphos 20EC	3.0 l
T11	Untreated control	-

3. **Stored Grain Pest Management**

(a) **To evaluate seed protectants for management of storage insect pests of wheat** (**Centres**: Karnal, Ludhiana, Kharibari, Niphad)

Following seed protectants will be tested against infestation of major storage insect pests; *Sitophilusoryzae* or *Rhizoperthadominica* inwheat.

Tr.No.	**Treatments**	**Doses/ kg seed**
T1	Neem oil (*Azadiractaindica)*	15 ml
T2	Blue gum oil (*Eucalyptus globulus*)	15 ml
T3	Karanj oil (*Pongamiapinnata*)	15 ml
T4	Castor oil (*Ricinuscumunis*)	15 ml
T5	Sweet flag (Vekhand) powder (*Acoruscalamus*)	5 g
T6	Turmeric Powder (*Curcuma longa*)	5 g
T7	Diatomaceous earth	500 ppm
T8	Untreated control	-

PROGRAMME 11. NEMATOLOGY

1. **Monitoring of Nematodes:** *Heteroderaavenae***,** *Anguina tritici*, *Meloidogyne graminicola* and other plant parasitic nematode: All centres of Nematology

2. **Evaluation of resistance against nematodes parasitizing wheat**

   (a) ***Heteroderaavenae*:**Hisar and Durgapura. (AVT and EMDSN lines)

3. **Evaluation of new chemical against cereal cyst nematode, *Heteroderaavenae***

   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

List of Cooperators

PLANT PATHOLOGY PROGRAMME

NHZ	NEPZ
ICAR-IIWBR, Regional Station, Flowerdale, Shimla. *O.P. Gangwar, Pramod Prasad, Subodh Kumar*	**RPCAU, Pusa, Bihar** *Dinesh Rai*
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HPKVV, RWRC, Malan *Sachin Upmanyu and A.D. Bhindra*	**BHU, Varanasi** *S.S. Vaish*
SKUAST-K, Khudwani, Srinagar *Fayaz Ahmad Mohiddin*	**BCKV, Kalyani (W.B.)** *Mr. Raghunath Mandal*
CSKHPKV, HAR&EC,Dhaulakuan *Shiwani Dhiman*	**NDUA &T, Faizabad** *S.P. Singh*
CSKHPKV, HAR&EC, Bajoura *Rakesh Devlash*	**UBKV, Pundibari, Coochbehar** *Satyajit Hembram*
NWPZ	**BAU, Sabour** *C. S. Azad*
ICAR-IIWBR, Karnal *Sudheer Kumar, Prem Lal Kashyap, Ravindra Kumar*	**RARS, Assam Agricultural University, Shillongani** *Ranjana Chakrabarty*
ICAR-IARI, New Delhi *V.K. Singh, M.S. Saharan*	**CZ**
GBPUA&T, Pantnagar *Deepshikha*	**ICAR- IARI, Regional Station, Indore** *T.L. Prakasha*
CCS HAU, Hisar *R. S. Beniwal*	**JAU, Junagadh** *I.B. Kapadia*
PAU, Ludhiana *Jaspal Kaur, Ritu Bala*	**SDAU, Vijapur** *Ms. Elangbam Premabatidevi, Ronak Thakkar*
PAU, RS, GURDASPUR *Jaspal Kaur*	**JNKVV. Research Station, Powarkheda** *K.K. Mishra*
SKNAU, RARI, Durgapura *P.S. Shekhawat*	**PZ**
SKUAST-J, Chatha, Jammu *M.K. Pandey*	**ARI, Pune** *Sudhir Navathe*

UAS, Dharwad *Gurudatt M. Hegde* **MPKV, Mahabaleshwar** *M. A. Sushir, V. M. Sali* **ARS, Niphad** *B.M. Ilhe, B.C. Game* **SHZ** **ICAR-IARI, Regional Station, Wellington** *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 2022-23 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	7		
2	Bajaura	Dr. Rakesh Devlash	2		
3	Coochbehar	Dr. Satyajit Hembram	5		1
4	Delhi	Drs. V. K. Singh, M.S.Saharan	13	1	
5	Dharwad	Dr. Gurudatt. M. Hegde	9		3
6	Dhaulakuan	Dr. Shiwani Dhiman	7	1	
7	Durgapura	Dr. P.S. Shekhawat	11		
8	Ayodhya	Dr. Shiv Pratap Singh	8		
9	Hisar	Dr Rajender Singh Beniwal	12		1
10	RPCAU, Pusa	Dr. Dinesh Rai	2		
11	Indore	Mr. Prakasha T.L.	6		
12	Jammu	Dr.M.K. Panday	9		
13	Junagarh	Dr. I. B. Kapadiya	1		1
14	Kalyani(Nadia)	Mr. Raghunath Mandal	6		1
15	Kanpur	Dr. JavedBahar Khan	4		
16	Kudwani	Drs.NazirA.Bhat, FayazMohdin	2		
17	Karnal	Drs.Sudheer Kumar, Prem Lal Kashyap, Ravindra Kumar	13		3
18	Ludhiana	Drs. .JaspalKaur, RituBala	18		
19	Gurdaspur	Dr. JaspalKaur,	5		
20	Mahabaleshwar	Drs. M. A. Sushir, V. M. Sali	6		1
21	Malan	Dr. SachinUpmanyu and A.D. Bhindra	10	3	1
22	Niphad	Dr. B. M. Ilhe, B.C. Game	5		1
23	Pantnagar	Dr. Deepshikha	11		
24	Powerkheda	Dr. K. K. Mishra	4		
25	Pune	Dr. Sudhir Navathe	9		
26	Sabour	Dr. C.S. Azad	5		
27	Shillongani	Mrs. R. Chakravarty	1		
28	Shimla	Drs.O.P. Gangwar and Pramod Prasad	4		
29	Varanasi	Dr. S.S. Vaish	3		
30	Vijapur	Drs. Elangbam Premabati Devi and Ronak Thakkar	4		
31	Wellington	Dr. P. Nallathambi	8	1	3
	Entomology				
1	Dharwad	Dr. Gurudatt M. Hegde	4		2
2	Duragupra	Drs. A.S. Baloda and B.N. Sharma	2		2
3	Kanpur	Dr. J.K.Singh	5		
4	Karnal	Dr. Poonam Jasrotia	11		
5	Kharibari	Dr. Wasim Reza	5		2
6	Ludhiana	Dr. Beant Singh	11		
7	Niphad	Dr. Bhalchandra Mhaske	7		
8	RPCAU, Pusa	Dr. M.S. Sai Reddy	1		
9	Vijapur	Mr. Ronal Thakkar	5		
10	Khudwani	Dr. Shabir Hussain Wani	2		2
	Nematology				
1	Durgapura	Dr. S.P.Bishnoi	3		
2	Hisar	Dr. Priyanka Duggal	3		
	Total		**269**	**6**	**24**

SUMMARY

Biotic stresses are adversely affecting the wheat crop and causing considerable yield losses. To circumvent 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 2022-23 are summarised below:

PATHOLOGY

Survey and surveillance for diseases

During 2022-23, to monitor the wheat and barley crop health, regular surveys were conducted with major emphasis on occurrence of yellow rust in NWPZ and surveillance for wheat blast. The surveys were conducted by the wheat crop protection scientists of different cooperating centers including ICAR-IIWBR, Karnal and information was shared through the *"Wheat Crop Health Newsletter"*, Vol. 27 (Issues 1 to 4) 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 was noticed on 20.12.2022 from village Donal of Rupnagar on wheat cultivar HD3086. Subsequently, stripe rust spread to other parts of Punjab, Haryana, Himachal Pradesh, Uttarakhand, Jammu and Rajasthan. Likewise, the first occurrence of leaf rust was noticed in Nalwipar village of Karnal district on wheat cultivar DBW303. The occurrences of leaf rust were also noticed from central India in Moti Monpari village of Gujarat, Nadia districts of West Bengal and in Ozarkhed (Dindori tehsil) and PimpalgaonMor (Igatpuritahasil in Nashik district) in Maharasthra on variety Ajeet 102 and on some off-type plants. Stem (black) rust occurred naturally in Wellington areas of Tamil Nadu. Other then rusts, the minor incidences of foliar blight was recorded in eastern, central and peninsular India. Similarly, minor sporadic incidence of loose smut, flag smut and foot rot was also reported. So far, the exotic diseases and pathotypes like Ug99 race of stem rust and wheat blast were not reported from any part of the country. The overall crop health status was excellent in all the wheat growing areas of the country.

Host resistance

Wheat germplasm and advance breeding materials were evaluated against diseases and insect pests resistance at various hot spot locations under artificially inoculated conditions during 2022-23. The major plant pathological nurseries were: Initial Plant Pathological Nursery (IPPSN), Plant Pathological Nursery (PPSN), Elite Multiple Disease Screening Nursery (EMDSN), 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.

Rust resistance materials in AVT (2022-23) with ACI upto 10.0 are given below:

Stem, Leaf and Stripe rusts

UP3102, PBW893, DBW173(C), PBW771(C), WH1402, DBW296(C), HI1654 (I)(C), HD3388, DBW444 and NIDW1149 (d)(C)

Stem and leaf rusts

HS691, VL907(C), VL892(C), VL2041(I)(C), DBW386, HD3428, K2108, HD3059(C), PBW826 (I)(C), DBW252(C), HI1669, HI1670, GW547, HI1636(C), HI1650 (I)(C), HI1674, HI1634(C), CG1029(C), CG1036(I)(C), HI1655(I)(C), NIAW4183, NIAW4153, AKAW5314, AKAW5100, MP1378, DBW443, PWU15, PBW891, HI8841(d), HI8826(C), MACS6222(C), HI1672, HI1673,

HI1675, DBW394, DBW395, MACS6814, NIAW4114, NIAW4120, UAS3022, MP3557, PBW897, GW538, LOK79, RAJ4083(C), HD3090(C), HI1633(C), HI1665, DBW397, NIAW4028, PBW872(C), DBW377, GW543, DBW187(C) and DBW303(C)

Stem and Stripe rusts

DBW359, MP3556

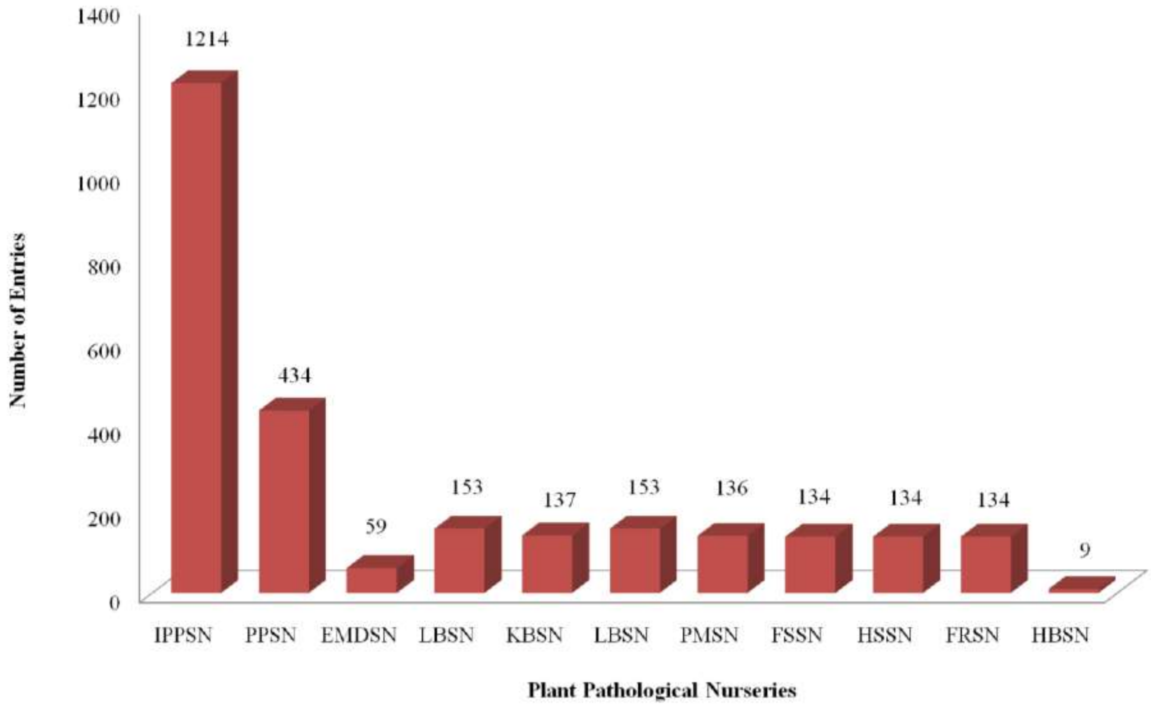

Fig 1: Number of entries in different plant pathological screening nurseries during 2022-23

Leaf and Stripe rusts

PBW889, HD3369 (I)(C), UAS478(d), HI8840(d), DDW61(d), UAS446(d)(C)

Identification of multiple disease resistant entries

Resistant to all three rusts + KB + FS + PM:

HI8846, HI 8830 (d), WHD 965 (d), HI 8827 (d), HI8839(d), WH1403, HI8847

Resistant to all three rusts + KB + PM:

PBW870

Resistant to all three rusts + FS + PM:

PBW902, VL3029, HD3407*, HPW 489, HPW 495

Resistant to all rusts+ LB+ FS+PM

HPW493

Resistant to yellow rust+ leaf rust + KB+ PM+FS:

HPW484, VL3028

Resistant to yellow rust+ stem rust + FS +PM:

HPW487

Resistant to yellow rust+ leaf rust + FS:

HD3440

Resistant to yellow rust + leaf rust:
VL3028, HPW 484, B2011\CIMCOG\18, 41st ESWYT 141
Resistant to yellow rust+ KB+ PM+FS:
HS694
Resistant to yellow rust+ PM + FS:
VL2043, HD3402
Resistant to leaf rust + stem rust + KB+ PM + FS:
CG 1036, WH1402, HPW 496
Resistant to leaf rust + stem rust + PM + FS:
HI1654*, HD3438, HD3437
Resistant to leaf rust + stem rust + PM:
GW547[B], NIAW4028, GW532, HI1655Q*, MACS6795, HI 1651
Resistant to leaf rust + stem rust:
HI1665, WH1403, HD3407*, HI8847, 41st ESWYT 113, EC 0529881, IC 624342
Resistant to stem rust+ PM+FS:
HD3392
Resistant to KB+FS+PM:
VL2044
Resistant to FS + PM:
HPW 497

Utilization of resistant sources
The NGSN comprising 15 entries with confirmed sources of high level of disease resistance were shared with 30 breeding centers across different agro climatic zone the country for their cultivation in breeding for resistance to biotic stresses. The utilization was 0 to 60% by different centres. The entries utilized at most of the centres were HI 1544, HS 681and DBW 342 and RAJ 4541. Durgapur centre utilized maximum nine entries in their breeding programme followed by Coochbihar and Sagar.
Pathotype distribution of *Puccinia* species on wheat and barley
During 2022-23, a total of 772 samples of three rusts of wheat were pathotyped from India and Nepal.

Yellow or stripe rust of wheat and barley (*Puccinia striiformis*)
During this crop year, 230 samples of stripe rust of wheat [*Puccinia striiformis* f. sp. *tritici, Pst*) were analyzed from five Indian states (Himachal Pradesh, Punjab, Haryana, Uttarakhand, and Rajasthan) and Nepal. A total of eight pathotypes {238S119, 110S119, 46S119, T (47S103), P (46S103), 79S68, 6S0, and 7S0] of wheat stripe rust pathogen were identified. The field population was avirulent to *Yr5*, *Yr10*, *Yr15*, and *Yr*Sp. Most of the stripe rust samples of wheat were analyzed from Punjab (132) followed by Himachal Pradesh (51) and Uttarakhand (31). During the cropping season frequency of pathotype 238S119 was maximum (54.78%) followed by 110S119 (27.39 %). The frequency of 46S119 (virulent on *Yr2*, *Yr3*, *Yr4*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr18*, *Yr19*, *Yr21*, *Yr22*, *Yr23*, *Yr25*, and *Yr*A) was reduced to 12.17%. Pathotypes 46S103 and 79S68 were identified in 2 and 1 samples, respectively. Only one pathotype 57 (0S0) of *Puccinia striiformis* f. sp. *hordei*(*Psh*)was identified in 2 barley yellow rust samples collected from Tehri, Ranichauri (UK).

Stem rust of wheat (*P. graminis* f. sp. *tritici*)
A total of 49 samples of wheat stem (black) rust were received from four Indian states (Gujarat, Maharashtra, Tamil Nadu, and Uttarakhand) during the crop season. Five pathotypes of *P. graminis*f. sp.*tritici* were identified from the analysis of 49 samples. Population analyzed during the year had avirulence to *Sr26*, *Sr27, Sr31, Sr32, Sr35, Sr39, Sr40, Sr43, SrTt3* and*SrTmp*. Pathotype 11 (79G31=RRTSF), virulent on *Sr2, Sr5, Sr6, Sr7b Sr9a, Sr9b,Sr9c, Sr9d, Sr9f, Sr9g, Sr10, Sr13, Sr14, Sr15, Sr16, Sr17, Sr18, Sr19, Sr20, Sr21, Sr28, Sr29, Sr30, Sr34, Sr36, Sr38,Sr*McN was recorded in more than 32% of the samples analyzed during the season, which was followed by 40A (26.53%) and 40-3 (22.4%). Pathotypes 40-3 and 21 were identified in eleven and three samples, respectively. Diversity of black rust pathogen was maximum in Tamil Nadu.

Brown or leaf rust of wheat (*Puccinia triticina*)

A total of 493 samples of wheat leaf rust pathogen were analyzed from 12 states of India and neighboring country Nepal. Nineteen pathotypes were identified in these samples. Pathotype 77-9 (121R60-1) was the most widely distributed and occurred in 36.11% of the samples followed by 52-4 (121R60-1,7) in 27.79% samples (Table 3). Pathotype 77-5 (121R63-1), which remained most predominant for more than 20 years was observed in 15.82% samples only. The remaining 14 pathotypes were identified in 20.28% samples only. The *P. triticina* population from Uttarakhand was highly diverse as highest number of pathotypes (14) was detected in the samples collected from Uttarakhand. In Nepal 4 pathotypes were detected in 26 samples. Unlike Indian scenario pathotype 52-4, detected in 16 samples, was the most predominant in Nepal.

Seedling resistance test (SRT) to virulent pathotypes of wheat and barley rust pathogens and characterization of *Lr, Sr* and *Yr* genes in AVT material

For identifying rust resistance sources, more than 8500 wheat and barley lines were evaluated at seedling stage under controlled conditions during 2022-23. Of these, 270 lines including 134 of AVT and 136 of NBDSN/EBDSN were subjected to multiple pathotypes screening under controlled light and temperature conditions. Advanced wheat lines (134) were evaluated at seedling stage against 60 pathotypes of stem rust (*P. graminis* f. sp. *tritici*), leaf rust (*P. triticina*) and stripe rust (*P. striiformis* f.sp. *tritici*) possessing different avirulence/virulence structures. Seedling (all-stage) rust resistance remains effective throughout the life of wheat plants.

Rust resistant lines in AVT

***Sr*-genes**

Thirteen stem rust resistance genes (*Sr*2, *Sr5, Sr7b, Sr8a, Sr8b, Sr9b, Sr9e, Sr11, Sr13, Sr24, Sr28, Sr30* and *Sr31*) were characterized in 93 AVT lines (Table 3). The frequency of *Sr7b* was maximum as it was postulated in 43 AVT entries followed by *Sr11*and *Sr2,* which were characterized in 25 and 24 entries, respectively. *Sr31* linked with *Lr26* and *Yr9* and conferring resistance to all the known *Pgt* pathotypes in Indian subcontinent was postulated in seven AVT entries, while *Sr24* linked to *Lr24* was characterized in three entries. Other *Sr* genes i.e. *Sr9b* & *Sr13, Sr30, Sr5, Sr8a, Sr9e* & *Sr8b,* and *Sr28*, were postulated in 20, 18, 16, 06, 03, and 1 entry, respectively. The *Sr* genes were characterized singly or in combination of up to four gens. DBW252 (C) had combination of four *Sr* genes (*Sr8a+5+11+2+*).

***Lr*-genes**

Eight *Lr* genes viz. *Lr1*, *Lr3*, *Lr10*, *Lr13*, *Lr23*, *Lr24*, *Lr26,* and *Lr28* were characterized in 100 AVT lines. *Lr13* was the most commonly occurring leaf rust resistance and was characterized in highest number of lines (68) followed by *Lr10* (45 lines), *Lr1* (22 lines), and *Lr23* (20 lines). *Lr24* was postulated in 03 entries. *Lr26* and *Lr3* were characterized in seven and four entries, respectively. *Lr28* was postulated in three entries (HD3469, HI1669, and K1317*). Majority of the genes occurred in combination and many of the lines have leaf rust resistance derived from 3 or more *Lr* genes.

***Yr*-genes**

Among the 134 lines of AVT, *Yr* genes were characterized in 78 lines. *Yr* genes were postulated in lines where differential interactions were observed and in other cases tight linkage of *Yr*genes to other *Lr* and *Sr* genes also facilitated the inference for the presence of a resistance gene. Three *Yr* genes viz. *Yr2*, *Yr9*, and *YrA* contributed to yellow rust resistance in Indian wheat material. Among the postulated *Yr* genes *Yr2* was most common and characterized in 62 lines. *Yr9* and *YrA* were postulated in 10 and 08 entries, respectively, whereas their combined presence was postulated in two AVT entries (HI1668 and K2108).

Management of diseases through chemicals

Field experimental trials for the evaluation of efficacy of six chemical fungicide combinations *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%), Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC (0.1%), Azoxystrobin 11% + Tebuconazole 18.3% w/w SC (0.1%), along with standard recommended fungicides [Propiconazole (0.1%) and Tebuconazole (0.1%) were performed in randomized block design with three replications for the management of head scab, leaf rust, stem rust and leaf blight during the cropping season 2022-23 at different locations. Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% followed by Picoxystrobin 7.05% + Propiconazole 11.7% SC @0.1% and Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @0.1% was found most effective against head scab of wheat, when tested at three different locations. Similarity, Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% was showed maximum disease reduction against both leaf rust and stem rust diseases across the locations. In case of leaf blight, Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% was the best performing fungicide across the seven locations. No phytotoxicity was recorded with any of the tested concentrations of fungicides on wheat plants.

Advisory for stripe rust management

During the current season 2022-23, the weather remains congenial in the month of January for yellow rust in NWPZ. However disease severity remained low to elopement of resistant varieties. Need based advisories for stripe rust and Karnal bunt disease management were issued. Awareness among farmers for stripe rust management was created trough mobile, internet, toll free number, newspapers, discussions and delivering lectures in farmers training progarmmes.

Preparedness to wheat blast

Survey was conducted during the cropping season 2022-23 in North and South West Bengal near Indo-Bangladesh borders by teams of scientists from ICAR-IIWBR, Karnal, UBKV, Cooch Behar and BCKV, Kalyani, Nadia and no wheat blast was observed. Awareness was also created in farmers to take all preventative measures available against blast and to grow the identified resistant varieties. For identification of wheat blast resistant sources, advance breeding lines and potential germplasm were screened at Jessore, Bangladesh through, CIMMYT. A total of 350 entries were screened against blast at Jessore at two different dates of sowing during 2022-23. Twenty three entries [NIDW1520(d), MP3577, PBW905, PBW906, DBW439, WH1321, RAJ4583, DBW441, DBW442, RWP2024, RWP2030, RWP1332, WAP2214, WAP2222, WAP2223, WAP2224, BRNS 88-11, BRNS 88-16, BRNS 88-17, BRNS 88-18, BRNS 88-19, BRNS 88-22, and BRNS 88-23] were found free from infection and 80 are categorized resistant on the basis of highest score upto 10% infection.

Post harvest surveys for Karnal bunt

A total of 7997 grain samples collected from various mandies in different zones and were analyzed at cooperating centers (Table 4). The overall 15.41% samples were found infected. The samples from Rajasthan showed maximum infection (34.99%). In general the Karnal bunt infection was less in comparison to previous year.

Training for Human Resource development

To bring more uniformity in disease creation and data recording, training was organized on “Precise and uniform data recording and reporting in wheat and barley crop protection trials” from February 22-24, 2023 at ICAR-IIWBR, Karnal. The scientists and technical workers of research institutes and private companies involved in disease and insect pest recording participated in the training progarmme.

ENTOMOLOGY

Survey and surveillance for insect pests

- In order to monitor the insect pest of wheat and barley, a survey of Punjab state were undertaken during 2022-23 crop season. The aphid incidence was below economic threshold level in most parts of Punjab during the months of February-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 2022-23 crop year except for few minor infestations.
- In Maharashtra state, survey was carried out in the villages of Nashik viz., Talegaon,Avankhede Ozarkhed, Ambaner, Sajola and Khirad of different wheat crop stages on farmer’s field during the February 2023. There were 58 samples were observed, medium incidence of aphid was recorded during the survey. The Coccinellids larvae, beetles & *Chrysoperla carnea* predator adults were also observed. The incidence of stem borer and jassids were recorded to be of low intensity.

- In Gujarat state, surveys were conducted to insect pest situation in wheat crop during Rabi 2022-23. The termite damage in wheat fields was recorded below 1 % in the fields across the area surveyed. The incidence of aphid was observed to be 0.5 to 1% 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 various villages viz., Araul, Daleep Nagar, Magharwara, Kundi, Devpura, Jahanabad during 2022-23. Incidence of shootfly was recorded to be between 1 to 1.66 at these locations. The incidence of termite was observed 13 per cent on wheat varieties viz., PBW343 and HUW 234 of wheat at Daleep Nagar. However, it was 10% in locations Magharwara, Kundi, Devpura, Jahanabad on variety HD2967. High infestation (30-35 aphid/tiller) of foliar aphid was on barley variety namely, 'Barley Local' at surveyed locations. The higher incidence of pink stem of 13.3% borer was observed in irrigated crop one per cent in variety HD-2967 at Daleep Nagar.
- Moderate to severe incidence of foliar wheat aphid was observed in Karnal district of Haryana. The minor damage of termite and root aphids was also observed in early period of crop growth in Karnal as its nearby locations Kunjpura, Kathial, Racina and Hajwna.In some fields, incidence of pink stem borer was observed in early (December month) and alter in the season (March month). The grubs and adults of coccinellid beetles were seen frequently in fields infested with aphids. This year incidence of aphids, termites, pink stem borer and army worm was reported to be low (1-2%). Termites and root aphid was reported to be around 1-2% during November and December. Aphid infestation started appearing in the month of January and the population in the beginning was around 2-5 aphids/tiller but in February, higher infestation of aphids (20-25 aphids/tiller on an average) was observed 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 of 5.42% of shoot fly entry was reported in entry NIAW4120. However, the highest shoot fly infestation index of 19.02% was recorded in entry UP3102. At Ludhiana centre, lowest infestation index of 4.26% reported on PBW891 and highest infestation index of 8.51% on Sonalika. At Dharwad location, the lowest shootfly index (1.56%) was recorded on entry HI1612(C) while highest infestation (37.88%) was observed on UP3102. At Kanpur location, lowest infestation 3.33 % was observed on MACS3949(d)(C) and highest infestation of 21.87% was recorded on entry MP1378.

Brown wheat mite: At Ludhiana, entry MP1386 recorded the minimum mite population of 8.33/10 cm^2 area while maximum mite population of 17.33 /10 cm^2 was recorded in entry Sonalika. This seasonal incidence of mite was very low at Durgapura and Kanpur locations; therefore data of mite incidence was not included.

Foliar aphid: Based on the average score of aphids at four locations; Ludhiana, Karnal, Niphad and Pusa, seven entries viz.,HI1612(C), HD3059(C), DBW252(C), MP3288(C), HI1655(I)(C), MACS6811 and DBW395 scored an average score of below 3.5 and were in moderately resistance category (grade 3). Location-wise, at Ludhiana centre three entries, HI1650 (I) (C), MP3288(C) & HI1655(I)(C) and eleven entries at Karnal centre viz., HD3249(C), PBW826(I)(C), DBW398, GW513(C), HI1650(I)(C), MP3288(C), DBW110(C), HI1655(I)(C), NIDW1149(d)(C), DBW380 and CG1044 were found to be moderately resistance category (grade 3). At Niphad, five entries, HD3171(C), HI1669, MP4010(C), HI1634(C) and NIAW4153 were found to be resistance category (grade 2) whereas at Pusa, twelve entries showed resistance response (grade2). 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, Kharibari, Pantnagar, Khudwani was recorded to very low and therefore data was rejected.

Root aphid: Out of total 134 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 & Kanpur) was to be lowest (7.69%) in entry HD3392 and the maximum score of 18.50% was recorded for HI8839(d). The lowest population of 9.00 brown wheat mites/10 cm^2 was recorded in entry HD3438 while Sonalika had highest population of 15.67 mites/10 cm^2 at Ludhiana. Based on average score of four locations (Ludhiana, Karnal, Pusa and Niphad), 8 entries NIAW4028, HI1655Q*, WHD 965 (d), PBW902, GW547B, GW532, VL2043 and HPW 489 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 wheat crop (first fortnight of Nov 2022) 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. 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 2023 in all sowing dates. The root aphid appeared in the early growing season and its attack was observed on 3-5 week old crop.
- 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. The data revealed that pink stem borer incidence was significantly higher in all residue management conditions as compared to conventional tillage conditions. Its 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.
- Studies on the population dynamics of foliar aphids on wheat and barley crops showed that the population of aphids on the barley crop was significantly larger than that on the wheat crop. Following the height of the aphid infestation on the wheat and barley crop, the coccinellid beetle began to emerge.
- Effect of silicon application in the form sodium meta-silicate@ 10, 30 and 50 g/litre was tested alongwith one and two sprays of Actara (thiamethoxam 25WG) @ 50 g/ha to determine the effect on aphid abundance and their coccinellid predators in wheat. It was found 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.
- Seed treatments with different insecticides are recommended for the control termites in wheat. Farmers are also applying hydrogel 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, keeping in view, an experiment was conducted to study their compatibility with each other. 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. Among the different insecticide seed

treatments, termites damage was lowest in goond Katira (5kg/ha) + neonix @ 2 ml/kg of seed after 3-6 weeks of sowing. Whereas among the soil application, it was minimum in goond Katira (5kg/ha) + fipronil 0.6% GR when applied before Ist irrigation and it recorded lower termite damage (0.38-0.86%) after 4-6 weeks of sowing.

- Efficacy of Pymetrozine 50% WG at three doses viz., 80 g /ha, 100 g/ha and 120 g/ha was evaluated against foliar aphid and compared with already recommended insecticides i.e. Thiamethoxam 25% WG @12.5 g/ha, Imidacloprid 17.8 SL @100 ml/ha and Acetamiprid 20SP @100 g/ha. The results revealed that the treatment of pymetrozine 50 % EC @ 100 and 80 g a.i./ha and the treatment with thiamethoxam 25 % WG @ 12.5 g a.i./ha were found equally effective against foliar aphids and were found at par with each other.
- Evaluation of insecticides was carried out against lepidopterous pests (pink stem borer, army worm & cutworms) of wheat. The results indicated that the lowest damage was recorded in soil application of fipronil 0.6% GR @ 8 kg/ha followed by foliar application of chlorantraniliprole 18.5 SC @ 150 ml/ha. However, all insecticidal treatments were significantly better than untreated control.
- Seed treatment of two chemicals i.e. Neonix (Imidacloprid 18.5% + Hexaconazole 1.5% FS) @ 1.5 ml/kg seed and 2 ml/kg seed & Cruiser 70 WS (thiamethoxam) @ 1 ml and 2ml and soil application of fipronil 0.3 GR @15 kg/ha, 17.5 kg/ha and 20 kg/ha and chlorpyriphos 20EC @ 2 L/ha, 2.5 L/ha and 3.0L/ha were evaluated for management of termites. Per cent damaged effective tillers/m row recorded after 3, 4 & 5 weeks of germination indicated that all treatments recorded significantly lower per cent damaged effective tillers/m row except lower dosage of fipronil 0.6 GR and chlorpyriphos 20 EC and untreated check. However, the lowest termite damage was recorded in Cruiser 70 WS@1.5 ml/kg of seed. At ear head stage, the per cent damaged effective tillers per meter row were also minimum in the Cruiser 70 WS@1.5 ml/kg of seed (0.97 %) treatment and it was on par with all the other treatments except lower dosage fipronil 0.6 GR and chlorpyriphos 20 EC and untreated check.
- Seed protectants viz., Neem oil (*Azadiracta indica*), Blue gum oil (*Eucalyptus globulus*), Karanj oil (*Pongamia pinnata*), Castor oil (*Ricinus cumunis*), Sweet flag (Vekhand) powder (*Acorus calamus*), Turmeric Powder (*Curcuma longa*) and Diatomaceous earth were evaluated against storage insect pest i.e. *Sitophilus oryzae* of wheat. The results indicated that the treatment with Karanj oil (*Pongamia pinnata*) @ 15 ml/kg seed was found best effective treatment against *S. oryzae*. However, neem oil, blue gum oil @ 15 ml/kg seed treatments and the treatment with Sweet flag powder@ 5 g/kg seed were found equally effective and were at par with Karanj oil treatment.

NEMATOLOGY

Resistance against *Heterodera avenae*

One hundred thirty four entries of AVT were screened for resistance against *H. avenae* (CCN) under sick plot conditions or pot condition at Hisar and Durgapura centers. Two entries at Durgapura viz., VL2041(I)(C) and PBW887 and four entries i.e. HS692, UP3111,NIAW4114 and LOK79 at Hisar showed moderate level of resistance to *H. avenae* (CCN)

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.

Survey for nematode incidence

Crop health monitoring survey **of** wheat and barley was done during March, 2023 in Rewari and Hisar districts of Haryana. Out of 42 samples, cereal cyst nematode (CCN) was reported from 18 samples. Number of cysts ranged from 2-22 per 200 cc soil. Plant parasitic nematodes present in 200 cc soil samples were *Pratylenchus* sp., *Tylenchorhynchus* sp., *Hoplolaimus* sp., *Helicotylenchus* sp., Criconematids etc. Wheat seed gall nematode (*Anguina tritici*) and rice root-knot nematode (*Meloidogyne graminicola*) were not recorded from these samples.

PROGRAMME 1. HOST RESISTANCE: IPPSN AND PPSN

Constitution of different plant pathological nurseries during 2022-23

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 Multiple Disease Screening Nursery (EMDSN), 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.

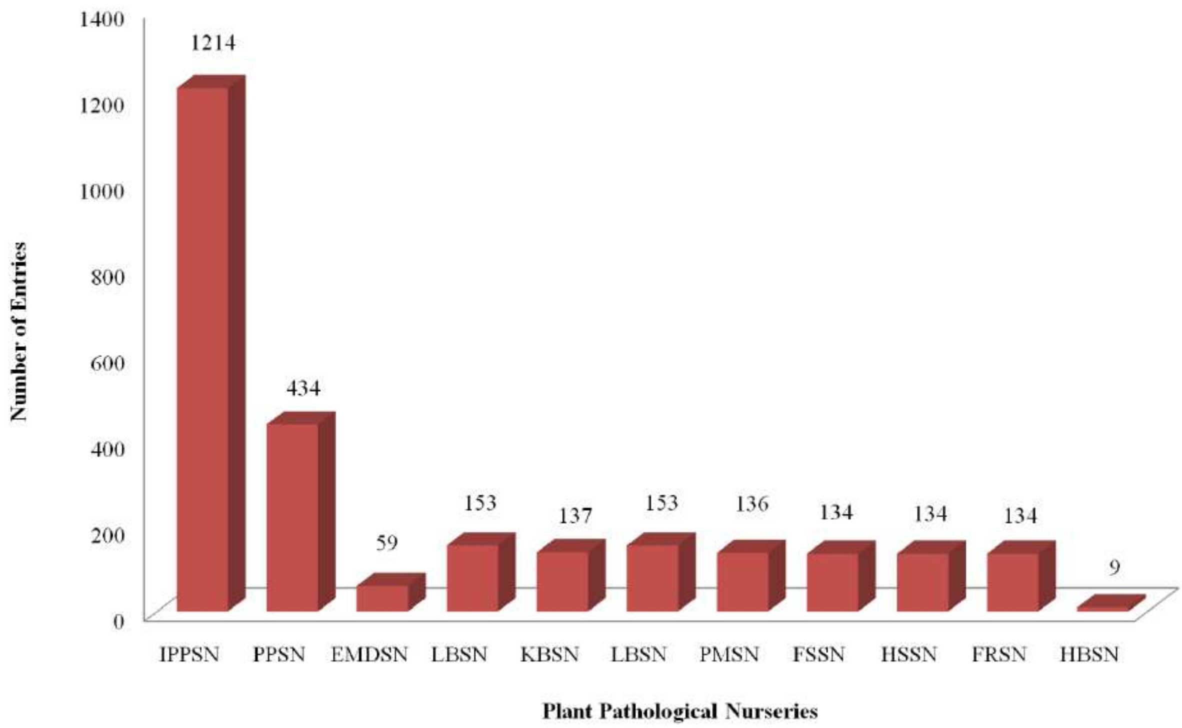

Fig. 1. Constitution of different plant pathological nurseries during 2022-23

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: 1214

No. of breeding centers: 41

Test Locations

(a) Rusts

Stripe rust: Durgapura, Ludhiana, Gurdaspur, Pantnagar, Bajaura, Karnal, Hisar, Delhi, Dhaulakuan, Almora, Malan, Jammu, and Khudwani (13)
Leaf rust: Ayodhya, Durgapura, Ludhiana, Pantnagar, Karnal, Kanpur, Delhi, Hisar and Jammu (9)
South
Stem rust: Junagadh, Mahabaleshwar, Pune, Indore, Niphad, Powarkheda, Vijapur, Dharwad and Wellington (9)
Leaf rust: Junagadh, Mahabaleshwar Pune, Dharwad Indore, Niphad, Powarkheda, Vijapur, and Wellington (9)
(b) Leaf Blight: Ayodhya, Varanasi, RPCAU Pusa, Sabour, Kalyani, Coochbehar, Pune and Dharwad (8)
Leaf rust data of Coochbehar 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**	
		Flowerdale	**Other Centres**
Stem/Black	*P. graministritici*	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

The entries found resistant (ACI<10) and qualify for promotion (ACI<20) to three rusts are given in Table 1.1. A total 1214 entries were screened for rusts at multilocation under artificially inoculated condition. Out of these, 764, 846, 786 and 453 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.

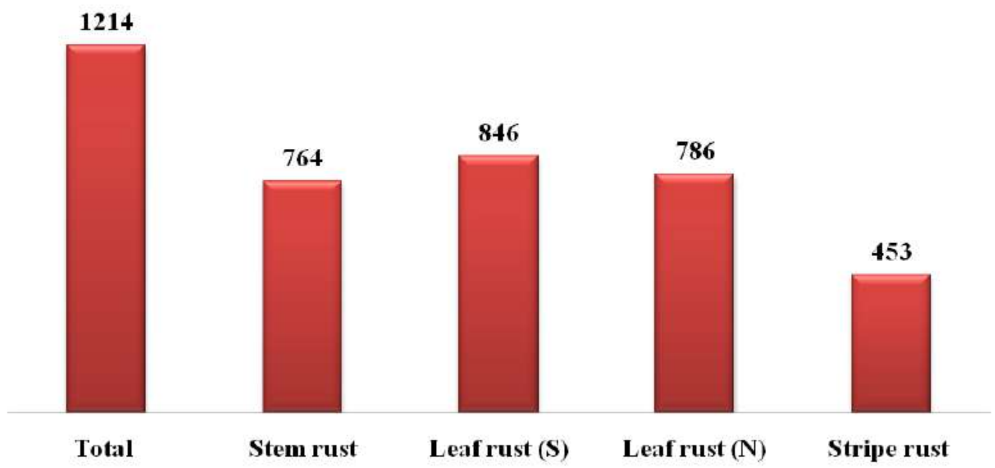

Fig. 1.2 Number of IPPSN entries found resistant to different rusts

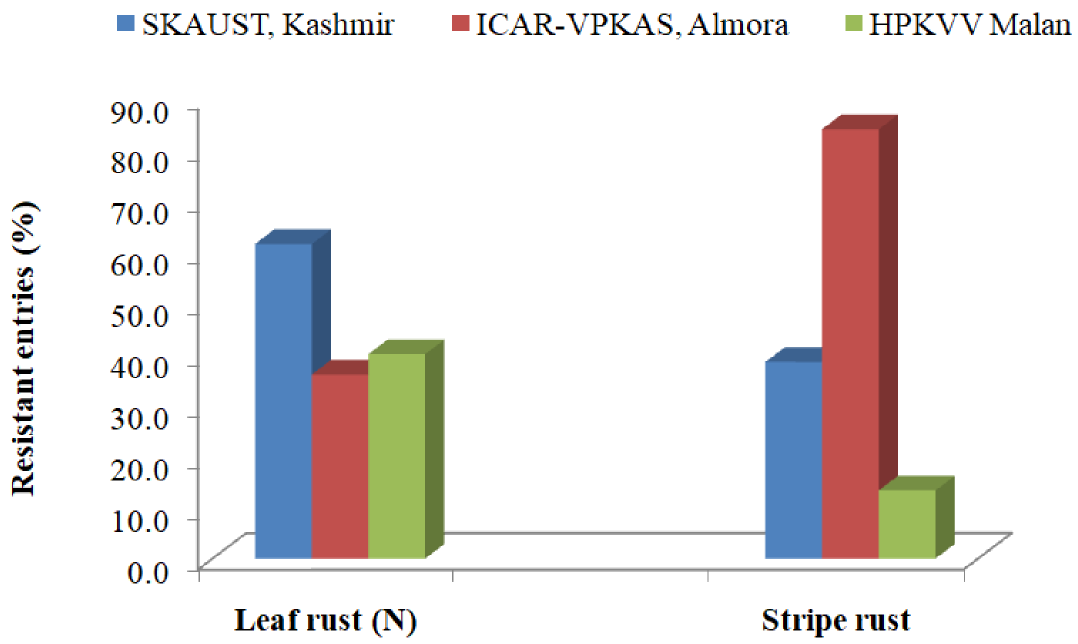

Fig. 1.3. Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of NHZ (Leaf (N) and Stripe rust)

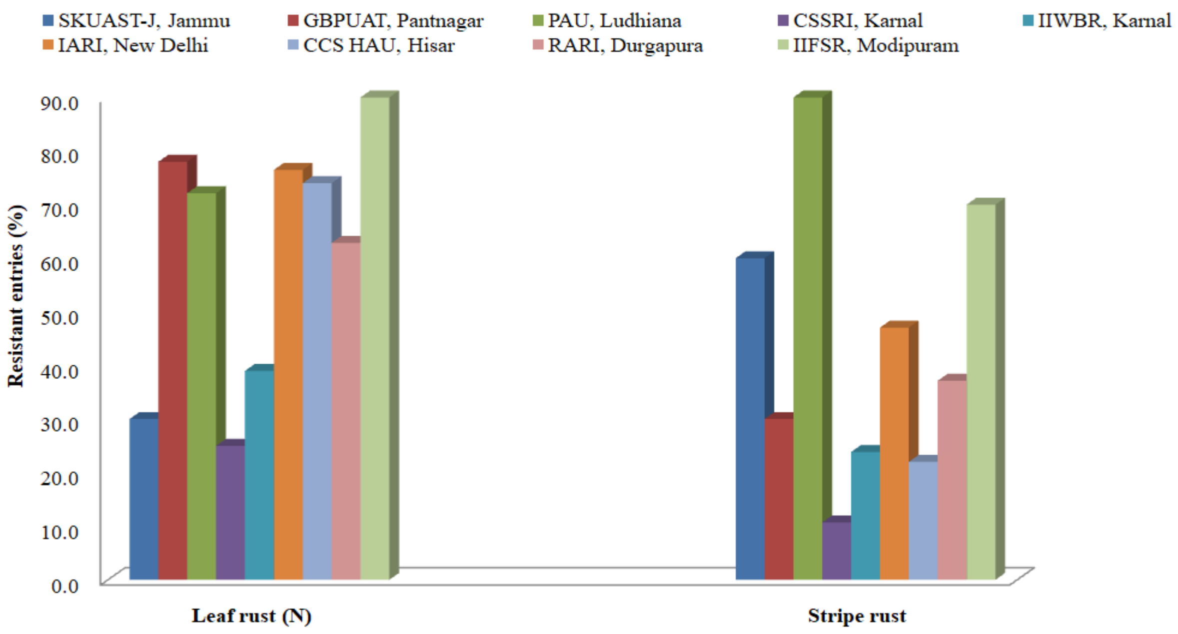

Fig. 1.4 Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of NWPZ (Leaf (N) and Stripe rust)

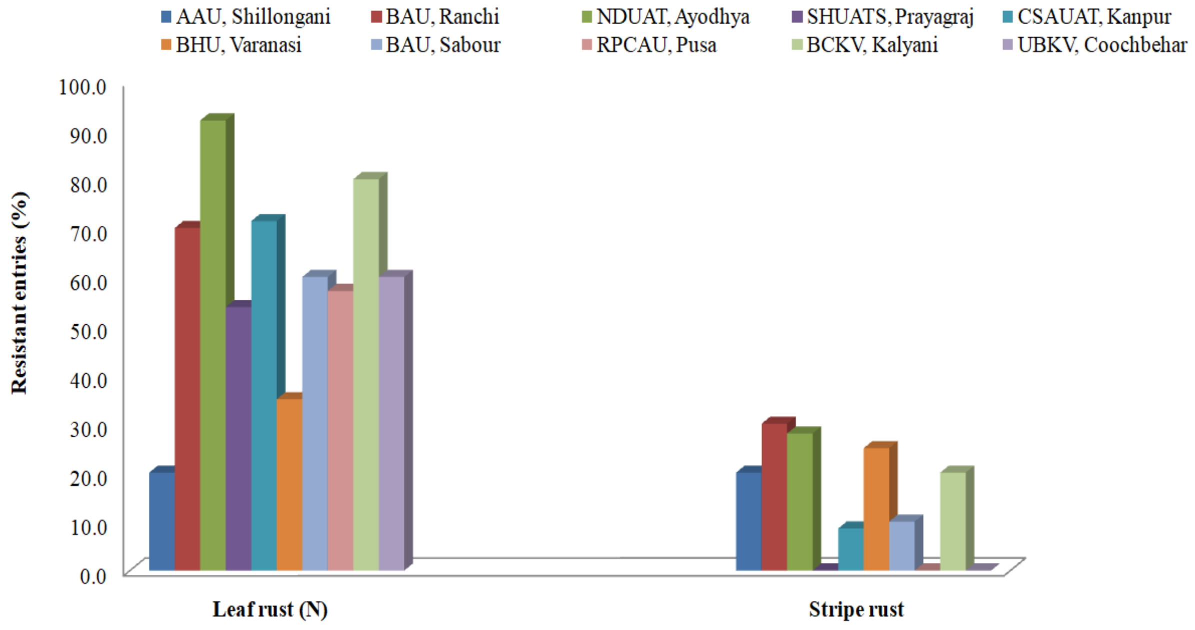

Fig. 1.5 Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of NEPZ (Leaf (N) and Stripe rust)

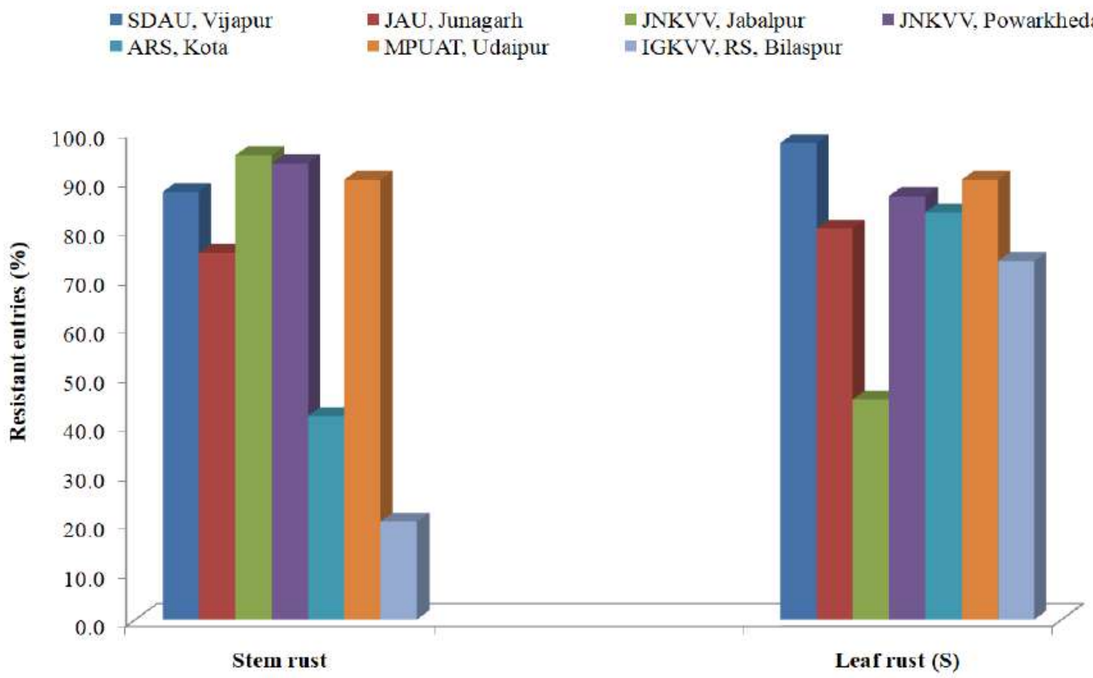

Fig. 1.6. Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of CZ (Stem and Leaf rust)

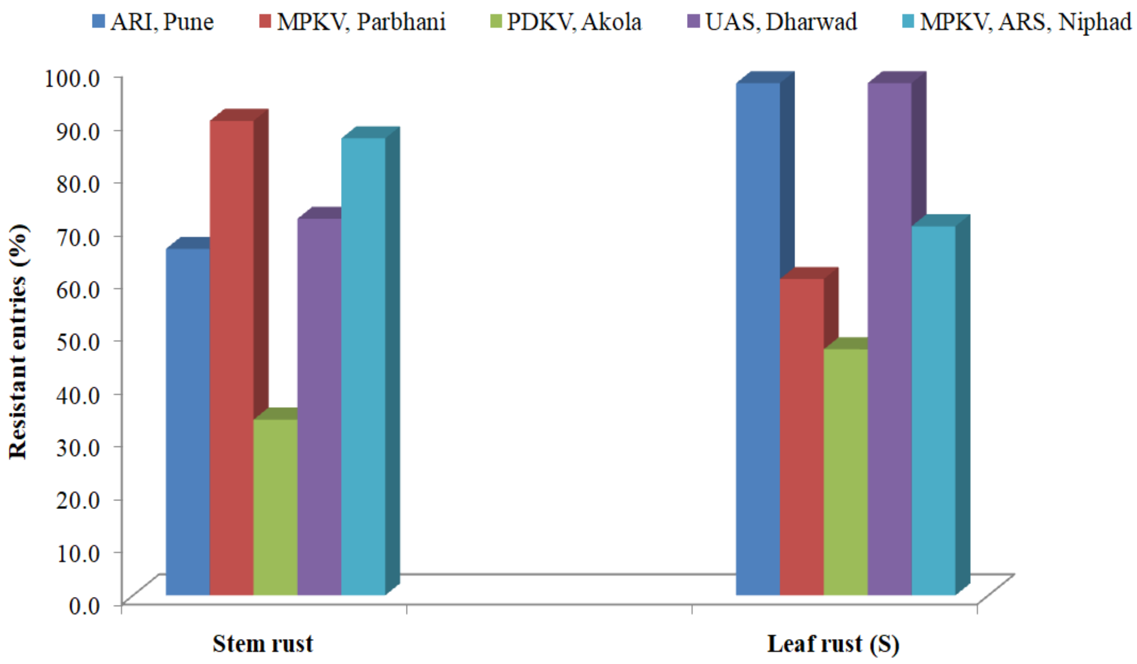

Fig. 1.7. Per cent of rust resistant entries in IPPSN slots belonging to cooperating centres of PZ (Stem and Leaf rust)

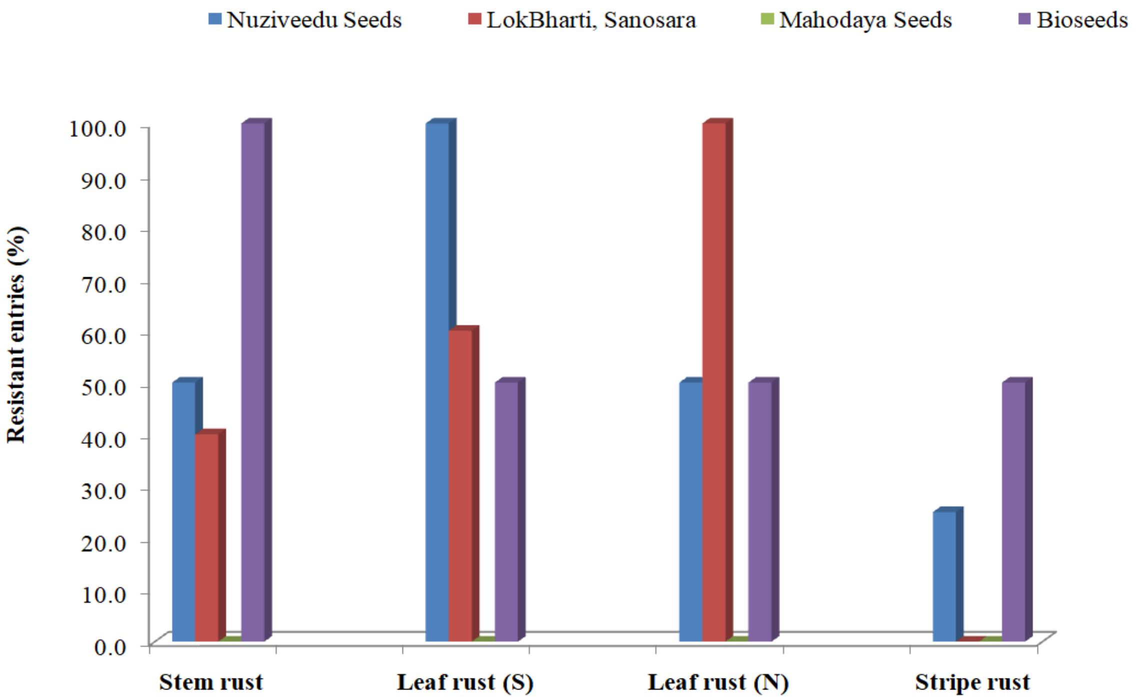

Fig. 1.7 Per cent of rust resistant entries in IPPSN slots belonging to different private seed companies (Stem, Leaf and stripe rust)

Table 1.1: Number to resistant entries (ACI<10) and entries qualify for promotion (ACI <20) in IPPSN slots of different centres during 2022-23.

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	13	13	9	8	5	13	12	12	8
ICAR-VPKAS, Almora	25	16	17	9	21	23	23	21	24
HPKVV Malan	15	9	10	6	2	14	15	13	8
NWPZ									
SKUAST-J, Jammu	10	8	8	3	6	10	10	9	8
GBPUAT, Pantnagar	50	40	45	39	15	49	49	49	23
PAU, Ludhiana	140	79	107	101	126	116	126	125	137
CSSRI, Karnal	28	6	8	7	3	7	10	10	6
IIWBR, Karnal	218	97	108	85	52	121	121	122	96
IARI, New Delhi	170	124	146	130	80	153	169	166	112
CCS HAU, Hisar	50	29	30	37	11	43	44	48	40
RARI, Durgapura	35	21	21	22	13	30	25	5	25
IIFSR, Modipuram	10	7	9	9	7	9	10	10	10
NEPZ									
AAU, Shillongani	5	0	0	1	1	1	2	4	5
BAU, Ranchi	10	7	8	7	3	10	10	10	6
NDUAT, Ayodhya	25	23	23	23	7	25	25	24	19
SHUATS, Prayagraj	13	0	4	7	0	3	10	9	0
CSAUAT, Kanpur	35	27	8	25	3	33	35	35	13
BHU, Varanasi	20	7	11	7	5	17	14	14	9
BAU, Sabour	20	15	17	12	2	19	19	17	8
RPCAU, Pusa	7	4	5	4	0	7	6	7	3
BCKV, Kalyani	10	9	10	8	2	10	10	10	4
UBKV, Coochbehar	10	8	6	6	0	10	9	8	6
CZ									
SDAU, Vijapur	40	35	39	39	9	37	40	40	11
JAU, Junagarh	20	15	16	16	4	18	18	18	4
JNKVV, Jabalpur	20	19	9	14	4	20	18	20	4
JNKVV, Powarkheda	30	28	26	23	8	30	29	30	11
ARS, Kota	12	5	10	12	4	9	12	12	8
MPUAT, Udaipur	10	9	9	9	4	10	10	10	6
IGKVV, RS, Bilaspur	15	3	11	6	5	10	14	11	9
JNKVV, Sagar	11	7	6	4	0	10	8	8	0
PZ									
ARI, Pune	35	23	34	35	16	31	35	33	23
MPKV, Parbhani	10	9	6	7	3	10	9	7	5
PDKV, Akola	15	5	7	7	2	11	10	13	3
UAS, Dharwad	35	25	34	35	20	31	35	35	23
MPKV, ARS, Niphad	30	26	21	15	8	28	30	29	10
Private companies									
Nuziveedu Seeds	4	2	4	2	1	4	4	4	2
LokBharti, Sanosara	5	2	3	5	0	3	4	5	0
Mahodaya Seeds	1	0	0	0	0	1	0	0	0
Bioseeds	2	2	1	1	1	2	2	1	1
Total	**1214**	**764**	**846**	**786**	**453**	**988**	**1032**	**1004**	**690**

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 434 entries that comprise AVT, NIVT and special trials including checks during 2022-23. 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:

Stripe rust: Durgapura, Ludhiana, Gurdaspur, Pantnagar, Bajaura, Karnal, Hisar, Delhi, Dhaulakuan, Almora, Malan, Jammu, and Khudwani (13)

Leaf rust: Ayodhya, Durgapura, Ludhiana, Pantnagar, Karnal, Kanpur, Delhi, Hisar and Jammu (9)

South:
Stem rust: Junagadh, Mahabaleshwar, Pune, Indore, Niphad, Powarkheda, Vijapur, Dharwad and Wellington (9)
Leaf rust: Junagadh, Mahabaleshwar Pune, Dharwad Indore, Niphad, Powarkheda, Vijapur, and Wellington (9)

Leaf Blight: Ayodhya, Varanasi, RPCAU Pusa, Sabour, Kalyani, Coochbehar, Pune and Dharwad (8)
Data were not considered due to poor/erratic disease development from the following centres:
Stripe rust: Malan
Leaf rust (N): Hisar
Leaf rust (S): Junagadh and Wellington
Stem rust: Dharwad

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 (2022-23) with ACI upto 10.0 are given below:

Stem, Leaf and Stripe rusts

UP3102, PBW893, DBW173(C), PBW771(C), WH1402, DBW296(C), HI1654 (I)(C), HD3388, DBW444 and NIDW1149 (d)(C)

Stem and leaf rusts

HS691, VL907(C), VL892(C), VL2041(I)(C), DBW386, HD3428, K2108, HD3059(C), PBW826 (I)(C), DBW252(C), HI1669, HI1670, GW547, HI1636(C), HI1650 (I)(C), HI1674, HI1634(C), CG1029(C), CG1036(I)(C), HI1655(I)(C), NIAW4183, NIAW4153, AKAW5314, AKAW5100, MP1378, DBW443, PWU15, PBW891, HI8841(d), HI8826(C), MACS6222(C), HI1672, HI1673, HI1675, DBW394, DBW395, MACS6814, NIAW4114, NIAW4120, UAS3022, MP3557, PBW897, GW538, LOK79, RAJ4083(C), HD3090(C), HI1633(C), HI1665, DBW397, NIAW4028, PBW872(C), DBW377, GW543, DBW187(C) and DBW303(C)

Stem and Stripe rusts

DBW359 and MP3556

Leaf and Stripe rusts

PBW889, HD3369 (I)(C), UAS478(d), HI8840(d), DDW61(d) and UAS446(d)(C)

Table 1.2. Adult plant response of AVT entries against three rusts under epiphytotic conditions at hot spot locations in field during 2022-23

AVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Gene Postulation		
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	*Sr*	*Lr*	*Yr*
1	HS691	1.3	10MR	0.4	5MR	0.6	5MS	10.8	40S	-*	-*	-
2	HS692	7.4	20MS	3.1	10S	11.6	60S	13.8	60S	-*	*Lr13+10+ **	*Yr2+**
3	VL3028	11.0	40S	4.6	10MS	1.9	5S	11.3	80S	*Sr30+5+11+*	*Lr13+ 10+ **	*Yr2+*
4	HPW484	18.2	40S	3.9	10MS	4.9	20S	15.1	20MS	*Sr30+5+11+*	*Lr13+**	*R**
5	VL907(C)	2.0	20MR	3.6	10MS	3.8	20MS	21.4	80S	-*	-*	*Yr2+**
6	VL892(C)	5.4	20S	1.2	5MS	3.2	20MS	28.2	80S	*Sr30+11+*	*Lr13+10+*	*Yr2+*
7	HPW349(C)	22.1	60S	10.1	40MS	3.9	20S	13.1	80S	*Sr7b+2+*	*Lr23+10+*	*Yr2+*
8	HS562(C)	27.5	60S	16.9	40S	9.8	20S	14.2	80S	*Sr8a+9b+11+*	*Lr23+10+3+*	*Yr2+*
9	VL2041(I)(C)	9.5	20S	5.3	10S	1.8	10MS	24.4	60S	*Sr30+5+11+*	*Lr13+*	*Yr2+*
10	PBW887	11.5	40S	3.7	10MS	2.5	10S	17.8	40S	R	*Lr13+*	*YrA+*
11	PBW889	11.6	40S	4.1	20MS	1.3	5MS	9.2	40S	*Sr30+5+*	*R*	*R*
12	HD3386	4.0	20S	2.6	20MR	11.0	40S	13.7	60S	R*	-*	*R**
13	HD3470	38.5	60S	14.0	20S	22.3	60S	36.3	80S	*Sr5+13+7b+*	*Lr13+1+*	*Yr2+*
14	HI1668	13.7	60S	4.0	10S	8.0	20S	19.8	80S	*Sr31+*	*Lr26+ R*	*Yr9+A+*
15	DBW386	2.8	20MS	4.1	20MS	4.9	20S	12.3	60S	R	*R*	*R*
16	UP3102	7.6	20S	5.4	20MS	2.4	15MS	9.2	40MS	*Sr5+9b+7b+*	*Lr13+1+*	*Yr2+*
17	HD3428	5.3	20MS	1.2	5MS	1.1	5S	13.8	60S	*Sr13+7b+*	*Lr23+1+*	*Yr2+*
18	PBW893	9.5	20S	1.4	10MS	0.1	TMS	2.0	10MS	*Sr13+7b+*	*Lr23+10+*	*Yr2+*
19	K2108	2.7	20MR	2.3	10S	1.2	5S	10.5	40S	*Sr31+*	*Lr26+1+*	*Yr9+A+*
20	HD3059(C)	4.1	20MS	1.1	10MR	7.4	20S	27.7	60S	*Sr11+2+*	*R**	-
20A	Infector	72.5	100S	80.0	100S	78.8	100S	79.2	90S			
21	DBW173(C)	0.9	10MR	0.7	5MS	1.9	10MS	7.3	40MS	*Sr30+2+**	*Lr23+10+1+**	*Yr2+**
22	PBW771(C)	8.0	20MS	6.0	20MS	3.3	10S	8.8	40S	R*	Lr13+*	*R**
23	JKW261(C)	21.3	60S	4.3	20S	3.1	15MS	20.0	60S	*Sr11+*	*Lr13+**	-
24	WH1402	7.5	20S	5.6	20MS	1.8	10S	1.8	10MS	*Sr30+5+**	*Lr13+1+*	*YrA+**
25	WH1311	12.3	40S	3.5	20MS	1.9	10S	10.3	60S	*Sr30+5+*	*Lr23+*	-
26	UP3111	10.0	20MS	8.0	20MS	13.0	40S	12.7	60S	*Sr13+9b+11+*	*Lr13+10+*	-
27	PBW899	19.3	40S	14.3	40S	2.6	20MS	5.0	20MS	R	*Lr23+10+1+*	-
28	PBW644(C)	9.4	20S	7.4	20MS	20.6	60S	22.3	60S	*Sr11+2+*	*Lr13+1+*	*Yr2+*
29	DBW296(C)	6.3	20MS	1.5	5MS	3.9	15S	6.4	40MS	*Sr13+7b+*	*Lr23+13+10+*	*Yr2+*
30	HD3369(I)(C)	14.0	40S	5.4	20S	4.3	20S	7.3	60S*	*Sr13+*	*Lr13+*	*Yr2+*
31	HI1653(I)(C)	12.7	40S	9.1	40S	8.6	20S	13.2	60S	*Sr7b+*	*Lr13+10+3+*	*R**
32	HI1654(I)(C)	2.3	10MS	1.4	5MS	1.5	10S	9.9	60S	*Sr13+*	*Lr13+*	*Yr2+*
33	HD3388	8.3	20MS	4.0	20MS	4.9	20S	8.6	40S	*Sr13+7b+*	*Lr13+3+**	*R**
34	HD3471	11.3	20S	1.4	5MS	9.5	40S	11.8	60S	*Sr7b+*	*Lr13+10+*	*Yr2+*
35	HD3249(C)	13.5	40S	2.9	10MS	1.6	5S	11.7	60S	*Sr7b+2+**	*Lr13+**	-
36	HD3086(C)	38.0	60S	14.6	20S	31.3	80S	19.0	80S	*Sr7b+2+*	*Lr13+10+3+*	*Yr2+*
37	HD2967(C)	5.4	10S	8.0	20S	7.1	20S	40.2	80S	*Sr8a+11+2+*	*R**	*Yr2+*
38	DBW222(C)	10.1	40S	4.1	20MS	0.9	5MR	19.2	40S	R*	*R**	*R**
39	PBW826(I)(C)	3.6	10MS	6.0	20MS	9.9	40S	14.3	60S	*Sr30+8a+2+*	*Lr13+10+**	*R**
40	DBW398	10.9	40S	10.0	40MS	11.1	40S	17.4	80S	*Sr9b+7b+*	*Lr13+10+*	*Yr2+*

AVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Gene Postulation		
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	***Sr***	***Lr***	***Yr***
40A	Infector	70.0	100S	80.0	100S	80.0	100S	77.5	90S			
41	HI1612(C)	29.5	60S	5.8	10MS	11.0	40S	16.0	80S	*Sr7b+2+*	*Lr23+*	*Yr2+*
42	K1317(C)	12.3	40MS	7.4	20MS	7.8	40S	16.4	40S	-*	*Lr28+**	-*
43	HD3171(C)	18.6	40S	28.6	60S	41.0	80S	25.5	60S	*Sr11+7b+2+*	*Lr23+13+10+*	*Yr2+*
44	HD3293(C)	18.0	40S	15.1	30S	26.8	60S	11.5	40S	*Sr13+2+*	*Lr13+10+*	-
45	DBW252(C)	9.0	20S	6.6	20S	4.3	10MS	14.4	40S	*Sr8a+5+11+2+*	*Lr13+10+*	*R**
46	NWS2194	10.2	20S	8.3	20MS	0.1	TMR	47.4	100S	*Sr30+11+*	R*	-
47	HI1669	3.8	10MS	2.1	5MS	0.3	5MR	57.2	100S	*Sr8b+9e+*	*Lr28+*	*R*
48	HI1670	8.5	20MS	0.9	5MS	2.6	20S	58.3	100S	*Sr9b+7b+*	*Lr13+10+*	*R*
49	GW547	2.1	20MR	0.3	5MR	1.4	10S	33.3	100S	*Sr30+**	*Lr13+**	*Yr2+*
50	GW513(C)	3.8	10MS	0.1	TMR	8.9	60S*	62.5	100S	-*	*Lr23+ **	*Yr2+*
51	HI1636 (C)	5.0	20MS	0.6	10R	3.5	20MS	56.3	80S	*Sr24+2+*	*Lr24+*	*R*
52	HI1650(I)(C)	3.1	10MS	0.6	5MS	1.3	5S	39.8	100S	-*	-*	*Yr2+**
53	MACS6768(I)(C)	11.3	20S	4.3	20MS	3.0	20S	66.7	80S	-*	-*	*Yr9+*
54	HI1674	5.8	20MS	1.0	10MR	1.6	10S	55.5	100S	*Sr9b+7b+2+*	*Lr13+10+ 1+*	*Yr2+*
55	AKAW5104	11.4	40S	1.2	20MR	2.5	20MS	59.7	100S	*Sr13+8b+7b+*	*Lr13+*	*YrA+*
56	HD2932(C)	17.5	30MS	27.4	40S	33.1	60S	57.3	100S	*Sr11+*	*Lr13+*	-
57	MP4010(C)	15.8	40S	30.9	60S	42.3	60S	54.7	80S	-*	*Lr13+1+**	*Yr9+*
58	HI1634(C)	3.9	10MS	3.7	10S	8.8	60S*	67.5	80S	-*	*R*	*Yr2+*
59	CG1029(C)	3.3	10S	2.9	10S	2.5	10S	46.7	90S	-*	-*	*Yr2+*
60	DBW359	7.3	20S	5.5	20MS	14.5	40S	8.6	20MS	*Sr9b+7b+*	*Lr13+10+*	*Yr2+*
60A	Infector	72.5	100S	82.9	100S	81.3	100S	80.0	100S			
61	DBW441	10.7	40S	10.6	20S	12.5	40S	45.2	80S	*Sr13+9b+7b+*	*Lr13+*	-
62	DBW442	13.8	40S	16.9	20S	19.0	40S	40.2	70S	*Sr5+30+*	*Lr13+*	*Yr2+*
63	CG1040	18.3	40S	14.9	30S	18.3	40S	50.2	80S	R	*Lr13+*	-
64	MP3288(C)	7.4	20MS	2.4	10MS	10.6	60S	40.7	80S	*Sr24+*	*Lr24+*	*Yr2+*
65	DBW110(C)	17.0	40S	7.7	20MS	6.6	20S	43.3	80S	-*	-*	*R**
66	CG1036(I)(C)	5.8	20MS	3.1	10MS	8.6	60S*	68.3	100S	*Sr7b+2+*	*Lr13+*	*R*
67	HI1655(I)(C)	1.5	10MS	1.2	5MS	0.3	5MR	38.3	100S	-*	*Lr13+* 10+1+	-
68	UAS3020	44.8	60S	9.7	20MS	5.2	20S	18.6	40S	*Sr13+9b+7b+*	*Lr13+10+*	*Yr2+*
69	UAS3021	15.3	40S	10.9	40S	0.4	5MR	13.7	40S	*Sr13+7b+*	-	*Yr2+*
70	MACS6811	28.8	60S	15.9	40S	2.5	20MS	29.7	60S	*Sr31+*	*Lr26+10+*	*Yr9+*
71	MACS6809	10.8	20S	4.2	20MS	1.0	10MS	50.8	80S	*Sr13+9b+7b+*	*Lr13*+10+	-
72	NIAW4183	2.5	5MS	1.6	5S	6.3	40S	63.3	100S	R	*Lr13+10+*	-
73	NIAW4153	2.5	20MR	1.9	5MS	6.0	40S	65.8	100S	*Sr31+*	*Lr26*+23+10+	*Yr9+*
74	AKAW5314	10.4	20S	8.0	20S	1.8	10S	58.3	100S	*Sr5+30+*	*Lr23+10+1+*	*YrA+*
75	AKAW5100	2.5	10MS	4.3	20S	1.3	10S	41.2	90S	*Sr5+30+*	*Lr13+10+1+*	-
76	MP1378	5.0	20MS	3.6	10MS	1.6	10S	56.3	100S	R*	*Lr13+**	*Yr2+**
77	MP1386	36.0	60S	35.4	60S	23.6	80S	77.5	100S	*Sr31+*	*Lr26+10+*	*Yr9+*
78	DBW443	4.5	20MS	5.2	20MS	9.2	40S	15.5	40S	*Sr31+*	*Lr26+R*	*Yr9+*
79	DBW444	5.9	20S	8.0	20S	6.9	40S	8.9	25S	R	R	*Yr2+*
80	HD3469	14.0	40S	22.6	40S	40.0	60S	30.8	60S	*Sr5+30+*	*Lr28+*	*R*
80A	Infector	72.5	100S	82.9	100S	81.3	100S	79.2	100S			

AVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Gene Postulation		
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	***Sr***	***Lr***	***Yr***
81	NWS2222	7.3	20MS	5.7	20MS	19.7	60S	30.0	60S	*Sr30+*	*Lr13+*	*Yr2+*
82	PWU15	4.5	20MS	2.6	10MS	8.5	60S*	57.5	100S	R	*R*	-
83	WH1306	11.9	40S	8.4	20S	11.1	20S	8.3	20S	*Sr5+30+*	*Lr23+10+*	-
84	PBW891	6.6	20MS	8.0	20S	4.4	20S	30.3	90S	*Sr9b+7b+*	*Lr13+10+*	-
85	HI8841(d)	6.0	20S	4.1	20MS	2.2	20S	13.2	60S	*Sr9e+7b+*	*Lr13*+1+	*R*
86	UP3083	11.2	40S	3.7	10S	4.4	20S	11.5	60S	-	-	*Yr2+*
87	MACS3949(d)(C)	16.3	60S	5.5	20S	1.2	5S	11.0	40S	*Sr7b+2+*	-*	*Yr2+*
88	HI8826(d)(I)(C)	5.0	10S	2.6	10S	1.3	10MS	15.0	60S	R*	*R**	-
89	MACS4100(d)(I)(C)	34.5	60S	8.9	20S	1.6	TS	11.3	60S	-	*Lr13*+1+	*Yr2+*
90	MACS6222 (C)	6.8	20MS	8.0	20S	1.9	10S	33.3	100S	*Sr24*+R	*Lr24+R*	*Yr2+*
91	HI1672	5.5	20MS	1.3	5MS	0.0	0	70.0	100S	*Sr31+*	*Lr26+R*	*Yr9+*
92	HI1673	6.8	20MS	2.6	10MS	6.0	40S	62.3	100S	R	*R*	*Yr2+*
93	HI1675	3.8	20S	1.2	10MS	0.3	5MR	56.4	100S	R	*R*	-
94	DBW394	9.9	20S	5.6	20MS	1.6	10S	29.2	80S	R	R	*YrA+*
95	DBW395	6.8	20MS	6.6	20MS	7.6	40S	30.4	100S	*Sr8b+9e+7b+*	-	-
96	MACS6814	7.8	20MS	2.9	10S	0.6	10MR	34.9	100S	R	*Lr13+10+*	-
97	MACS6805	16.0	40S	6.6	20MS	0.5	10MR	35.8	100S	*Sr9b+11+7b+*	-	-
98	NIAW4114	6.8	20MS	1.7	10MR	0.6	5MS	70.0	100S	*Sr9b+11+7b+*	*Lr13+10+*	*Yr2+*
99	NIAW4120	2.6	10MS	2.0	10MS	1.0	10MS	68.3	100S	R	*R*	*Yr2+*
100	UAS3022	8.3	20S	2.1	10MS	0.0	0	32.0	80S	R	*Lr23+10+*	*Yr2+*
100A	Infector	72.5	100S	80.0	100S	78.8	100S	79.2	100S			
101	UAS3023	29.5	60S	12.9	40S	11.1	40S	20.4	40S	*Sr13+11+7b+*	*Lr13+1+*	*YrA+*
102	MP3557	9.2	30S	9.1	20S	4.1	15MS	13.9	40MS	*Sr13+11+9b+*	*Lr13+*	-
103	MP3556	6.2	20S	12.6	40S	7.4	20S	9.9	60S	*Sr13+11+7b+*	*Lr23+10+*	*Yr2+*
104	PBW897	6.3	20MS	5.4	20MS	0.0	0	42.4	80S	R	*R*	-
105	MP1388	5.0	10MS	15.9	40S	11.6	40S	59.2	100S	*Sr13+9b+7b+*	*Lr13+10+*	-
106	GW542	6.3	20MS	12.3	20S	15.0	60S	60.0	100S	*Sr7b+*	*Lr13+*	*Yr2+*
107	GW538	3.0	10MS	3.6	20MS	0.5	5MS	38.3	60S	*Sr9b+7b+*	*Lr13+*	*R*
108	WH1310	10.6	40S	1.3	5S	1.0	10MS	12.3	80S	*Sr7b+2+*	-*	*R*
109	LOK79	2.8	10MS	1.7	20MR	8.0	60S*	61.7	100S	*Sr9b+7b+*	*R*	-
110	RAJ4083(C)	5.3	20MS	5.7	20MS	7.8	20S	37.7	60S	*Sr11+*	*Lr13+*	*Yr2+*
111	HD3090(C)	4.9	20MS	1.9	10MS	0.4	5MR	49.3	80S	-*	*Lr13+10+ **	*Yr2+**
112	HI1633(C)	3.5	10S	1.2	10MS	3.5	20S	43.8	80S	-*	*Lr13+10+**	*Yr2+**
113	UAS478(d)	31.3	60S	3.2	10S	0.6	5MS	6.2	40S	*Sr7b+2+*	*Lr23+*	*Yr2+*
114	UAS481(d)	12.0	40S	5.5	20MS	1.0	10MS	11.8	80S	R	*Lr13+*	*R*
115	HI1665	1.8	20MR	2.9	20S	2.8	20S	57.2	100S	R*	*R*	*R**
116	HI8840(d)	11.8	40S	6.1	20MS	1.8	10MS	5.1	20S	*Sr13+7b+*	*Lr23+ 10+1+*	*Yr2+*
117	DBW397	2.6	10MS	4.0	10S	7.9	40S	15.3	40S	*Sr13+9b+7b+*	*Lr13+10+*	*R*
118	DDW61(d)	27.3	40S	5.5	20MS	2.0	20MS	9.9	60S	*Sr9b+7b+*	*R*	*R*
119	NIAW4028	1.1	5S	0.7	10MR	2.5	20S	49.7	90S	*Sr5+30+2+*	-	*R*
120	HI1605(C)	7.3	30S	16.6	40MS	21.1	60S	36.5	100S	*Sr11+*	*Lr13+*	*Yr2+*
120A	Infector	72.5	100S	82.9	100S	83.8	100S	80.8	100S			

AVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Gene Postulation		
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	***Sr***	***Lr***	***Yr***
121	NIAW3170(C)	19.5	40S	6.6	20MS	14.0	60S	26.7	60S	*Sr8a+2+*	*Lr13+10+1+*	*Yr2+*
122	UAS446(d)(C)	14.6	60S	3.7	20S	9.3	60S*	7.9	30S	*Sr11+2+*	*Lr13*+10+*	*Yr2+*
123	NIDW1149(d)(C)	6.2	20S	1.2	5MS	8.0	60S*	7.9	40S	*Sr11+2+*	*Lr23+10+*	*Yr2+*
124	DBW380	16.5	40S	4.3	20MS	0.4	5MR	12.0	40S	R	*Lr13+10+*	-
125	DBW370(I)(C)	23.3	60S	9.5	40S	1.2	5MS	19.8	60S	*Sr7b+*	*Lr13+1+*	-
126	DBW371(I)(C)	16.9	60S	4.0	20MS	0.6	5MS	20.2	60S	*Sr8a+2+*	*Lr23+ 1+*	-
127	DBW372(I)(C)	10.8	40MS	7.5	20S	8.4	40S	29.2	80S	*Sr28+*	*Lr13+**	*Yr2+*
128	PBW872(I)(C)	5.2	20MS	4.6	20MS	4.0	20S	20.3	80S	-*	*Lr13+1+**	*Yr2+*
129	DBW377	9.3	20S	4.6	20S	1.5	5MS	18.0	80S	R	*Lr13+1+**	*Yr2+*
130	CG1044	11.5	40S	9.6	20S	18.9	80S	55.0	100S	*Sr9b+7b+*	-	*Yr2+*
131	GW543	8.8	20S	7.7	20MS	3.1	10MS	37.2	100S	*Sr7b+*	*Lr13+10+*	*Yr2+*
132	DBW187(C)	9.2	20S	3.2	10S	0.9	5S	12.7	60S	*Sr5+11+*	*Lr13+**	*Yr2+*
133	DBW303(C)	8.6	20S	8.1	40S	0.9	5MS	14.8	60S	R	*Lr13+*	*Yr2+*
134	GW322(C)	9.0	20S	11.1	40S	20.0	60S	45.0	100S	*Sr11+2+*	-*	*Yr9+**
134A	Infector	70.0	100S	80.0	100S	81.3	100S	79.2	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; * Different seed lot to that of previous cropping season, **-** Gene not postulated, R resistantto all pathotypes

Table 1.3. Performance of AVTs entries against different diseases under multilocation testing during 2022-23

Sr. No.	Variety	LB (dd)		PM(0-9)		KB(%)		LS(%)		FS(%)		FR (%)	FHB	HB (%)
		HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	Av.	HS	HS	HS
1	HS691	79	46	6	2	8.3	3.1	45	19.9	34	16.1	22.22	4	23.3
2	HS692	89	57	6	4	12	4.8	56	31.6	51.1	27.1	14.29	5	9.2
3	VL3028	79	57	5	3	11.1	4.7	76	23.7	8.3	2.8	25.00	3	5.2
4	HPW484	67	35	7	3	48.8	12.3	70	22.6	9.2	4.1	35.00	4	5.8
5	VL907(C)	99	56	6	4	36	12.7	55	21.2	10	3.3	22.22	5	17.4
6	VL892(C)	89	56	9	3	47.6	12.5	70	36.8	11.5	9.9	27.78	9	6.9
7	HPW349(C)	79	46	8	3	44.9	11.2	65	21.0	22.7	15.2	35.00	4	6.1
8	HS562(C)	78	56	8	4	43.7	12.5	66	22.5	6.6	3.6	33.33	4	20.6
9	VL2041(I)(C)	89	56	9	5	65.7	14.9	65	23.8	6.5	2.2	30.00	5	33.3
10	PBW887	89	46	7	4	22.6	7.5	_	_	8.3	4.4	12.50	4	_
11	PBW889	78	56	8	3	54.1	14.2	_	_	11.1	3.7	27.78	5	_
12	HD3386	68	46	9	6	48.3	17	70	19.4	8.1	3.8	18.75	4	_
13	HD3470	89	57	8	4	70.3	18.5	_	_	10	3.3	31.25	8	_
14	HI1668	79	57	9	5	65.6	15.5	_	_	6.6	2.8	22.22	4	_
15	DBW386	79	46	9	4	55.8	14.1	_	_	5.3	1.8	33.33	5	_
16	UP3102	89	46	6	4	36.1	10.6	_	_	5	1.7	22.22	4	_
17	HD3428	78	46	7	3	18.3	8.2	_	_	6.3	3.2	33.33	5	_
18	PBW893	57	35	5	3	38.5	8.7	_	_	7.8	5.1	28.57	4	_
19	K2108	89	57	8	4	18	6	_	_	5	2.2	7.14	4	_
20	HD3059(C)	89	57	8	3	11.6	3.4	_	_	0	0	25.00	4	_
20A	**Infector**	99	68	8	7	50	23.1			41.5	31.8		8	_
21	DBW173(C)	97	56	9	3	39.3	10.2	_	_	12.5	4.2	25.00	4	_
22	PBW771(C)	89	57	7	3	56.1	13.2	40	18.9	34	21	11.11	4	_
23	JKW261(C)	79	56	9	4	16.2	5.7	75	36.2	11.1	8.3	33.33	4	_
24	WH1402	89	56	9	4	45.7	10.4	48.4	31.9	12.5	5.5	25.00	4	_
25	WH1311	89	56	7	4	47	12.6	_	_	10	6.3	33.33	3	_
26	UP3111	89	57	9	4	37.6	10.6	_	_	11.3	5.4	31.25	5	_
27	PBW899	77	45	6	3	13.6	7.8	_	_	11	8.6	25.00	5	_
28	PBW644(C)	67	45	8	5	24.2	7.6	_	_	14.1	11.8	27.78	4	_
29	DBW296(C)	78	56	7	4	21.9	8.5	_	_	12.6	7.1	25.00	5	_
30	HD3369(I)(C)	99	56	7	5	31.5	9.5	65	31.6	10.5	8.5	25.00	4	_
31	HI1653(I)(C)	89	57	9	4	51.8	14.2	55	32.2	9.5	3.2	28.57	4	_
32	HI1654(I)(C)	89	57	7	4	58.5	17.5	60	33.7	10.8	4.7	28.57	4	_

33	HD3388	89	57	7	4	12.5	3.3	80	28.4	10.4	7.9	27.78	5	_
34	HD3471	99	57	7	4	32.4	13.3	_	_	7.3	2.4	18.75	3	_
35	HD3249(C)	89	57	7	4	95	22.4	65	18.1	7.5	4.5	14.29	3	_
36	HD3086(C)	89	57	6	3	40.5	10	_	_	8.1	7.1	31.25	5	_
37	HD2967(C)	89	56	7	3	14.4	4	60	17.6	11	8.4	25.00	3	_
38	DBW222(C)	78	46	7	4	33.3	10.4	_	_	6.3	2.1	21.43	7	_
39	PBW826(I)(C)	68	46	7	4	50.4	15	65	21.8	6.6	3.5	30.00	5	_
40	DBW398	89	57	9	4	46.6	12.9	_	_	7.5	5.8	35.00	4	_
40A	**Infector**	99	78	9	7	60.6	23.5			65	39.5		8	_
41	HI1612(C)	89	56	8	4	19.5	7.6	_	_	7.9	6.2	25.00	7	_
42	K1317(C)	89	57	7	3	32.3	8.9	_	_	8.1	2.7	31.25	3	_
43	HD3171(C)	78	46	7	4	51.8	12	80	21.5	7.3	2.9	38.89	5	_
44	HD3293(C)	79	46	9	4	25.6	7.4	75	29	6.5	2.2	22.22	4	_
45	DBW252(C)	89	56	8	5	38.5	13	70	27.7	10.3	7.7	31.25	5	_
46	NWS2194	89	56	7	4	42	13	55	32.4	6.8	2.3	33.33	4	_
47	HI1669	98	57	7	4	47.9	12.4		_	35.7	21.1	31.25	5	_
48	HI1670	89	46	7	3	48.4	14.7	_	_	11.9	6.3	35.00	8	_
49	GW547	79	46	7	4	48.5	12.5	75	22.4	8.5	4.6	0.00	9	_
50	GW513(C)	89	57	9	4	30.9	9.1	85	36.4	8.6	4.5	35.00	5	_
51	HI1636 (C)	99	57	8	4	53	12.4	45	25.4	43.3	23.8	33.33	7	_
52	HI1650(I)(C)	89	56	7	4	37.9	12.5	85	40	9.3	4.2	31.25	5	_
53	MACS6768(I)(C)	99	56	5	2	67.3	13.7	80	41.5	10.1	3.7	7.14	5	_
54	HI1674	99	57	7	4	32.6	9.8	_	_	7.6	2.5	27.78	8	_
55	AKAW5104	89	57	7	3	44.2	10.7	_	_	56.3	26	31.25	8	_
56	HD2932(C)	99	57	7	3	23.2	7.8	_	_	11.1	7.3	35.00	5	_
57	MP4010(C)	89	56	7	4	22.8	6.8	_	_	8.3	2.8	35.00	6	_
58	HI1634(C)	89	57	7	4	32	12.2	76.1	42.1	13	7.7	33.33	7	_
59	CG1029(C)	89	57	6	4	48.9	13.2	70	40.2	12.3	4.1	33.33	5	_
60	DBW359	89	57	6	4	45.4	11.1	83.3	31.6	11.1	3.7	27.78	5	_
60A	**Infector**	99	68	9	8	29.3	19.4			39.3	34.6		7	_
61	DBW441	99	57	8	4	12.9	4.9	_	_	8.6	2.9	35.00	5	_
62	DBW442	99	57	6	4	34.2	14.5	_	_	6.5	3.1	22.22	5	_
63	CG1040	99	57	7	4	46.7	15.4	65	23.5	6.6	2.2	0.00	5	_
64	MP3288(C)	89	57	7	5	66	17	71.5	27.2	29.4	14.7	12.50	4	_
65	DBW110(C)	88	46	8	4	77.3	16.1	85	25.5	8.6	2.9	25.00	5	_
66	CG1036(I)(C)	89	56	8	4	58.3	13.5	55	31.5	8.5	2.8	35.00	4	_
67	HI1655(I)(C)	89	57	8	4	45.7	11.9	80	39.3	63.2	29.2	27.78	3	_

68	UAS3020	99	57	7	3	60.3	13.7	_	_	8.4	3.7	27.78	4	_
69	UAS3021	99	55	8	3	47.3	17.4	_	_	8.3	4.3	25.00	5	_
70	MACS6811	89	57	8	3	32.9	11.1	_	_	6.5	2.2	35.00	4	_
71	MACS6809	99	68	9	5	34.3	11.1	_	_	7.6	3.3	31.25	5	_
72	NIAW4183	99	57	7	4	77	19	_	_	31.3	18.1	12.50	5	_
73	NIAW4153	99	67	8	5	26.4	12	_	_	13.6	10.4	25.00	7	_
74	AKAW5314	89	57	8	4	50	14.5	_	_	8.5	3.8	20.00	5	_
75	AKAW5100	99	67	9	4	23.5	8.4	_	_	8.6	3.2	33.33	4	_
76	MP1378	89	67	7	3	33.1	8.2	43.7	17.2	13	8.7	21.43	5	_
77	MP1386	89	67	8	3	64.4	12.8	_	_	8.1	2.7	16.67	5	_
78	DBW443	89	68	8	4	15.7	5.2	_	_	9.6	3.8	35.00	5	_
79	DBW444	99	57	7	4	9.9	4.1	_	_	10	6.7	33.33	4	_
80	HD3469	89	57	9	5	36.4	14.3	_	_	9.8	3.3	35.00	9	_
80A	Infector	99	78	9	8	50.6	22.3			46.3	35.2		8	_
81	NWS2222	99	67	8	3	61.7	15.5	_	_	11.1	4.2	27.78	4	_
82	PWU15	89	67	9	3	64.6	17.5	_	_	13.2	9.4	27.78	5	_
83	WH1306	99	57	8	4	57	14.3	_	_	8.7	2.9	40.00	4	_
84	PBW891	99	67	7	4	31.2	9.9	_	_	8.1	2.7	38.89	3	_
85	HI8841(d)	99	57	7	4	10.9	4.4	_	_	0	0	31.25	5	_
86	UP3083	89	56	7	4	39.3	9.6	_	_	3.5	1.2	18.75	3	_
87	MACS3949(d)(C)	99	56	8	5	36.7	8.8	_	_	0	0	31.25	5	_
88	HI8826(d)(I)(C)	99	67	9	6	65.5	14	_	_	0	0	31.25	5	_
89	MACS4100(d)(I)(C)	89	67	8	4	26.7	7.9	35	9	0	0	25.00	7	_
90	MACS6222 (C)	89	67	8	5	37.5	9.1	_	_	12.8	7.9	30.00	4	_
91	HI1672	99	57	9	7	70.1	16	_	_	12.5	4.2	33.33	8	_
92	HI1673	99	57	7	5	66.7	16.2	_	_	13.3	4.4	22.22	8	_
93	HI1675	99	57	9	5	54.1	14.4	_	_	29	18.2	20.00	8	_
94	DBW394	99	57	9	6	58.9	12	_	_	12.6	4.2	35.00	5	_
95	DBW395	99	57	8	4	54.1	10.4	_	_	13.1	4.4	25.00	3	_
96	MACS6814	89	57	7	3	15	5	_	_	14.1	8.5	28.57	3	_
97	MACS6805	99	57	6	5	16.6	7.6	_	_	12.9	7.1	18.75	4	_
98	NIAW4114	79	46	8	4	55.8	11.6	_	_	42.3	20.7	21.43	6	_
99	NIAW4120	99	57	9	6	61.6	16.4	_	_	28.8	14.7	35.00	7	_
100	UAS3022	99	57	9	6	33.3	9	_	_	0	0	31.25	3	_
100A	Infector	99	78	9	8	50.5	20.5			63.2	41		8	_
101	UAS3023	89	57	7	4	56.8	11.7	_	_	5.6	4.7	31.25	5	_
102	MP3557	89	46	7	5	42.1	12	_	_	6.6	5.9	37.50	5	_

103	MP3556	89	57	8	4	76.7	17.2	_	_	5	2.3	35.00	5	_
104	PBW897	89	67	9	6	25	8.9	_	_	32.1	15.6	5.56	5	_
105	MP1388	89	57	8	5	31.6	8.9	_	_	5.5	1.8	25.00	5	_
106	GW542	89	46	9	5	30.9	10.5	_	_	5	1.7	25.00	5	_
107	GW538	89	47	8	4	57.4	13.5	_	_	28.3	16.6	6.25	8	_
108	WH1310	79	46	6	5	29.8	7.9	_	_	6.7	4.5	31.25	9	_
109	LOK79	89	46	8	5	35	8.4	_	_	35.2	17.4	35.00	9	_
110	RAJ4083(C)	99	57	8	5	43	12.4	90	31.5	10.4	8	35.00	4	_
111	HD3090(C)	99	67	8	6	48.8	15.8	65	29.1	5.6	2.7	10.00	3	_
112	HI1633(C)	89	57	8	6	60.3	13.7	80	37.1	7.5	3.7	25.00	5	_
113	UAS478(d)	89	46	8	6	26.3	8.2	15	3.8	0	0	18.75	5	_
114	UAS481(d)	79	46	8	4	31.6	8.2	_	_	0	0	16.67	3	_
115	HI1665	89	57	6	4	28.6	9.2	45	24	67.2	30.8	33.33	8	_
116	HI8840(d)	89	57	7	5	26	9.2	35	12.4	0	0	35.00	8	_
117	DBW397	89	57	8	5	42.8	10.6	_	_	3.9	1.3	27.78	4	_
118	DDW61(d)	99	57	9	6	31.5	10.2	_	_	0	0	22.22	4	_
119	NIAW4028	99	57	8	6	42.6	14.3	27.2	20.8	6.6	2.2	31.25	6	_
120	HI1605(C)	99	57	8	6	56.5	16.1	_	_	7.5	2.5	18.75	4	_
120A	Check-HD3436	99	78	8	7	66.7	26.9			51.6	37		8	_
121	NIAW3170(C)	89	47	8	5	20.2	7.8	85	25.5	8.3	3.5	30.00	5	_
122	UAS446(d)(C)	89	57	7	4	25.2	8	_	_	1.6	0.5	35.00	7	_
123	NIDW1149(d)(C)	89	46	8	5	13.5	6.9	55	16.8	0	0	25.00	9	_
124	DBW380	99	56	8	5	21.1	6.7	_	_	5	1.7	18.75	5	_
125	DBW370(I)(C)	89	56	8	5	20.6	8.6	65	22.7	6.6	2.7	35.00	4	_
126	DBW371(I)(C)	99	57	8	6	25	8.3	55	25.9	8.3	2.8	33.33	4	_
127	DBW372(I)(C)	99	57	7	5	58.8	15.2	60	21.2	8.2	2.7	33.33	5	_
128	PBW872(I)(C)	89	47	6	3	46.4	10.4	80	35.2	7.5	3.2	25.00	9	_
129	DBW377	99	46	6	4	58.3	13.4	60	18.2	6.6	2.2	27.78	5	_
130	CG1044	89	57	7	5	12.9	6.4	_	_	32.5	17.4	30.00	4	_
131	GW543	99	57	7	4	7.3	5.9	_	_	9.5	3.6	0.00	8	_
132	DBW187(C)	99	57	7	5	40.8	11.4	_	_	8.1	5.2	20.00	7	_
133	DBW303(C)	79	46	5	3	45.1	13.6	_	_	11.1	4.2	38.89	4	_
134	GW322(C)	99	46	6	3	64.4	15.5	_	_	10.8	4.3	38.89	8	_
134A	Infector	89	45	6	2	6.6	3.3			49	33.2		9	_

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 2020-21, 2021-22 and 2022-23

S. No.	Entry		Stem rust		Leaf rust				Stripe rust		LB (dd)		KB (%)		PM (0-9)		FS (%)		FHB (0-5)	FR (%)	LS (%)	
			South		South		North		North													
			ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS	AV	HS	HS	HS	AV	HS
1	**HD 3386***																					
		2020-21	4.5	20MS	3.9	20MS	3.6	20S	4.6	10S												
		2021-22	7.0	20S	2.0	15MR	9.7	40S	13.4	40S	36	68	13.1	42.1	5	9	7.9	11.5	5	27.8		
		2022-23	4.0	20S	2.6	20MR	11.0	40S	13.7	60S	46	68	17.0	48.3	6	9	3.8	8.1	4	18.8	19.4	70.0
		MEAN	5.2	20S	2.8	20MS	8.1	40S	10.6	60S	46	68	15.1	48.3	5	9	5.9	11.5	5	27.8	19.4	70.0
2	**WH 1402***																					
		2020-21	4.6	20MS	3.7	20MR	0.7	5S	1.4	10MS												
		2021-22	5.4	40MR	4.9	20MS	2.9	10S	2.9	20MS	35	69	7.5	20.3	6	9	4.3	6.6	4	16.7		
		2022-23	7.5	20S	5.6	20MS	1.8	10S	1.8	10MS	56	89	10.4	45.7	4	9	5.5	12.5	4	25.0	31.9	48.4
		MEAN	5.8	20S	4.7	20MS	1.8	10S	2.0	20MS	46	89	9.0	45.7	5	9	4.9	12.5	4	25.0	31.9	48.4
3	**PBW826(I)(C)**																					
		2020-21	6.9	40MS	2.0	10S	12.3	40S	4.6	10MS	45	68	6.8	8.2	4	7	2.5	7.5	4	80.0		
		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	15.0
		2022-23	3.6	10MS	6.0	20MS	9.9	40S	14.3	60S	46	68	15.0	50.4	4	7	3.5	6.6	5	30.0	21.8	65.0
		MEAN	5.6	40MS	5.0	30S	11.3	60S	10.1	60S	46	78	12.0	54.2	4	7	3.5	7.5	5	80.0	21.8	65.0
4	**HD3369(I)(C)**																					
		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	50.0		
		2021-22	6.0	40S	5.6	20MS	11.5	40S	5.9	20S	47	89	6.2	15.6	4	7	3.4	6.8	5	35.0	19.4	35.0
		2022-23	14.0	40S	5.4	20S	4.3	20S	7.3	60S*	56	99	9.5	31.9	5	7	8.5	10.5	4	25.0	31.6	65.0
		MEAN	8.8	40S	4.3	20S	6.5	40S	7.1	60S	46	99	6.2	31.9	4	9	6.8	18.3	5	50.0	31.6	65.0
5	**HI1653(I)(C)**																					
		2020-21	13.5	60S	13.2	60S	5.9	20S	5.6	20S	46	89	22.6	90.0	4	7	4.6	9.6	4	50.0		
		2021-22	11.4	20MS	3.3	20MS	2.9	20S	14.4	40S	46	89	14.5	41.5	5	9	5.7	10.0	5	25.0	20.7	31.7
		2022-23	12.7	40S	9.1	40S	8.6	20S	13.2	60S	57	89	14.2	15.8	4	9	3.2	9.5	4	28.6	32.2	55.0
		MEAN	12.5	60S	8.5	60S	5.8	20S	11.1	60S	46	89	17.1	90.0	4	9	4.5	10.0	5	50.0	32.2	55.0
6	**HI1654(I)(C)**																					
		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	30.0	28.0	45.0
		2022-23	2.3	10MS	1.4	5MS	1.5	10S	9.9	60S	57	89	17.5	58.5	4	7	4.7	10.8	4	28.6	33.7	60.0
		MEAN	3.4	20MS	3.1	30MS	1.5	15S	9.4	60S	46	89	9.4	58.5	4	9	4.0	10.8	5	30.0	33.7	60.0
7	**DBW 187(C)**																					
		2020-21	8.0	20S	1.0	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												
		2022-23	9.2	20S	3.2	10S	0.9	5S	12.7	60S	57	99	11.4	40.8	5	7	5.2	8.1	7	20.0		
		MEAN	7.5	20S	3.3	20MS	1.9	10S	12.9	60S	47	99	8.8	40.8	5	9	3.8	8.1	7	20.0		
8	**DBW222(C)**																					
		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	16.0	20S	5.6	20S	5.7	20S	25.8	60S												
		2022-23	10.1	40S	4.1	20MS	0.9	5MR	19.2	40S	46	78	10.4	33.3	4	7	2.1	3.6	7	21.4		
		MEAN	16.7	60S	5.2	40S	3.9	30S	21.7	60S	46	78	7.9	33.3	4	9	4.1	9.6	7	60.0	19.0	76.0
9	**HD 3086(C)**																					
		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												
		2022-23	38.0	60S	14.6	20S	31.3	80S	19.0	80S	57	89	10.0	40.5	3	6	7.1	8.1	5	31.3		

		MEAN	29.8	80S	14.9	60S	24.3	80S	15.5	80S	57	89	8.8	40.5	4	7	12.3	25.0	5	50.0	18.3	73.3
10	**HD2967(C)**																					
		2020-21	9.0	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	13.0	3	5	6.6	12.5	4	33.3	28.3	71.1
		2022-23	5.4	10S	8.0	20S	7.1	20S	40.2	80S	56	89	4.0	14.4	3	7	8.4	11.0	3	25.0	17.6	60.0
		MEAN	7.4	40S	10.2	80S	5.0	20S	39.5	80S	35	89	9.4	84.8	3	9	5.6	12.5	5	50.0	25.2	71.1
11	**PBW 644 (C)**																					
		2020-21	18.3	60S	23.1	80S	12.9	30S	8.9	20S	34	57	5.0	10.0	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												
		2022-23	9.4	20S	7.4	20MS	20.6	60S	22.3	60S	45	67	7.6	24.2	5	8	11.8	14.1	4	27.8		
		MEAN	10.9	60S	11.8	80S	14.0	60S	19.9	60S	45	67	6.3	24.2	5	9	9.4	14.1	4	27.8	20.7	33.5
12	**NIAW3170(C)**																					
		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	30.0	37.2	47.1
		2022-23	19.5	40S	6.6	20MS	14.0	60S	26.7	60S	47	89	7.8	20.2	5	8	3.5	8.3	5	30.0	25.5	85.0
		MEAN	8.9	40S	6.6	40S	6.3	60S	28.9	80S	47	89	6.4	20.2	4	9	4.3	8.3	5	40.0	35.7	85.0
13	**DBW 296(I)**																					
		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	10.0	60MS	1.7	10MS	0.7	5S	7.0	40S												
		2022-23	6.3	20MS	1.5	5MS	3.9	15S	6.4	40MS	56	78	8.5	21.9	4	7	7.1	12.6	5	25.0		
		MEAN	6.7	60MS	1.5	10MS	2.5	15S	5.3	40S	56	78	6.1	21.9	4	7	6.3	16.6	5	60.0	33.7	50.0
14	**HD 3388***																					
		2020-21	11.1	40MS	3.3	15MS	2.2	10S	2.0	10MS												
		2021-22	14.4	30S	4.9	20MS	5.9	20S	14.9	40S	46	78	6.8	16.3	3	6	5.2	6.6	3	25.0	21.2	28.6
		2022-23	8.3	20MS	4.0	20MS	4.9	20S	8.6	40S	57	89	3.3	12.5	4	7	7.9	10.4	5	27.8	28.4	80.0
		MEAN	11.3	40MS	4.1	20MS	4.3	20S	8.5	40S	57	89	5.1	16.3	4	7	6.6	10.4	5	27.8	24.8	80.0
15	**PBW826(I)(C)**																					
		2020-21	6.9	40MS	2.0	10S	12.3	40S	4.6	10MS	45	68	6.8	8.2	4	7	2.5	7.5	4	80.0		
		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	15.0
		2022-23	3.6	10MS	6.0	20MS	9.9	40S	14.3	60S	46	68	15.0	50.4	4	7	3.5	6.6	5	30.0	21.8	65.0
		MEAN	5.6	40MS	5.0	30S	11.3	60S	10.1	60S	46	78	12.0	54.2	4	7	3.5	7.5	5	80.0	15.3	65.0
16	**HD3249(C)**																					
		2020-21	9.1	40S	9.5	60S	2.7	10S	7.3	30S	46	79	10.7	20.0	4	9	4.5	7.0	3	40.0	17.2	28.2
		2021-22	13.7	60S	4.0	10S	3.5	10S	4.1	15MS	46	79	3.4	10.0	3	7	1.3	2.5	5	33.3	24.2	36.2
		2022-23	13.5	40S	2.9	10MS	1.6	5S	11.7	60S	57	89	22.4	95.0	4	7	4.5	7.5	3	14.3	18.1	65.0
		MEAN	12.1	60S	5.5	60S	2.6	10S	7.7	60S	46	89	12.2	95.0	4	9	3.4	7.5	5	40.0	19.8	65.0
17	**HD 3086(C)**																					
		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												
		2022-23	38.0	60S	14.6	20S	31.3	80S	19.0	80S	57	89	10.0	40.5	3	6	7.1	8.1	5	31.3	_	_
		MEAN	29.8	80S	14.9	60S	24.3	80S	15.5	80S	57	89	8.8	40.5	4	7	12.3	25.0	5	50.0	18.3	73.3
18	**HD2967(C)**																					
		2020-21	9.0	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	13.0	3	5	6.6	12.5	4	33.3	28.3	71.1
		2022-23	5.4	10S	8.0	20S	7.1	20S	40.2	80S	56	89	4.0	14.4	3	7	8.4	11.0	3	25.0	17.6	60.0
		MEAN	7.4	40S	10.2	80S*	5.0	20S	39.5	80S	36	89	9.4	84.8	3	9	5.6	12.5	4	33.3	23.0	60.0
19	**DBW222(C)**																					
		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	16.0	20S	5.6	20S	5.7	20S	25.8	60S												

		2022-23	10.1	40S	4.1	20MS	0.9	5MR	19.2	40S	56	78	10.4	33.3	4	7	2.1	6.3	7	21.4		
		MEAN	16.7	60S	5.2	40S	3.9	30S	21.7	60S	56	78	7.9	33.3	4	9	4.1	9.6	7	60.0	19.0	76.0
20	**DBW 187 (C)**																					
		2020-21	8.0	20S	1.0	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												
		2022-23	9.2	20S	3.2	10S	0.9	5S	12.7	60S	57	99	11.4	40.8	45	7	5.2	8.1	7	20.0		
		MEAN	7.5	20S	3.3	20MS	1.9	10S	12.9	60S	57	99	8.8	40.8	4	9	3.8	8.1	7	20.0		
21	**NWS2194***																					
		2020-21	8.3	40MS	6.6	40S	2.7	10S	34.6	60S												
		2021-22	8.6	20MS	9.7	30S	3.6	15S	47.2	90S	57	89	5.9	19.3	4	7	3.3	6.5	4	11.1		
		2022-23	10.2	20S	8.3	20MS	0.1	TMR	47.4	100S	56	89	13.0	42.0	4	7	2.3	6.8	4	33.3	32.4	55.0
		MEAN	9.0	40MS	8.2	40S	2.1	15S	43.1	100S	57	89	9.5	42.0	4	7	2.8	6.8	4	33.3	32.4	55.0
22	**GW547***																					
		2020-21																				
		2021-22	1.9	10MR	1.3	15MR	3.2	10S	42.8	90S	57	89	4.5	15.9	4	7	4.3	9.6	4	15.0		
		2022-23	2.1	20MR	0.3	5MR	1.4	10S	33.3	100S	46	79	48.5	12.5	4	7	4.6	8.5	9	0.0	22.4	75.0
		MEAN	2.0	20MR	0.8	15MR	2.3	10S	38.1	100S	57	89	26.5	15.9	4	7	4.5	9.6	9	15.0	22.4	75.0
23	**DBW359***																					
		2020-21	11.1	40MS	22.4	80S	9.7	50S	3.4	20MS												
		2021-22	5.0	10S	8.1	20MS	10.1	40S	7.7	20S	46	68	14.7	52.9	2	5	5.7	9.6	5	30.0		
		2022-23	7.3	20S	5.5	20MS	14.5	40S	8.6	20MS	57	89	11.1	45.4	4	6	3.7	11.1	5	27.8	31.6	83.3
		MEAN	7.8	40MS	12.0	80S	11.4	50S	6.6	20S	57	89	12.9	52.9	3	6	4.7	11.1	5	30.0	31.6	83.3
24	**CG1040***																					
		2020-21	11.3	40S	8.0	20S	9.9	40S	26.3	60S												
		2021-22	17.1	40MS	15.6	40S	15.4	60S	54.2	80S	46	89	4.2	9.7	3	6	2.5	4.3	4	31.3		
		2022-23	18.3	40S	14.9	30S	18.3	40S	50.2	80S	57	99	15.4	46.7	4	7	2.2	6.6	5	0.0	23.5	65.0
		MEAN	15.6	40S	12.8	40S	14.5	60S	43.6	80S	46	99	9.8	46.7	4	7	2.4	6.6	5	31.3	23.5	65.0
25	**HI1650(I)(C)**																					
		2020-21	2.8	10S	1.0	15MR	1.1	10MS	27.4	60S	57	89	7.8	23.7	5	9	10.9	16.6	4	65.0		
		2021-22	0.4	5MR	4.0	20S	5.3	40MS	55.7	80S	57	79	4.9	13.0	3	5	5.4	12.2	5	27.8	22.7	27.7
		2022-23	3.1	10MS	0.6	5MS	1.3	5S	39.8	100S	56	89	12.5	37.9	4	7	4.2	9.3	5	31.3	40.0	85.0
		MEAN	2.1	10S	1.9	20S	2.6	40MS	41.0	100S	57	89	8.4	37.9	4	9	6.8	16.6	5	65.0	31.4	85.0
26	**MACS6768(I)(C)**																					
		2020-21	3.8	20MS	6.4	30S	4.1	20S	56.0	80S	56	99	11.5	36.0	7	9	2.8	8.3	4	65.0		
		2021-22	3.0	20MR	12.1	60S*	6.0	20S	73.0	100S	57	89	12.8	36.0	4	7	3.7	7.3	4	27.8	14.8	36.6
		2022-23	11.3	20S	4.3	20MS	3.0	20S	66.7	80S	56	99	13.7	67.3	2	5	3.7	10.1	5	7.1	41.5	80.0
		MEAN	6.0	20S	7.6	60S	4.4	20S	65.2	100S	57	99	12.7	67.3	4	9	3.4	10.1	5	65.0	28.2	80.0
27	**CG1036(I)(C)**																					
		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	25.0		
		2021-22	1.2	5MS	8.1	40S	4.3	30S	66.7	100S	56	99	4.4	10.5	4	7	3.1	5.0	5	27.8	20.6	46.6
		2022-23	5.8	20MS	3.1	10MS	8.6	60S*	68.3	100S	56	89	13.5	58.3	4	8	2.8	8.5	4	35.0	31.5	55.0
		MEAN	2.9	20MS	4.2	40S	5.7	60S	62.2	100S	56	99	7.6	58.3	4	9	3.7	12.5	5	35.0	26.1	55.0
28	**HI1655(I)(C)**																					
		2020-21	1.3	10MS	1.0	10MR	0.0	0	25.3	60S	46	79	7.2	17.7	5	9	11.4	16.1	3	55.0		
		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	30.0	25.2	46.6
		2022-23	1.5	10MS	1.2	5MS	0.3	5MR	38.3	100S	57	89	11.9	45.7	4	8	29.2	63.2	3	27.8	39.3	80.0
		MEAN	1.2	10MS	0.9	5MS	1.0	10S	34.4	100S	57	89	9.9	45.7	4	9	15.0	63.2	5	55.0	32.3	80.0
29	**GW 322 (C)**																					
		2020-21	8.3	30S	7.3	20MS	8.6	20S	36.0	60S	46	79	4.8	8.5	6	9	8.6	9.7	5	35.0	14.3	22.2
		2021-22	8.0	20S	14.4	30S	8.9	40S	54.5	90S												
		2022-23	9.0	20S	11.1	40S	20.0	60S	45.0	100S	46	99	15.5	64.4	3	6	4.3	10.8	8	38.9	_	_
		MEAN	8.4	30S	10.9	40S	12.5	60S	45.2	100S	46	99	10.2	64.4	4	9	6.5	10.8	8	38.9	14.3	22.2

30	**HI1636 (C)**																					
		2020-21	3.3	10S	4.0	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	25.0	16.3	25.0
		2022-23	5.0	20MS	0.6	10R	3.5	20MS	56.3	80S	57	99	12.4	53.0	4	8	23.8	43.3	7	33.3	25.4	45.0
		MEAN	2.8	20MS	1.7	20MS	3.5	40S	54.2	100S	57	99	12.6	53.0	5	9	13.9	43.3	7	33.3	20.9	45.0
31	**GW513(C)**																					
		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	31.0	5	9	5.0	8.5	5	8.3	10.1	30.0
		2022-23	3.8	10MS	0.1	TMR	8.9	60S*	62.5	100S	57	89	9.1	30.9	4	9	4.5	8.6	5	35.0	36.1	85.0
		MEAN	2.9	10MS	2.2	20S	7.1	60S	58.8	100S	57	99	8.4	31.0	5	9	7.3	20.0	5	68.8	23.1	85.0
32	**MP3288(C)**																					
		2020-21	2.8	20MR	2.7	20MS	2.1	10S	26.0	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	47.0	80S												
		2022-23	7.4	20MS	2.4	10MS	10.6	60S	40.7	80S	57	89	17.0	66.0	5	7	14.7	29.4	4	12.5	27.2	71.5
		MEAN	5.8	20S	3.3	20MS	7.7	60S	37.9	80S	57	89	11.8	66.0	5	7	11.0	29.4	4	12.5	17.2	71.5
33	**DBW 110 (C)**																					
		2020-21	8.3	40MS	2.9	20MS	11.7	40S	24.8	60S	46	79	4.0	10.0	4	9	3.9	7.3	3	65.0	18.0	43.8
		2021-22																				
		2022-23	17.0	40S	7.7	20MS	6.6	20S	43.3	80S	46	89	16.1	77.3	4	8	2.9	8.6	5	25.0	25.5	85.0
		MEAN	12.7	40S	5.3	20MS	9.2	40S	34.1	80S	46	89	10.1	77.3	4	9	3.4	8.6	5	65.0	21.8	85.0
34	**MP1378***																					
		2020-21	5.9	40MR	4.7	10MS	3.6	15S	40.6	60S												
		2021-22	1.5	20MR	8.0	30S	2.5	15S	55.0	80S	46	68	4.6	13.6	5	9	3.2	5.0	5	30.0		
		2022-23	5.0	20MS	3.6	10MS	1.6	10S	56.3	100S	67	89	8.2	33.1	3	7	8.7	13.0	5	21.4	17.2	43.2
		MEAN	4.1	20MS	5.4	30S	2.6	15S	50.6	100S	67	89	6.4	33.1	4	9	6.0	13.0	5	30.0	17.2	43.2
35	**UAS478(D)***																					
		2020-21	11.0	40S	3.8	20MS	8.6	30S	3.1	10S												
		2021-22	16.9	80S	4.9	30MS	7.4	40S	6.2	40MS	56	89	3.6	11.1	2	7	1.8	3.5	3	18.8		
		2022-23	31.3	60S	3.2	10S	0.6	5MS	6.2	40S	46	89	8.2	26.3	6	8	0.0	0.0	5	18.8	3.8	15.0
		MEAN	19.7	80S	4.0	30MS	5.5	40S	5.2	40S	56	89	5.9	26.3	3	7	0.9	3.5	5	18.8	3.8	15.0
36	**HI8840(d)***																					
		2020-21	3.0	10S	5.2	20MS	4.0	20S	7.3	40S												
		2021-22	5.8	40MS	4.1	20S	1.9	5S	9.3	20S	46	89	2.4	4.5	6	9	5.1	8.3	3	27.8		
		2022-23	11.8	40S	6.1	20MS	1.8	10MS	5.1	20S	57	89	9.2	26.0	5	7	0.0	0.0	8	35.0	12.4	35.0
		MEAN	6.9	40S	5.1	20S	2.6	20S	7.2	40S	57	89	5.8	26.0	5	9	2.6	8.3	8	35.0	12.4	35.0
37	**HI1665***																					
		2020-21	1.6	10MS	3.5	10S	1.5	10S	41.8	80S												
		2021-22	0.6	5MR	3.2	20MS	1.5	10S	64.0	100S	57	89	9.9	23.9	3	7	2.3	4.5	4	25.0		
		2022-23	1.8	20MR	2.9	20S	2.8	20S	57.2	100S	57	89	9.2	28.6	4	6	30.8	67.2	8	33.3	24.0	45.0
		MEAN	1.3	10MS	3.2	20S	1.9	20S	54.3	100S	57	89	9.6	28.6	4	7	16.6	67.2	8	33.3	24.0	45.0
38	**DBW359***																					
		2020-21	11.1	40MS	22.4	80S	9.7	50S	3.4	20MS												
		2021-22	5.0	10S	8.1	20MS	10.1	40S	7.7	20S	46	68	14.7	52.9	2	5	5.7	9.6	5	30.0		
		2022-23	7.3	20S	5.5	20MS	14.5	40S	8.6	20MS	57	89	11.1	45.4	4	6	3.7	11.1	5	27.8	31.6	83.3
		MEAN	7.8	40MS	12.0	80S	11.4	40S	6.6	20S	57	89	12.9	52.9	4	6	4.7	11.1	5	30.0	31.6	83.3
39	**NIAW4028***																					
		2020-21	2.6	10MS	0.9	15MR	5.9	20S	4.3	80S												
		2021-22	1.2	10MS	3.2	20MS	7.3	20MS	60.3	100S	57	89	8.4	25.6	3	5	3.1	4.5	5	33.3		
		2022-23	1.1	5S	0.7	10MR	2.5	20S	49.7	90S	57	99	14.3	42.6	6	8	2.2	6.6	6	31.3	20.8	27.2
		MEAN	1.6	10MS	1.6	20MS	5.2	20S	38.1	100S	57	99	11.4	42.6	5	8	2.7	6.6	6	33.3	20.8	27.2
40	**HI8826(d)(I)(C)**																					
		2020-21	2.1	10MS	6.0	20S	0.8	5S	11.6	60S	46	89	1.3	4.2	6	9	0.0	0.0	4	70.0		

		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
		2022-23	5.0	10S	2.6	10S	1.3	10MS	15.0	60S	67	99	14.0	65.5	6	9	0.0	0.0	5	31.3		
		MEAN	4.6	40S	4.5	30MS	2.8	20S	13.1	60S	57	99	8.2	65.5	6	9	0.3	1.5	5	70.0	2.1	8.3
41	**MACS4100(d)(I)(C)**																					
		2020-21	6.5	20S	5.7	30MS	0.2	TS	8.8	60S	46	78	2.3	8.0	4	7	0.0	0.0	3	70.0		
		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	10.0
		2022-23	34.5	60S	8.9	20S	1.6	TS	11.3	60S	67	89	7.9	26.7	4	8	0.0	0.0	7	25.0	9.0	35.0
		MEAN	19.3	100S	8.9	60S	1.2	10S	12.1	60S	56	89	4.2	26.7	4	9	0.7	3.9	7	70.0	7.3	35.0
42	**MACS 3949 (C)**																					
		2020-21	7.0	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												
		2022-23	16.3	60S	5.5	20S	1.2	5S	11.0	40S	56	99	8.8	36.7	5	8	0.0	0.0	5	31.3	_	_
		MEAN	10.5	60S	4.2	20S	1.3	20MS	6.0	40S	56	99	6.0	36.7	5	8	0.7	4.3	5	31.3	3.8	15.0
43	**GW 322 (C)**																					
		2020-21	8.3	30S	7.3	20MS	8.6	20S	36.0	60S	46	79	4.8	8.5	6	9	8.6	9.7	5	35.0	14.3	22.2
		2021-22	8.0	20S	14.4	30S	8.9	40S	54.5	90S												
		2022-23	9.0	20S	11.1	40S	20.0	60S	45.0	100S	46	99	15.5	64.4	6	9	4.3	10.8	8	38.9	_	_
		MEAN	8.4	30S	10.9	40S	12.5	60S	45.2	100S	46	99	10.2	64.4	6	9	6.5	10.8	8	38.9	14.3	22.2
44	**UAS446 (D)**																					
		2020-21	5.5	40MR	3.5	20MS	1.3	5S	1.0	10MR	46	58	7.4	21.9	5	9	0.0	0.0	4	45.0		
		2021-22	2.0	10MS	1.7	10MS	0.7	5S	4.9	40S												
		2022-23	14.6	60S	3.7	20S	9.3	60S*	7.9	30S	57	89	8.0	25.2	4	7	1.6	0.5	7	35.0		
		MEAN	7.4	60S	3.0	20S	3.8	60S	4.6	40S	57	89	7.4	25.2	4	9	1.6	0.5	7	45.0		
45	**NIDW1149(d)(C)**																					
		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	5.0	3	27.8	8.7	18.3
		2022-23	6.2	20S	1.2	5MS	8.0	60S*	7.9	40S	46	89	6.9	13.5	5	8	0.0	0.0	9	25.0	16.8	55.0
		MEAN	6.9	20S	2.6	20MS	3.4	60S	7.2	50S	47	89	5.4	13.5	5	9	0.8	5.0	9	31.3	17.0	55.0
46	**MACS6222(C)**																					
		2020-21	4.6	10MS	4.0	20MS	3.1	20S	18.7	60S	45	78	6.0	13.3	7	9	1.9	5.6	4	85.0	4.4	16.6
		2021-22	3.2	10MS	4.3	20S	1.7	10S	16.0	60S	46	78	11.4	28.4	6	9	2.4	5.0	3	35.0		
		2022-23	6.8	20MS	8.0	20S	1.9	10S	33.3	100S	67	89	9.1	37.5	5	8	7.9	12.8	4	30.0		
		MEAN	4.9	20MS	5.4	20S	2.2	20S	22.7	100S	57	89	8.8	37.5	6	9	4.1	12.8	4	85.0	4.4	16.6
47	**NIAW3170**																					
		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	30.0	37.2	47.1
		2022-23	19.5	40S	6.6	20MS	14.0	60S	26.7	60S	47	89	7.8	20.2	5	8	3.5	8.3	5	30.0	25.5	85.0
		MEAN	8.9	40S	6.6	40S	6.3	60S	28.9	80S	57	89	6.4	20.2	4	9	4.3	8.3	5	40.0	35.7	85.0
48	**HI1605(C)**																					
		2020-21	15.6	60S	20.3	80S	12.9	60S	17.4	40S	36	78	8.0	18.8	6	9	4.9	11.1	4	25.0	39.9	83.3
		2021-22	3.7	20MS	14.4	40S	6.3	20S	38.8	60S												
		2022-23	7.3	30S	16.6	40MS	21.1	60S	36.5	100S	57	99	16.1	56.5	6	8	2.5	7.5	4	18.8		
		MEAN	8.9	60S	17.1	80S	13.4	60S	30.9	100S	57	99	16.1	56.0	6	9	3.7	11.1	4	25.0	39.9	83.3
49	**DBW377**																					
		2020-21	11.5	40MS	4.3	30S	2.9	20S	3.1	20MR												
		2021-22	3.8	20MS	6.8	20MS	2.2	10S	12.5	40S	47	89	9.6	23.6	5	7	5.2	8.3	4	31.3		
		2022-23	9.3	20S	4.6	20S	1.5	5MS	18.0	80S	46	99	13.4	58.3	4	6	2.2	6.6	5	27.8	18.2	60.0
		MEAN	8.2	40MS	5.2	30S	2.2	20S	11.2	80S	47	99	11.5	58.3	4	7	3.7	8.3	5	31.3	18.2	60.0

50	**DBW 187 (C)**																					
		2020-21	8.0	20S	1.0	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												
		2022-23	9.2	20S	3.2	10S	0.9	5S	12.7	60S	57	99	11.4	40.8	5	7	5.2	8.1	7	20.0		
		MEAN	7.5	20S	3.3	20MS	1.9	10S	12.9	60S	57	99	8.8	40.8	4	9	3.8	8.1	7	20.0		
51	**DBW 303(C)**																					
		2020-21	5.6	20MS	2.3	15MS	1.6	10S	4.0	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												
		2022-23	8.6	20S	8.1	40S	0.9	5MS	14.8	60S	46	79	13.6	45.1	3	5	4.2	11.1	4	38.9		
		MEAN	6.3	20S	4.0	40S	1.8	15S	11.0	60S	46	79	12.2	45.1	4	9	2.5	11.1	4	85.0		
52	**GW 322 (C)**																					
		2020-21	8.3	30S	7.3	20MS	8.6	20S	36.0	60S	46	79	4.8	8.5	6	9	8.6	9.7	5	35.0	14.3	22.2
		2021-22	8.0	20S	14.4	30S	8.9	40S	54.5	90S												
		2022-23	9.0	20S	11.1	40S	20.0	60S	45.0	100S	46	99	15.5	64.4	3	6	4.3	10.8	8	38.9		
		MEAN	8.4	30S	10.9	40S	12.5	60S	45.2	100S	46	99	10.2	64.4	3	9	6.5	10.8	8	38.9	14.3	22.2

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 2022-23

NIVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
1	HD3472	12.4	20S	6.0	10S	15.7	40S	8.4	40MS
2	HD3444	21.5	40S	9.4	20S	6.1	20S	12.0	40S
3	HD3445	10.5	20S	5.5	20MS	5.6	40S	6.8	40S
4	HD3446	9.0	20S	6.3	20MS	15.9	60S	1.7	5S
5	HD3447	19.2	60S	5.2	20MS	3.9	10S	6.5	40MS
6	DBW408	13.2	40S	3.5	20MS	0.8	5S	9.7	60S
7	DBW409	10.5	40S	2.9	10MS	0.1	TMS	5.5	40S
8	DBW410	2.7	10MS	4.9	20MS	2.6	10MS	7.4	40S
9	DBW411	7.8	20S	6.0	20MS	2.0	15MR	7.9	60S*
10	DBW412	4.9	20MS	3.7	10S	2.3	10MS	7.3	40S
11	PBW908	30.3	60S	7.0	20S	2.7	10S	3.2	40MS
12	PBW909	3.5	10S	3.9	10MS	4.1	10S	0.8	20MR
13	PBW910	7.4	20S	4.3	20MS	3.8	20S	11.1	40S
14	PBW911	6.3	20S	1.8	10MS	0.2	TS	4.9	40MR
15	PBW912	1.1	5S	3.3	20S	0.0	0	6.5	60S*
16	UP3121	14.8	20S	10.9	40S	0.5	5MS	21.4	70S
17	UP3122	22.6	40S	5.4	10S	0.2	TMS	8.1	60S
18	UP3123	17.3	40S	5.1	10MS	1.4	5S	8.4	60S
19	RAJ4576	2.8	10MS	11.7	40S	6.5	20S	11.6	60S
20	RAJ4577	4.0	10MS	1.7	20MR	1.0	5S	14.7	80S
20A	Infector	72.5	100S	77.1	100S	78.8	100S	80.8	100S
21	RAJ4578	8.8	20S	4.0	10S	3.8	20MS	14.8	60S
22	WH1315	12.8	40S	5.2	20MS	2.0	20MS	1.4	20MR
23	WH1316	5.0	20S	3.7	10S	0.5	5MS	21.8	40S
24	NW8072	17.5	40S	7.0	20S	4.4	20S	15.3	40S
25	K2201	35.0	80S	11.7	20S	3.8	20S	14.7	60S
26	HUW854	17.5	40S	9.1	40S	0.7	5S	25.1	60S
27	BRW3944	13.9	60S	5.1	20MS	11.8	40S	15.5	40S
28	KRL2106	10.3	40S	4.6	20MS	1.0	5MS	8.3	40S
29	JAUW711	14.8	60S	7.5	20S	3.4	10S	16.0	80S

NIVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
30	NWS2442	2.5	10S	4.3	20S	1.7	5S	8.3	40S
31	BCW28	14.1	20S	6.7	20MS	12.2	40S	2.2	20MR
32	UBW18	1.4	10MR	8.1	20MS	11.4	40S	10.1	40S
33	SVPWL21-15	18.3	80S	14.0	40S	16.4	80S	3.8	40MS
34	HD3086(C)	39.5	80S	21.4	40S	29.0	60S	14.7	60S
35	HD3448	7.2	20S	7.7	40S	2.7	10S	10.3	60S
36	HD3449	18.3	60S	6.9	20S	1.4	5S	5.0	40MS
37	HP1978	9.2	60S*	1.8	10S	0.3	5MR	4.3	40MS
38	HP1979	1.3	10MS	1.5	10MS	0.0	0	1.8	10S
39	HD3467	9.9	20S	8.9	30S	11.9	40S	1.7	10MS
40	DBW413	6.4	20MS	7.4	20MS	22.5	60S	10.8	40S
40A	Infector	70.0	100S	77.1	100S	78.8	100S	77.5	90S
41	DBW414	13.0	40S	4.9	20MS	5.2	20MS	18.5	60S
42	DBW415	20.1	40S	4.9	10S	1.8	10S	26.1	80S
43	DBW416	12.5	40MS	4.9	10S	1.5	5S	14.7	60S
44	DBW417	15.4	40S	4.0	10S	1.6	10S	14.8	60S
45	PBW913	7.0	20S	5.0	20S	2.3	10S	2.1	20MR
46	PBW914	1.7	5S	0.7	10MR	0.0	0	18.2	40S
47	PBW915	15.1	40S	3.7	20MS	0.3	5MR	2.4	10S
48	PBW916	16.5	40S	5.4	20MS	0.1	TR	1.9	10S
49	PBW917	6.2	20S	8.1	20MS	8.8	20S	14.7	40S
50	UP3124	27.7	80S	8.9	20MS	7.9	20S	11.3	60S
51	UP3125	30.3	80S	5.2	20MS	2.0	10MS	5.6	20MS
52	UP3132	7.3	20S	3.8	10S	3.4	20S	8.8	20S
53	NW8073	5.9	20MS	11.2	40S	15.0	40S	20.0	40S
54	NW8075	6.9	20MS	11.5	40S	3.9	10S	19.1	60S
55	WH1317	17.8	40S	10.9	40S	15.6	60S	18.9	40S
56	WH1318	8.4	20S	10.3	40S	13.8	40S	13.6	40S
57	K2203	0.7	5MS	2.5	10S	0.5	5MS	24.6	60S
58	K2204	23.0	40S	6.9	20S	0.5	10MR	22.1	60S
59	BRW3946	11.0	40S	13.7	40S	8.0	20S	32.4	60S
60	BRW3942	5.1	20S	9.7	40S	18.2	40S	15.8	60S

NIVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
60A	Infector	72.5	100S	80.0	100S	78.8	100S	76.7	90S
61	RAJ4579	13.3	40S	11.7	40S	6.2	20S	19.0	80S
62	JKW305	9.5	20MS	9.9	20S	5.6	20S	22.5	60S
63	HUW855	7.1	20MS	7.4	20S	3.3	20S	23.2	40S
64	NWS2216	28.3	80S	3.5	10S	1.9	10S	17.2	40S
65	BCW29	9.6	40S	6.9	40S	3.8	10S	5.3	40MS
66	UBW19	21.1	40S	15.3	60S	19.8	40S	0.7	5MS
67	SVPWL21-07	6.1	20MS	1.8	10MS	2.5	20S	6.8	40S
68	DBW222(C)	9.4	20S	4.0	20MS	0.8	5S	18.6	60S
69	HD3450	3.9	10S	5.2	20S	6.9	40S	6.4	40MS
70	HD3451	1.5	10MR	12.4	40S	7.5	40S	36.5	80S
71	HI1683	2.1	10MS	0.9	5MS	6.1	40S	43.8	80S
72	HI1684	3.0	10MS	1.1	5MS	6.3	40S	59.5	100S
73	MACS6826	2.6	5S	10.3	40S	5.8	20S	18.5	80S
74	MACS6837	5.7	20MS	5.7	20MS	0.1	TMS	33.8	60S
75	MACS6842	3.5	10S	5.1	10S	8.8	20S	23.9	60S
76	MACS6844	6.5	20S	8.0	20S	4.9	20S	57.5	80S
77	GW548	2.3	10MS	8.9	20S	15.3	60S	35.0	80S
78	GW549	1.5	10MR	1.5	10MS	4.5	20S	49.2	90S
79	GW550	2.5	20MR	1.1	5MS	2.3	20MS	41.3	60S
80	DBW418	2.1	10MS	2.9	20MS	5.6	40S	3.4	10S
80A	Infector	70.0	100S	77.1	100S	78.8	100S	77.5	90S
81	DBW419	16.3	40S	18.9	40S	16.4	40S	15.5	40S
82	UAS3025	8.6	40S	2.9	20S	0.0	0	29.4	60S
83	UAS3026	10.5	20S	6.0	20MS	0.1	TMR	36.4	60S
84	MP3570	9.5	20S	12.0	40S	10.3	40S	33.8	60S
85	MP3573	4.8	20S	6.0	20S	9.8	40S	5.1	15MS
86	NIAW4364	8.4	20MS	12.6	40S	17.4	40S	38.6	80S
87	NIAW4440	13.3	20S	15.4	40S	11.2	40S	25.1	40S
88	MP1392	1.1	10MR	2.3	10MS	1.3	0	60.3	100S
89	MP1393	7.1	20S	7.1	20S	0.7	5S	30.8	60S
90	GW554	2.1	10MS	1.4	10MS	1.1	5S	60.8	90S

NIVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
91	GW555	2.3	10MS	2.0	10S	2.1	20MS	58.3	100S
92	PWU16	1.8	10MR	1.7	5MS	2.0	10S	51.5	100S
93	PWU20	3.1	10MS	4.0	20MS	1.3	10S	45.5	90S
94	PBW918	4.8	10S	5.1	20S	4.1	20S	9.9	40S
95	RAJ4582	9.0	20S	5.4	20MS	6.5	10S	11.2	60S
96	CG1045	9.3	20S	8.6	20MS	7.4	40S	13.7	60S
97	AKAW5347	10.1	40MS	7.5	40MS	11.8	40S	36.3	70S
98	PBN16-1766	9.8	20S	10.3	20S	7.3	40S	41.7	90S
99	LOK80	5.1	10MS	2.9	20MS	5.1	40S	37.1	80S
100	NWS2170	8.4	20S	5.7	20S	8.3	20S	20.4	60S
100A	Infector	72.5	100S	77.1	100S	81.3	100S	74.2	90S
101	BW18R6016	3.6	10S	5.4	20MS	31.3	60S	36.8	80S
102	GW322(C)	4.8	20MS	8.3	20S	20.8	60S	47.2	80S
103	DBW187(C)	12.1	60S	4.6	20MS	8.4	40S	9.8	40S
104	MACS6222(C)	4.3	10S	1.5	5MS	1.3	5S	24.4	100S
105	HD3452	14.3	20S	6.6	10S	4.0	20S	12.0	60S
106	HD3453	12.3	20S	5.3	20MS	4.5	20S	11.6	60S
107	HD3454	5.9	10S	4.6	20S	1.9	10S	1.0	20MR
108	HD3455	17.3	40S	9.4	20S	10.6	40S	3.3	10S
109	HP1980	1.3	5MS	0.3	5MR	0.0	0	4.4	40MS
110	DBW420	15.3	40S	7.1	20MS	2.9	10MS	9.8	60S
111	DBW421	30.9	60S	14.9	40S	21.3	40S	16.2	60S
112	DBW422	22.8	40S	14.4	40MS	9.1	20S	15.2	80S
113	DBW423	17.5	40S	6.9	20S	1.3	5S	19.7	60S
114	DBW424	8.8	20S	5.1	20MS	0.1	TMS	1.2	20MR
115	PBW919	10.5	20S	2.9	10MS	2.5	20S	2.0	15S
116	PBW920	22.5	40S	9.2	20S	2.6	10S	9.5	70S*
117	PBW921	14.0	20S	5.7	20MS	2.5	10S	1.5	10S
118	PBW922	9.9	20S	2.6	20MS	2.5	20S	1.5	10S
119	PBW923	10.3	40S	2.9	20MS	1.4	10S	4.6	40S
120	WH1322	5.9	10S	5.2	20MS	5.3	20S	17.2	80S
120A	Infector	70.0	100S	77.1	100S	78.8	100S	80.8	100S

NIVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
121	WH1323	12.7	40S	3.9	20MS	11.7	60S*	13.8	100S
122	WH1324	9.2	20S	3.8	10S	3.1	20S	13.8	80S
123	K2206	12.8	20S	8.3	20S	0.0	0	9.1	40MS
124	K2207	5.3	10S	2.3	10MS	0.3	5MR	13.6	60S
125	K2208	22.3	40S	4.3	20MS	1.3	10S	14.0	60S
126	RAJ4580	23.0	60S	14.0	40S	13.9	40S	7.1	40MS
127	RAJ4581	18.4	60S	4.1	20S	3.1	20S	6.4	40MS
128	NW8055	10.5	20S	6.3	20S	5.7	20S	24.2	40S
129	NW8071	12.7	40S	6.0	20MS	8.5	40S	15.7	60S
130	UP3126	14.5	40S	10.3	40S	12.0	40S	10.0	40S
131	UP3127	13.0	40S	2.9	10MS	5.1	10S	25.6	60S
132	JKW303	10.8	40S	16.0	60S	19.4	60S	12.2	60S
133	BRW3941	2.7	20S	3.4	10S	2.4	10S	27.6	60S
134	BCW30	7.5	20S	9.7	30S	13.0	40S	26.3	80S
135	UBW20	11.5	40S	14.9	40S	7.4	40S	13.0	40S
136	SVPWL21-14	17.9	40S	15.4	40S	7.4	40S	7.2	40S
137	HD3059(C)	9.4	40S	2.6	10S	0.7	5S	30.6	60S
138	DBW173(C)	1.2	5MS	0.3	5MR	0.7	5S	13.2	40MS
139	HI1563(C)	1.2	10MR	0.3	10R	5.0	40S	49.1	100S
140	DBW107(C)	20.7	60S	14.0	30S	17.3	40S	24.3	80S
140A	Infector	70.0	100S	77.1	100S	78.8	100S	74.2	90S
141	HD3456	10.5	20MS	6.3	20MS	10.1	60S	18.9	80S
142	HI1685	3.6	10MS	1.2	20MR	5.0	40S	54.5	80S
143	HI1686	1.1	10MR	0.0	R	7.0	40S	59.7	100S
144	HI1687	2.3	10MS	2.3	10S	2.5	20S	48.0	100S
145	DBW425	9.3	20S	4.2	10MS	9.6	40S	3.8	10S
146	DBW426	4.6	10S	0.6	10MR	1.4	10S	11.5	40S
147	UAS3027	4.8	20S	1.1	10MR	1.1	5S	39.6	90S
148	UAS3028	6.0	20MS	4.4	20MS	0.3	5MR	43.3	100S
149	MP3568	0.5	5MR	1.5	10S	5.0	40S	52.5	100S
150	MP3575	2.6	10MS	17.4	40S	9.5	20S	44.2	80S
151	NIAW4300	1.5	10MS	4.0	20MS	2.5	20MS	43.3	80S

NIVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**
152	NIAW4432	2.4	15MS	0.6	10MR	1.3	10S	42.1	80S
153	MACS6829	2.1	20MR	1.2	10MS	1.0	10MS	53.0	90S
154	MACS6830	2.1	20MR	0.6	5MS	1.0	10MS	59.7	100S
155	GW551	1.1	10MR	0.0	R	5.0	40S	47.0	80S
156	GW558	3.1	15MS	1.8	20MR	1.3	10S	45.7	80S
157	WSM138	1.8	10S	0.2	5R	0.7	5S	32.9	60S
158	CG1046	7.3	20S	12.3	40S	20.1	60S	52.3	100S
159	WH1325	11.0	40S	5.7	20MS	8.1	20S	20.6	60S
160	GW556	5.0	15MS	2.9	10MS	9.4	40S	63.0	100S
160A	Infector	70.0	100S	77.1	100S	81.3	100S	80.0	90S
161	LOK81	18.3	60S	12.2	40S	13.6	60S	53.0	100S
162	PBW924	12.3	40S	2.9	10MS	0.0	0	6.1	40S
163	MP1394	2.5	10MS	1.4	10MR	0.7	5MS	11.5	80S
164	HD2864(C)	4.1	20MS	1.1	20MR	7.5	60S*	58.2	100S
165	HD2932(C)	17.5	60S	23.4	60S	14.0	40S	56.7	100S
166	HI8848(d)	7.0	40S	3.8	10S	1.2	10MS	12.5	40S
167	HI8849(d)	7.5	40S	2.6	10S	1.1	10MS	4.6	20MS
168	HI8850(d)	14.5	60S	6.3	20S	0.6	5MS	3.7	40MS
169	NIDW1499(d)	6.3	40S	0.9	5MS	0.1	TS	9.0	40MS
170	NIDW1534(d)	22.0	80S	2.9	10MS	1.5	10S	4.8	20S
171	NIDW1520(d)	13.5	60S	3.8	20MS	0.1	TMS	3.6	20S
172	DDW62(d)	11.3	60S	1.6	5S	0.6	5MS	4.9	40MS
173	DDW63(d)	21.0	80S	2.3	20MS	1.2	5S	7.4	20S
174	UAS482(d)	19.5	80S	2.6	10S	1.4	10S	5.1	40MS
175	UAS483(d)	13.3	60S	0.9	5MS	0.3	5MR	6.7	40MS
176	PDW364(d)	28.3	60S	3.7	20MS	0.5	5MS	3.7	10S
177	PDW365(d)	18.5	40S	3.2	20MS	0.1	TMR	3.5	40MS
178	MPO1395(d)	13.0	20S	3.2	20MS	1.3	10S	5.1	40MS
179	MPO1396(d)	4.8	20MS	1.5	20MR	0.1	TMR	6.4	40MS
180	MACS4125(d)	6.0	20S	1.3	20MR	0.0	0	4.6	40MS
180A	Infector	72.5	100S	77.1	100S	76.3	100S	77.5	100S
181	MACS4135(d)	8.8	40S	2.6	20MS	2.8	20S	9.8	60S

NIVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
182	GW1365(d)	4.8	20S	3.1	20MS	2.1	20MS	5.9	40S
183	GW1366(d)	1.8	10S	0.0	R	0.5	5MS	10.6	40S
184	WHD968(d)	38.8	60S	17.4	80S	1.0	5MS	12.4	40S
185	PWU24(d)	6.3	40S	0.6	5MS	0.6	5MS	5.9	40S
186	GW1367(d)	6.2	20S	0.6	5MR	0.1	TMR	9.8	60S
187	AKDW5516	6.1	20MS	2.9	20MS	0.6	10MR	7.3	40S
188	HI8713(d)(C)	11.3	40S	0.6	5MR	0.9	5MS	16.4	60S
189	HI8737(d)(C)	5.0	20S	0.6	5MR	0.2	5R	7.5	40S
190	MACS3949(d)(C)	15.0	40S	4.3	20S	1.6	10MS	6.1	40S
191	HD3457	9.5	20S	2.3	10MS	2.0	10S	2.9	40MS
192	HD3458	19.0	80S	29.1	60S	33.1	60S	3.1	40MS
193	HD3459	16.5	60S	6.3	20MS	7.2	20S	18.0	80S
194	HD3460	15.5	60S	8.0	20MS	1.5	10S	14.9	60S
195	HD3468	16.2	60S	12.7	40S	9.8	20S	9.9	60S
196	DBW427	40.5	80S	19.4	40S	28.0	60S	15.9	80S
197	DBW428	1.4	10MS	2.9	20S	3.8	15S	13.0	80S
198	DBW429	5.0	20S	8.6	40S	0.6	5MS	14.5	60S
199	DBW430	12.1	60S	4.0	20MS	2.1	10S	25.1	60S
200	PBW925	13.5	40S	4.0	20MS	0.1	TMS	9.3	60S
200A	Infector	72.5	100S	77.1	100S	78.8	100S	79.2	100S
201	PBW926	5.0	10S	2.3	10MS	11.2	60S	15.3	60S
202	PBW927	4.3	10S	3.7	20MS	2.6	20S	1.7	10MS
203	PBW928	5.1	10S	23.6	60S	32.5	60S	1.8	10MS
204	UP3129	12.5	40S	1.7	10MS	1.3	5S	24.6	60S
205	UP3133	5.3	20S	0.3	5MR	0.0	0	28.1	60S
206	WH1326	13.4	60S	4.7	20MS	3.2	10S	13.9	60S
207	WH1327	9.6	40S	1.7	5MS	0.6	5S	3.9	40S
208	K2210	16.2	80S	7.5	20S	7.1	15S	15.6	60S
209	NW8053	8.1	40S	1.9	10MS	2.6	10S	19.7	40S
210	JKW304	12.4	60S	10.6	40MS	6.6	20S	14.8	40S
211	BRW3935	7.0	20S	0.9	10MR	1.6	10MS	21.3	60S
212	JAUW705	13.0	40S	4.3	10S	1.9	10S	16.9	80S

NIVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS
213	HI1612(C)	27.5	80S	5.0	20S	1.3	10S	18.8	60S
214	K1317(C)	11.1	40S	4.3	15MS	10.8	40S	18.8	60S
215	PBW644(C)	6.0	20S	6.1	20S	13.2	40S	30.5	60S
216	HI1688	5.8	40S	0.4	5MR	5.0	40S	34.0	80S
217	HI1689	3.2	20S	0.3	10R	0.0	0	47.3	90S
218	HI1693	1.8	10S	0.0	R	0.5	5MS	38.8	90S
219	HI8851(d)	6.9	40S	1.1	10MR	0.1	TR	6.8	40MS
220	HI8852(d)	4.7	20S	0.9	10MR	0.7	5S	5.8	40MS
220A	Infector	70.0	100S	77.1	100S	78.8	100S	77.5	90S
221	DBW431	3.0	10MS	10.1	20S	7.5	10S	26.9	60S
222	DBW432	3.4	10S	2.3	15MS	0.5	5MS	20.0	60S
223	DDW64(d)	46.5	100S	17.1	60S	5.3	40S	15.9	40S
224	UAS3029	16.5	80S	1.2	5MS	1.4	10S	20.7	40S
225	UAS484(d)	2.7	20S	1.7	10MS	1.3	10S	2.6	10MS
226	NIAW4267	10.0	60MS	0.9	10MR	0.0	0	63.3	100S
227	NIAW4387	10.1	40S	4.0	20MS	8.9	60MS	51.7	100S
228	GW552	4.8	40MS	0.3	10R	1.1	5S	56.7	100S
229	GW1368(d)	8.5	30S	0.6	10MR	7.6	40S	49.2	100S
230	AKAW5514	20.8	60S	10.0	30MS	10.0	60S	70.0	100S
231	CG1047	7.6	20S	3.7	20MS	18.8	40S	42.5	100S
232	MP3577	1.0	10MR	0.0	R	0.0	0	42.4	90S
233	MPO1398(d)	7.8	40S	2.9	10MS	1.7	10MS	6.9	40MS
234	MACS4131(d)	6.5	20MS	1.4	20MR	0.0	0	3.4	40S
235	PBN16-1826	12.3	40S	22.6	60S	37.5	60S	53.1	100S
236	DBW110(C)	11.3	40S	3.7	10S	3.6	20S	46.7	100S
237	HI1605(C)	13.8	40S	17.7	40S	14.9	40S	29.0	60S
238	HI8627(d)(C)	9.1	40S	1.4	5MS	0.7	5S	8.5	40MS
239	UAS446(d)(C)	14.0	60S	4.0	20MS	0.6	5S	3.5	40MS
240	HD3461	2.1	10MS	0.3	5MR	6.9	20S	6.1	40MS
240A	Infector	77.5	100S	74.3	100S	78.8	100S	77.5	90S
241	HD3462	14.3	40S	11.1	20S	4.1	10S	15.0	60S
242	HD3463	3.2	20S	0.3	5MR	0.0	0	10.2	40S

NIVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**
243	HD3464	9.1	20S	10.6	40S	10.0	40S	3.7	40MS
244	HI1690	4.3	10S	5.4	20S	0.0	0	61.7	100S
245	HI1691	1.6	10MS	0.6	5MR	0.0	0	48.2	100S
246	PBW903	14.3	40S	4.6	20MS	0.0	0	1.0	20MR
247	PBW904	12.8	40S	7.1	20MS	0.6	5MS	3.2	20S
248	PBW905	3.8	10S	6.9	20S	3.0	10S	12.8	40S
249	PBW906	1.6	5S	6.3	20S	2.8	10S	8.6	40S
250	PBW907	8.4	20S	28.0	60S	40.0	80S	4.5	40MS
251	PBW929	11.1	20S	6.3	20MS	1.8	5S	13.4	80S
252	DBW433	11.3	20S	5.9	15MS	3.2	20S	18.4	60S
253	DBW434	11.3	40MS	5.7	10S	1.9	5S	13.9	60S
254	DBW435	2.0	10MS	9.4	20S	16.3	40S	14.1	40S
255	DBW436	11.6	40S	7.9	20MS	3.4	20S	15.0	80S
256	DBW437	9.6	40S	6.3	20S	0.0	0	12.3	40MS
257	DBW438	7.8	20S	6.0	20S	1.8	10S	14.5	40S
258	DBW439	10.0	20S	6.9	20S	3.9	20S	9.9	60S
259	DBW440	8.6	20S	2.7	10S	2.3	10S	20.6	60S
260	WH1320	5.2	20S	10.6	30S	9.3	20S	15.8	40S
260A	Infector	72.5	100S	77.1	100S	78.8	100S	79.2	100S
261	WH1321	11.3	20S	16.3	40S	14.5	60S	17.4	60S
262	UP3130	6.8	20S	10.6	20S	11.8	40S	46.8	100S
263	RAJ4583	14.3	40S	5.7	10S	2.6	20S	21.6	100S
264	BRW3922	27.3	60S	11.0	20S	0.3	5MR	32.3	100S
265	CG1049	1.8	10MS	0.6	5MS	1.9	10S	55.5	100S
266	DBW445	5.1	20S	0.9	10MR	0.3	5MR	12.2	80S
267	JWS1333	6.8	40S	9.5	40MS	22.6	40S	35.9	70S
268	GW553	3.3	10MS	3.7	10S	1.3	10MS	47.0	100S
269	GW557	3.3	15MS	2.3	20MS	2.0	20MS	68.3	100S
270	MP3572	0.6	10MR	0.0	R	0.3	5MR	57.5	100S
271	MP1399	5.6	20S	8.0	20S	1.8	5S	38.4	80S
272	DBW303(C)	5.9	20S	4.3	15MS	3.8	10S	19.7	60S
273	DBW327(C)	4.9	20MS	4.0	20S	3.9	10S	14.6	60S

NIVT No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**
274	DBW332(C)	17.8	40S	4.9	20S	2.8	10S	14.0	60S
275	HS695	12.0	20S	8.9	20S	5.7	10S	1.5	10MS
276	HS696	11.6	20S	16.9	40S	15.1	40S	1.8	10MS
277	HS697	13.8	40S	7.1	20MS	2.0	10S	3.4	10S
278	HS698	3.3	20MS	2.9	20MS	0.6	5S	6.6	60S
279	HS699	1.1	5S	0.0	R	0.7	5S	10.7	40S
280	HD3466	16.4	40S	11.2	40S	13.2	80S*	6.4	40MS
280A	Infector	75.0	100S	80.0	100S	81.3	100S	77.5	100S
281	HPW489	2.0	10S	0.0	R	5.6	40S	7.2	40MS
282	HPW490	6.3	20S	2.9	10S	2.5	20S	7.2	40MS
283	HPW491	6.0	10S	6.2	15MS	6.8	40S	12.2	60S
284	HPW492	5.0	20S	1.7	5MS	0.6	5S	8.8	40S
285	HPW493	4.1	10S	5.2	20S	0.8	5S	3.6	10S
286	HPW494	1.7	10MS	8.6	20MS	6.9	20S	13.9	60S
287	VL2051	5.3	20MS	8.3	40MS	0.1	TMR	18.1	40S
288	VL2052	11.4	40MS	6.3	20S	1.3	10S	6.1	20S
289	VL2053	14.6	20S	8.6	20S	1.9	10S	15.7	40S
290	VL2054	23.5	40S	15.0	40S	2.4	5S	14.4	60S
291	VL3031	3.4	10S	0.3	5MR	0.0	TR	9.8	40MS
292	VL3032	6.1	20S	2.3	10MS	0.0	0	17.0	40S
293	SKW368	4.3	10S	15.1	40S	17.8	40S	10.1	60S
294	SKUAW101	11.8	30MS	12.6	20S	6.0	20S	16.9	80S
295	SKUAW102	11.3	20S	13.7	40S	7.4	20S	24.4	80S
296	UP3131	2.0	5S	11.7	40S	4.6	20S	45.5	90S
297	UP3134	29.5	60S	10.3	40S	20.1	60S	19.7	80S
298	HS507(C)	2.7	10MS	8.3	20S	9.8	40S	10.3	40S
299	HS562(C)	30.5	60S	14.3	20S	16.3	40S	11.1	80S
300	VL892(C)	6.0	10S	9.7	20S	9.6	40S	31.2	60S
300A	Infector	70.0	100S	77.1	100S	81.3	100S	80.8	100S

Abbreviations: ACI = Average Coefficient of Infection, HS = Highest Score, *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

Brown rust and yellow rust – Ludhiana and New Delhi

Black rust (under controlled conditions): Pune, Indore and Mahabaleshwar

Race specific adult plant resistance (APR) response of AVT lines (2022-23)

For identifying race specific adult plant resistance (APR), 134AVT lines of wheat were screened against the most predominant and virulent pathotypes of *P. graminis* f. sp. *tritici Puccinia triticina*, and *P. striiformis* f. sp. *tritici* during 2022-23. Two pathotypes of *P. graminis* f. sp. *tritici* (11 and 40A), three pathotypes of *P. triticina* (77-5, 77-9 and 104-2) and three pathotypes of *P. striiformis* f. sp. *tritici* (46S119, 110S119 and 238S119) were used in present study. The experiments were conducted under controlled conditions in polyhouse. The lines which showed susceptibility at seedling and resistance at adult plant stage were considered to have APR. The detailed information of wheat lines showing race specific APR to eight pathotypes of three wheat rust pathogens is presented in Table 2.1.

Table 2.1: Race specific adult plant rust resistance of AVT entries at ICAR-IIWBR, RS, Shimla during 2022-23

S. No.	Variety/ line	APR Response							
		Black rust		Brown rust			Yellow Rust		
		11	40A	77-5	77-9	104-2	46S119	110S119	238S119
1	HS691	60S	20S	10MR	0R	0R	NG	30MS	10R
2	HS692	40S	20MS	5R	NG	5MR	20S	10S	20S
3	VL3028	30S	10MR	5R	NG	0R	10S	TS	20S
4	HPW484	40S	TS	0R	0R	5MR	0R	0R	0R
5	VL907(C)	20MS	5MR	0R	NG	5R	TS	TR	TS
6	VL892(C)	30M	TS	0R	NG	0R	5MR	TR	10MS
7	HPW349(C)	30M	5R	TS	NG	0R	TS	TMS	5S
8	HS562(C)	0	TR	0R	NG	0R	TS	TS	5S
9	VL2041(I)(C)	20MS	5S	0R	5MR	0R	5S	0R	0R
10	PBW887	TMR	0	NG	0R	0R	TS	0R	TR
11	PBW889	60S	5MS	0R	0R	0R	0R	0R	0R
12	HD3386	30M	0	0R	0R	0R	0R	0R	0R
13	HD3470	30MS	0	0R	NG	NG	NG	5S	5S
14	HI1668	10MSS	0	NG	0R	0R	NG	0R	5S
15	DBW386	0	0	0R	0R	0R	0R	0R	0R
16	UP3102	20M	10MS	0R	NG	0R	10S	10S	10S
17	HD3428	30S	5MS	0R	0R	5S	0R	0R	0R
18	PBW893	40S	10M	5MR	5S	10MR	NG	0R	5MR
19	K2108	0	0	0R	0R	0R	20S	TS	NG
20	HD3059(C)	10MR	0	NG	5R	0R	0R	0R	0R
21	DBW173(C)	40MSS	0	NG	NG	0R	NG	0R	TMS
22	PBW771(C)	30MSS	TR	5MR	5MR	TMR	TS	0R	5R
23	JKW261(C)	5MS	5MR	TS	NG	OR	NG	30S	0R
24	WH1402	40MSS	20MS	NG	NG	5MR	NG	10S	10S
25	WH1311	40MR	5MR	NG	0R	10MR	20S	20S	40S
26	UP3111	30S	10MS	5MR	TS	0R	5S	30S	5S

27	PBW899	20M	TS	0R	5MR	0R	NG	NG	5S
28	PBW644(C)	20MS	TMS	0R	5MR	0R	NG	10S	10S
29	DBW296(C)	30M	20MS	NG	5S	0R	5R	5S	0R
30	HD3369(I)(C)	0	5MS	0R	NG	0R	NG	5S	20S
31	HI1653(I)(C)	40MS	TMS	NG	5S	0R	0R	0R	0R
32	HI1654(I)(C)	20MSS	0	NG	30S	5R	NG	5S	20S
33	HD3388	30M	5MS	0R	5MR	5MR	0R	0R	0R
34	HD3471	60S	TMR	NG	10S	5MR	10MS	10MS	TMS
35	HD3249(C)	40S	5S	5R	5MR	0R	NG	TMS	10S
36	HD3086(C)	30MSS	0	40MS	0R	0R	5S	0R	TMS
37	HD2967(C)	10MSS	10MSS	0R	0R	0R	TS	0R	TR
38	DBW222(C)	0	0	0R	0R	0R	0R	0R	0R
39	PBW826(I)(C)	20MR	TS	5MS	30S	0R	TS	0R	0R
40	DBW398	40MSS	0	0R	5MR	NG	NG	5S	10S
41	HI1612(C)	60S	10MS	NG	10S	0R	80S	5MR	20S
42	K1317(C)	40S	5MS	0R	0R	0R	10S	0R	0S
43	HD3171(C)	30S	10MS	5MR	5MR	5MR	10S	0R	40MS
44	HD3293(C)	40S	5MS	NG	5S	0R	NG	5S	10S
45	DBW252(C)	20MS	0	NG	0R	0R	0R	0R	0R
46	NWS2194	20R	0	10MR	0R	0R	NG	30S	40S
47	HI1669	40MS	10MS	0R	0R	0R	0R	0R	0R
48	HI1670	40MS	10MSS	NG	5S	0R	0R	0R	0R
49	GW547	30MSS	0	NG	5S	5R	TS	5S	5MR
50	GW513(C)	20S	0	NG	TS	NG	10MS	TS	5MS
51	HI1636 (C)	40MSS	5MS	5R	0R	5R	NG	NG	NG
52	HI1650(I)(C)	30MS	0	0R	30S	5MR	5S	5S	10MS
53	MACS6768(I)(C)	20M	0	0R	60S	0R	NG	NG	40S
54	HI1674	30S	0	5R	20S	5R	NG	0R	10S
55	AKAW5104	40MSS	10MS	5MR	10MR	0R	NG	5MR	20MR
56	HD2932(C)	40MSS	5MSS	5MR	10S	40SMS	5S	5S	20S
57	MP4010(C)	30MSS	TS	5S	10MS	5R	NG	5MS	30S
58	HI1634(C)	10M	TMS	5R	5R	0R	30MS	10MS	20MS
59	CG1029(C)	40MS	10MS	TMR	10MSS	30MR	10S	60S	10S
60	DBW359	30MS	0	0R	40S	5MR	NG	20S	30S
61	DBW441	40MS	5MS	NG	0R	5MR	30S	5MS	40S
62	DBW442	20MS	5MS	10S	5MR	5MR	10S	10MS	30S
63	CG1040	30MS	0	5MR	5MR	0R	NG	NG	NG
64	MP3288(C)	40S	10MR	5MR	0R	0R	10MR	20S	20S
65	DBW110(C)	20MS	0	5MR	10R	0R	0R	0R	0R
66	CG1036(I)(C)	30MS	5MSS	NG	20S	0R	0R	0R	0R
67	HI1655(I)(C)	20M	TS	NG	0R	0R	0R	0R	0R
68	UAS3020	60M	TMSS	0R	0R	0R	NG	60S	TS
69	UAS3021	40S	5MS	5R	5MR	5MR	NG	10S	10S
70	MACS6811	0	0	NG	10MRMS	10MR	10MS	40S	30S
71	MACS6809	5MR	0	5MR	0R	5R	30S	80S	60S
72	NIAW4183	10MR	10MR	0R	0R	0R	40S	80S	80S
73	NIAW4153	0	0	20S	30S	0R	NG	10R	5MS
74	AKAW5314	30M	TMR	5MR	20S	0R	20MS	40S	40S
75	AKAW5100	30MS	TS	0R	5S	0R	30MS	40S	40S
76	MP1378	40MS	TMS	0R	10S	5MR	60S	60S	80S
77	MP1386	0	TMR	NG	5MR	0R	60S	40S	80S
78	DBW443	0	0	0R	0R	0R	40S	60S	40S
79	DBW444	20MR	0	0R	5R	0R	40S	60S	60S
80	HD3469	30M	TMR	0R	10MS	0R	0R	0R	NG
81	NWS2222	40M	5MS	5MR	10MS	0R	0R	5R	5S
82	PWU15	0	0	0R	0R	0R	NG	40MS	40S
83	WH1306	40MSS	TMR	0R	0R	0R	NG	60S	40S
84	PBW891	20MS	10MR	NG	30S	5R	40S	60S	60S

85	HI8841(d)	0	0	NG	0R	0R	NG	NG	NG
86	UP3083	30MS	TMS	0R	5MR	10MR	60S	40S	40S
87	MACS3949(d)(C)	20M	10MR	NG	0R	5MR	NG	20MS	60S
88	HI8826(d)(I)(C)	10MR	5R	0R	0R	0R	40S	60S	80S
89	MACS4100(d)(I)(C)	20M	10MS	0R	5MR	0R	10S	20S	40S
90	MACS6222 (C)	0	0	0R	0R	0R	60S	60S	60S
91	HI1672	0	0	10R	0R	0R	NG	60S	80S
92	HI1673	0	0	0R	5MR	0R	20MR	60S	40S
93	HI1675	10MR	0	0R	0R	0R	20S	40S	80S
94	DBW394	0	0	0R	5MR	0R	0R	10MS	5MS
95	DBW395	10MR	TS	NG	0R	5R	10S	5S	5MS
96	MACS6814	40S	TMS	NG	10MS	0R	10MR	0R	TMR
97	MACS6805	10S	0	NG	5MR	0R	40S	40S	60S
98	NIAW4114	30MSS	0	5MR	5S	0R	10S	10S	60S
99	NIAW4120	40MR	0	10R	10MR	0R	10S	40S	10MS
100	UAS3022	20MS	5MS	NG	5S	5MR	NG	20MS	40S
101	UAS3023	30S	0	0R	20S	0R	5S	20S	20MS
102	MP3557	30MSS	TMS	NG	10S	0R	10MS	20S	40S
103	MP3556	20MSS	0	0R	0R	0R	10S	TMS	TMR
104	PBW897	10MR	0	0R	0R	0R	20S	20S	10S
105	MP1388	20MSS	10M	NG	0R	5MR	5S	0R	10S
106	GW542	20MSS	TMR	0R	0R	0R	0R	0R	TR
107	GW538	10MSS	TMS	0R	NG	0R	0R	0R	TS
108	WH1310	20MSS	10MR	60S	20S	20M	0R	0R	0R
109	LOK79	10MS	0	5MR	0R	0R	5S	0R	5S
110	RAJ4083(C)	20MS	5MS	0R	5S	0R	NG	0R	5MS
111	HD3090(C)	40MS	20MS	80S	40S	40MR	10S	10S	20S
112	HI1633(C)	40S	0	NG	0R	0R	5MS	TR	10S
113	UAS478(d)	40S	10MS	0R	0R	0R	20S	10MS	30S
114	UAS481(d)	10MR	0	NG	0R	0R	0R	0R	TS
115	HI1665	30MS	0	0R	0R	0R	0R	0R	0R
116	HI8840(d)	40MSS	10MS	5S	0R	0R	0R	0R	10S
117	DBW397	40MSS	5MR	0R	0R	0R	0R	0R	0R
118	DDW61(d)	60S	0	0R	0R	0R	0R	0R	0R
119	NIAW4028	20MS	20S	0R	0R	5MR	0R	0R	TMS
120	HI1605(C)	20MS	0	0R	0R	0R	0R	0R	5S
121	NIAW3170(C)	20MS	5MS	NG	NG	5R	NG	5S	20S
122	UAS446(d)(C)	30MS	0	5MR	NG	5MR	NG	0R	20MS
123	NIDW1149(d)(C)	20MR	0	NG	NG	0R	10S	0R	10S
124	DBW380	0	0	NG	NG	0R	5S	0R	10S
125	DBW370(I)(C)	40MS	5MS	NG	0R	0R	0R	0R	5S
126	DBW371(I)(C)	10MS	40S	TS	10S	5MR	5S	5MS	10MS
127	DBW372(I)(C)	40MSS	20MSS	0R	5MR	0R	30S	0R	10MS
128	PBW872(I)(C)	30S	5MS	NG	20S	5MR	NG	40S	40S
129	DBW377	20MS	0	0R	TS	0R	NG	10S	20S
130	CG1044	40MS	10MSS	NG	20S	10MS	30MS	5S	10MS
131	GW543	30S	5MS	5MR	10S	5R	40S	40S	5MS
132	DBW187(C)	20MS	TMS	NG	10S	0R	NG	20S	5MR
133	DBW303(C)	5MS	5MSS	NG	TS	NG	NG	20S	10S
134	GW322(C)	0	5MS	0R	80S	0R	NG	20S	40S

‘-‘: Not germinated

None of the entry possessed APR to all testedpathotypes of three rust pathogens. A total of three entries lines showed APR to all three pathotypes both brown and yellow rustpathogens, while MACS6805 was the only entry with APR to both the pathotypes of black rust pathogen. AVT entryHS691* that had APR to all tested pathotypes of *P. triticina,* also conferred APR to 238S119 pathotypes of *P. striiformis* f. sp.*tritici* (Table 2.2 and 2.3). Likewise, GW542, with APR to all three pathotypes of *P. striiformis* f. sp.*tritici*, also conferred APR to pathotype 77-9 of *P. triticina* and 40A of *P. graminis* f. sp.*tritici* (Table 2.2, 2.3, and 2.4). AVT entry MACS6805 with APR to both the pathotypes of black rust also had combined APR against pathotypes 77-9 and 104-2 of brown rust pathogen (Table 2.2 and 2.4).

Leaf rust

Fifty-eight 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 03lines (HD3388, HS691, UP3083). Seven entries had combined APR to 77-5 and 77-9 while combined APR to 77-9 & 104-2 and 77-5 & 104-2 was recorded in five and three entries, respectively. APR to individual pathotypes 77-5, 77-9 and 104-2 was observed in 18, 12 and 10 lines, respectively (Table 2.2).

Table 2.2. Race specific adult plant resistance (APR) response in AVT lines to virulent pathotypes of *Puccinia triticina* during 2022-23

Pathotypes	**No. of lines**	**Wheat Lines**
All three pts. 77-5, 77-9 and 104-2	3	HD3388*, HS691*, UP3083
Both 77-5 and 77-9	7	AKAW5104, DBW372*, DBW377*, HD3171, MACS4100, MP3556, VL2041,
Both 77-9 and 104-2	5	DBW395, DBW397, MACS6805, WH1311, UAS478
Both77-5 and 104-2	3	CG1029*, DBW371, PBW771*,
77-5	18	AKAW5100, GW322*, GW538, GW543, HD2932, HD3369, HD3470, HI1674, HS562, JKW261*, K2108, MACS6768*, MP1378*, NWS2222, RAJ4083, UAS446*, UAS3023, UP3111
77-9	12	CG1040, DBW252, DBW303, DBW370, DBW398, DBW441, DBW442, GW542, HI8841, MACS3949*, UAS3020, WH1306,
104-2	10	DBW187*, DBW296, DBW380, HD3090*, HD3471, HS692*, PBW893, UAS481, VL907*, VL3028*
Total	**58**	
* Different seed lot to that of previous cropping season		

Stripe rust

Thirty-two lines showed APR to different tested pathotypes of stripe rust pathogen (Table 2.3). Among these, three lines (GW542, HD3428, and MACS6814)possessed APR to three major pathotypes of *P. striiformis* in India. Fifteen lines had APR to 110S119. Four entries K1317(C)*, PBW887, PBW893, VL2041(I)(C) possessed APR to both 110S119 and 238S119 (Table 2.3). DBW370(I)(C) had combined APR to 110S119 and 46S119 while DBW296(C) APR to238S119 and 46S119.

Table 2.3. Race specific adult plant resistance (APR) response in AVT lines to virulent pathotypes of *Puccinia striiformis* f. sp. *tritici* during 2022-23

APR to pathotype	**No. of lines**	**Detail**
238S119, 110S119 and 46S119	03	GW542, HD3428, MACS6814
238S119 and 110S119	04	K1317(C)*, PBW887, PBW893, VL2041(I)(C)
110S119 and 46S119	01	DBW370(I)(C)

238S119 and 46S119	01	DBW296(C)
238S119	04	AKAW5104, HS691, JKW261(C), MP3556
10S119	15	AKAW5314, DBW173(C)*, DBW372(I)(C), DBW380, HD2967(C), HD3086(C), HD3171, HI1612(C), HI1633(C)*, HI1674, LOK79, MP1388, RAJ4083(C), UAS446(d)(C), VL892(C)
46S119	04	DBW394, HD3059(C), HI1673, MP3288(C)
Total	**32**	
* Different seed lot to that of previous cropping season		

Stem rust

Combined APR to both the pathotypes of *P. graminis* f. sp. *tritici*was recorded in MACS6805. Seven entries {HI1654(I)(C), HD3249(C)*, DBW252(C), NWS2194, MACS6809, DBW394, DBW187(C)}had APR to pathotype 11. While, APR to pathotype 40A was observed in five entries (HD3471, HI1669, PBW891, GW542, and WH1310) (Table 2.4).

Table 2.4. Race specific adult plant resistance to the predominant and virulent pathotypes *Puccinia graminis tritici* in wheat lines of AVT during 2022-23

APR to Pathotype	No. of lines	Wheat Lines
11 and 40A	01	MACS6805
11	07	HI1654(I)(C), HD3249(C)*, DBW252(C), NWS2194, MACS6809, DBW394, DBW187(C)
40A	05	HD3471, HI1669, PBW891, GW542, WH1310
Total	**13**	
* Different seed lot to that of previous cropping season		

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 2022-23.

S. No.	Entries	Stem rust						Leaf rust			Yellow rust				
		Pune		**Indore**		**Mahabaleshwar**		**Delhi**	**Ludhiana**		**Delhi**			**Ludhiana**	
		40A	**117-6**	**11**	**40A**	**11**	**40A**	**77-5**	**77-9**	**77-5**	**238S119**	**46S119**	**110S119**	**238S119**	**110S119**
1	HS691	5R	10MS	40S	5MS	10MS	R	5MR	60S	20S	10S	0	5S	5MS	40MS
2	HS692	20MR	10MS	30S	20MS	20MS	5MR	0	40S	10S	5MS	0	5S	5MS	5MS
3	VL3028	5MS	5S	30S	10MR	10MS	5MR	0	0	5S	5MR	5MR	TR	10MS	0
4	HPW484	5MS	5S	20MS	10S	20MS	R	5MR	60S	20S	5MR	0	0	0	0
5	VL907(C)	0	0	20MS	20MR	20MS	R	0	0	10S	TR	0	0	10MS	0
6	VL892(C)	10MS	0	10MS	5MR	20S	20MR	TR	10S	10S	5MS	0	0	0	10S
7	HPW349(C)	15S	30S	10S	10MS	10S	R	0	10S	TS	5MS	0	5MR	10S	5MS
8	HS562(C)	10S	30S	20MR	5MR	10MR	R	5MS	40S	20S	5MS	5MR	5MR	20MS	10S
9	VL2041(I)(C)	0	5MR	20MS	5MR	10S	5MS	TR	20S	5S	10S	0	5S	5S	10S
10	PBW887	0	5S	20MR	5MR	R	R	TR	40S	TS	5MR	0	0	10S	5MS
11	PBW889	5MR	10MS	40S	10S	20MR	5MS	0	0	0	20S	0	10S	0	0
12	HD3386	0	5MR	10MS	5MR	R	R	0	0	20S	5MR	0	TR	0	5S
13	HD3470	20S	60S	10MS	5MR	20S	R	5MS	40S	40S	20S	0	20S	10S	10S
14	HI1668	10S	20MS	10MS	10MR	R	R	0	0	0	TR	0	0	5S	5MS
15	DBW386	0	10MR	5MR	5R	10MR	R	0	0	0	5MS	0	0	0	0
16	UP3102	0	0	40S	10S	10S	R	5MR	5S	10S	0	20S	0	60MS	40S
17	HD3428	5S	0	40S	10MS	10S	10MS	0	0	TS	0	0	0	0	5MS
18	PBW893	20MS	10S	40S	10R	20MR	R	0	10S	5S	0	0	0	0	5MS
19	K2108	5S	5S	20MR	10MR	R	R	TR	60S	20S	TR	0	0	10MS	5MS
20	HD3059(C)	0	5MS	10MR	20MR	R	R	TR	0	0	TR	0	0	20S	20S
21	DBW173(C)	0	0	40S	TMS	R	10S	0	10S	5S	TR	0	0	5S	10MS
22	PBW771(C)	0	5MS	20MR	20MR	5MR	R	10S	0	0	0	0	0	0	0
23	JKW261(C)	5S	20S	10MR	TR	R	5MS	5MR	10S	5MS	5MR	0	0	20S	40S
24	WH1402	10S	10MR	40S	10MS	5MS	R	10S	60S	10S	0	5MS	0	10MS	10MS
25	WH1311	0	20MR	20MS	30MR	R	5MS	5MS	5S	10S	0	5MS	0	10MS	5MS
26	UP3111	15MS	10MS	20S	10S	10MR	R	0	0	TMS	0	5MS	0	40S	40S
27	PBW899	0	20MR	10MS	5MS	R	R	10MS	40S	20S	0	0	0	20S	5MS
28	PBW644(C)	10S	10MR	10MS	5S	10MS	R	0	0	0	10MS	5MS	5MS	10S	40S
29	DBW296(C)	0	20MS	20MS	10MS	R	10S	10MS	40S	10-20S	0	0	0	0	10MS
30	HD3369(I)(C)	10S	40S	5R	5R	R	20MS	10MS	0	10S	0	0	0	5MS	0

31	HI1653(I)(C)	10MR	20S	20MS	10MR	R	R	5MR	20S	40S	5R	5MS	0	0	0
32	HI1654(I)(C)	0	10MS	5MR	0	R	20MR	0	40S	40S	0	0	0	20MS	5S
33	HD3388	5MR	10S	20MS	20MR	R	5MS	0	60S	20S	5MS	0	0	5MS	0
34	HD3471	10MS	20S	40S	20MS	10MS	10S	5MR	60S	60S	10MS	5MS	0	5MR	5MS
35	HD3249(C)	10S	30MS	20S	5MR	5S	5MS	0	10S	5S	0	0	0	10MS	5MS
36	HD3086(C)	20S	60S	20MS	10MS	5S	20MS	5MS	0	0	0	0	0	5S	5S
37	HD2967(C)	0	10MS	10MR	0	R	R	0	0	0	60S	0	40S	20S	0
38	DBW222(C)	0	10MS	20MR	TMR	R	R	0	0	0	0	0	0	20S	0
39	PBW826(I)(C)	0	5MS	20MR	5R	R	R	0	40S	20S	5R	0	0	10S	0
40	DBW398	5MR	10MR	20S	5R	20MS	20MR	5MS	40S	20S	5MR	0	TR	5S	5MS
41	HI1612(C)	5MR	40S	40S	10MS	5MR	R	10MR	0	5MS	0	5S	0	5MS	5MS
42	K1317(C)	5MR	30MR	20S	10MS	5S	R	10MR	0	0	0	5S	0	40S	20S
43	HD3171(C)	0	20MS	40S	10S	R	R	10MS	10S	10S	10MS	0	5S	20S	5MS
44	HD3293(C)	0	10MS	40S	10S	20MS	R	10MS	0	TMS	0	10S	0	10MS	5S
45	DBW252(C)	0	5MR	20MR	10MR	R	R	5MS	10S	20S	5MS	0	0	5MS	0
46	NWS2194	0	10MS	10MR	5R	R	R	5MR	0	0	40S	10S	20S	20S	10MS
47	HI1669	5MS	5MS	40S	20S	10MR	R	5MR	0	0	40S	0	20S	20S	0
48	HI1670	0	20MS	20MS	10MS	10S	10MR	0	5S	5S	60S	5R	40S	20S	0
49	GW547	0	20MR	10MS	5MR	10S	20MR	0	40S	20S	40S	5S	40S	10MS	20MS
50	GW513(C)	0	20MR	20S	20MR	5S	10MS	5MR	20S	5S	80S	0	60S	20S	5MS
51	HI1636 (C)	5S	20MR	20MS	20MR	10S	10MS	10MR	0	0	40S	0	40S	20S	5S
52	HI1650(I)(C)	5S	10MR	10MR	5R	20S	R	5MS	5S	0	10MR	10S	5MR	20MS	5MS
53	MACS6768(I)(C)	10MR	20MR	20MS	10MS	10MS	R	5MS	60S	10S	80S	10S	60S	60S	10MS
54	HI1674	10MS	10MR	20MS	5MR	5MR	R	5MR	40S	20S	60S	10S	60S	40S	20MS
55	AKAW5104	5MR	10MR	40S	20MS	R	TMR	0	60S	10S	60S	10S	40S	20MS	10MS
56	HD2932(C)	10S	30MS	20MS	10MR	10MR	5MS	20MS	40S	10S	80S	10S	60S	10S	10S
57	MP4010(C)	10MS	20MS	10MR	TMS	5MS	R	20S	0	0	60S	20S	60S	40S	40S
58	HI1634(C)	10S	10MR	20MS	20MR	10S	10MS	0	0	0	80S	20S	60S	40S	40MS
59	CG1029(C)	10S	10MR	40S	10MR	20MS	R	10MR	40S	TS	40S	10S	40S	40S	60S
60	DBW359	10S	10MS	10MS	0	10MR	R	0	40S	5S	TR	0	0	10S	10S
61	DBW441	0	10MR	20S	5MS	10S	R	10S	10S	10S	60S	10S	40S	10S	5MS
62	DBW442	0	20MS	20S	5S	R	10MS	10S	0	5S	40S	20S	40S	20MS	10S
63	CG1040	10S	10MR	20MS	5R	10S	5MS	10S	10S	5MS	60S	20S	40S	40S	20MS
64	MP3288(C)	10S	10MR	40S	20MR	R	20MS	5MS	0	0	60S	10S	60S	40S	20MS
65	DBW110(C)	0	20MR	10MR	5MR	5MS	R	5S	20S	40S	60S	0	40S	40S	5MS
66	CG1036(I)(C)	5R	0	20MS	5MS	10S	R	10MS	60S	80S	80S	0	60S	10S	5S
67	HI1655(I)(C)	0	10MS	20MS	5MS	5MS	10MR	5MR	0	5MS	40S	0	40S	10S	TS

68	UAS3020	10MR	30S	20MS	5MS	20MR	5S	10S	0	0	5R	5S	0	5MS	20MS
69	UAS3021	0	10MS	20MS	TS	R	R	0	0	0	5MR	0	0	5MS	5S
70	MACS6811	5MR	10MS	10MR	10MR	R	10MR	20MS	40S	0	5R	20S	0	40S	40S
71	MACS6809	0	5MS	5R	5MR	R	R	10MS	0	0	40S	40S	40S	60S	40S
72	NIAW4183	0	5MS	10MR	10MR	R	R	0	0	0	80S	60S	60S	60S	60S
73	NIAW4153	0	5MS	5MR	10MR	R	R	5MS	40S	10S	80S	10S	80S	10MS	5MS
74	AKAW5314	10MS	20MS	20MS	0	R	R	10MS	0	0	60S	40S	60S	60S	60S
75	AKAW5100	0	10MS	20MS	5MR	R	R	0	40S	0	40S	20S	40S	60S	40S
76	MP1378	0	10MR	30MS	5MR	10MR	R	10MS	10S	0	60S	60S	60S	60S	60S
77	MP1386	20S	60S	10MR	10MR	5MR	10MR	20MS	20S	10-20S	80S	60S	60S	40S	40S
78	DBW443	0	5MS	10MR	10MR	R	R	0	0	0	TR	40S	0	40S	40S
79	DBW444	10MS	0	10MR	20MR	R	10MR	0	0	0	0	40S	0	60S	60S
80	HD3469	0	0	20S	5R	R	R	5MS	0	0	TR	0	0	10S	0
81	NWS2222	0	5MR	20MS	5R	20S	R	0	60S	20S	20S	10MS	20S	40S	10S
82	PWU15	5MR	10MR	20MR	0	10S	R	10MS	0	0	90S	60S	80S	20S	40S
83	WH1306	TS	5MR	40S	20MR	R	10S	5MS	20S	0	0	40S	0	60S	60S
84	PBW891	TMR	5MR	20MR	30MR	5S	10MS	5MR	40S	20S	60S	40S	60S	40S	40S
85	HI8841(d)	TMR	5MR	10R	5R	20S	20MS	20MS	10MS	5S	20S	0	20S	5MS	20MS
86	UP3083	10MS	10MR	20MS	20MR	R	R	0	60S	5S	0	20S	0	40S	40S
87	MACS3949(d)(C)	0	10MS	20MR	5R	10S	10MR	5MS	60S	20S	0	20S	0	20MS	10MS
88	HI8826(d)(I)(C)	0	10MR	10R	10MR	R	R	5MR	0	0	5MR	60S	0	5MS	5MS
89	MACS4100(d)(I)(C)	15S	40S	10MS	5MR	R	R	10MR	20S	0	10MR	40S	5MR	TS	TS
90	MACS6222 (C)	0	10MR	10MR	10MR	10MR	R	10S	0	0	10S	60S	0	60S	60S
91	HI1672	0	10S	10MR	20MR	R	R	5MR	0	0	80S	80S	60S	60S	60S
92	HI1673	0	10S	10MR	10MR	R	R	0	0	0	80S	40S	80S	40S	60S
93	HI1675	5S	5MS	10MR	20MR	R	10MS	5MR	0	0	80S	60S	80S	60S	40S
94	DBW394	0	10MS	20MR	20MR	5MR	R	0	0	0	40S	0	40S	20S	10MS
95	DBW395	0	10S	20MS	20MR	20MS	R	0	10S	20S	40S	5S	40S	10MS	5MS
96	MACS6814	0	20MR	20S	5MR	R	TMR	10MR	10S	5S	5S	5S	0	5MS	5MR
97	MACS6805	30S	20MS	20S	20MR	10MS	R	5MR	40S	10S	5S	40S	0	60S	60S
98	NIAW4114	5MR	10MR	30S	10MS	10S	R	5MS	20S	TS	90S	80S	80S	60S	60S
99	NIAW4120	5MR	10MR	20MR	20MR	R	TMR	0	0	0	90S	60S	80S	40S	40S
100	UAS3022	0	20S	20MS	10MR	20MS	R	0	0	0	0	5MS	0	10MS	20MS
101	UAS3023	10S	30S	20S	5R	5MS	R	10MS	40S	10S	5MS	20S	0	40MS	40S
102	MP3557	20S	30S	20MS	10MR	10S	10S	5MS	40S	20S	5MS	40S	0	60S	40S
103	MP3556	0	20MR	20MS	5R	10S	R	5MS	10S	5MS	0	0	0	5MS	5MS
104	PBW897	0	10MR	30MR	20MR	5MR	R	0	0	0	5MS	5S	0	10S	5MS

105	MP1388	10S	10MS	40S	20MS	10S	R	5MS	40S	20S	80S	5S	80S	10MS	10S
106	GW542	5MS	10MR	30S	5R	20S	R	5MS	10S	0	80S	5S	80S	10MS	5S
107	GW538	10MS	10MR	20MS	5MS	10S	R	5MS	20S	40S	10MR	0	5MR	10S	5S
108	WH1310	0	0	20MS	20MR	20MS	5S	0	20S	0	10S	0	10S	0	0
109	LOK79	0	0	10MR	0	20S	R	5MR	0	0	90S	0	80S	10S	5S
110	RAJ4083(C)	10S	10MS	20MR	0	10S	R	0	10S	0	40S	5S	40S	10S	0
111	HD3090(C)	0	0	20S	20MR	R	R	5MR	40S	40S	60S	10S	40S	10S	5MS
112	HI1633(C)	0	0	40S	10S	5S	R	0	60S	20S	40S	10S	40S	5MS	5MS
113	UAS478(d)	20MS	30S	60S	10S	5MS	10MS	5MS	0	10S	5MS	10S	0	0	10MS
114	UAS481(d)	10MS	10MR	20MS	20MR	TMS	R	10MS	0	0	TR	0	0	0	0
115	HI1665	0	0	40S	20MR	R	R	5MR	0	0	80S	0	60S	5MS	0
116	HI8840(d)	5MS	20MR	40S	20MR	R	20S	5MR	0	0	5R	0	0	5MS	0
117	DBW397	0	5MR	40S	10MS	R	5S	0	10S	10S	0	0	0	10MS	0
118	DDW61(d)	10S	20S	60S	10MR	10MR	10S	10S	0	0	TR	0	0	0	0
119	NIAW4028	0	0	40S	40S	R	R	0	0	0	80S	0	60S	10S	5MS
120	HI1605(C)	0	0	40S	5R	10S	R	20S	40S	20S	20S	0	10S	10MS	20S
121	NIAW3170(C)	10S	30MR	20MS	5R	5S	5S	10MR	10S	20S	0	10S	0	20S	5MS
122	UAS446(d)(C)	0	20MS	20MS	TR	10MR	5S	5MR	40S	10S	0	5S	0	5MS	5MS
123	NIDW1149(d)(C)	0	20MR	20S	5MR	R	R	5S	10S	5S	0	5S	5MR	40S	5MS
124	DBW380	0	10MR	20MR	10MR	R	R	0	0	0	0	0	TR	0	5MS
125	DBW370(I)(C)	5MS	5MR	20S	TMR	20MS	5S	0	10S	10S	10MS	5S	5MS	10MS	5MS
126	DBW371(I)(C)	10MS	5S	20S	30S	10MR	20S	0	60S	80S	10S	0	5MS	10MS	5MS
127	DBW372(I)(C)	5S	10MR	20MR	TMR	10S	20S	5MR	0	0	20S	0	10S	10MS	5MS
128	PBW872(I)(C)	5S	5MR	20S	5MS	10MR	R	0	20S	10S	TR	10S	0	10MS	20-40S
129	DBW377	5S	5MS	20S	0	10MS	20MS	0	20S	20S	0	5S	0	5MS	40S
130	CG1044	0	5MR	20S	10MS	20S	10S	5MR	40S	40S	40S	5S	20S	10S	20S
131	GW543	5MS	5MR	20S	0	20S	R	0	5S	10S	20S	5S	10S	20S	40S
132	DBW187(C)	0	5MR	20S	TMS	10S	R	0	40S	40S	0	0	0	10MS	5S
133	DBW303(C)	0	5MR	5MR	0	R	R	5MR	5S	5S	5MR	20S	0	10MS	20MS
134	GW322(C)	5MR	5MR	10MR	0	10S	R	5MR	40S	40S	10MS	20S	5MR	40S	10MS

2.2 Identification of slow ruster lines in AVT Material 2022-23

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. Ludhiana

AUDPC	Entries
0	WH1402, HD3086(C), UAS3022
0.1 – 10	MACS3949(d)(C) , MACS4100(d)(I)(C)
10.1 – 100	WH1311, PBW771(C), UAS446(d)(C), PBW893, DBW296(C) , PBW899, NIDW1149(d)(C), HD3369(I)(C) , HS692, HS562(C)
100.1 - 200	HPW484, UAS478(d), HI1612(C), VL3028, DBW173(C), HD3388, MACS6222(C), DBW187(C), WH1306, DDW61(d), HI1654(I)(C), HI8826(d)(I)(C), WH1310, HS691, UAS481(d), UAS3020, HD3471, HD3249(C), HI8840(d), UP3111, HI1653(I)(C), HD3293(C), MACS6814, MACS6805, HPW349(C), DBW386, HD3428 and HI8841(d)

B. Durgapura

AUDPC	Entries
0	WH1402, WH1311, VL907(C), VL3028, PWU15, PBW893, HS691, HI8841(d), HI1612(C), DBW296(C) , DBW173(C)
0.1 – 10	UP3111, PBW899, HS562(C), HPW349(C), HI1654(I)(C), HD3471, HD3388, HD3369(I)(C), HD3086(C), DBW377, NIDW1149(d)(C) , MP3556, HI1655(I)(C)
10.1 – 100	MACS3949(d)(C), HPW484, HI1668, HI1653(I)(C), HD3386, HD3293(C), HD3249(C), DBW398, DBW303(C), NIAW3170(C), K1317(C), HI8840(d), HI8826(d)(I)(C), DBW370(I)(C), DBW359 , PBW872(I)(C), MP3557, DDW61(d), VL892(C), UP3102, PBW889, PBW771(C), DBW187(C), UAS481(d), UAS3023,

	PBW891, PBW887, PBW644(C), MACS6814, MACS4100(d)(I)(C), K2108, JKW261(C), HI1650(I)(C), HD3428, GW547, DBW443, DBW386, DBW252(C), CG1029(C), DBW380, HS692, WH1310, UP3083, UAS478(d), UAS446(d)(C), UAS3020, PBW826(I)(C)
100.1 - 200	UAS3021, DBW371(I)(C), CG1036(I)(C)

Leaf Rust

A. Mahabaleshwar

AUDPC	**Entries**
0	NIL
0.1 – 10	HS692, HD3428, K2108, DBW173(C), JKW261(C), HD3388, DBW252(C) , HI1669, HI1636 (C), HI1655(I)(C), MACS6809, MP1378, DBW443, HI8826(d)(I)(C), HI1675, GW538, WH1310, HI1665, DBW380, GW547, HI1650(I)(C), CG1029(C), DBW371(I)(C), HS691, HI1670, NIAW4183 , NIAW4153, HD3090(C), HI1633(C), NIAW4028, DBW370(I)(C), UAS446(d)(C) , NIAW4120, HI8841(d), GW513(C), UAS3022, DBW222(C), NIDW1149(d)(C), HI1674, PBW889
10.1 – 100	HPW349(C), MP3288(C), DBW397, PBW893, DBW303(C) , MACS6814 , HD3471, UAS3021, PBW887, DBW296(C), HI1654(I)(C), UP3083, HI1612(C), NWS2222, HD3369(I)(C), G1036(I)(C), HI1672, NIAW4114, RAJ4083(C), DBW394, HD3249(C), MACS6768(I)(C), VL907(C), VL892(C), HD3059(C), HI1653(I)(C), HD2967(C), DDW61(d), AKAW5104, DBW377, UAS3020, PWU15, HD3386, VL2041(I)(C) , AKAW5314, AKAW5100, PBW891, HI1673, PBW897, LOK79, UAS478(d), UAS481(d), NWS2194, UP3102, K1317(C), MACS6222 (C), MACS6805, DBW444, DBW359, HPW484, HI1634(C) , DBW372(I)(C), VL3028
100.1 - 200	HI1668, DBW398, PBW899, DBW110(C), DBW395, PBW771(C), WH1311, UP3111, PBW826(I)(C), HD3293(C), MACS6811, MP1388, HI8840(d), PBW872(I)(C) , GW543, WH1306, UAS3023, WH1402, PBW644(C), HD2932(C), DBW441, DBW386, DBW187(C), HD3086(C), DBW442, HS562(C), HD3470, CG1040, MP3557, MP3556, GW542, HI1605(C), NIAW3170(C), CG1044, MACS4100(d)(I)(C)

B. Ayodhya

AUDPC	**Entries**
0	VL907(C), VL892(C), VL2041(I)(C), PBW887, PBW889, HD3470, PBW893, PBW899, HD3249(C), DBW222(C), K1317(C),HD3171(C), NWS2194, HI1669, HI1670, HI1636 (C), HI1650(I)(C), MACS6768(I)(C), HI1674 , HI1634(C), CG1029(C), CG1040, MP3288(C), HI1655(I)(C), UAS3021, MACS6811, MACS6809,NIAW4183, NIAW4153, AKAW5314, AKAW5100, MP1378, DBW444, PWU15, PBW891, HI8841(d), MACS3949(d)(C), HI8826(d)(I)(C), MACS4100(d)(I)(C), MACS6222 (C), HI1672, HI1673, HI1675, MACS6814, MACS6805, NIAW4114, NIAW4120, UAS3022, PBW897, GW542, GW538, WH1310, LOK79, HD3090(C), HI1633(C), UAS478(d), UAS481(d), HI1665, DBW397, DDW61(d), NIAW4028, NIAW3170(C), NIDW1149(d)(C), DBW380, DBW370(I)(C), DBW371(I)(C), DBW372(I)(C), PBW872(I)(C), CG1044, DBW187(C), GW322(C)
0.1 – 10	DBW394 , VL3028, PBW771(C), WH1311, UAS3020, MP1386, DBW303(C), HPW349(C), GW547, GW513(C), DBW110(C) , CG1036(I)(C) , WH1306, UP3083, HD3369(I)(C), HI8840(d), DBW252(C)
10.1 – 100	HD3428,HD2932(C), DBW443,UAS446(d)(C), DBW377,HI1668, HD3059(C) , HPW484, HD3386 , K2108, DBW173(C), HS691, WH1402, AKAW5104, HS692, HS562(C), HI1653(I)(C), MP1388, HD3086(C), DBW359, GW543, HI1605(C), PBW644(C), HD3388, MP3556, HI1654(I)(C), HD3293(C), DBW441, DBW395,JKW261(C),UP3111,DBW398,HD2967(C), HI1612(C), RAJ4083(C)
100.1 - 200	UP3102, MP3557, DBW296(C), DBW386, HD3471, DBW442, UAS3023, MP4010(C)

Stem Rust

A. Indore

AUDPC	Entries
0	Nil
0.1 – 10	HI1654(I)(C), VL2041(I)(C), UP3083, MP3556, NIAW4028, PBW889, DBW187(C), DBW303(C)
10.1 – 100	DBW443, WH1306, PBW891, DBW395, DBW377,GW543, VL3028,VL892(C), HD3249(C), DBW359, HI1655(I)(C), AKAW5100, DBW394, DBW397, NWS2194, MP3557, DBW386, HI1633(C), HPW484, HD2967(C), HD3386, HI1668, HI1653(I)(C), DBW222(C), GW547, NIAW4120, HD3471, HD3428, HS691, K2108, DBW296(C), HD3369(I)(C) , HD3171(C) , CG1029(C) , DBW441, DBW110(C), CG1036(I)(C), UAS3021, DBW444, HI1675, NIAW4114, HI1665, PBW872(I)(C), GW322(C), HD3059(C), DBW173(C), PBW887, MACS6814, DBW442, PWU15,GW542, RAJ4083(C), HI8840(d), NIAW3170(C), HI1634(C), UAS3020, NIAW4153, MP1378, HD3090(C), DBW372(I)(C), PBW644(C), HI1669, LOK79, K1317(C), PBW893, GW513(C), WH1311, HI1670, NIAW4183, MP1388, GW538, HS692, PBW771(C), HD3388,PBW826(I)(C), DBW252(C), HI1674, AKAW5314, HI1673, MACS6805, UAS481(d), UAS446(d)(C), NIDW1149(d)(C), CG1044, UP3111, MP3288(C), JKW261(C), HI1612(C), VL907(C), HD3470, WH1402, CG1040, PBW897
100.1 - 200	UP3102, HD3469, WH1310, DBW371(I)(C), HD3293(C), DBW380, HS562(C), NWS2222, MACS6222 (C), HI8826(d)(I)(C), AKAW5104, MP4010(C), DBW398, HI1650(I)(C), MACS6768(I)(C), HI8841(d), HI1672,HPW349(C), MACS6809

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AUDPC	
0	Nil
0.1 – 10	DBW173(C), GW547, HI1655(I)(C), HI8826(d)(I)(C), K2108, HI1665, NIAW4028
10.1 – 100	HI1650(I)(C), HS691, MP1378, NIAW4153, DBW443, DBW444, HI1675, NIAW4120, VL907(C) , CG1029(C) , HI1674 , NIAW4183, HI1672, HI1633(C), HI8841(d), MACS6222 (C), NIAW4114, GW538, HD3090(C), AKAW5100, GW513(C), HD3059(C), HI1654(I)(C), DBW222(C), PBW826(I)(C), DBW252(C), HI1669, HI1670, HI1636(C), MACS6809, DBW395, NIDW1149(d)(C), HS692, HI1634(C), MP3288(C), CG1036(I)(C), HI1673, MP1388, LOK79, HD3388, DBW398, DBW397, DBW371(I)(C) , DBW372(I)(C), GW543
100.1 - 200	MACS3949(d)(C), UAS3022, DBW296(C), PBW891, HI1605(C), PBW771(C), PBW899, HD2967(C), WH1310, DBW370(I)(C), HD3428, UP3111, DBW386, HD3293(C), NWS2222, PWU15, MACS6814, PBW897, GW542, RAJ4083(C), DBW380,PBW872(I)(C), GW322(C), PBW644(C), HD3369(I)(C), UAS446(d)(C), MP3557, CG1044

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

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To know the rust resistance, more than 8500 lines of wheat and barley were evaluated at seedling stage during 2022-23. Among these, 286 lines including 134 of AVT were subjected to multipathotype screening under controlled light and temperature conditions. Seedling rust resistance remains effective throughout the life of wheat plants. AVT lines of wheat were screened at seedling stage against 60 pathotypes of three species of *Puccinia* on wheat were used for screening. Fifteen pathotypes of stripe rust, 23 of leaf rust, and 22 pathotypes of stem rust pathogens, which are most virulent and predominant, were used for evaluation of AVT lines.

Rust Resistant Lines

The detail of wheat lines showing resistance to one or the other rusts is given below. Three AVT entries (DBW222*, DBW386, and HI1665*) were resistant to all the pathotypes of *P. graminis tritici*, *P. triticina* and *P. striiformis*. Resistance to black and brown rusts was observed in nine entries while resistance to brown & yellow, and black & yellow was recorded in three entries. Eighteen lines were found resistant to leaf rust whereas 19 to stem rust pathotypes. Fifteen entries conferred resistance only to yellow rust pathotypes, while, nine and ten entries were resistant to all the pathotypes of brown and black rusts, respectively (Table 2.6).

Table 2.6. Rust resistant wheat lines in AVT lines

Rusts	No. of lines	Detail of lines
Brown, Black and Yellow	03	DBW222*, DBW386, HI1665*
Brown and Black	09	DBW394, DBW444, HI1673, HI1675, HI8826*, MACS6222, NIAW4120, PBW897, PWU15
Brown and Yellow	03	DDW61, HI1636, PBW889
Black and Yellow	03	HD3386*, PBW771*, UAS481
Brown only	09	DBW443, HD2967*, HD3059*, HI1634, HI1668, HI1672, LOK79, MP3288, NWS2194*
Black only	10	CG1040, DBW303, DBW377, DBW380, MACS6814, MP1378*, NIAW4183, PBW887, PBW899, UAS3022
Yellow only	15	CG1036, DBW110*, DBW252*, DBW397, GW538, HD3388*, HD3469, HI1653*, HI1669, HI1670, HI8841, HPW484*, NIAW4028, PBW826*, WH1310

* Different seed lot to that of previous cropping season

***Yr* genes**

Among the 134 lines of AVT, *Yr* genes were characterized in 78 lines. *Yr* genes were postulated in lines where differential interactions were observed and in other cases tight linkage of *Yr*genesto other *Lr* and *Sr* genes also facilitated the inference for the presence of a resistance gene. Three*Yr* genes viz. *Yr2*, *Yr9*, and *YrA* contributed to yellow rust resistance in Indian wheat material. Among the postulated*Yr* genes *Yr2* was most common and characterized in 62 lines. *Yr9*and *YrA* were postulated in 10 and 08 entries, respectively, whereas their combined presence was postulated in two AVT entries (HI1668 and K2108) (Table 2.7).

Table 2.7 *Yr* genes in AVTlines during 2022-23

***Yr*-gene**	**No. of Lines**	**Details of Lines**
Yr2+	62	CG1029(C), CG1044, DBW173(C)*, DBW187(C), DBW296(C), DBW303(C), DBW359, DBW372(I)(C), DBW377, DBW398,

		DBW442, DBW444, GW513(C), GW542, GW543, GW547, HD2967(C), HD3086(C), HD3090(C)*, HD3171(C), HD3369(I)(C), HD3428, HD3470, HD3471, HI1605(C), HI1612(C), HI1633(C)*, HI1634(C), HI1650(I)(C)*, HI1654(I)(C), HI1673, HI1674, HI8840(d), HPW349(C), HS562(C), HS692*, MACS3949(d)(C), MACS4100(d)(I)(C), MACS6222 (C), MP1378*, MP3288(C), MP3556, NIAW3170(C), NIAW4114, NIAW4120, NIDW1149(d)(C), NWS2222, PBW644(C), PBW872(I)(C), PBW893, RAJ4083(C), UAS3020, UAS3021, UAS3022, UAS446(d)(C), UAS478(d), UP3083, UP3102, VL2041(I)(C), VL3028, VL892(C), VL907(C)*
Yr9+	8	DBW443,GW322(C)*, HI1672, MACS6811, MACS6768(I)(C), MP1386,MP4010(C), NIAW4153
Yr9+A+	2	HI1668, K2108
YrA+	6	AKAW5104,AKAW5314,DBW394,PBW887, UAS3023,WH1402*
Total	**78**	

* Different seed lot to that of previous cropping season

***Sr* genes**

Thirteen stem rust resistance genes (*Sr*2, *Sr5, Sr7b, Sr8a, Sr8b, Sr9b, Sr9e, Sr11, Sr13, Sr24, Sr28, Sr30* and *Sr31*) were characterized in 93AVT lines (Table 2.8). The frequency of *Sr7b*was maximum as it was postulated in 43AVT entries followed by *Sr11*and *Sr2*, which were characterized in 25 and 24 entries, respectively. *Sr31* linked with *Lr26* and *Yr9* and conferring resistance to all the known*Pgt* pathotypes in Indian subcontinent was postulated in seven AVT entries, while *Sr24* linked to *Lr24* was characterized in three entries. Other *Sr* genes i.e. *Sr9b* &*Sr13, Sr30, Sr5, Sr8a, Sr9e* & *Sr8b*, and *Sr28*, were postulated in 20, 18, 16, 06, 03, and 1 entry, respectively. The *Sr* genes were characterized singly or in combination of up to four gens. DBW252 (C) had combination of four *Sr* genes (*Sr8a+5+11+2+*) (Table 2.8).

Table 2.8. *Sr* genes in AVT entries during 2022-23

***Sr*-genes**	**No. of Lines**	**Detail of lines**
Sr31+	07	DBW443, HI1668, HI1672, K2108, MACS6811, MP1386, NIAW4153
Sr24+2+	01	HI1636 (C)
Sr24+	02	MACS6222 (C), MP3288(C)
Sr30+8a+2+	01	PBW826(I)(C)
Sr30+5+11+	03	HPW484, VL2041(I)(C), VL3028
Sr30+5+2+	01	NIAW4028
Sr30+5+	08	AKAW5100, AKAW5314, DBW442, HD3469, PBW889, WH1306, WH1311, WH1402*
Sr30+11+	02	NWS2194, VL892(C)
Sr30+2+	01	DBW173(C)*
Sr30+	02	GW547*, NWS2222
Sr28+	01	DBW372(I)(C)
Sr8a+5+11+2+	01	DBW252(C)
Sr8a+9b+11+	01	HS562(C)
Sr8a+11+2+	01	HD2967(C)
Sr8a+2+	02	DBW371(I)(C), NIAW3170(C)
Sr8b+9e+7b+	01	DBW395
Sr8b+9e+	01	HI1669

Sr8b+13+7b+	01	AKAW5104
Sr5+9b+7b+	01	UP3102
Sr5+13+7b+	01	HD3470
Sr5+11+	01	DBW187(C)
Sr9e+7b+	01	HI8841(d)
Sr9b+13+11+	02	MP3557, UP3111
Sr9b+13+7b+	05	DBW397, DBW441, MACS6809, MP1388, UAS3020
Sr9b+11+7b+	02	MACS6805, NIAW4114
Sr9b+7b+2+	01	HI1674
Sr9b+7b+	08	CG1044, DBW359, DBW398, DDW61(d), GW538, HI1670, LOK79, PBW891
Sr13+11+7b+	02	MP3556, UAS3023
Sr13+7b+	06	DBW296(C), HD3388, HD3428, HI8840(d), PBW893, UAS3021
Sr13+2+	01	HD3293(C)
Sr13+	02	HD3369(I)(C), HI1654(I)(C)
Sr11+7b+2+	01	HD3171(C)
Sr11+2+	05	GW322(C), HD3059(C), NIDW1149(d)(C), PBW644(C), UAS446(d)(C)
Sr11+	04	HD2932(C), HI1605(C), JKW261(C) RAJ4083(C)
Sr7b+2+	08	CG1036(I)(C), HD3086(C), HD3249(C)*, HI1612(C), HPW349(C), MACS3949(d)(C), UAS478(d), WH1310
Sr7b+	05	DBW370(I)(C), GW542, GW543, HD3471, HI1653(I)(C)
Total	**93**	

* Different seed lot to that of previous cropping season

Lr genes

Eight *Lr* genes viz. *Lr1*, *Lr3*, *Lr10*, *Lr13*, *Lr23*, *Lr24*, *Lr26,* and *Lr28*were characterized in 100 AVT lines. *Lr13* was the most commonly occurring leaf rust resistance and was characterized in highest number of lines (68) followed by *Lr10* (45 lines), *Lr1* (22 lines), and *Lr23* (20 lines). *Lr24* was postulated in 03entries.*Lr26* and *Lr3* were characterized in seven and four entries, respectively. *Lr28* was postulated in three entries (HD3469, HI1669, and K1317*). Majority of the genes occurred in combinationand many of the lines have leaf rust resistance derived from 3 or more *Lr* genes (Table 2.9).

Table 2.9. *Lr* genes in AVT entries during 2022-23

***Lr*-Gene**	**No. of lines**	**Lines/Varieties**
*Lr*13+	26	AKAW5104, CG1036, CG1040, DBW187*, DBW303, DBW372*, DBW441, DBW442, HD2932, GW538, GW542, GW547*, HD3249*, HD3369, HI1605, HI1654, HPW484*, JKW261*, MP1378*, MP3557, NWS2222, RAJ4083, PBW771*, PBW887, UAS481, VL2041
*Lr*13+1+	12	DBW370, DBW377*, HD3470, HI1633*, HI8841, MACS4100, MP4010*, PBW644, PBW872*, UAS3023, UP3102, WH1402
*Lr*13+3+	1	HD3388*
*Lr*13+10+	23	DBW252, DBW359, DBW380, DBW397, DBW398, GW543, HD3090*, HD3293, HD3471, HI1670, HS692*, MACS6809, MACS6814, MP1388, NIAW4114, NIAW4183, PBW826*, PBW891, UAS446*, UAS3020, UP3111, VL892, VL3028*
Lr13+10+1+	4	AKAW5100, HI1655, HI1674, NIAW3170
Lr13+10+3+	2	HD3086, HI1653
*Lr*23+	4	GW513*, HI1612, UAS478, WH1311

*Lr*23+1+	2	DBW371, HD3428
*Lr*23+10+	7	DBW173*, HPW349, MP3556, NIDW1149, PBW893, UAS3022, WH1306
*Lr*23+10+1+	3	AKAW5314, HI8840, PBW899
*Lr*23+10+3+	1	HS562
*Lr*23+13+10+	2	DBW296, HD3171
*Lr*24+	3	HI1636, MACS6222, MP3288
*Lr*26+	3	DBW443, HI1668, HI1672
*Lr*26+1+	1	K2108
*Lr*26+10+	2	MACS6811, MP1386
*Lr*26+23+10+	1	NIAW4153
Lr28+	3	HD3469, HI1669, K1317*
Total	**100**	
* Different seed lot to that of previous cropping season		

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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 12 pathotypes of stem rust and 12 pathotypes of leaf rust. The entries found resistant in seedling resistance test are depicted in Table 2.10 as detailed below.

Pathotypes used:
Stem Rust: 11, 17, 40-1, 42B, 21-1, 117-1, 117-3, 117-6, 122, 295, 40A, and 21A2
Leaf Rust: 12-3, 12-5, 77A, 77-1, 77-2, 77-3, 77-5, 77-6, 77-8, 77-9, 104-2 and 162A

Table 2.10: Resistant entries from AVT during 2022-23 against selective pathotypes at seedling stage under glass house condition.

Stem rust	HS692, PBW887, HD3386, DBW386, K2108, HD3059(C), DBW173(C), PBW771(C), PBW899, HD3369(I)(C), HI1654(I)(C), DBW222(C), DBW398, NWS2194, HI1636 (C), MACS6768(I)(C), HI1674, AKAW5104, MACS6809, NIAW4183, DBW444, HD3469, UP3083, MACS3949(d)(C), DBW394, DBW395, UAS3022, MP3557, MP3556, WH1310, HI1665, DBW397, NIAW4028, HI1605(C), DBW372(I)(C), PBW872(I)(C), CG1044, DBW303(C), GW322(C)
Leaf rust	HPW349(C), VL2041(I)(C), PBW887, PBW889, HD3386, HI1668, HD3428, PBW893, K2108, HD3059(C), DBW173(C), JKW261(C), WH1402, PBW899, PBW644(C), HD3369(I)(C), HI1654(I)(C), HD3086(C), HD2967(C), DBW222(C), HI1612(C), K1317(C), DBW252(C), NWS2194, HI1669, HI1670, GW547, GW513(C), MP4010(C), HI1634(C), MP3288(C), UAS3020, UAS3021, MACS6809, NIAW4183, DBW443, DBW444, PWU15, HI8826(d)(I)(C),MACS6222 (C), HI1672, HI1673, HI1675, NIAW4120, UAS3022, PBW897, LOK79, RAJ4083(C), HD3090(C), HI1665, HI8840(d), DBW397, DDW61(d), NIAW4028, DBW370(I)(C), DBW371(I)(C), DBW372(I)(C), PBW872(I)(C), DBW303(C)

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PROGRAMME 3. LEAF BLIGHT

3.1. LEAF BLIGHT SCREENING NURSERY (LBSN), 2022-23

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°C. The grain yield losses may vary from 10-50%. In addition to yield losses, the quality also deteriorates depending on the level of susceptibility of a cultivar against the pathogen. Since leaf blight occurs in all the wheat growing agro-climatic zones, deployment of resistant cultivars remains the most effective strategy for the management of disease.

This nursery was planted at 13 centres listed below:

Zone	**Test locations**
NWPZ	Ludhiana, Karnal, Hisar and Pantnagar (4)
NEPZ	Ayodhya, Varanasi, RPCAU Pusa, Sabour, Kalyani, Coochbehar and Shillongani (7)
PZ	Pune and Dharwad (2)

The nursery was planted at 13 centers cited as above, the data from Dharwad and Karnal was not considered due to poor/ erratic disease development.

The entries were planted in one row each of 1m length and a row of a highly susceptible entry HD3436 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 scorescale (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.

Table 3.1 Center wise leaf blight score of different entries at hard dough growth stage 2022-23

S. No.	**Entry**	**Leaf Blight Score (00-99, dd) IIIrd (Hard dough) stage**												
		Hisar	**Ludhiana**	**Pantnagar**	**Ayodhya**	**Varanasi**	**RPCAU Pusa**	**Sabour**	**Kalyani**	**Coochbehar**	**Shillongani**	**Pune**	**Av.**	**HS**
1	HS691	24	68	35	57	79	23	57	49	24	24	49	46	79
2	HS692	35	89	45	68	89	12	57	48	34	68	49	57	89
3	VL3028	57	78	46	56	79	23	57	48	27	35	59	47	79
4	HPW484	23	11	25	67	47	34	46	49	25	24	59	35	67
5	VL907(C)	24	78	34	57	99	34	46	48	34	46	77	56	99
6	VL892(C)	36	89	45	67	79	12	46	48	36	34	79	56	89
7	HPW349(C)	23	78	24	56	78	23	57	48	38	46	79	46	79

8	HS562(C)	57	78	45	56	67	23	45	47	45	57	57	56	78
9	VL2041(I)(C)	46	89	34	57	68	12	46	48	24	57	79	46	89
10	PBW887	47	89	45	57	35	12	46	48	35	35	79	46	89
11	PBW889	67	78	56	56	78	23	56	47	26	46	57	56	78
12	HD3386	45	68	00	45	24	34	56	46	36	35	39	35	68
13	HD3470	78	89	36	56	79	23	46	46	27	68	59	57	89
14	HI1668	45	78	56	57	68	23	45	48	28	57	79	57	79
15	DBW386	46	78	34	46	57	12	45	47	23	24	79	46	79
16	UP3102	67	89	12	56	68	12	46	48	24	24	78	46	89
17	HD3428	45	78	12	46	57	12	57	46	25	24	67	45	78
18	PBW893	46	25	35	56	47	23	35	47	36	13	57	35	57
19	K2108	57	89	56	57	79	23	57	49	34	13	78	57	89
20	HD3059(C)	68	89	35	68	89	12	67	48	46	57	79	57	89
20A	Infector	78	89	67	89	89	23	78	59	67	46	99	68	99
21	DBW173(C)	35	78	46	56	89	12	67	49	25	46	97	56	97
22	PBW771(C)	47	78	12	67	89	23	56	49	26	46	79	57	89
23	JKW261(C)	45	78	45	57	79	23	56	49	35	46	77	56	79
24	WH1402	57	78	23	47	89	23	45	48	27	35	78	46	89
25	WH1311	46	89	46	56	57	34	46	48	26	46	77	56	89
26	UP3111	35	89	56	57	89	34	56	47	37	46	78	57	89
27	PBW899	45	35	12	56	59	34	56	46	23	24	77	45	77
28	PBW644(C)	57	12	13	67	24	34	56	47	27	57	57	46	67
29	DBW296(C)	45	68	34	57	78	12	67	46	46	35	77	56	78
30	HD3369(I)(C)	35	89	45	57	79	23	45	47	34	46	99	56	99
31	HI1653(I)(C)	47	89	46	68	68	34	46	48	45	57	79	57	89
32	HI1654(I)(C)	34	89	57	46	78	45	46	47	25	46	79	57	89
33	HD3388	68	89	35	68	79	23	56	49	24	57	78	57	89
34	HD3471	58	89	46	57	99	23	67	48	26	57	67	57	99
35	HD3249(C)	46	89	25	67	89	23	67	58	27	68	67	57	89
36	HD3086(C)	57	78	35	68	89	12	46	47	37	46	59	57	89
37	HD2967(C)	67	89	56	67	57	23	36	48	24	46	58	56	89
38	DBW222(C)	78	45	13	57	47	23	36	59	25	24	57	46	78
39	PBW826(I)(C)	68	57	34	57	57	23	57	46	26	35	57	46	68
40	DBW398	68	89	45	67	79	12	57	47	27	24	59	57	89
40A	Infector	78	89	78	89	99	23	78	59	67	46	99	78	99
41	HI1612(C)	47	89	35	57	78	23	56	59	23	24	79	56	89
42	K1317(C)	35	89	56	78	79	12	56	48	25	57	79	57	89
43	HD3171(C)	24	78	23	57	78	23	46	47	34	24	77	46	78
44	HD3293(C)	35	78	12	68	78	23	45	48	26	46	79	46	79
45	DBW252(C)	47	78	12	57	89	23	56	58	34	57	78	56	89
46	NWS2194	36	78	45	57	89	23	45	49	34	57	77	56	89
47	HI1669	25	89	56	78	89	23	56	57	28	46	98	57	98
48	HI1670	25	89	34	57	79	34	56	48	24	24	57	46	89
49	GW547	35	35	46	67	79	34	57	47	28	46	67	46	79
50	GW513(C)	57	89	45	56	79	34	45	49	28	35	68	57	89
51	HI1636 (C)	35	89	56	68	99	23	45	48	24	57	69	57	99
52	HI1650(I)(C)	46	89	35	78	89	23	46	47	24	24	77	56	89
53	MACS6768(I)(C)	57	68	67	56	99	34	47	47	24	35	56	56	99
54	HI1674	68	78	35	56	99	34	56	49	26	24	59	57	99
55	AKAW5104	78	89	46	68	89	23	57	58	34	24	57	57	89
56	HD2932(C)	57	89	56	67	99	45	57	59	27	35	49	57	99
57	MP4010(C)	56	89	13	56	79	23	57	47	24	35	68	46	89
58	HI1634(C)	67	89	45	56	89	23	67	48	36	24	66	56	89
59	CG1029(C)	46	78	67	67	89	23	67	47	24	24	89	56	89
60	DBW359	57	68	01	57	89	23	67	48	34	35	88	57	89
60A	**Infector**	89	89	67	79	99	12	78	58	67	46	89	68	99
61	DBW441	67	89	35	68	99	45	67	49	26	46	79	57	99
62	DBW442	57	89	56	67	99	45	67	59	25	46	89	67	99

63	CG1040	67	78	46	68	99	45	56	47	27	24	58	57	99
64	MP3288(C)	46	89	68	57	89	56	56	47	46	46	87	67	89
65	DBW110(C)	35	47	56	56	68	34	57	48	37	24	88	46	88
66	CG1036(I)(C)	46	78	34	57	79	34	67	49	23	46	89	57	89
67	HI1655(I)(C)	45	89	46	57	79	34	67	58	25	35	89	57	89
68	UAS3020	56	89	35	57	79	45	57	48	35	35	99	57	99
69	UAS3021	78	11	00	68	99	56	57	59	23	35	47	46	99
70	MACS6811	78	37	34	79	89	56	56	59	37	46	69	57	89
71	MACS6809	89	89	45	79	99	67	57	49	34	46	89	68	99
72	NIAW4183	24	89	57	78	99	67	57	49	24	46	46	57	99
73	NIAW4153	46	89	67	68	99	67	56	48	37	46	67	67	99
74	AKAW5314	67	89	23	68	89	56	45	49	38	46	88	57	89
75	AKAW5100	68	89	46	67	99	56	57	49	35	46	88	67	99
76	MP1378	78	89	48	67	79	56	57	47	36	57	88	67	89
77	MP1386	78	89	89	68	89	67	67	47	35	46	67	67	89
78	DBW443	78	89	57	68	89	56	67	47	26	57	59	68	89
79	DBW444	45	89	56	68	89	56	67	48	23	24	99	57	99
80	HD3469	56	68	00	57	89	45	67	59	26	12	58	47	89
80A	Infector	79	89	79	78	99	23	78	59	67	46	99	68	99
81	NWS2222	78	89	35	68	99	45	67	49	34	46	66	57	99
82	PWU15	79	89	45	68	89	34	56	59	38	46	77	57	89
83	WH1306	24	89	56	57	99	34	56	59	37	35	89	57	99
84	PBW891	78	89	57	78	99	45	67	58	45	35	88	67	99
85	HI8841(d)	24	89	12	78	99	34	67	49	46	46	99	57	99
86	UP3083	78	57	45	56	89	45	56	48	56	35	78	57	89
87	MACS3949(d)(C)	67	45	56	67	99	67	56	49	37	12	89	57	99
88	HI8826(d)(I)(C)	78	89	01	78	99	78	67	49	56	24	69	67	99
89	MACS4100(d)(I)(C)	79	89	34	68	89	67	67	47	45	24	68	57	89
90	MACS6222 (C)	79	89	56	67	89	56	57	49	36	46	66	67	89
91	HI1672	35	89	46	57	99	45	57	49	46	12	78	57	99
92	HI1673	45	78	35	56	99	45	56	49	37	57	79	57	99
93	HI1675	45	89	57	57	89	34	56	48	45	24	99	57	99
94	DBW394	34	89	13	58	99	34	56	48	46	24	79	56	99
95	DBW395	35	89	23	57	99	56	67	48	37	24	67	57	99
96	MACS6814	37	89	34	67	89	34	56	49	24	35	69	57	89
97	MACS6805	78	89	45	57	99	34	57	48	36	35	57	57	99
98	NIAW4114	45	78	56	56	79	23	67	48	26	24	58	46	79
99	NIAW4120	56	89	35	67	99	34	67	49	27	46	58	57	99
100	UAS3022	57	89	01	78	99	56	67	49	28	13	57	57	99
100A	Infector	89	89	78	79	99	23	78	58	68	46	79	68	99
101	UAS3023	57	89	45	67	79	34	67	47	46	24	57	57	89
102	MP3557	12	89	56	57	89	23	67	48	34	35	57	56	89
103	MP3556	23	89	57	57	89	56	56	58	36	35	77	57	89
104	PBW897	58	89	12	78	79	78	56	59	36	45	79	57	89
105	MP1388	56	89	45	67	89	56	57	48	25	24	69	57	89
106	GW542	23	89	35	57	79	56	57	47	27	35	46	46	89
107	GW538	35	89	00	46	79	45	67	48	26	24	89	47	89
108	WH1310	12	78	56	47	79	56	45	49	25	12	68	46	79
109	LOK79	35	89	01	46	68	34	45	47	56	24	79	46	89
110	RAJ4083(C)	58	89	46	67	99	56	67	48	46	24	79	57	99
111	HD3090(C)	46	89	56	68	99	56	67	47	57	45	68	67	99
112	HI1633(C)	23	89	34	46	89	56	67	59	46	24	69	57	89
113	UAS478(d)	35	57	45	46	89	45	67	48	37	24	46	46	89
114	UAS481(d)	46	NG	01	57	79	45	56	47	25	35	58	46	79
115	HI1665	45	89	35	67	89	56	57	47	23	35	67	56	89
116	HI8840(d)	46	89	35	57	79	34	57	47	26	46	45	46	89
117	DBW397	35	89	45	68	89	56	67	48	24	46	79	57	89
118	DDW61(d)	45	89	34	67	99	78	67	49	26	46	89	67	99

119	NIAW4028	23	89	57	57	99	67	56	47	37	35	46	57	99
120	HI1605(C)	45	89	34	67	99	34	67	47	38	35	77	57	99
120A	Infector	79	89	68	78	99	23	78	69	78	46	79	68	99
121	NIAW3170(C)	24	89	45	46	68	34	67	49	39	46	47	47	89
122	UAS446(d)(C)	46	89	35	57	89	34	67	46	37	46	67	57	89
123	NIDW1149(d)(C)	35	89	46	46	57	23	67	47	35	35	77	46	89
124	DBW380	23	89	45	68	99	45	56	48	26	35	77	56	99
125	DBW370(I)(C)	34	89	34	67	89	45	46	48	34	35	79	56	89
126	DBW371(I)(C)	12	89	45	78	99	45	46	49	46	24	79	57	99
127	DBW372(I)(C)	46	89	56	67	99	56	57	46	26	46	79	57	99
128	PBW872(I)(C)	23	67	35	67	89	34	57	49	27	46	79	57	89
129	DBW377	34	89	13	57	99	34	46	46	26	35	47	46	99
130	CG1044	45	89	46	46	79	45	57	47	27	35	77	57	89
131	GW543	34	89	56	57	89	34	56	48	46	24	99	57	99
132	DBW187(C)	78	78	35	56	99	34	67	49	28	24	68	57	99
133	DBW303(C)	12	68	45	46	79	34	46	46	25	24	69	46	79
134	GW322(C)	13	68	24	46	68	34	45	46	34	12	99	45	99
135	VL 2041	24	57	56	35	24	23	45	46	46	13	89	45	89
136	HS 562	35	78	46	57	47	23	45	47	27	13	99	46	99
137	K 1910	45	89	35	67	79	34	46	48	36	35	99	57	99
138	PBW 838	46	89	45	67	79	34	56	47	35	35	79	57	89
139	HD 3369	23	57	34	67	79	45	45	46	37	46	79	46	79
140	UP 3062	24	78	12	78	67	34	56	46	25	46	69	46	78
140A	Infector	78	25	78	79	99	34	78	69	67	46	89	67	99
141	HD 3368	23	68	01	67	89	34	67	49	37	35	67	46	89
142	HD 3249	12	89	34	57	89	34	56	49	28	24	59	46	89
143	HD 2967	23	12	45	57	25	23	36	46	45	12	59	35	68
144	DBW 317	45	57	56	46	57	34	35	47	28	24	89	46	89
145	PBW 835	34	89	35	67	89	45	67	48	27	46	59	57	89
146	PBW 834	12	75	34	57	89	34	67	46	27	46	59	46	89
147	DBW 316	23	78	46	67	68	56	56	48	26	24	59	46	78
148	PBW 833	24	78	24	78	79	56	45	57	57	35	99	57	99
149	DBW 321	23	89	25	67	68	56	45	58	24	24	59	46	89
150	DBW 372	13	78	56	67	68	67	46	49	26	35	48	47	78
151	PBW 874	34	78	34	46	79	56	47	48	25	24	79	46	79
152	PBW 870	24	89	46	57	79	56	57	49	23	13	79	57	89
153	VL 2043	78	89	56	67	89	56	57	49	26	46	69	57	89
153A	Infector	78	89	67	79	89	45	78	69	68	46	99	78	99

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:

A. Ludhiana

AUDPC	Entries
Upto 100	Nil
101 - 500	UAS3021, HPW484, PBW644(C), HD 2967, MACS6811, PBW893, GW547, MACS3949(d)(C), PBW899, UP3083, PBW826(I)(C), HD 3369, DBW 317

B. Pantnagar

AUDPC	Entries
Upto 100	HD3386, UAS3021, HD3469, GW538, DBW359, HI8826(d)(I)(C), UAS3022, UAS481(d), HD3368, LOK79, UP3102, HD3428, PBW771(C), PBW899, HD3293(C), DBW252(C), HI8841(d), PBW897, UP3062, DBW222(C), MP4010(C), DBW394 , DBW377, PBW644(C)
101 - 500	HD3171(C) , DBW395, WH1402, AKAW5314 , HPW349(C), PBW 833, DBW 321, HPW484, HD3249(C), GW322(C), VL907(C), PBW826(I)(C), CG1036(I)(C), MACS6811, MACS4100(d)(I)(C), MACS6814, HI1633(C) , HI1605(C) , PBW 834, DDW61(d), DBW370(I)(C), HD 3369, HD 3249, PBW 874, UAS3020 , NIAW4120, GW542, K 1910, DBW386, HI1612(C), HI1670, NWS2222, PBW872(I)(C), DBW187(C) , DBW296(C), HD3470, PBW893, HD3059(C), HI1673, VL2041(I)(C), HD3388, HI1650(I)(C), HI1674, DBW441, UAS446(d)(C), PBW 835, HD3086(C), HD3369(I)(C) , GW513(C) , HI1634(C) , UAS3023, HI8840(d), AKAW5104, PWU15, MP1388, HI1665, MACS6809, HI1655(I)(C), CG1044, PBW 870, UP3083, HI1669, PBW889, PBW887, DBW303(C) , DBW397, DBW380, PBW 838, HD 2967, VL3028, NIDW1149(d)(C)

C. Ayodhya

AUDPC	Entries
Upto 100	Nil
101 - 500	VL 2041, UAS478(d)

D. Varanasi

AUDPC	Entries
Upto 100	Nil
101 - 500	HD3386, PBW644(C), VL 2041, HD 2967, PBW887

E. Sabour

AUDPC	**Entries**
Upto 100	Nil
101 - 500	DBW 317

F. Kalyani

AUDPC	Entries
Upto 100	Nil
101 - 500	NIl

G. Coochbihar

AUDPC	Entries
Upto 100	Nil
101 - 500	PBW899, HI1612(C), CG1036(I)(C) , UAS3021, DBW444, HI1665, PBW 870, HI1636 (C), HI1650(I)(C) , MACS6768(I)(C) , MP4010(C) , CG1029(C) ,NIAW4183 , MACS6814 , DBW397, K1317(C), HI1655(I)(C), UAS481(d), HD3293(C), HI1674, DBW443, HI8840(d), DDW61(d), DBW386, HD2932(C) , VL2041(I)(C) , WH1311, NWS2194, HS691, HD3388, HD2967(C), UP3102, HI1670, DBW222(C), DBW 321, HD3469, NIAW4114, UP 3062, DBW173(C), HI1654(I)(C), WH1310, DBW398,

	WH1306, DBW442, HPW484, PBW889, HD3471, PBW826(I)(C), DBW380, VL 2043, GW542, MP1388, NIAW4120, VL3028, PBW771(C), HI1669, GW547, GW513(C), DBW441, GW538, WH1402, PBW872(I)(C), DBW 316, HD3470, PBW 835, K2108, CG1040, HI1668, HD 3249, HD3171(C) , PBW644(C), UAS3022, DBW 317, DBW252(C), MP3557, HD3369(I)(C), NWS2222, MACS6809, AKAW5104, DBW372(I)(C), MP1386, HS692, AKAW5100, DBW303(C), PBW 874, DBW 372, MACS3949(d)(C), DBW377, JKW261(C), MP1378, MP3556, CG1044, PBW 834, PBW893, MACS6222(C), HD3249(C), MACS6811, DBW187(C), HS 562, HPW349(C), HI1634(C), HI1673 , NIAW4153, AKAW5314, DBW359, HS562(C), UAS3020, NIDW1149(d)(C), DBW394, HD3428, PBW897, DBW395, UAS446(d)(C), DBW110(C), UAS478(d), HD3368, NIAW4028, HI1605(C), VL907(C), NIAW3170(C), PBW887, K1910, VL892(C), HD3386, RAJ4083(C), DBW371(I)(C), GW543, GW322(C), DBW370(I)(C)

H. Shillongani

AUDPC	Entries
Upto 100	HD3469, MACS3949(d)(C), HI1672, WH1310, GW322(C), HD 2967, UAS3022, VL 2041, HS 562, PBW 870, PBW893, K2108
101 - 500	HD3171(C), GW543, DBW187(C), HD 3249, HS691, HPW484, DBW386, UP3102, PBW899, DBW222(C), DBW398, HI1612(C), HI1670,HI1650(I)(C), HI1674, AKAW5104, HI1634(C), CG1029(C), DBW110(C), HI8826(d)(I)(C), MACS4100(d)(I)(C), DBW394, DBW395, NIAW4114, UAS3023, GW538, LOK79, RAJ4083(C), UAS478(d), DBW371(I)(C), DBW 317, DBW 316, DBW321, PBW874, HD3428, DBW444, HI1675, MP1388, HI1633(C), DBW303(C), VL892(C), VL3028, MACS6814, HI1605(C), HD 3368, DBW 372, PBW887, PBW826(I)(C) , GW513(C), MACS6768(I)(C), DBW359, I1655(I)(C), UAS3020, UAS3021, PBW891, MACS6805, MP3556, NIDW1149(d)(C), DBW380, BW370(I)(C), MP3557, NIAW4028, MP3288(C), PBW833, HD3386, GW542, CG1044, CG1040, DBW377, PBW 838, HD2932(C), WH1306

I. Pune

AUDPC	Entries
Upto 100	Nil
Nil	Nil

COOPERATORS

NAME	CENTRE
SATYAJIT HEMBRAM	COOCHBEHAR
S. P. SINGH	AYODHYA
R. S. BENIWAL	HISAR
RAGHUNATH MANDAL	KALYANI
JASPAL KAUR, RITU BALA	LUDHIANA
DEEPSHIKHA	PANTNAGAR
R. CHAKRABARTY	SHILLONGANI
S.S. VAISH	VARANASI
DINESH RAI	RPCAU, PUSA
T.L. PRAKASHA	INDORE
K. K. MISHRA	POWARKHEDA
SUDHIR NAVATHE	PUNE
SUDHEER KUMAR, P.L. KASHYAP AND RAVINDRA KUMAR	KARNAL(COORDINATING UNIT)

PROGRAMME 4. KARNAL BUNT

4.1 KARNAL BUNT SCREENING NURSERY (KBSN) 2022-23

Wheat entries along with checks were evaluated for resistance to Karnal bunt at multilocations (Jammu, Ludhiana, Karnal, Hisar, New Delhi, and Pantnagar) during 2022-23 crop season under artificially inoculated conditions. To determine the response of genotypes to Karnal bunt, earheads were injected with hypodermic syringe with adequate amount of inoculum (10,000 allantoids/ml water) at crop growth stage 49. The local isolates were used at all the test centres. Five earheads were inoculated in each entry during evening hours. After inoculation, high humidity was maintained for proper development of disease. The disease incidence in the earheads was recorded at crop maturity and was calculated by reckoning the infected and the total number of grains (both diseased and healthy) of 5 ear-heads 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. The resistant entries identified are listed below:

AVTs (2022-23)

Free from infection: Nil

Resistant (average incidence upto 5%):
MACS6814, DBW441, HS692 VL3028, HI8841(d), DBW444, HD2967(C), HD3059(C), HPW 485, HD3388, HI 8840 (d), and HS691

Table 4.1: Karnal bunt incidence in KBSN entries evaluated under artificially inoculated conditions at multilocations during 2022-23

Sr. No.	Entries	Karnal bunt incidence (%)							
		Pantnagar	Karnal	Hisar	Delhi	Ludhiana	Jammu	AV	HS
1	HS691	2.6	0.0	8.3	8.0	0.0	0.0	3.1	8.3
2	HS692	4.5	0.0	9.1	12.0	0.0	3.3	4.8	12.0
3	VL3028	3.8	2.0	11.1	9.2	2.2	0.0	4.7	11.1
4	HPW484	5.0	6.3	9.6	48.8	0.0	4.2	12.3	48.8
5	VL907(C)	2.7	36.0	12.5	9.6	10.9	4.5	12.7	36.0
6	VL892(C)	3.8	10.6	8.1	47.6	0.0	5.1	12.5	47.6
7	HPW349(C)	2.0	3.6	9.6	44.9	0.0	7.1	11.2	44.9
8	HS562(C)	0.0	9.2	13.3	43.7	3.9	5.0	12.5	43.7
9	VL2041(I)(C)	3.1	0.0	12.6	65.7	4.8	3.3	14.9	65.7
10	PBW887	0.0	0.0	8.3	22.6	6.5	7.5	7.5	22.6
11	PBW889	2.7	10.6	9.6	54.1	3.9	4.1	14.2	54.1
12	HD3386	2.4	13.0	14.2	48.3	19.0	5.1	17.0	48.3
13	HD3470	4.3	16.0	12.6	70.3	3.5	4.3	18.5	70.3
14	HI1668	3.6	10.7	9.3	65.6	3.5	0.3	15.5	65.6
15	DBW386	5.1	5.0	12.8	55.8	4.8	1.3	14.1	55.8
16	UP3102	2.6	9.9	10.6	36.1	0.0	4.3	10.6	36.1
17	HD3428	4.0	3.4	18.3	17.4	0.0	6.1	8.2	18.3
18	PBW893	4.2	0.0	9.3	38.5	0.0	0.0	8.7	38.5
19	K2108	3.6	0.0	10.5	18.0	3.6	0.0	6.0	18.0
20	HD3059(C)	5.1	0.0	11.6	2.6	0.0	1.3	3.4	11.6
20A	Infector	6.6	28.6	24.0	50.0	11.1	18.3	23.1	50.0

21	DBW173(C)	3.2	6.1	12.3	39.3	0.0	0.0	10.2	39.3
22	PBW771(C)	4.0	7.4	8.1	56.1	0.0	3.3	13.2	56.1
23	JKW261(C)	0.0	3.5	6.3	16.2	0.0	8.1	5.7	16.2
24	WH1402	1.9	0.0	9.5	45.7	5.4	0.0	10.4	45.7
25	WH1311	0.0	8.3	11.3	47.0	1.5	7.3	12.6	47.0
26	UP3111	2.5	0.0	12.5	37.6	6.7	4.1	10.6	37.6
27	PBW899	2.1	10.8	10.5	13.6	4.8	5.1	7.8	13.6
28	PBW644(C)	3.9	0.0	12.6	24.2	0.0	5.1	7.6	24.2
29	DBW296(C)	4.1	8.5	8.5	21.9	0.0	8.1	8.5	21.9
30	HD3369(I)(C)	2.5	3.8	6.5	31.5	5.0	7.5	9.5	31.5
31	HI1653(I)(C)	3.4	14.0	8.3	51.8	2.8	5.2	14.2	51.8
32	HI1654(I)(C)	4.1	11.6	9.1	58.5	10.7	11.3	17.5	58.5
33	HD3388	3.4	0.0	12.5	3.8	0.0	0.0	3.3	12.5
34	HD3471	4.2	8.5	10.6	32.4	16.0	8.4	13.3	32.4
35	HD3249(C)	2.6	19.5	8.6	95.0	1.1	7.4	22.4	95.0
36	HD3086(C)	1.4	2.1	12.3	40.5	2.5	1.3	10.0	40.5
37	HD2967(C)	2.4	1.0	6.2	14.4	0.0	0.0	4.0	14.4
38	DBW222(C)	5.4	13.4	5.3	33.3	5.0	0.3	10.4	33.3
39	PBW826(I)(C)	3.5	27.8	6.5	50.4	0.7	1.3	15.0	50.4
40	DBW398	2.5	12.4	7.5	46.6	3.1	5.1	12.9	46.6
40A	Infector	6.2	14.9	25.0	60.6	17.8	16.3	23.5	60.6
41	HI1612(C)	4.6	1.7	11.3	19.5	0.0	8.4	7.6	19.5
42	K1317(C)	3.8	3.5	12.5	32.3	1.0	0.0	8.9	32.3
43	HD3171(C)	0.0	4.6	8.2	51.8	5.0	2.5	12.0	51.8
44	HD3293(C)	4.2	0.0	7.6	25.6	0.0	7.1	7.4	25.6
45	DBW252(C)	4.4	12.1	9.3	38.5	5.0	8.6	13.0	38.5
46	NWS2194	0.0	21.8	8.1	42.0	0.0	6.1	13.0	42.0
47	HI1669	3.5	9.5	11.6	47.9	2.0	0.0	12.4	47.9
48	HI1670	2.6	15.6	12.7	48.4	2.8	6.4	14.7	48.4
49	GW547	3.4	4.1	8.1	48.5	4.8	6.3	12.5	48.5
50	GW513(C)	3.0	0.0	7.5	30.9	1.1	12.3	9.1	30.9
51	HI1636 (C)	1.5	9.2	6.5	53.0	0.0	4.4	12.4	53.0
52	HI1650(I)(C)	4.2	11.1	7.3	37.9	7.4	7.1	12.5	37.9
53	MACS6768(I)(C)	0.0	0.0	8.5	67.3	6.5	0.0	13.7	67.3
54	HI1674	2.3	6.6	9.6	32.6	0.0	7.6	9.8	32.6
55	AKAW5104	4.3	0.0	12.3	44.2	0.0	3.3	10.7	44.2
56	HD2932(C)	2.4	3.9	11.5	23.2	2.0	4.1	7.8	23.2
57	MP4010(C)	3.9	2.9	6.2	22.8	1.7	3.3	6.8	22.8
58	HI1634(C)	0.0	22.5	8.3	32.0	2.5	7.6	12.2	32.0
59	CG1029(C)	0.0	12.0	11.1	48.9	2.3	5.1	13.2	48.9
60	DBW359	1.7	4.6	9.3	45.4	1.0	4.5	11.1	45.4
60A	Infector	8.3	17.1	26.6	29.3	16.7	18.4	19.4	29.3
61	DBW441	4.2	0.0	12.5	12.9	0.0	0.0	4.9	12.9
62	DBW442	2.9	25.8	10.6	34.2	11.0	2.5	14.5	34.2
63	CG1040	5.3	22.0	8.1	46.7	3.9	6.6	15.4	46.7
64	MP3288(C)	0.5	15.4	7.5	66.0	6.1	6.6	17.0	66.0
65	DBW110(C)	0.0	6.7	9.1	77.3	0.0	3.3	16.1	77.3
66	CG1036(I)(C)	4.5	1.9	11.1	58.3	0.0	5.1	13.5	58.3
67	HI1655(I)(C)	3.1	9.8	12.5	45.7	0.0	0.0	11.9	45.7
68	UAS3020	3.3	0.0	13.3	60.3	0.0	5.5	13.7	60.3
69	UAS3021	4.0	14.9	12.5	47.3	23.1	2.5	17.4	47.3
70	MACS6811	3.6	1.3	10.5	32.9	18.5	0.0	11.1	32.9
71	MACS6809	0.0	2.3	11.1	34.3	10.6	8.2	11.1	34.3

72	NIAW4183	0.0	6.7	10.5	77.0	11.1	8.6	19.0	77.0
73	NIAW4153	4.1	0.0	9.5	24.6	26.4	7.7	12.0	26.4
74	AKAW5314	4.0	0.0	11.1	50.0	8.6	13.3	14.5	50.0
75	AKAW5100	2.1	5.1	6.3	23.5	0.0	13.3	8.4	23.5
76	MP1378	0.7	2.7	6.6	33.1	0.0	6.2	8.2	33.1
77	MP1386	3.1	0.0	8.1	64.4	0.0	1.3	12.8	64.4
78	DBW443	0.0	5.8	9.5	15.7	0.0	0.0	5.2	15.7
79	DBW444	4.1	3.1	7.3	9.9	0.0	0.0	4.1	9.9
80	HD3469	2.0	17.0	11.1	36.4	4.0	15.1	14.3	36.4
80A	Infector	6.9	10.3	28.7	50.6	18.3	19.2	22.3	50.6
81	NWS2222	3.7	11.1	8.1	61.7	0.0	8.2	15.5	61.7
82	PWU15	3.3	14.3	7.3	64.6	4.7	10.5	17.5	64.6
83	WH1306	4.2	4.4	5.5	57.0	9.9	5.1	14.3	57.0
84	PBW891	2.6	0.0	9.1	31.2	8.9	7.7	9.9	31.2
85	HI8841(d)	3.1	1.4	5.3	6.0	10.9	0.0	4.4	10.9
86	UP3083	3.5	0.8	6.7	39.3	0.0	7.1	9.6	39.3
87	MACS3949(d)(C)	0.0	0.0	7.3	36.7	0.0	8.6	8.8	36.7
88	HI8826(d)(I)(C)	2.9	0.0	8.5	65.5	3.9	3.3	14.0	65.5
89	MACS4100(d)(I)(C)	4.1	0.0	11.1	26.7	1.1	4.5	7.9	26.7
90	MACS6222 (C)	5.0	0.0	10.5	37.5	0.0	1.3	9.1	37.5
91	HI1672	0.0	1.1	8.1	70.1	12.3	4.6	16.0	70.1
92	HI1673	2.7	3.0	5.0	66.7	17.9	2.1	16.2	66.7
93	HI1675	4.1	5.2	7.5	54.1	10.0	5.3	14.4	54.1
94	DBW394	3.2	0.0	6.3	58.9	3.5	0.0	12.0	58.9
95	DBW395	0.0	0.0	8.3	54.1	0.0	0.0	10.4	54.1
96	MACS6814	0.0	2.2	9.5	15.0	0.0	3.3	5.0	15.0
97	MACS6805	2.7	16.6	7.3	16.3	0.0	2.5	7.6	16.6
98	NIAW4114	2.1	3.8	6.6	55.8	1.3	0.0	11.6	55.8
99	NIAW4120	3.7	18.0	9.5	61.6	4.5	1.3	16.4	61.6
100	UAS3022	2.0	0.0	8.6	33.3	3.5	6.4	9.0	33.3
100A	Infector	7.0	6.7	22.2	50.5	18.0	18.6	20.5	50.5
101	UAS3023	0.9	2.9	7.2	56.8	0.0	2.2	11.7	56.8
102	MP3557	3.6	7.1	9.6	42.1	5.6	4.1	12.0	42.1
103	MP3556	2.0	12.2	5.3	76.7	1.5	5.6	17.2	76.7
104	PBW897	2.1	13.3	6.2	25.0	1.8	4.8	8.9	25.0
105	MP1388	4.1	6.6	5.5	31.6	2.6	3.3	8.9	31.6
106	GW542	3.0	18.5	7.5	30.9	2.8	0.0	10.5	30.9
107	GW538	2.1	9.8	5.0	57.4	6.7	0.0	13.5	57.4
108	WH1310	4.7	3.2	5.2	29.8	3.4	1.3	7.9	29.8
109	LOK79	0.0	1.1	7.3	35.0	3.1	4.1	8.4	35.0
110	RAJ4083(C)	0.0	13.1	8.3	43.0	2.1	8.2	12.4	43.0
111	HD3090(C)	1.7	25.1	7.1	48.8	5.3	7.1	15.8	48.8
112	HI1633(C)	3.3	0.0	7.3	60.3	6.1	5.1	13.7	60.3
113	UAS478(d)	2.2	1.8	8.3	26.3	6.9	4.1	8.2	26.3
114	UAS481(d)	0.0	31.6	5.0	8.3	0.0	4.0	8.2	31.6
115	HI1665	3.1	28.6	7.1	12.6	0.0	4.1	9.2	28.6
116	HI8840(d)	3.9	16.8	6.3	26.0	0.0	2.3	9.2	26.0
117	DBW397	4.1	6.3	5.3	42.8	2.8	2.5	10.6	42.8
118	DDW61(d)	2.2	3.8	7.3	31.5	8.7	7.8	10.2	31.5
119	NIAW4028	0.0	23.7	8.5	42.6	9.9	1.3	14.3	42.6
120	HI1605(C)	2.0	16.1	11.3	56.5	3.4	7.5	16.1	56.5
120A	Infector	6.9	18.1	26.6	66.7	23.1	20.1	26.9	66.7
121	NIAW3170(C)	3.6	9.4	8.3	20.2	5.2	0.0	7.8	20.2

122	UAS446(d)(C)	0.7	1.2	9.1	25.2	7.5	4.1	8.0	25.2
123	NIDW1149(d)(C)	3.6	4.2	9.5	13.5	2.4	8.2	6.9	13.5
124	DBW380	2.4	3.5	7.3	21.1	1.8	4.3	6.7	21.1
125	DBW370(I)(C)	3.8	5.1	9.5	20.6	8.4	4.3	8.6	20.6
126	DBW371(I)(C)	2.2	-	11.3	25.0	3.2	0.0	8.3	25.0
127	DBW372(I)(C)	0.0	16.7	6.6	58.8	4.7	4.1	15.2	58.8
128	PBW872(I)(C)	2.7	7.6	5.6	46.4	0.0	0.0	10.4	46.4
129	DBW377	5.0	9.9	7.3	58.3	0.0	0.0	13.4	58.3
130	CG1044	4.2	5.0	8.1	12.9	0.0	8.2	6.4	12.9
131	GW543	2.9	6.9	7.3	7.0	5.3	6.2	5.9	7.3
132	DBW187(C)	3.5	5.4	6.2	40.8	2.2	10.5	11.4	40.8
133	DBW303(C)	3.3	22.7	7.6	45.1	1.0	2.1	13.6	45.1
134	GW322(C)	0.0	18.0	5.2	64.4	5.3	0.0	15.5	64.4
135	HPW 485	3.2	3.4	6.6	4.8	0.0	2.1	3.3	6.6
136	HI 8840 (d)	0.0	0.0	8.3	5.9	0.0	0.0	2.4	8.3
137	RAJ 4565	4.1	11.5	5.0	9.4	0.0	8.2	6.4	11.5
137A	Infector	6.0	15.3	24.0	64.0	21.4	19.6	25.0	64.0

COOPERATORS

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PROGRAMME 5. LOOSE SMUT

5.1 Evaluation of AVT material (2021-22) 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 by 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 (2021-22), were inoculated with local isolates of loose smut pathogen using 'Go go' method at hot spot locations like Ludhiana, Durgapura, Almora, and Hisar. The inoculated seeds were sown again during 2022-23 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. Data from Malan centre was not received.

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, 2021-22

Free (No infection at any location): Nil

Resistant (Average score: 0.1-5.0 % infection):
DDW48(d)(C) and UAS478(d)

Table 5.1. Per cent loose smut infection in the entries of AVTs of year 2021-22 expressed during 2022-23 crop season

S. No	Entry	Loose smut incidence (%)					
		Ludhiana	Durgapura	Almora	Hisar	Av	HS
1	VL2041*	0.0	6.4	23.9	65.0	23.8	65.0
2	VL2043	0.0	2.2	6.0	45.0	13.3	45.0
3	VL2044	0.0	0.0	21.8	76.6	24.6	76.6
4	HD3402	0.0	17.6	19.1	80.0	29.2	80.0
5	HPW481	0.0	0.0	0.0	70.0	17.5	70.0
6	HPW487	8.6	16.7	34.5	86.6	36.6	86.6
7	HPW488	12.3	17.0	56.4	45.0	32.7	56.4
8	HS692	13.5	6.4	50.5	56.0	31.6	56.0
9	HS693	0.0	1.0	2.6	60.0	15.9	60.0
10	HS694	0.0	0.0	0.0	60.0	15.0	60.0
11	UP3114	10.2	0.0	11.2	50.0	17.9	50.0
12	VL3028	6.3	0.0	12.4	76.0	23.7	76.0
13	VL3029	0.0	0.0	0.0	60.0	15.0	60.0
14	VL3030	10.2	22.2	52.6	85.0	42.5	85.0
15	HPW483	7.7	13.3	1.9	75.0	24.5	75.0
16	HPW484	6.2	7.9	6.4	70.0	22.6	70.0
17	HPW485	0.0	0.0	2.3	76.0	19.6	76.0
18	HPW486	0.0	3.0	25.5	85.0	28.4	85.0
19	HS688	0.0	0.7	20.1	66.6	21.9	66.6
20	HS689	0.0	0.6	0.6	85.0	21.5	85.0
20A	Sonalika (Check)	25.6	39.3	57.5	86.6	52.2	86.6
21	HS690	0.0	0.0	9.0	25.0	8.5	25.0
22	HS691	6.9	0.0	27.8	45.0	19.9	45.0
23	SKW362	0.0	11.8	9.9	65.0	21.7	65.0

24	UP3113	3.8	3.7	2.1	35.0	11.1	35.0
25	VL2047	0.0	1.4	16.0	65.0	20.6	65.0
26	VL2048	0.0	42.3	18.5	55.0	28.9	55.0
27	VL2049	0.0	0.0	15.6	60.0	18.9	60.0
28	VL2050	0.0	0.0	0.0	70.0	17.5	70.0
29	HS507(C)	6.9	7.4	24.1	55.0	23.3	55.0
30	HS562(C)	0.0	1.4	22.8	66.0	22.5	66.0
31	HS490(C)	0.0	2.1	14.4	70.0	21.6	70.0
32	HPW349(C)	5.2	0.0	14.0	65.0	21.0	65.0
33	VL907(C)	0.0	2.2	27.8	55.0	21.2	55.0
34	VL892(C)	0.0	45.5	31.7	70.0	36.8	70.0
35	DBW377	3.8	0.0	8.9	60.0	18.2	60.0
36	PBW870	4.1	3.4	11.4	50.0	17.2	50.0
37	DBW372	6.6	18.1	0.0	60.0	21.2	60.0
38	DBW318	4.8	23.5	11.7	70.0	27.5	70.0
39	DBW327 (C)	4.1	30.7	16.5	60.0	27.8	60.0
40	DBW332(C)	7.5	3.7	NG	45.0	18.7	45.0
40A	Sonalika (Check)	21.3	38.6	66.2	80.0	51.5	80.0
41	DBW370	8.2	2.6	15.0	65.0	22.7	65.0
42	DBW371	23.1	8.3	17.0	55.0	25.9	55.0
43	DBW373	19.7	17.7	57.5	80.0	43.7	80.0
44	PBW868	22.0	3.3	59.4	75.0	39.9	75.0
45	PBW871	11.4	20.8	31.2	45.0	27.1	45.0
46	PBW872	17.9	20.1	22.8	80.0	35.2	80.0
47	HD3090(C)	8.1	17.4	26.0	65.0	29.1	65.0
48	HI1633(C)	10.3	15.3	42.8	80.0	37.1	80.0
49	RAJ4083(C)	0.0	22.5	13.6	90.0	31.5	90.0
50	DBW320#*	14.3	17.5	30.1	75.0	34.2	75.0
51	MP1380#	6.3	14.0	9.1	65.0	23.6	65.0
52	DBW407[B]	50.8	18.2	19.2	55.0	35.8	55.0
53	DDW48(d)(C)	0.0	0.0	0.0	20.0	5.0	20.0
54	HI8826(d)*	0.0	0.0	0.0	25.0	6.3	25.0
55	MACS4100(d)*	0.0	1.0	0.0	35.0	9.0	35.0
56	MP1378	0.0	0.0	43.7	25.0	17.2	43.7
57	MP3552	0.0	0.0	0.0	35.0	8.8	35.0
58	UAS3015	6.1	6.9	7.1	45.0	16.3	45.0
59	HI8839(d)	10.8	0.0	0.0	55.0	16.5	55.0
60	HI8840(d)	14.7	0.0	0.0	35.0	12.4	35.0
60A	Sonalika (Check)	43.8	47.9	65.5	86.6	60.9	86.6
61	MP1358(I)(C)	0.0	2.8	58.5	15.0	19.1	58.5
62	NIAW3922	0.0	13.8	24.0	15.0	13.2	24.0
63	NIDW1149(d)(C)	0.0	0.0	12.3	55.0	16.8	55.0
64	UAS478(d)	0.0	0.0	0.0	15.0	3.8	15.0
65	DBW352#	0.0	0.0	0.0	85.0	21.3	85.0
66	GW513(I)(C)	14.3	0.0	46.4	85.0	36.4	85.0
67	GW547[B]	14.5	0.0	0.0	75.0	22.4	75.0
68	HI1636(I)(C)	7.4	13.5	35.5	45.0	25.4	45.0
69	HI1650*	0.0	18.6	68.3	85.0	43.0	85.0
70	MACS6768*	0.0	32.7	53.4	80.0	41.5	80.0
71	MP3535*	0.0	0.0	0.0	65.0	16.3	65.0
72	NWS2194#	12.3	11.9	50.5	55.0	32.4	55.0
73	HI1665	9.7	0.0	41.4	45.0	24.0	45.0
74	NIAW4028	21.9	19.0	27.2	15.0	20.8	27.2

75	CG1036*	5.8	22.7	42.4	55.0	31.5	55.0
76	CG1040	2.2	1.7	25.0	65.0	23.5	65.0
77	DDW47(d)(C)	1.9	0.0	0.0	65.0	16.7	65.0
78	DDW55(d)^{Q}*	0.0	0.0	0.0	65.0	16.3	65.0
79	GW532	0.0	0.0	0.0	70.0	17.5	70.0
80	HD3401	0.0	0.6	17.5	80.0	24.5	80.0
80A	Sonalika (Check)	24.7	45.5	28.6	90.0	47.2	90.0
81	HI1655^{Q}*	0.0	50.0	27.2	80.0	39.3	80.0
82	HI1666	0.0	28.1	61.7	45.0	33.7	61.7
83	HI8823(d)(I)(C)	0.0	0.0	0.0	30.0	7.5	30.0
84	HI8830(d)*	0.0	0.0	0.0	65.0	16.3	65.0
85	MACS6795	0.0	0.7	33.6	65.0	24.8	65.0
86	MP1377	0.0	0.0	0.0	65.0	16.3	65.0
87	MP3288(C)	0.0	2.1	71.5	35.0	27.2	71.5
88	UAS3019	4.3	3.9	55.3	65.0	32.1	65.0
89	DBW316#*	0.0	0.0	0.0	65.0	16.3	65.0
90	HD3118(C)	5.1	20.9	24.8	75.0	31.5	75.0
91	HD3392	0.0	20.7	15.4	80.0	29.0	80.0
92	HI1621(C)	0.0	3.2	13.8	65.0	20.5	65.0
93	PBW833*	0.0	4.3	80.9	75.0	40.1	80.9
94	PBW835^{Q}*	4.3	3.7	59.1	85.0	38.0	85.0
95	HD3249(C)	3.9	2.5	0.8	65.0	18.1	65.0
96	PBW826#*	10.6	2.3	9.2	65.0	21.8	65.0
97	HD3388	0.0	0.0	33.7	80.0	28.4	80.0
98	PBW852	0.0	9.7	2.9	15.0	6.9	15.0
99	DBW252(C)	0.0	10.5	30.3	70.0	27.7	70.0
100	HD3171(C)	0.0	4.2	2.0	80.0	21.5	80.0
100A	Sonalika (Check)	27.7	36.8	40.0	85.0	47.4	85.0
101	HD3293(C)	1.7	11.8	27.7	75.0	29.0	75.0
102	DBW353	8.2	0.0	24.5	65.0	24.4	65.0
103	JKW261(I)(C)	11.3	11.5	47.2	75.0	36.2	75.0
104	PBW771(C)	0.0	9.6	25.8	40.0	18.9	40.0
105	WH1124(C)	16.3	0.0	0.5	50.0	16.7	50.0
106	HD2967(C)	2.6	0.0	7.6	60.0	17.6	60.0
107	HD3386	0.0	0.0	7.6	70.0	19.4	70.0
108	DBW359	9.1	25.0	8.9	83.3	31.6	83.3
109	DBW358	8.8	0.0	3.1	86.6	24.6	86.6
110	NIAW3170(C)	5.4	3.5	8.0	85.0	25.5	85.0
111	HD3043(C)	17.1	4.3	19.9	80.0	30.3	80.0
112	HD3369*	7.1	22.6	NG	65.0	31.6	65.0
113	HD3397	8.8	16.0	27.3	75.0	31.8	75.0
114	HD3400	14.0	1.3	50.0	80.0	36.3	80.0
115	HD3418	3.3	0.0	50.8	65.0	29.8	65.0
116	HI1628(C)	4.0	16.7	69.1	55.0	36.2	69.1
117	HI1653*	20.0	21.4	36.4	55.0	33.2	55.0
118	HI1654*	12.5	8.4	54.0	60.0	33.7	60.0
119	HUW838(I)(C)	4.6	31.4	36.4	80.0	38.1	80.0
120	UP3090	10.9	0.0	0.0	75.0	21.5	75.0
120A	Sonalika (Check)	25.5	42.0	22.9	85.0	43.8	85.0
121	WH1402	0.0	44.3	48.4	35.0	31.9	48.4
122	WH1403	13.7	0.0	45.0	45.0	25.9	45.0
123	DBW365	17.4	35.3	64.5	65.0	45.5	65.0
124	DBW366	8.6	14.2	52.7	80.0	38.9	80.0

125	DBW402	13.3	0.0	43.8	60.0	29.3	60.0
126	HD3415	13.0	9.5	28.8	75.0	31.6	75.0
127	Kharchia65(C)	5.5	34.9	57.2	95.0	48.2	95.0
128	KRL19(C)	0.0	13.1	33.8	65.0	28.0	65.0
129	KRL2006	6.1	0.0	0.0	55.0	15.3	55.0
130	UAS310	13.3	2.1	15.3	35.0	16.4	35.0
131	KRL2021	7.5	6.8	3.9	60.0	19.5	60.0
132	KRL210(C)	0.0	0.0	0.0	75.0	18.8	75.0
133	RAJ4565	0.0	0.0	16.0	56.0	18.0	56.0
134	HD3438	0.0	7.1	48.6	56.0	27.9	56.0
135	HD3439	6.1	16.0	70.6	60.0	38.2	70.6
136	CG1029(C)	1.9	24.4	64.3	70.0	40.1	70.0
137	HD3407*	7.1	8.7	78.0	60.0	38.5	78.0
138	HI1634(C)	0.0	22.4	76.1	70.0	42.1	76.1
139	MP3336(C)	0.0	12.4	45.7	40.0	24.5	45.7
140	HI8498(C)	0.0	0.0	0.0	30.0	7.5	30.0
140A	Sonalika (Check)	23.3	35.4	57.3	80.0	49.0	80.0
141	HI8759(C)	0.0	0.0	0.0	45.0	11.3	45.0
142	HI8846	0.0	4.6	0.0	55.0	14.9	55.0
143	HI8847	0.0	0.0	1.3	65.0	16.6	65.0
144	HD2733(C)	0.0	0.0	17.6	35.0	13.1	35.0
145	HD3411*	3.4	1.9	14.1	62.5	20.5	62.5
146	HD3440	0.0	0.0	3.6	73.3	19.2	73.3
147	HD3406*	1.9	0.0	11.3	56.6	17.5	56.6
148	HD3436	0.0	11.7	7.3	60.0	19.7	60.0
149	HD3437	17.4	2.6	6.4	65.0	22.8	65.0
150	PBW175(C)	15.6	6.0	59.1	55.0	33.9	59.1
151	PBW677(C)	4.1	6.8	30.1	46.6	21.9	46.6
152	PBW901	2.8	2.3	43.0	56.6	26.2	56.6
153	PBW902	2.6	3.2	60.2	60.0	31.5	60.2
153A	Sonalika (Check)	21.3	37.4	25.4	85.0	42.3	85.0

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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 2022-23 crop season, 136 entries of AVTs and promising entries were screened against powdery mildew at hot spot locations in NHZ and NWPZ *viz*., Shimla, Karnal Pantnagar, Almora, Wellington, Dhaulakuan, Malan, and Jammu. 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 2022-23

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

VL3028, PBW893, MACS6768(I)(C) and DBW303(C). Besides these entries the average score upto 3 are HS691, VL892(C), PBW889, PBW893, HD3059(C), PBW771(C), PBW899, HD3086(C), HD2967(C), K1317(C), HD2932(C), UAS3021, MP1386, PWU15, MACS6814, PBW872(I)(C), GW322(C), ONS 27 and ONS 29 but highest score exceeded above 5 at only one center.

Table 6.1 Powdery mildew severity in PMSN entries evaluated under artificially inoculated conditions at multilocations during 2022-23

S. No.	Entry	Powdery Mildew Score (0-9)									
		Shimla	Karnal	Pantnagar	Almora	Wellington	Dhaulkuan	Malan	Jammu	HS	AV
1	HS691	3	1	1	0	0	0	6	1	6	2
2	HS692	5	5	0	3	2	4	6	5	6	4
3	VL3028	5	5	3	1	0	0	5	3	5	3
4	HPW484	3	6	2	1	2	0	7	5	7	3
5	VL907(C)	3	6	4	1	3	4	6	5	6	4
6	VL892(C)	3	2	5	3	0	0	9	5	9	3
7	HPW349(C)	3	3	2	1	2	0	8	6	8	3
8	HS562(C)	3	8	3	1	0	4	6	5	8	4
9	VL2041(I)(C)	3	7	5	3	3	4	9	5	9	5
10	PBW887	3	3	6	1	3	0	7	6	7	4
11	PBW889	3	1	4	1	1	0	8	5	8	3
12	HD3386	5	8	5	3	4	6	9	5	9	6
13	HD3470	3	6	3	1	2	0	8	5	8	4
14	HI1668	5	8	3	3	4	8	9	3	9	5
15	DBW386	5	5	1	3	1	8	9	3	9	4
16	UP3102	5	5	0	1	1	6	6	5	6	4
17	HD3428	3	3	3	0	1	0	5	7	7	3
18	PBW893	3	1	4	3	3	0	5	3	5	3
19	K2108	5	4	2	3	1	4	8	2	8	4
20	HD3059(C)	5	2	4	1	0	4	8	2	8	3
20A	Infector	7	8	6	5	5	8	8	8	8	7
21	DBW173(C)	5	3	0	1	2	0	9	3	9	3
22	PBW771(C)	5	4	0	1	0	4	7	5	7	3
23	JKW261(C)	5	2	3	1	0	6	9	7	9	4
24	WH1402	7	4	5	1	0	6	9	1	9	4
25	WH1311	3	2	4	3	0	6	7	7	7	4
26	UP3111	5	3	2	1	1	4	9	5	9	4
27	PBW899	5	3	1	3	1	0	6	5	6	3
28	PBW644(C)	7	5	4	5	0	8	6	5	8	5
29	DBW296(C)	7	5	3	3	1	0	7	7	7	4
30	HD3369(I)(C)	7	5	5	1	2	4	6	7	7	5
31	HI1653(I)(C)	7	2	3	1	3	4	9	6	9	4
32	HI1654(I)(C)	7	4	4	3	0	4	6	7	7	4
33	HD3388	7	2	3	5	0	6	6	1	7	4

34	HD3471	7	3	5	1	0	0	5	7	7	4
35	HD3249(C)	7	2	2	1	1	4	6	7	7	4
36	HD3086(C)	5	3	1	3	1	0	6	1	6	3
37	HD2967(C)	5	2	0	3	1	0	7	3	7	3
38	DBW222(C)	5	4	2	3	0	4	7	3	7	4
39	PBW826(I)(C)	5	3	3	5	0	6	7	3	7	4
40	DBW398	5	8	4	1	2	4	9	2	9	4
40A	Infector	7	7	7	7	5	8	9	9	9	7
41	HI1612(C)	5	0	0	5	3	0	8	7	8	4
42	K1317(C)	5	0	0	5	1	0	7	3	7	3
43	HD3171(C)	7	6	2	5	0	4	6	5	7	4
44	HD3293(C)	5	5	5	1	1	2	9	7	9	4
45	DBW252(C)	5	7	3	1	3	2	8	7	8	5
46	NWS2194	7	4	4	3	0	0	7	6	7	4
47	HI1669	7	7	1	3	3	0	7	3	7	4
48	HI1670	5	3	3	3	0	0	6	7	7	3
49	GW547	5	0	5	5	1	4	7	7	7	4
50	GW513(C)	3	1	4	5	1	0	5	9	9	4
51	HI1636 (C)	5	4	2	7	0	2	8	5	8	4
52	HI1650(I)(C)	7	1	4	3	2	0	4	7	7	4
53	MACS6768(I)(C)	3	1	3	1	0	0	5	3	5	2
54	HI1674	5	2	4	1	1	4	6	7	7	4
55	AKAW5104	7	1	2	3	0	0	6	4	7	3
56	HD2932(C)	5	2	5	0	0	0	7	5	7	3
57	MP4010(C)	7	4	1	3	3	0	7	5	7	4
58	HI1634(C)	7	2	3	3	0	4	5	7	7	4
59	CG1029(C)	3	3	3	3	3	4	6	5	6	4
60	DBW359	5	6	4	3	1	4	6	5	6	4
60A	Infector	7	7	6	9	7	8	9	8	9	8
61	DBW441	5	5	3	3	1	0	8	3	8	4
62	DBW442	5	4	5	3	3	0	6	5	6	4
63	CG1040	7	4	4	1	5	0	4	7	7	4
64	MP3288(C)	7	4	2	3	3	4	7	7	7	5
65	DBW110(C)	7	3	3	1	3	4	8	5	8	4
66	CG1036(I)(C)	5	0	5	5	1	4	8	5	8	4
67	HI1655(I)(C)	5	7	2	5	0	2	8	3	8	4
68	UAS3020	5	1	0	3	0	0	7	6	7	3
69	UAS3021	3	1	3	3	3	0	8	5	8	3
70	MACS6811	7	2	5	3	0	0	8	1	8	3
71	MACS6809	7	3	2	3	3	4	9	7	9	5
72	NIAW4183	7	4	3	7	1	0	6	7	7	4
73	NIAW4153	5	6	4	5	1	0	8	7	8	5
74	AKAW5314	5	3	0	3	0	4	5	8	8	4
75	AKAW5100	5	3	0	3	0	4	5	9	9	4
76	MP1378	5	2	1	1	3	0	6	7	7	3
77	MP1386	1	4	3	3	1	0	8	4	8	3
78	DBW443	7	6	4	5	0	2	8	3	8	4
79	DBW444	5	5	2	7	0	2	6	3	7	4
80	HD3469	5	6	3	5	1	2	9	8	9	5
80A	Infector	7	8	5	7	7	8	9	9	9	8
81	NWS2222	5	3	2	1	1	0	8	6	8	3
82	PWU15	3	4	3	1	0	3	4	9	9	3
83	WH1306	7	3	5	3	1	0	8	5	8	4
84	PBW891	5	4	4	3	0	0	7	7	7	4
85	HI8841(d)	3	5	3	1	3	2	7	5	7	4
86	UP3083	5	3	5	3	1	0	6	7	7	4
87	MACS3949(d)(C)	5	8	6	3	1	2	6	7	8	5
88	HI8826(d)(I)(C)	7	5	4	9	7	2	8	7	9	6

89	MACS4100(d)(I)(C)	5	8	4	1	3	0	8	3	8	4
90	MACS6222 (C)	5	8	3	3	3	4	8	5	8	5
91	HI1672	5	8	5	7	5	6	8	9	9	7
92	HI1673	5	7	4	7	3	0	7	7	7	5
93	HI1675	5	9	5	5	5	0	6	5	9	5
94	DBW394	7	8	6	7	3	4	9	7	9	6
95	DBW395	5	8	4	3	3	0	8	3	8	4
96	MACS6814	3	4	3	1	1	0	7	5	7	3
97	MACS6805	5	4	5	5	5	4	6	5	6	5
98	NIAW4114	5	8	4	3	3	0	6	5	8	4
99	NIAW4120	5	8	1	3	5	8	9	7	9	6
100	UAS3022	5	7	5	5	5	4	9	7	9	6
100A	Infector	5	9	7	9	7	8	9	8	9	8
101	UAS3023	5	7	5	1	0	4	4	7	7	4
102	MP3557	5	7	3	3	1	6	6	7	7	5
103	MP3556	5	8	2	3	0	6	6	3	8	4
104	PBW897	5	8	4	1	5	8	7	9	9	6
105	MP1388	5	8	6	1	3	6	6	7	8	5
106	GW542	3	7	5	3	1	6	9	5	9	5
107	GW538	3	8	5	0	3	6	6	4	8	4
108	WH1310	5	5	5	3	5	6	6	5	6	5
109	LOK79	5	7	4	1	3	4	8	5	8	5
110	RAJ4083(C)	3	7	5	1	3	6	8	7	8	5
111	HD3090(C)	5	8	5	1	5	6	8	7	8	6
112	HI1633(C)	7	7	5	1	3	6	8	7	8	6
113	UAS478(d)	5	8	5	5	3	8	7	6	8	6
114	UAS481(d)	5	6	1	1	1	8	7	3	8	4
115	HI1665	5	5	2	1	3	6	6	6	6	4
116	HI8840(d)	7	7	0	1	3	6	7	5	7	5
117	DBW397	3	8	3	1	5	6	8	5	8	5
118	DDW61(d)	5	8	4	3	3	6	9	7	9	6
119	NIAW4028	5	7	3	5	5	6	8	7	8	6
120	HI1605(C)	5	8	5	3	3	6	8	7	8	6
120A	Infector	5	8	6	7	7	8	8	7	8	7
121	NIAW3170(C)	5	8	3	3	1	6	6	5	8	5
122	UAS446(d)(C)	3	7	5	1	3	2	6	5	7	4
123	NIDW1149(d)(C)	3	8	4	5	3	0	7	7	8	5
124	DBW380	5	6	2	5	5	4	8	5	8	5
125	DBW370(I)(C)	5	7	1	3	5	4	8	5	8	5
126	DBW371(I)(C)	5	8	6	3	7	4	7	7	8	6
127	DBW372(I)(C)	5	7	4	3	1	4	6	7	7	5
128	PBW872(I)(C)	3	3	5	3	3	0	6	4	6	3
129	DBW377	5	5	2	3	3	4	6	4	6	4
130	CG1044	5	5	5	5	1	2	6	7	7	5
131	GW543	5	6	3	3	1	0	6	7	7	4
132	DBW187(C)	5	7	3	1	5	4	6	5	7	5
133	DBW303(C)	3	5	5	1	1	0	4	5	5	3
134	GW322(C)	3	0	4	3	3	0	6	5	6	3
135	ONS 27	0	0	6	0	1	0	4	4	6	2
136	ONS 29	0	2	5	1	0	0	3	8	8	2
136A	Infector	7	8	7	7	7	8	8	9	9	8

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PROGRAMME 7. REGION SPECIFIC DISEASES OF LIMITED IMPORTANCE

7.1 FUSARIUM HEAD BLIGHT (FHB) OR HEAD SCAB

AVT entries alongwith checks were evaluated under artificially inoculated conditions at Gurdaspur and Delhi. Disease scoring scale (0-5) has been used. A total 134 entries were evaluated and entry-wise reaction of AVTs entries (2022-23) has been given in Tables 7.1. On the basis of highest score, none of the genotype was found resistant or moderately resistant. Data from Gurdaspur centre was not received.

Test Locations: Gurdaspur and Delhi

Table7.1. Performance of AVTs material against head scab (% incidence) under multilocational testing during 2022-23

S. No.	Entry	Head Scab Severity (0-5 Scale)			
		Gurdaspur	Delhi	Av.	HS
1	HS691	1	4	3	4
2	HS692	2	5	4	5
3	VL3028	2	3	3	3
4	HPW484	1	4	3	4
5	VL907(C)	2	5	4	5
6	VL892(C)	5	5	5	5
7	HPW349(C)	3	4	4	4
8	HS562(C)	2	4	3	4
9	VL2041(I)(C)	1	5	3	5
10	PBW887	3	4	4	4
11	PBW889	5	4	5	5
12	HD3386	2	4	3	4
13	HD3470	4	4	4	4
14	HI1668	4	4	4	4
15	DBW386	4	5	5	5
16	UP3102	3	4	4	4
17	HD3428	5	4	5	5
18	PBW893	3	4	4	4
19	K2108	1	4	3	4
20	HD3059(C)	4	3	4	4
20A	Infector (WH147)	5	4	5	5
21	DBW173(C)	1	4	3	4
22	PBW771(C)	3	4	4	4
23	JKW261(C)	3	4	4	4
24	WH1402	1	4	3	3
25	WH1311	2	3	3	5
26	UP3111	3	5	4	5
27	PBW899	2	5	4	4
28	PBW644(C)	2	4	3	5
29	DBW296(C)	4	5	5	5
30	HD3369(I)(C)	4	4	4	4
31	HI1653(I)(C)	1	4	3	4
32	HI1654(I)(C)	3	4	4	4
33	HD3388	2	5	4	5
34	HD3471	3	3	3	3
35	HD3249(C)	1	3	2	3
36	HD3086(C)	5	4	5	5
37	HD2967(C)	3	3	3	3

38	DBW222(C)	4	4	4	4
39	PBW826(I)(C)	3	5	4	5
40	DBW398	2	4	3	4
40A	Infector (WH147)	4	5	5	5
41	HI1612(C)	3	4	4	4
42	K1317(C)	1	3	2	3
43	HD3171(C)	1	5	3	5
44	HD3293(C)	2	4	3	4
45	DBW252(C)	2	5	4	5
46	NWS2194	2	4	3	4
47	HI1669	3	5	4	5
48	HI1670	4	5	5	5
49	GW547	3	4	4	4
50	GW513(C)	3	5	4	5
51	HI1636 (C)	4	5	5	5
52	HI1650(I)(C)	5	5	5	5
53	MACS6768(I)(C)	5	4	5	5
54	HI1674	4	5	5	5
55	AKAW5104	4	5	5	5
56	HD2932(C)	3	5	4	5
57	MP4010(C)	3	5	4	5
58	HI1634(C)	3	3	3	3
59	CG1029(C)	3	5	4	5
60	DBW359	2	5	4	5
60A	Infector (WH147)	4	4	4	4
61	DBW441	1	5	3	5
62	DBW442	5	5	5	5
63	CG1040	5	4	5	5
64	MP3288(C)	2	4	3	4
65	DBW110(C)	5	4	5	5
66	CG1036(I)(C)	1	4	3	4
67	HI1655(I)(C)	1	3	2	3
68	UAS3020	1	4	3	4
69	UAS3021	2	5	4	5
70	MACS6811	1	4	3	4
71	MACS6809	3	5	4	5
72	NIAW4183	3	5	4	5
73	NIAW4153	4	5	5	5
74	AKAW5314	3	5	4	5
75	AKAW5100	4	4	4	4
76	MP1378	4	5	5	5
77	MP1386	4	5	5	5
78	DBW443	2	5	4	5
79	DBW444	2	4	3	4
80	HD3469	4	4	4	4
80A	Infector (WH147)	5	5	5	5
81	NWS2222	2	4	3	4
82	PWU15	5	4	5	5
83	WH1306	1	4	3	4
84	PBW891	3	3	3	3
85	HI8841(d)	4	5	5	5
86	UP3083	2	3	3	3
87	MACS3949(d)(C)	2	5	4	5
88	HI8826(d)(I)(C)	2	5	4	5
89	MACS4100(d)(I)(C)	4	5	5	5

90	MACS6222 (C)	1	4	3	4
91	HI1672	4	5	5	5
92	HI1673	4	5	5	5
93	HI1675	4	4	4	4
94	DBW394	1	5	3	5
95	DBW395	1	3	2	3
96	MACS6814	2	3	3	3
97	MACS6805	3	4	4	4
98	NIAW4114	3	4	4	4
99	NIAW4120	4	5	5	5
100	UAS3022	1	3	2	3
100A	Infector (WH147)	5	5	5	5
101	UAS3023	2	5	4	5
102	MP3557	1	5	3	5
103	MP3556	1	5	3	5
104	PBW897	4	5	5	5
105	MP1388	5	4	5	5
106	GW542	5	4	5	5
107	GW538	4	3	4	4
108	WH1310	4	4	4	4
109	LOK79	4	3	4	4
110	RAJ4083(C)	4	4	4	4
111	HD3090(C)	3	3	3	3
112	HI1633(C)	5	5	5	5
113	UAS478(d)	2	5	4	5
114	UAS481(d)	1	3	2	3
115	HI1665	4	5	5	5
116	HI8840(d)	4	5	5	5
117	DBW397	2	4	3	4
118	DDW61(d)	4	3	4	4
119	NIAW4028	4	3	4	4
120	HI1605(C)	4	4	4	4
120A	Infector (WH147)	5	5	5	5
121	NIAW3170(C)	1	5	3	5
122	UAS446(d)(C)	4	3	4	4
123	NIDW1149(d)(C)	5	3	4	5
124	DBW380	4	5	5	5
125	DBW370(I)(C)	2	4	3	4
126	DBW371(I)(C)	2	4	3	4
127	DBW372(I)(C)	2	5	4	5
128	PBW872(I)(C)	4	3	4	4
129	DBW377	4	5	5	5
130	CG1044	1	4	3	4
131	GW543	5	4	5	5
132	DBW187(C)	4	4	4	4
133	DBW303(C)	1	4	3	4
134	GW322(C)	4	3	4	4
134A	Infector (WH147)	5	4	5	5

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

Test Locations: Durgapura, Ludhiana and Hisar
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. A total 134 entries were screened and entry-wise reaction of AVTs (2022-23) has been given in Table 7.2. The entries HD3059(C), HI8841(d), MACS3949(d)(C), HI8826(d)(I)(C), MACS4100(d)(I)(C), UAS3022, UAS478(d), UAS481(d), HI8840(d), DDW61(d), and NIDW1149(d)(C) were found free at all the locations.

Table 7.2. Performance of AVTs entries against flag smut (% incidence) under multilocational testing during 2022-23

S. No.	Entries	Flag smut incidence (%)				
		Durgapura	Ludhiana	Hisar	HS	Av.
1	HS691	8.97	34.04	5.30	34.04	16.10
2	HS692	15.25	51.09	15.00	51.09	27.11
3	VL3028	0.00	0.00	8.30	8.30	2.77
4	HPW484	1.39	1.59	9.20	9.20	4.06
5	VL907(C)	0.00	0.00	10.00	10.00	3.33
6	VL892(C)	11.54	10.53	7.50	11.54	9.86
7	HPW349(C)	14.52	22.73	8.20	22.73	15.15
8	HS562(C)	2.94	1.20	6.60	6.60	3.58
9	VL2041(I)(C)	0.00	0.00	6.50	6.50	2.17
10	PBW887	3.49	1.33	8.30	8.30	4.37
11	PBW889	0.00	0.00	11.10	11.10	3.70
12	HD3386	2.04	1.16	8.10	8.10	3.77
13	HD3470	0.00	0.00	10.00	10.00	3.33
14	HI1668	1.83	0.00	6.60	6.60	2.81
15	DBW386	0.00	0.00	5.30	5.30	1.77
16	UP3102	0.00	0.00	5.00	5.00	1.67
17	HD3428	2.59	0.75	6.30	6.30	3.21
18	PBW893	2.06	7.84	5.50	7.84	5.13
19	K2108	1.47	0.00	5.00	5.00	2.16
20	HD3059(C)	0.00	0.00	0.00	0.00	0.00
20A	Infector (PBW343)	35.63	41.54	18.30	41.54	31.82
21	DBW173(C)	0.00	0.00	12.50	12.50	4.17
22	PBW771(C)	18.92	34.04	10.00	34.04	20.99
23	JKW261(C)	6.82	7.04	11.10	11.10	8.32
24	WH1402	2.78	1.25	12.50	12.50	5.51
25	WH1311	5.21	3.61	10.00	10.00	6.27
26	UP3111	3.33	1.52	11.30	11.30	5.38
27	PBW899	6.48	10.99	8.20	10.99	8.56
28	PBW644(C)	9.76	14.06	11.70	14.06	11.84
29	DBW296(C)	5.13	3.64	12.60	12.60	7.12
30	HD3369(I)(C)	10.17	4.76	10.50	10.50	8.48
31	HI1653(I)(C)	0.00	0.00	9.50	9.50	3.17
32	HI1654(I)(C)	2.06	1.11	10.80	10.80	4.66
33	HD3388	4.76	10.42	8.60	10.42	7.93
34	HD3471	0.00	0.00	7.30	7.30	2.43
35	HD3249(C)	4.76	1.27	7.50	7.50	4.51
36	HD3086(C)	7.22	6.06	8.10	8.10	7.13
37	HD2967(C)	10.98	10.61	3.50	10.98	8.36
38	DBW222(C)	0.00	0.00	6.30	6.30	2.10
39	PBW826(I)(C)	2.56	1.37	6.60	6.60	3.51
40	DBW398	5.89	4.00	7.50	7.50	5.80
40A	Infector (PBW343)	31.17	65.00	22.20	65.00	39.46
41	HI1612(C)	4.21	7.89	6.50	7.89	6.20
42	K1317(C)	0.00	0.00	8.10	8.10	2.70

43	HD3171(C)	1.25	0.00	7.30	7.30	2.85
44	HD3293(C)	0.00	0.00	6.50	6.50	2.17
45	DBW252(C)	4.48	10.26	8.30	10.26	7.68
46	NWS2194	0.00	0.00	6.80	6.80	2.27
47	HI1669	15.52	35.71	12.20	35.71	21.14
48	HI1670	3.70	3.23	11.90	11.90	6.28
49	GW547	3.85	1.59	8.50	8.50	4.65
50	GW513(C)	1.63	3.23	8.60	8.60	4.49
51	HI1636 (C)	20.59	43.27	7.50	43.27	23.79
52	HI1650(I)(C)	0.00	3.23	9.30	9.30	4.18
53	MACS6768(I)(C)	1.03	0.00	10.10	10.10	3.71
54	HI1674	0.00	0.00	7.60	7.60	2.53
55	AKAW5104	13.64	56.25	8.20	56.25	26.03
56	HD2932(C)	4.08	11.11	6.60	11.11	7.26
57	MP4010(C)	0.00	0.00	8.30	8.30	2.77
58	HI1634(C)	0.00	13.04	10.20	13.04	7.75
59	CG1029(C)	0.00	0.00	12.30	12.30	4.10
60	DBW359	0.00	0.00	11.10	11.10	3.70
60A	Infector (PBW343)	39.33	37.93	26.60	39.33	34.62
61	DBW441	0.00	0.00	8.60	8.60	2.87
62	DBW442	2.82	0.00	6.50	6.50	3.11
63	CG1040	0.00	0.00	6.60	6.60	2.20
64	MP3288(C)	6.67	29.41	8.10	29.41	14.73
65	DBW110(C)	0.00	0.00	8.60	8.60	2.87
66	CG1036(I)(C)	0.00	0.00	8.50	8.50	2.83
67	HI1655(I)(C)	16.18	63.16	8.30	63.16	29.21
68	UAS3020	2.70	0.00	8.40	8.40	3.70
69	UAS3021	3.61	1.00	8.30	8.30	4.30
70	MACS6811	0.00	0.00	6.50	6.50	2.17
71	MACS6809	0.00	2.30	7.60	7.60	3.30
72	NIAW4183	12.07	31.25	11.10	31.25	18.14
73	NIAW4153	8.42	13.58	9.30	13.58	10.43
74	AKAW5314	2.78	0.00	8.50	8.50	3.76
75	AKAW5100	1.14	0.00	8.60	8.60	3.25
76	MP1378	5.56	12.99	7.50	12.99	8.68
77	MP1386	0.00	0.00	8.10	8.10	2.70
78	DBW443	1.74	0.00	9.60	9.60	3.78
79	DBW444	6.67	3.49	10.00	10.00	6.72
80	HD3469	0.00	0.00	9.80	9.80	3.27
80A	Infector (PBW343)	34.15	46.34	25.00	46.34	35.16
81	NWS2222	0.00	1.64	11.10	11.10	4.25
82	PWU15	5.33	13.16	9.60	13.16	9.36
83	WH1306	0.00	0.00	8.70	8.70	2.90
84	PBW891	0.00	0.00	8.10	8.10	2.70
85	HI8841(d)	0.00	0.00	0.00	0.00	0.00
86	UP3083	0.00	0.00	3.50	3.50	1.17
87	MACS3949(d)(C)	0.00	0.00	0.00	0.00	0.00
88	HI8826(d)(I)(C)	0.00	0.00	0.00	0.00	0.00
89	MACS4100(d)(I)(C)	0.00	0.00	0.00	0.00	0.00
90	MACS6222 (C)	12.77	5.63	5.30	12.77	7.90
91	HI1672	0.00	0.00	12.50	12.50	4.17
92	HI1673	0.00	0.00	13.30	13.30	4.43
93	HI1675	14.06	28.95	11.50	28.95	18.17
94	DBW394	0.00	0.00	12.60	12.60	4.20
95	DBW395	0.00	0.00	13.10	13.10	4.37
96	MACS6814	14.06	8.93	2.50	14.06	8.50
97	MACS6805	5.63	12.94	2.60	12.94	7.06
98	NIAW4114	13.10	42.25	6.60	42.25	20.65

99	NIAW4120	10.13	28.81	5.30	28.81	14.75
100	UAS3022	0.00	0.00	NG	0.00	0.00
100A	Infector (PBW343)	37.50	63.16	22.20	63.16	40.95
101	UAS3023	3.16	5.63	5.30	5.63	4.70
102	MP3557	6.06	5.08	6.60	6.60	5.91
103	MP3556	0.00	1.82	5.00	5.00	2.27
104	PBW897	8.54	32.08	6.20	32.08	15.61
105	MP1388	0.00	0.00	5.50	5.50	1.83
106	GW542	0.00	0.00	5.00	5.00	1.67
107	GW538	14.12	28.30	7.50	28.30	16.64
108	WH1310	2.19	6.67	4.50	6.67	4.45
109	LOK79	10.26	35.19	6.60	35.19	17.35
110	RAJ4083(C)	6.25	10.42	7.30	10.42	7.99
111	HD3090(C)	0.00	2.60	5.60	5.60	2.73
112	HI1633(C)	0.00	3.70	7.50	7.50	3.73
113	UAS478(d)	0.00	0.00	0.00	0.00	0.00
114	UAS481(d)	0.00	0.00	0.00	0.00	0.00
115	HI1665	18.58	67.24	6.50	67.24	30.77
116	HI8840(d)	0.00	0.00	0.00	0.00	0.00
117	DBW397	0.00	3.85	0.00	3.85	1.28
118	DDW61(d)	0.00	0.00	0.00	0.00	0.00
119	NIAW4028	0.00	0.00	6.60	6.60	2.20
120	HI1605(C)	0.00	0.00	7.50	7.50	2.50
120A	Infector (PBW343)	32.93	51.61	26.60	51.61	37.05
121	NIAW3170(C)	2.13	0.00	8.30	8.30	3.48
122	UAS446(d)(C)	0.00	0.00	1.60	1.60	0.53
123	NIDW1149(d)(C)	0.00	0.00	0.00	0.00	0.00
124	DBW380	0.00	0.00	5.00	5.00	1.67
125	DBW370(I)(C)	0.00	1.39	6.60	6.60	2.66
126	DBW371(I)(C)	0.00	0.00	8.30	8.30	2.77
127	DBW372(I)(C)	0.00	0.00	8.20	8.20	2.73
128	PBW872(I)(C)	0.00	2.08	7.50	7.50	3.19
129	DBW377	0.00	0.00	6.60	6.60	2.20
130	CG1044	11.54	32.50	8.30	32.50	17.45
131	GW543	1.16	0.00	9.50	9.50	3.55
132	DBW187(C)	0.00	7.50	8.10	8.10	5.20
133	DBW303(C)	0.00	1.49	11.10	11.10	4.20
134	GW322(C)	0.00	1.96	10.80	10.80	4.25
134A	Infector (PBW343)	26.76	48.98	24.00	48.98	33.25

COOPERATORS

NAME	**CENTRE**
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7.3 FOOT ROT (*Sclerotium rolfsii*)

AVT entries were evaluated at Dharwad center. AVTs (2022-23) were evaluated against foot rot and entries wise reaction has been given in Tables 7.3. The entries showing upto 5 and 10.00 per cent incidence were categorized as highly resistant and resistant, respectively and are listed below:

AVTs Year 2022-23

Free
GW547, CG1040 and GW543

Highly resistant (upto 5 % disease): Nil

Resistant (5-10 % disease):
K2108, PBW897, GW538, and HD3090(C)

Table 7.3. Performance of AVTs material against foot rot (% incidence) at Dharwad during 2022-23

S. No.	Entry	Foot rot incidence (%)
		Dharwad
1	HS691	22.22
2	HS692	14.29
3	VL3028	25.00
4	HPW484	35.00
5	VL907(C)	22.22
6	VL892(C)	27.78
7	HPW349(C)	35.00
8	HS562(C)	33.33
9	VL2041(I)(C)	30.00
10	PBW887	12.50
11	PBW889	27.78
12	HD3386	18.75
13	HD3470	31.25
14	HI1668	22.22
15	DBW386	33.33
16	UP3102	22.22
17	HD3428	33.33
18	PBW893	28.57
19	K2108	7.14
20	HD3059(C)	25.00
21	DBW173(C)	25.00
22	PBW771(C)	11.11
23	JKW261(C)	33.33
24	WH1402	25.00
25	WH1311	33.33
26	UP3111	31.25
27	PBW899	25.00
28	PBW644(C)	27.78
29	DBW296(C)	25.00
30	HD3369(I)(C)	25.00
31	HI1653(I)(C)	28.57
32	HI1654(I)(C)	28.57
33	HD3388	27.78
34	HD3471	18.75
35	HD3249(C)	14.29
36	HD3086(C)	31.25
37	HD2967(C)	25.00
38	DBW222(C)	21.43
39	PBW826(I)(C)	30.00
40	DBW398	35.00
41	HI1612(C)	25.00
42	K1317(C)	31.25
43	HD3171(C)	38.89
44	HD3293(C)	22.22
45	DBW252(C)	31.25
46	NWS2194	33.33
47	HI1669	31.25
48	HI1670	35.00
49	GW547	0.00
50	GW513(C)	35.00
51	HI1636 (C)	33.33
52	HI1650(I)(C)	31.25
53	MACS6768(I)(C)	7.14
54	HI1674	27.78
55	AKAW5104	31.25
56	HD2932(C)	35.00
57	MP4010(C)	35.00
58	HI1634(C)	33.33
59	CG1029(C)	33.33
60	DBW359	27.78
61	DBW441	35.00
62	DBW442	22.22
63	CG1040	0.00
64	MP3288(C)	12.50
65	DBW110(C)	25.00
66	CG1036(I)(C)	35.00

67	HI1655(I)(C)	27.78
68	UAS3020	27.78
69	UAS3021	25.00
70	MACS6811	35.00
71	MACS6809	31.25
72	NIAW4183	12.50
73	NIAW4153	25.00
74	AKAW5314	20.00
75	AKAW5100	33.33
76	MP1378	21.43
77	MP1386	16.67
78	DBW443	35.00
79	DBW444	33.33
80	HD3469	35.00
81	NWS2222	27.78
82	PWU15	27.78
83	WH1306	40.00
84	PBW891	38.89
85	HI8841(d)	31.25
86	UP3083	18.75
87	MACS3949(d)(C)	31.25
88	HI8826(d)(I)(C)	31.25
89	MACS4100(d)(I)(C)	25.00
90	MACS6222 (C)	30.00
91	HI1672	33.33
92	HI1673	22.22
93	HI1675	20.00
94	DBW394	35.00
95	DBW395	25.00
96	MACS6814	28.57
97	MACS6805	18.75
98	NIAW4114	21.43
99	NIAW4120	35.00
100	UAS3022	31.25
101	UAS3023	31.25

102	MP3557	37.50
103	MP3556	35.00
104	PBW897	5.56
105	MP1388	25.00
106	GW542	25.00
107	GW538	6.25
108	WH1310	31.25
109	LOK79	35.00
110	RAJ4083(C)	35.00
111	HD3090(C)	10.00
112	HI1633(C)	25.00
113	UAS478(d)	18.75
114	UAS481(d)	16.67
115	HI1665	33.33
116	HI8840(d)	35.00
117	DBW397	27.78
118	DDW61(d)	22.22
119	NIAW4028	31.25
120	HI1605(C)	18.75
121	NIAW3170(C)	30.00
122	UAS446(d)(C)	35.00
123	NIDW1149(d)(C)	25.00
124	DBW380	18.75
125	DBW370(I)(C)	35.00
126	DBW371(I)(C)	33.33
127	DBW372(I)(C)	33.33
128	PBW872(I)(C)	25.00
129	DBW377	27.78
130	CG1044	30.00
131	GW543	0.00
132	DBW187(C)	20.00
133	DBW303(C)	38.89
134	GW322(C)	38.89

COOPERATORS

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

Test Locations: Malan, Bajaura and Almora

A total 5 AVT (2022-23) 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.

Resistant (1-10 % disease):

HS692, VL3028, HPW484, VL907(C), VL892(C) and HPW349(C)

Table 7.4. Performance of AVT material against hill bunt (% incidence) under multilocational testing during 2022-23

S. No.	Entry	Hill bunt incidence (%)			
		Almora	Bajaura	Av.	HS
1	HS691	23.25	2.8	13.0	23.3
2	HS692	9.22	0	4.6	9.2
3	VL3028	5.17	4.3	4.7	5.2
4	HPW484	5.84	0	2.9	5.8
5	VL907(C)	17.39	0	8.7	17.4
6	VL892(C)	6.87	3.4	5.1	6.9
7	HPW349(C)	2.65	6.1	4.4	6.1
8	HS562(C)	20.59	6.9	13.7	20.6
9	VL2041(I)(C)	33.33	4.8	19.1	33.3

COOPERATORS

NAME	CENTRE
K. K. MISHRA	ALMORA
SACHIN UPMANYU & A.D.BHINDRA	MALAN
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PROGRAMME 8. CROP HEALTH

8.1 Pre- Harvest Crop Health Monitoring

During 2022-23, to monitor the wheat and barley crop health, regular surveys were conducted with major emphasis on occurrence of yellow rust in NWPZ and surveillance for wheat blast. The surveys were conducted by the wheat crop protection scientists of different cooperating centers including ICAR-IIWBR Karnal and information was shared through the *"Wheat Crop Health Newsletter"*, Vol. 28 (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 Donal of Rupnagar on wheat cultivar HD3086 on 20.12.2022. Subsequently, stripe rust spread to other parts of Punjab, Haryana, Himachal Pradesh, Uttarakhand, Jammu and Rajasthan. Likewise, the first occurrence of leaf (brown) rust was noticed in Nalwipar village of Karnal district on wheat cultivar DBW303. The occurrences of leaf rust were also reported from central India in Moti Monpari village of Gujarat, Nadia districts of West Bengal and in Ozarkhed (Dindori tehsil) and PimpalgaonMor (Igatpuritahasil in Nashik district) in Maharasthra on variety Ajeet 102 and on some off-type plants. Stem (black) rust occurred naturally in Wellington areas of Tamil Nadu. Other then rusts, the some incidence of foliar blight was observed in eastern, central and peninsular India. Similarly minor sporadic incidence of loose smut, flag smut and foot rot was also reported. So far, the exotic diseases and pathotypes like Ug99 race of stem rust and wheat blast were not reported from any part of the country. The overall crop health status was excellent in the country.

Training for human resource development

To bring more uniformity in disease creation and data recording a training was organized on “Precise and uniform data recording and reporting in wheat and barley crop protection trials” from February 22-24, 2023 At ICAR-IIWBR, Karnal. 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 the weather remained uncongenial for diseases and pest therefore the sporadic occurrence of yellow rust has been reported from NWPZ. Need based advisory for stripe rust management was 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 in North and South West Bengal near Indo-Bangladesh boarder by team of scientist from UBKV, Cooch Behar, West Bengaland BCKV, Kalyani, Nadia, West Bengal and no wheat blast was observed. Wherever, wheat is grown use resistant varieties identified and recommended in the wheat blast prone areas. An anticipatory breeding programme has already initiated. 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, a total of 350 advance breeding lines and potential germplasm were screened at Jashore, Bangladesh at two different dates of sowing during 2022-23. Out of these, 23 entries found free from infection and 74 are categorised resistant on the basis of average disease upto 10% infection. The details are given as below:

Wheat blast reaction	AICRP/IIWBR	Genotypes	Total
0 (Free)	AICRP	NIDW1520(d), MP3577, PBW905, PBW906, DBW439, WH1321, RAJ4583, DBW441 and DBW442	9
	IIWBR	RWP2024, RWP2030, RWP1332, WAP2214, WAP2222, WAP2223, WAP2224, BRNS 88-11, BRNS 88-16, BRNS 88-17, BRNS 88-18, BRNS 88-19, BRNS 88-22, BRNS 88-23	14
Upto 10 (Resistant)	AICRP	DBW408, RAJ4576, RAJ4577, RAJ4578, HUW854, BRW3944, KRL2106, NWS2442, BCW28, HD3449, HD3467, DBW416, DBW417, MACS6837, GW554, PWU16, DBW425, MP3568, UAS482(d), PDW364(d), DBW432, UAS484(d), HI1691, DBW433, DBW435, JWS1333, MP3572, DBW443, DDW64(d), DBW438, HI1687, MPO1396(d), BRW3922, PBW910, PBW914, UP3126, UP3130, GW557, HI8849(d), WH1316, WH1324, UP3122, MACS4135(d), GW1366(d), DBW429, MACS4131(d), RAUW107, DBW411, K2210, UBW18, PBW913, GW555, UAS3028, DBW428	54
	IIWBR	BRNS 88-24, WAP2218, WAP2213, RWP1939, RWP1944, RWP2036, RWP1365, RWP1449, WAP2217, WAP2219, BRNS 88-21, NE-WB22-4, BRNS 88-20, RWP1350, NE-WB22-12, CNM-1, CNM-2, NE-WB22-14, BRNS 88-3, NE-WB22-11, WAP2220, WAP2216, NE-WB22-1, RWP2020, NE-WB22-3, BRNS 88-1	26
Total			103

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 7997 grain samples collected from various mandies in different zones and were analyzed at cooperating centers (Table 8.1).The overall 17.22% samples were found infected. The samples from Rajasthan showed maximum infection (49.88%).

Table 8.1.Karnal bunt situation in the country during 2022-23 crop seasons

State	Total Samples	Infected Samples	Infected samples (%)	Range of infection (%)
Punjab	2521	188	7.46	0.00-0.292
Haryana	2281	488	21.39	0.00-0.85
Rajasthan	403	201	49.88	0.10-6.2
Uttrakhand	1534	416	27.11	0.01-0.75
Gujarat	574	0	--	--
Madhya Pradesh	406	0	--	--
Maharashtra	228	0	--	--

Karnataka	50	0	--	--
Overall	**7997**	**1293**	**17.22**	**0.00-6.2**

Haryana

A total of 1464 samples collected by IIWBR from Haryana and analysed for presence of KB and foud that 2.6% samples were infected with KB and range of infection was 0–0.8% (Table 8.2).

Table 8.2. Status of Karnal bunt in Karnal and adjoining distrcts of Haryana during 2022-23 crop season

Districts	Total samples	Infected samples	Infected samples (%)	Range of grain infection (%)
Kurukshetra	256	4	1.56	0.1-0.2
Karnal	500	19	3.80	0.1-1.0
Kaithal	303	4	1.32	0.1-0.3
Jind	128	5	3.91	0.2-0.8
Panipat	88	1	1.14	0.0-0.3
Rohtak	114	5	4.39	0.0-0.4
Ambala	75	1	1.33	0.0-0.1
Overall	**1464**	**39**	**2.67**	**0.0-1.0**

(ICAR-IIWBR)

Hisar

A total 817 grain samples were also collected from different districts of Haryana by cooprating center CCSHAU, Hisar. These sampales were analysed for Karnal bunt infection. Out of the 817 sample, 409 found infected and the percentage of infected sampales was 47.22. The range of infection was 0.05 – 0.85% (Table 8.3)

Table 8.3. Status of Karnal bunt in Karnal and adjoining distrcts of Haryana during 2022-23 crop season

Sr. No.	Location	Total samples	No of infected samples	Samples infected (%)	Range of incidence (%)
1	Hisar	149	81	45.63	0.05-0.45
2	Fatehabad	52	32	38.46	0.05-0.45
3	Sirsa	61	44	27.86	0.05-0.25
4	Rohtak	54	30	44.44	0.05-0.35
5	Bhiwani	60	30	50	0.05-0.40
6	Charkhi Dadri	83	19	77.10	0.05-0.55
7	Mahendergarh	24	7	70.83	0.05-2.30
8	Rewari	14	11	21.28	0.05-0.05
9	Jhajjar	58	23	60.34	0.05-0.25
10	Gurugram	84	24	71.28	0.05-0.85
11	Nuh	30	14	53.33	0.05-0.20
12	Palwal	66	43	34.5	0.05-0.30
13	Faridabad	56	50	10.71	0.05-0.20
	Overall	**817**	**409**	**47.22**	**0.05-0.85**

(R. S. Beniwal)

Rajasthan

To know the status of Karnal bunt and Black point diseases of wheat, a total of 403 wheat grains samples were collected from 15 different grain mandies of Rajasthan during crop season Rabi 2022-2023 (Table 8.4). The samples were brought into the laboratory to examine the incidence of Karnal bunt and black point diseases. The data revealed that 141 samples (34.99%) were found infected with Karnal bunt with infection range 0.1-4.8 percent being maximum found in a sample collected from Bassi (Alwar) mandi. The highest KB infected samples were found in Alwar mandi (70.0%) followed by Bansur (68.96%), Khertal (66.67%), Kotputli (60.0%),Bassi (32.0%), Bandikui (31.25%), Lalsot(24.24%), Malpura (22.22%), Dausa (21.88%), Deoli (18-18%), Todaraising(18-18%), Mandawari (15.63%), Niwai (12.5%), Chaksu (12.5%) and Tonk (6.25%%) mandies. However, among the total KB infected samples110 samples (27.3 %) were falling in the range of 0.1-1.0 percent disease incidence and 7.7 per cent samples were in the range of 0.1-4.8 whereas, none of the sample exhibited beyond this range (1.1-5.0).

Table 8.4: Status of Karnal bunt during Rabi, 2022-23 in Rajasthan

S. No.	Location	0	0.1-1	1.1-5.0	5.1-10	10.1-25	>25	Total samples	Samples infected (%)	Mean	Infection range
District : Alwar											
1	Alwar	12	15	13	0	0	0	40	70.00	0.625	0.1-3.0
2	Khertal	15	23	7	0	0	0	45	66.67	0.463	0.1-2.5
3	Bansur	9	13	7	0	0	0	29	68.96	0.696	0.1-4.2
	Total	36	51	27	0	0	0	114	68.42	0.595	0.1-4.2
District : Dausa											
4	Dausa	25	7	0	0	0	0	32	21.88	0.056	0.1-0.7
5	Bandikui	11	5	0	0	0	0	16	31.25	0.0866	0.1-0.5
6	Lalsot	25	6	2	0	0	0	33	24.24	0.123	0.1-1.8
7	Mandawari	27	5	0	0	0	0	32	15.63	0.0272	0.1-0.2
	Total	88	23	2	0	0	0	113	22.12	0.073	0.1-1.8
District: Jaipur											
8	Bassi	17	7	1	0	0	0	25	32.00	0.027	0.1-4.8
9	Chaksu	28	4	0	0	0	0	32	12.5	0.018	0.1-0.2
10	Kotputli	8	11	1	0	0	0	20	60.00	0.33	0.1-2.4
	Sub-tootal Total	53	22	2	0	0	0	77	31.17	0.125	0.1-4.8
District: Tonk											
11	Tonk	30	2	0	0	0	0	32	6.25	0.013	0.1-0.4
12	Deoli	18	4	0	0	0	0	22	18.18	0.033	0.1-0.5
13	Malpura	14	4	0	0	0	0	18	22.22	0.0866	0.1-0.8
14	Niwai	14	2	0	0	0	0	16	12.5	0.02	0.1-0.2
15	Todaraisingh	9	2	0	0	0	0	11	18.18	0.01	0.1-02
	Total	85	14	0	0	0	0	99	14.14	0.033	0.1-0.8
	Overall	**262**	**110**	**31**	**0**	**0**	**0**	**403**	**34.99**	**0.207**	**0.1-4.8**

(Pradeep S. Shekhawat)

Punjab

A total of 188 samples out of 2521 showed Karnal bunt infection i.e. 7.46 percent samples were found to be infected with KB. District Tarntaran showed the maximum KB infected samples followed by Hoshiarpur and Gurdaspur. The range of per cent KB infected samples was 0.83(Fazlika) to 70.31 (Pathankot) as depicted in Table 8.5. As far as severity in concerned, the highest KB infection was in the Tarntaran and Kapurthalla districts followed by Gurdaspur. An overall infection in rest of the districts ranged between 0.00 (Malerkotla) to 0.292 (Tarntaran) with average infection in the state 0.076.

Table 8.5: Status of Karnal bunt in Punjab during 2022-23

S. No.	District	Total Samples	Infected Samples	% infected samples	% Average infection
1	Amritsar	47	7	14.89	0.130
2	Barnala	158	3	1.90	0.004
3	Bathinda	177	22	12.43	0.023
4	Faridkot	95	3	3.16	0.025
5	Fatehgarh Sahib	107	2	1.87	0.000
6	Fazilka	120	1	0.83	0.003
7	Ferozepur	221	7	3.17	0.027
8	Gurdaspur	108	32	29.63	0.190
9	Hoshiarpur	167	22	13.17	0.125
10	Jallandhar	100	3	3.00	0.172
11	Kapurthala	56	2	3.57	0.270
12	Ludhiana	261	3	1.15	0.117
13	Malerkotla	38	0	0.00	0.000
14	Mansa	110	12	10.91	0.016
15	Moga	131	2	1.53	0.040
16	Mohali	36	3	8.33	0.006
17	Muktsar	150	6	4.00	0.054
18	Pathankot	64	45	70.31	0.094
19	Patiala	88	0	0.00	0.003
20	Ropar	80	2	2.50	0.104
21	Sangrur	78	6	7.69	0.009
22	Nawanshar	69	0	0.00	0.178
23	Tarantarn	60	5	8.33	0.292
	Overall	**2521**	188	7.46	0.076

(Jaspal Kaur, Ritu Bala)

Uttarakhand

A total 1534 wheat samples were collected and analyzed, all the samples were found free from Karnal bunt infection except one sample from Pantnagar (Table 8.6). These samples were collected from the seed growers of three districts of Uttarakhand namely, Udham Singh Nagar, Nainital and Haridwar. The range of infection was 0.00–0.75%.

Table 8.6: Incidence of Karnal bunt in different districts of Uttarakhand during 2022-2023 crop season

S. No.	Districts	Total samples	No. of infected samples	Infected Samples (%)
1.	Udham Singh Nagar			
	Jaspur	63	15	23.80
	Rudurpur	483	126	26.08

	Gadarpur	523	110	21.03
	Bajpur	63	24	38.09
	Khatima	144	56	38.88
2.	Dehradun	60	18	30.00
3.	Haridwar	67	21	31.34
4.	Kotabagh (Nainital)	131	46	35.11
	Overall	**1534**	**416**	**27.11**

(Deepshikha)

Delhi

During 2022-23, wheat grain samples were collected from IARI fields. Out of 50 samples collected, KB was not observed in any sample (natural field condition). From Shamli grain market (UP) 100 wheat grain samples were collected from varieties HD 2967, DBW 303 and DBW 187. Out of 100 samples, 17 samples were found infected with KB. KB incidence ranged from 0.12-3.65 % in the analysed samples.
(MS Saharan)

Madhya Pradesh

A total of 406n wheat grain samples collcted from different mandies of Madhya Pradesh were the analysis of Karnal bnt infecetions and none of the samples found infected with the disease (Table 8.7).

Table 8.7: Status of Karnal bunt during Rabi, 2022-23 in Madhya Pradesh

District	**Blocks**	**Total samples**	**Infected samples**	**Infected samples (%)**	**Range of infection**
Dewas	Dewas	106	0	--	--
	Bagali	12	0	--	--
	Tokh-Kurd	39	0	--	--
	Hatpipalia	3	0	--	--
	Sonkutch	41	0	--	--
Indore	Indore	81	0	--	--
	Hathod	28	0	--	--
	Sawer	31	0	--	--
	Depalpur	36	0	--	--
Ujjain	Ujjain	5	0	--	--
	Bhat nagar	2	0	--	--
	Tarana	10	0	--	--
Khargone	Khargone	1	0	--	--
	Barwaha	2	0	--	--
	Maheshwar	1	0	--	--
Shajapur	Shajapur	1	0	--	--
	Polai	4	0	--	--
Dhar	Dhar	3	0	--	--
	Overall	**406**	**0**	**--**	**--**

(T.L. Prakasha)

Gujarat
A total of 574 seed samples were collected and examined from different locations of Maharashtra (Table 8.8). All the samples were found free from karnal bunt incidence.

Table 8.8: Status of Karnal bunt during Rabi, 2022-23 in Gujarat

S. N.	Location	Total no. of Sample	Infected samples	Per cent infected samples	Range of infection
1	Visnagar	22	0	--	--
2	Mehsana	25	0	--	--
3	Kadi	43	0	--	--
4	Kalol	39	0	--	--
5	Mansa	47	0	--	--
6	Himmatnagar	53	0	--	--
7	Khedbrahma	47	0	--	--
8	Vijapur	42	0	--	--
9	Talod	64	0	--	--
10	Palanpur	56	0	--	--
11	Idar	50	0	--	--
12	Junagadh	86	0	--	--
Overall		**574**	**0**	--	--

(S.I. Patel and Premabati Devi, I.B. Kapadiya; Ronak Thakkar)

Maharastra
A total of 228 seed samples were collected and examined from different locations of Maharashtra during 2022-23. All the samples were found free from karnal bunt incidence (Table 8.9).

Table 8.9: Status of Karnal bunt during Rabi, 2022-23 in Maharashtra

Sr. No.	Location		Total samples	Infected samples	Per cent infected samples	Range of infection
	Tahasil	District				
1	Niphad	Nashik	35	0	0	--
2	Nashik	Nashik	14	0	0	--
3	Sinnar	Nashik	13	0	0	--
4	Yeola	Nashik	17	0	0	--
5	Dindori	Nashik	18	0	0	--
6	Chandwad	Nashik	16	0	0	--
7	Pachora	Jalgaon	23	0	0	--
8	Shahada	Nandurbar	25	0	0	--
9	Taloda	Nandurbar	16	0	0	--
10	Pune	Pune	51	0	0	--
	Overall		**228**	**0**	**0**	**--**

(B.C. Game, B.M. Ilhe, C.B. Beldar, Sudhir Navathe)

Karnataka

A total of 50 samples were collected from Dharwad, Vijayapur, Belagavi, Bagalkot and Gadag districts during 2022-23. All the samples were free from Karnal bunt incidence.

(Gurudatt M. Hegde)

Black Point (BP) and Shriveled Grains (SG)

Rajasthan

Among the total 403 wheat grain samples, 244 (49.88 %) samples were infected with black point in the range of 0.1-6.2 per cent incidence being highest incidence (6.2%) was noted in a sample collected from Deoli (Tonk) mandi. Highest BP infected samples (78.95%) were found in Deolio (Tonk) mandi, followed by Niwai (75.0%), Lalsot(57.58%), Chaksu (56.25%), Bassi (56.0%), Khertal (53.33%), Mandawari (53.13%), Dausa (40.63%),Malpura (40.0%), Bandikui (37.5%), Deoli (47.1%),Todaraisingh(36.36%), Alwar (35.0%), Kotputli (35.0%) and Bansur (34.48%) mandies (Table 8.10)

Table 8.10: Status of black point during Rabi, 2022-23 in Rajasthan

S.N.	**Location**	**Total samples**	**Infected samples**	**Infected samples (%)**	**Infection range**
1	Alwar	40	14	35.0	0.2-1.6
2	Khertal	45	24	53.33	0.2-1.1
3	Bansur	29	10	34.48	0.1-1.1
4	Dausa	32	13	40.63	0.2-2.1
5	Bandikui	16	6	37.5	0.1-0.5
6	Lalsot	33	19	57.58	0.1-1.2
7	Mandawari	32	17	53.13	0.1-1.4
8	Bassi	25	14	56.0	0.2-1.8
9	Chaksu	32	18	56.25	0.2-2.1
10	Kotputali	20	7	35	0.2-0.7
11	Tonk	32	22	68.75	0.1-3.8
12	Deoli	22	15	78.95	0.1-6.2
13	Malpura	18	6	40.0	0.2-0.5
14	Niwai	16	12	75.0	0.1-2.2
15	Todaraisingh	11	4	36.36	0.1-0.5
	Overall	403	201	49.88	0.1-6.2

(Pradeep S. Shekhawat)

Punjab

About 36.97 % samples collected from the grain markets of the Punjab were found to be infected with Black point infected while 49.42 percent samples had shriveled grains. An average infection of black point and shriveled grains was 0.123 and 0. 221% (Table 8.11).

Table 8.11: Status of BP and SG in Punjab during 2022-23

S. No	District	Black point				Shriveled grains		
		Total Samples	Infected Samples	Infected samples (%)	Average infection (%)	Total Samples	Infected samples (%)	Infected samples (%)
1	Amritsar	47	21	44.68	0.183	35	74.47	0.387
2	Barnala	158	95	60.13	0.223	23	14.56	0.284
3	Bathinda	177	25	14.12	0.054	36	20.34	0.093
4	Faridkot	95	29	30.53	0.074	67	70.53	0.283
5	Fatehgarh Sahib	107	55	51.40	0.184	58	54.21	0.214
6	Fazilka	120	25	20.83	0.043	39	32.50	0.133
7	Ferozepur	221	66	29.86	0.081	127	57.47	0.171
8	Gurdaspur	108	35	32.41	0.156	39	36.11	0.277
9	Hoshiarpur	167	66	39.52	0.114	74	44.31	0.144
10	Jallandhar	100	45	45.00	0.123	75	75.00	0.269
11	Kapurthala	56	31	55.36	0.157	37	66.07	0.214
12	Ludhiana	261	118	45.21	0.143	199	76.25	0.325
13	Malerkotla	38	25	65.79	0.216	23	60.53	0.266
14	Mansa	110	5	4.55	0.104	8	7.27	0.149
15	Moga	131	52	39.69	0.108	85	64.89	0.284
16	Mohali	36	21	58.33	0.211	23	63.89	0.236
17	Muktsar	150	7	4.67	0.011	16	10.67	0.037
18	Pathankot	64	11	17.19	0.053	10	15.63	0.055
19	Patiala	88	31	35.23	0.101	48	54.55	0.206
20	Ropar	80	66	82.50	0.288	78	97.50	0.368
21	Sangrur	78	42	53.85	0.178	59	75.64	0.309
22	Nawanshar	69	25	36.23	0.143	51	73.91	0.320
23	Tarantarn	60	36	60.00	0.197	36	**60.00**	0.375
	Overall	**2521**	**932**	**36.97**	**0.123**	**1246**	**49.42**	**0.221**

(Jaspal Kaur, Ritu Bala)

Haryana

A total 1464 grain samples were collected from mandies of Haryana by IIWBR. Out of these 0.06% samples showed black point disease infection (Table 8.12).

Table 8.12. Status of BP in Haryana during 2022-23 crop season

Districts	Total samples	Infected samples	Infected samples (%)	Range of grain infection (%)
Kurukshetra	256	17	6.6	0.0-0.2
Karnal	500	64	12.8	0.0-0.5
Kaithal	303	0	0	-
Jind	128	0	0	-
Panipat	88	0	0	-
Rohtak	114	0	0	-
Ambala	75	15	20.0	0.0-0.2
Overall	**1464**	**96**	**0.06**	**0.0-0.05**

(ICAR-IIWBR)

Gujarat

Twelve different marketing yards located in different wheat growing areas of Gujarat were surveyed for wheat seed health status (Table 8.13). A total of 574 seed samples from marketing yards were examined. The maximum percentage of infection of black point was found as 91.86 in Junagadh followed by 31.81 in Visnagar. The minimum percentage of infection was recorded in Mansa with 6.38. The range of BP ranges from 0-13.28%.

Table 8.13: Status of BP in Gujarat during 2022-23

S.N.	Location	Total no. of Sample	No. of infected samples	Infected samples (%)	Range of grain infection (%)
1	Visnagar	22	7	31.81	0 - 13.28
2	Mehsana	25	5	20.00	0 - 9.42
3	Kadi	43	5	11.62	0 - 7.01
4	Kalol	39	4	10.25	0 - 2.75
5	Mansa	47	3	6.38	0 - 3.04
6	Himmatnagar	53	6	11.32	0 - 3.17
7	Khedbrahma	47	8	17.02	0 - 4.37
8	Vijapur	42	9	21.43	0 - 4.11
9	Talod	64	6	9.37	0 - 5.52
10	Palanpur	56	12	21.43	0 - 3.25
11	Idar	50	4	8.00	0 - 4.25
12	Juangadh	86	79	91.86	0-6.25
Overall		574	148	25.78	0-13.28

(I.B. Kapadia, Ms. Elangbam Premabatidevi, Ronak Thakkar)

Maharashtra

About 36.84 % samples collected from the grain markets of the Maharashthra were found to be infected with black point disease. An range of infection of black point ranged between 0.4-13.8% (Table 8.14).

Table 8.14: Status of BP in Maharashtra during 2020-21

Sr. No.	Location		Total samples	Infected	Per cent infected samples	Range of infection (%)
	Tahasil	District				
1	Niphad	Nashik	35	22	62.86	0.8-13.8
2	Nashik	Nashik	14	8	57.14	0.8-11.6
3	Sinnar	Nashik	13	4	30.77	1.0-5.5
4	Yeola	Nashik	17	4	23.53	0.8-4.2
5	Dindori	Nashik	18	6	33.33	0.6-7.8
6	Chandwad	Nashik	16	3	18.75	0.8-2.9
7	Pachora	Jalgaon	23	6	26.09	1.2-2.2
8	Shahada	Nandurbar	25	12	48.00	1.0-4.3
9	Taloda	Nandurbar	16	6	37.50	1.2-6.4
10	Pune	Pune	51	13	25.49	0.4-3.0
	Overall		**288**	**84**	**36.84**	**0.4-13.8**

(B.C. Game, B.M. Ilhe, C.B. Beldar, Sudhir Navathe)

Karnataka

A total of 50 samples were collected from Dharwad, Vijayapur, Belagavi, Bagalkot and Gadag districts during 2022-23. Twenty samples (40%) showed BP infection with 0-4.0 range of infection.
(Gurudatt M. Hegde)

8.3 Pathotype distribution of rust pathogens in India and Nepal during 2022-23

A total of 772 samples of three rusts of wheat collected from fourteen Indian states, and Nepal were analyzed during 2022-23.

Stripe rust of wheat (*Puccinia striiformis* f. sp. *tritici*)

During this crop year, 230 samples of stripe rust of wheat were analyzed from five Indian states (Himachal Pradesh, Punjab, Haryana, Uttarakhand, and Rajasthan) and Nepal. A total of eight pathotypes {238S119, 110S119, 46S119, T (47S103), P (46S103), 79S68, 6S0, and 7S0}of wheat striperust pathogen were identified. The field population was avirulent to *Yr5*, *Yr10*, *Yr15*, and *Yr*Sp. Most of the stripe rust samples of wheat were analyzed from Punjab (132) followed by Himachal Pradesh (51) and Uttarakhand (31). During the cropping season frequency of pathotype 238S119 was maximum (54.78%) followed by 110S119 (27.39 %)(Table 1). The frequency of 46S119 (virulent on *Yr2*, *Yr3*, *Yr4*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr18*, *Yr19*, *Yr21*,*Yr22*, *Yr23*, *Yr25*, and *Yr*A) was reduced to 12.17%. Pathotypes 46S103 and 79S68 were identified in 2 and 1 samples, respectively (Table 8.15).

Table 8.15: Pathotype distribution of wheat yellow rust pathogen (*Puccinia striiformis* f. sp. *tritici*) in India and Nepal during 2022-23

S. No.	State/UT/Country	No. of isolates Analyzed	Pathotype							
			238S119	110S119	46S119	T (47S103)	P (46S103)	79S68	6S0	7S0
1.	Himachal Pradesh	51	25	19	2	-	1	1	1	2

2.	Punjab	132	85	27	17	2	-	-	-	1
3.	Haryana	3	-	2	1	-	-	-	-	-
4.	Uttarakhand	31	8	12	7	1	1	-	2	-
5.	Rajasthan	9	7	2	-	-	-	-	-	-
Other country										
1	Nepal	4	1	1	1	1	-	-	-	-
Total		**230**	**126**	**63**	**28**	**4**	**2**	**1**	**3**	**3**

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

A total of 49 samples of wheatstem (black) rust were received from four Indian states (Gujarat, Maharashtra, Tamil Nadu, and Uttarakhand) during the crop season. Five pathotypes of *P. graminis* f. sp. *tritici* were identified from the analysis of 49 samples. Population analyzed during the year had avirulence to *Sr26*, *Sr27*, *Sr31*, *Sr32*, *Sr35*, *Sr39*, *Sr40*, *Sr43*, *SrTt3* and*SrTmp*. Pathotype 11 (79G31=RRTSF), virulent on *Sr2, Sr5, Sr6, Sr7b Sr9a, Sr9b,Sr9c, Sr9d, Sr9f, Sr9g, Sr10, Sr13, Sr14, Sr15, Sr16, Sr17, Sr18, Sr19, Sr20, Sr21, Sr28, Sr29, Sr30, Sr34, Sr36, Sr38, Sr*McN was recorded in more than 32% of the samples analyzed during the season, which was followed by 40A (26.53%) and 40-3 (22.4%) (Table 8.16). Pathotypes 40-3 and 21 were identified in eleven and three samples, respectively. Diversity of black rust pathogen was maximum in Tamil Nadu.

Table 8.16: Pathotype distribution of wheat stem rust pathogen (*P. graminis* f. sp. *tritici*) in India during 2022-23

S. No.	States/Countries	Number of isolates analyzed	Pathotypes identified*¥				
			11	**21**	**40A**	**40-2**	**40-3**
1	Gujarat	7	7	-	-	-	-
2	Maharashtra	17	9	-	4	-	4
3	Tamil Nadu	22	-	-	9	6	7
4	Uttarakhand	3	-	3	-	-	-
Total		**49**	**16**	**03**	**13**	**06**	**11**
Indian binomial names ¥North American equivalents 11 (79G31; RRTSF¥), 21 (9G5; CHMSC), 40A (62G29; PTHSC), 40-2 (58G13-3; PKRSC), 40-3 (127G29; PTTSF) based on Jin *et al*., *Plant Dis.* 2008,92: 923-6.							

Leaf rust of wheat (*Puccinia triticina*)

A total of 493 samples of wheat leaf rust pathogen were analyzed from 12 states of India and neighboring country Nepal. Nineteen pathotypes were identified in these samples. Pathotype 77-9 (121R60-1) was the most widely distributed and occurred in 36.11% of the samples followed by 52-4 (121R60-1, 7) in 27.79% samples (Table 3). Pathotype 77-5 (121R63-1), which remained most predominant for more than 20 years was observed in 15.82% samples only. The remaining 14 pathotypes were identified in 20.28% samples only. The *P. triticina*population from Uttarakhand was highly diverse as highest number of pathotypes (14) was detected in the samples collected from Uttarakhand (Table 8.18). In Nepal 4 pathotypes were detected in 26 samples. Unlike Indian scenario pathotype 52-4, detected in 16 samples, was the most predominant in Nepal.

Table 8.18: Pathotype distribution of leaf rust pathogen (*Puccinia triticina*) in India and Nepal during 2022-23

S. No.	State/Country	No. of isolates Analyzed	Pathotypes identified																		
			12-2 (1R5)	12-3 (49R37)	12-5 (29R45)	12-6 (5R45)	77-1 (109R63)	77.2 (109R31-1	77-3 (125R55)	77-5 (121R63-1)	77-6 (121R55-1)	77-8 (253 R31)	77-9 (121R60-1)	52-4 (121R60-1,7)	77-11 (125R28)	104-1 (21R31-1)	104-2 (21R55)	104-3 (21R63)	162-2 (93R39)	143 (61R47)	1 R31
1.	Himachal Pradesh	10	-	-	1	-	-	1	-	5	-	-	3	-	-	-	-	-	-	-	-
2.	Punjab	47	-	-	3	-	-	-	-	3	-	-	21	16		-	3	1	-	-	-
3.	Rajasthan	30	-	-	-	-	-	-	-	3	1	1	12	7	2	-	1	1	1	1	-
4.	Uttar Pradesh	20	-	-	1	-	-	-	-	1	-	-	3	11	1	-	2	-	1		-
5.	Uttarakhand	277	-	4	4	4	2	-	2	45	2	-	106	72	9	-	18	6	-	1	2
6.	Madhya Pradesh	13	1	-	-	-	-	-	-	5	-	-	2	3	-	-	1	-	-	1	-
7	Chhattisgarh	2	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-
8.	Bihar	2	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
9.	West Bangal	9	-	-	-	-	-	-	-	3	-	-	2	4	-	-	-	-	-	-	-
10.	Gujarat	4	-	-	-	-	-	-	-	1	-	-	3		-	-	-	-	-	-	-
11.	Maharashtra	19	-	-	1	1	-	-	-	3	-	-	5	3	-	1	2	2	-	1	-
12.	Karnataka	34	1	-	1	-	2	1		8	-	-	10	4	3	-	2	1	-	1	-
Other Country																					
1.	Nepal	26	-	-	-	-	-	-	-	1	-	-	8	16	-	-	-	1	-	-	-
Total		**493**	**2**	**4**	**11**	**5**	**4**	**2**	**2**	**78**	**3**	**1**	**178**	**137**	**15**	**1**	**29**	**12**	**2**	**5**	**2**

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8.4 55th Wheat Disease Monitoring Nursery (WDMN) 2022-23

Wheat disease monitoring nursery (earlier trap plot nursery) is an effective tool for monitoring the occurrence of wheat diseases especially rusts across different wheat growing zones of India. In addition, it helps in knowing the seasonal progress of the diseases in all the zones. Samples analyzed from WDMN gives an overview of area wise 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.

There is more than twenty million hectares area in SAARC countries having more or less similar conditions for cultivation of wheat. Under these circumstances, it becomes a common interest of the SAARC nations to combat wheat diseases jointly. Like the objectives of WDMN in India, an exercise on the understanding of the difference, spread and intensity of wheat diseases in SAARC nations is attempted through the SAARC-Wheat Disease Monitoring Nursery (SAARC-WDMN). During 2022-23, SAARC-WDMN was planted at 31 locations across the six SAARC countries (Table 8.19).

Table 8.19. Detail of SAARC-WDMN locations and contact persons

S. No.	Country/ Locations	Contact person
1.	Nepal (9 sets)	CIMMYT, New Delhi, India*
2.	Bangladesh (3 sets)	-do-
3.	Pakistan (2 sets)	-do-
4.	Bhutan(1 set)	-do-
5.	Afghanistan(1 set)	-do-
6.	India (16 sets)	Head, ICAR-IIWBR RS, Flowerdale, Shimla
Total	**31 locations**	

*Coordinator: Dr. A.K. Joshi

Information on wheat diseases in SAARC Wheat Disease Monitoring Nurseryhas been received from 15 locations of India, four locations of Bangladesh, and 7 locations of Nepal. Data from Afghanistan, Bhutan, and Pakistan is awaited. In India SAARC wheat disease monitoring nursery data have been received from 15 locations as listed in Table 8.20.

Table 8.20. Locations of SAARC wheat disease monitoringnursery in India

State	Co-operator	Locations
Himachal Pradesh	ShiwaliDhiman	Dhaulakuan
Jammu & Kashmir	MK Pandey MK Pandey MK Pandey	Udhaywalla (Jammu) Kathua Rajauri
Delhi	VKSingh	New Delhi
Punjab	JaspalKaur	Abohar Gurdaspur Langroya Ludhiana Ropar
Rajasthan	PS Shekhawat	Durgapura (Jaipur)
Tamil Nadu	M. Sivasamy	Wellington
Uttar Pradesh	SP Singh	Faizabad
Uttarakhand	Deepshikha KK Mishra	Pantnagar Almora

The SAARC wheat disease monitoring nursery comprised 20 lines contributed by four SAARC countries (Table 8.21).

Table 8.21. 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

The SAARC nursery was planted at one locationof NHZ (Almora, Uttarakhand), 12 locations of NWPZ, Faizabad, Pusa, and Wellington.Yellow rust was observed at all the SAARC nursery locations in NHZ and NWPZ except Abohar, Gurdaspur, Langroya, and Ropar. Yellow was not reported from Pusa, Faizabad and Wellington in other zones. First report of yellow rust on SAARC WDMN was from Kathua (05.01.23) followed by Jammu (10.01.23), Dhaulakuan (11.02.2023), Durgapura (13.02.2023), Almora (25.02.2023), Delhi (26.02.2023), and Rajouri (06.03.23) (Table 4). At Delhi yellow rust was observed only on PBW343 (60S), HD2687 (TS), Inquilab 91 (TR), Kohsar (5S) and susceptible check (60S) other entries were yellow rust free. Similarly at Durgapura yellow rust was observed only on PBW343 (5S), Raj3765 (TMS), and susceptible check (5S). Maximum YR severity was observed at Ropar and Langroya, where 16 entries had ≥40S yellow rust severity. Similarly fifteen entries at Ludhiana and thirteen entries at Gurdaspur had ≥40S yellow rust severity. Entry Pak81 had ≥40S yellow rust severityat all the locations, except Delhi and Durgapura, where yellow rust was observed

Brown rust was observed at all the locations of SAARC-WDMN except Dhaulakuan, Gurdaspur, Langroya, and Ropar.The date of first appearance of brown rust is received from few locations, according to which the earliest appearance of brown rust was from Wellington (24.12.2022) followed by Durgapura (13.02.2023), Delhi (26.02.2023), Jammu and Kathua (27.02.2023), Faizabad (03.03.2023), andAlmora (03.04.2023)(Table 4). At Delhi brown rust was reported only on WL1562 (TR) and susceptible check (20S). Entry HP1633 was free from brown rust infection at all the locations except Abohar (TS) and Wellington (10MR), while it appeared on PBW660 only at Jammu (40S), Kathua and Rajouri (40S). Brown rust severity was high at Wellington with 12 entries showing equal to or more than 20S disease severity. Six entries (HD2687, HD2189, Punjab85, Chakwal86, Rawal87, and Bhaktawar94) had 20S brown rust severity at Ludhiana, while other entries were brown rust free. All the entries except PBW660, Punjab85, Rawal87, and Susceptible check at Abohar; PBW660, Chakwal86, Bhaktawar94, and Gourob at Wellington were infected with brown rust at these two locations. Black rust was observed only at Wellington other locations were black rust free. At wellington all entries except PBW660 and Punjab85 had black rust infection (Table 8.22).

Table 8.22. Incidence of rusts in SAARC Wheat Disease Monitoring Nursery in India during 2022-23

S. N.	Varieties	Yellow													Brown											Black
		ABO*	ALM	DEL	DKN	DUR	GUR	JAM	KAT	LAN	LUD	PAN	RAJ	ROP	ABO	ALM	DEL	DUR	FAZ	JAM	KAT	LUD	PAN	RAJ	WEL	WEL
1	Annapurna-1	5S	60S	0	40S	0	40S	40S	20S	60S	60S	60S	20S	40S	40S	20S	0	TS	50S	40S	40S	0	60S	20S	40S	10MR
2	WL1562	TS	20S	0	10S	0	40S	20S	20S	40S	20S	20S	20S	40S	5S	0	TR	0	0	10MS	10S	0	5S	10S	40S	10MS
3	HD2204	5S	20S	0	20S	0	20S	40S	40S	40MS	20S	30S	40S	40S	40S	20S	0	0	30S	20S	20S	0	15S	20S	10S	20MS
4	PBW343	20S	60S	60S	40S	5S	60S	60S	60S	60S	60S	100S	60S	80S	5S	5S	0	0	30S	5MS	10S	0	0	0	10S	10MR
5	HD2687	0	40S	10S	60S	0	40S	40S	40S	60S	60S	40S	20S	60S	40S	5S	0	TS	0	5MS	10S	20S	20S	0	20S	10MR
6	HD2189	0	20S	0	20S	0	10S	20S	10S	20S	20S	50S	20S	20S	10S	10S	0	0	0	0	0	20S	TS	0	20S	20MS
7	HP1633	TS	60S	0	60S	0	40S	60S	40S	80S	60S	100S	40S	80S	TS	0	0	0	0	0	0	0	0	0	10MR	40S
8	RAJ3765	TS	60S	0	80S	TMS	40S	20S	10S	60S	60S	90S	40S	60S	5S	0	0	0	20S	0	10S	0	0	0	20S	10S
9	PBW660	0	0	0	10S	0	40S	10MS	10MS	10S	10S	20S	20S	10S	0	0	0	0	0	40S	5S	0	0	40S	0	0
10	PAK81	0	60S	0	40S	0	40S	40S	40S	60S	40S	80S	40S	60S	40S	TS	0	5S	40S	20S	40S	0	20S	10S	40S	10MR
11	Punjab85	0	5S	0	10S	0	5S	20MS	10MS	20S	10S	10S	10MS	20S	0	0	0	0	10S	0	10S	20S	10S	0	10MR	0
12	Chakwal86	0	5S	0	10S	0	10S	20MS	10S	20MS	40S	5S	20MS	20S	TS	0	0	0	0	20S	10MS	20S	0	20S	0	60S
13	Faisalabad85	5S	60S	0	60S	0	40S	40S	60S	60S	60S	100S	40S	60S	10S	5S	0	5S	40S	20S	10S	0	30S	5S	40S	20MS
14	Inquilab91	40S	60S	TR	80S	0	40S	60S	40S	60S	60S	100S	40S	60S	60S	TS	0	5S	40S	TMS	40S	0	0	0	40S	20M
15	Faisalabad83	0	5S	0	20S	0	40S	40S	20S	60S	60S	80S	20S	60S	5S	0	0	0	20S	40S	10S	0	10S	20S	20S	20S
16	Rawal87	TS	10S	0	10S	0	20S	40S	40S	60S	40S	60S	20S	60S	0	0	0	0	0	0	40S	20S	20S	0	20S	10MR
17	Kohsar	TS	10S	5S	20S	0	10S	60S	40S	60S	60S	80S	60S	60S	5S	0	0	0	5MS	0	10S	0	TR	0	40S	20M
18	Bakhtawar94	TS	5S	0	10S	0	5MS	20S	40S	40S	40S	5S	10S	40S	10S	0	0	5MS	0	5MS	TMS	20S	10S	0	0	10M
19	Gourab	5S	60S	0	40S	0	60S	20S	10S	60S	60S	100S	20S	60S	5S	TS	0	0	0	0	10S	0	0	0	0	10MR
20	Susceptible check	40S	40S	60S	80S	5S	60S	60S	40S	80S	80S	100S	60S	80S	0	20S	20S	0	80S	40S	60S	0	70S	40S	40S	60S

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

Blights

Leaf Blight (LB) of wheat was observed only at four locations (Jammu, Kathua, Faizabad, and Rajouri) of SAARC-WDMN nursery, where all the entries were showing blight infection at all four locations. First report of blight was from Faizabad(25.01.2023) followed byJammu(10.02.2023), Kathua (27.02.2023) andRajouri (06.03.2023) (Table 5).Severity of leaf blight was maximum at Faizabad, where minimum LB score was 57on 8 entries and maximum score was 79 on susceptible check followed by LB score 68 on two entries and 67 on six entries (Table 8.23). At Jammu 17 entries had leaf blight score ≥23.

Table 8.23. Leaf blight Incidence in SAARC-Wheat Disease Monitoring Nursery in India during 2022-23

S. No.	Varieties	Leaf Blight Severity (dd)			
		Faizabad	**Jammu**	**Kathua**	**Rajouri**
1	Annapurna-1	57	23	35	13
2	WL1562	46	35	13	23
3	HD 2204	58	36	13	23
4	PBW 343	57	24	13	0
5	HD 2687	56	24	13	13
6	HD 2189	57	35	23	13
7	HP 1633	67	26	25	15
8	Raj 3765	57	24	24	15
9	PBW 373	57	13	24	13
10	Pak 81	67	24	15	13
11	Punjab 85	67	35	23	13
12	Chakwal 86	57	13	35	23
13	Faisalabad 85	67	24	24	24
14	Inquilab 91	68	24	24	13
15	Faisalabad 83	68	35	12	24
16	Rawal 87	67	35	25	12
17	Kohsar	57	26	34	23
18	Bakhtawar 94	67	13	24	12
19	Gourab	57	25	12	12
20	Susceptible check	79	36	24	25
Date of first appearance		25.01.23	10.02.23	27.02.23	06.03.23

Powdery mildew

Powdery mildew was observed only at six locations (Almora, Dhaulakuan, Jammu, Rajouri, Wellington, and Kathua) of SAARC-WDMN. First report of powdery mildew was from Wellington (05.12.2022) followed by Jammu & Dhaulakuan (10.02.2023), Almora (16.02.2023), and Rajouri (06.03.2023). All the entries were infected with powdery mildew at all four locationsexcept Gourob at Jammu and Kathua, Bhaktawar94 at Kathua, Inquilab91 at Jammu, PBW660 at Almora & Kathua,Pak81 at Almora, PBW343 at Rajouri, HD2204, Faisalabad85, Chakwal86, and Faisalabad83, Annapurna at Wellington (Table 8.13). Maximum severity of powdery mildew was observed at Dhaulakuan, where all SAARC-WDMN entries were showing PM severity of 4 or more.The severity of Powdery Mildew was minimum at Wellington, where fifteen entries had powdery mildew score of 1. The severity of Powdery was ≥4 on 13 entries at Jammu and Rajouri, while 10 entries at Kathua had ≥4 PM score (Table 8.24).

Table 8.24. Powdery Mildew incidence in SAARC Wheat Disease Monitoring Nursery in India during 2022-23

S. No.	Varieties	Powdery Mildew Severity					
		Almora	**Dhaulakuan**	**Jammu**	**Kathua**	**Rajouri**	**Wellington**
1	Annapurna-1	7	4	5	4	6	1
2	WL1562	5	4	4	2	3	2
3	HD 2204	0	6	3	4	4	1
4	PBW 343	9	9	6	7	6	2
5	HD 2687	9	9	5	4	5	4
6	HD 2189	9	4	1	3	3	2
7	HP 1633	3	6	2	3	2	3
8	Raj 3765	5	9	7	5	5	3
9	PBW 373	0	4	4	0	3	4
10	Pak 81	0	4	5	5	4	1
11	Punjab 85	5	4	4	2	4	2
12	Chakwal 86	0	6	5	4	3	1
13	Faisalabad 85	0	6	4	5	5	5
14	Inquilab 91	5	9	0	2	3	2
15	Faisalabad 83	0	6	1	2	6	1
16	Rawal 87	5	6	7	7	5	3
17	Kohsar	3	4	4	3	6	2
18	Bakhtawar 94	5	6	2	0	4	1
19	Gourab	7	4	0	0	3	3
20	Susceptible check	7	9	6	5	5	6
Date of first appearance		16.02.23	10.02.23	10.02.23	27.02.223	06.03.23	05.12.22

Loose Smut

Like previous years there was no report of loose smut from any of the locations of SAARC-WDMN nursery during 2022.23.

Disease situation in Bangladesh

SAARC-WDMN was planted at three locations in Bangladesh (Jashore, Dinajpur, Jamalpur,and Joydebpur). Brown rust was observed only on susceptible check at Jashore while at Dinajpur all the entries had brown rust infection with 7 entries showing more than 20S severity (Table 8.25). Wheat blast was reported only from Jashore where all the entries had blast infection with disease severity ranging between 2 to 100. Leaf blight was observed at all the locations with maximum disease severity at Dinajpur, where 12 entries had 85 or more LB severity. Similarly LB severity at Jashore, Jamalpur, and Joydebpurwas equal or more than 64, 32, and 31, respectively (Table 8.25).

Disease situation in Nepal

SAARC-WDMN was planted at seven locations (Hardinath, Rampur, Parwanipur, Bhairahawa, Khajura, Tarahara, and Khumaltar) in Nepal. Brown rust was observed at all the locations except Khumaltar, while yellow rust was observed only at Khumaltar (Table 8.26). Brown rust appeared on all the entries of SAARC-WDMN at all six locations. Likewise, yellow appeared on all the entries at Khumaltar.Highest brown rust severity was observed at Khajura, where thirteen entries had ≥30S severity of brown rust. At Khumaltar all the SAARC-WDMN entries, except HP-1633 (20MR), had ≥30MR severity of yellow rust (Table 8.15).Data from Afghanistan, Bhutan, and Pakistan is awaited.

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Table 8.25 .Incidence of wheat diseases in SAARC Wheat Disease Monitoring Nursery in Bangladesh during 2022-23

S. No.	Varieties	Brown Rust				Blast				Leaf blight			
		Jashore	Dinajpur	Jamalpur	Joydebpur	Jashore	Dinajpur	Jamalpur	Joydebpur	Jashore	Dinajpur	Jamalpur	Joydebpur
1	Annapurna-1	0	TMSS	30 S	0	63	-	-	-	64	75	63	65
2	WL1562	0	0	0	0	4	-	-	-	88	85	73	75
3	HD 2204	0	5 S	0	0	16	-	-	-	53	76	62	65
4	PBW 343	0	30 S	10 MS	20 MR	100	-	-	-	63	75	52	76
5	HD 2687	0	30 S	5 S	0	86	-	-	-	54	85	63	75
6	HD 2189	0	T MSS	0	0	3	-	-	-	41	76	62	75
7	HP 1633	0	0	0	0	5	-	-	-	76	87	61	75
8	Raj 3765	0	20 S	0	20 MR	100	-	-	-	75	85	62	77
9	PBW 373	0	30 S	10 MS	30 MR	56	-	-	-	43	85	51	75
10	Pak 81	0	10 S	0	10 MR	86	-	-	-	42	75	41	64
11	Punjab 85	0	10 S	0	0	14	-	-	-	65	76	31	65
12	Chakwal 86	0	20 S	5 MS	0	100	-	-	-	76	85	31	76
13	Faisalabad 85	0	10 S	40 MSS	20 MR	86	-	-	-	54	76	52	65
14	Inquilab 91	0	T MSS	0	0	2	-	-	-	77	86	52	76
15	Faisalabad 83	0	10 S	0	0	100	-	-	-	86	86	42	65
16	Rawal 87	0	20 S	0	30 MR	100	-	-	-	85	85	61	65
17	Kohsar	0	T MSS	0	0	42	-	-	-	53	84	52	64
18	Bakhtawar 94	0	5S	0	10 MR	24	-	-	-	74	85	52	66
19	Gourab	0	TMSS	0	0	2	-	-	-	32	75	41	76
20	Susceptible check	5MR	40S	10 MS	20 MR	14	-	-	-	64	87	41	65

Table 8.26 Incidence of wheat diseases in SAARC Wheat Disease Monitoring Nursery in Nepal during 2022-23

S. No.	Genotypes	Locations						
		Brown rust						Yellow rust
		Hardinath	Rampur	Parwanipur	Bhairahawa	Khajura	Tarahara	Khumaltar
1	Annapurna-1	25 MS	20MR	20R	80 MS	60S	30S	50MR/MS
2	WL-1563	20 S	10MR	5R	70 MS	60S	20MS	70S
3	HD-2204	50 MR	10MR	40MS	70 MS/S	40MSS	20S	90S
4	PBW-660	5 R	10MR/20 MS	40MS	Traces	TR	30S	50S
5	HD-2687	5 MR	10MR /10 MS	40MS	10 MR	20MS	10S	60MR/MS
6	HD-2189	5 R	TR	10R	60 MS/S	40MSS	30S	60MR/MS
7	HP-1633	Traces	Traces	Traces	10 MS	5MR	10MS	20MR
8	RAJ-3765	5 MR	20 MR	5R	40 MR/MS	40S	Traces	30MR
9	PBW-373	TRACES	TR	1R	10 MR	30S	Traces	50MR/MS
10	PAK-81	70 S	5 MR	5R	80 MS/S	60S	40MS	60MR/MS
11	PANJAB-85	5 R	10 MS	80S	10 MR	80S	60S	90S
12	CHAKWAL-86	TRACES	5 MR	60S	5 MR	20MS	20MS/S	90S
13	FAISALABAD-85	5 R	TR	10MR	T MR	20MS	5MR/MS	30MR
14	INQUILAB-85	5 MR	TR	40MS	5 MR	40S	60S	70S
15	FAISALABAD-83	10 MR	5 MR	60S	10 MR	40MSS	20S	90S
16	RAWAL-87	25 MS	60 MS/S	20MR	50 MR/MS	30MS	40S	60MR/MS
17	KOHSAR	15 MS	20 MS	30 MS	40 MS	20S	50S	60MR/MS
18	BAKHTWAR	50 S	40 S	30 S	80 MS	60S	90S	60MR/MS
19	GAURAB	10 MR	5 MR	5 MS	15 MR/MS	30S	20MS	70MR/MS
20	MOROCCO (S. Check)	15 MS	80 S	80 S	60 MS	10MS	60S	90S

PROGRAMME 9. INTEGRATED PEST MANGEMENT IN WHEAT

9.1 HOST RESISTANCE AGAINST DISEASES

I. Elite Multiple Disease Screening Nursery (EMDSN), 2022-23

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. A total of 59 resistant sources identified in EMDSN against rusts are cross checked for resistance to other diseases at hot spot multi-locations under artificially created conditions to reconfirm their resistance.

Testing Centres:
Stem rust: Mahabaleshwar, Indore, Dharwar, Niphad and Wellington;
Leaf rust (N): Delhi, Ludhiana, Hisar and Karnal; for leaf rust (S): Mahabaleshwar, Indore, Dharwar, Niphad and Wellington
Stripe rust: Ludhiana, Pantnagar, Hisar, Dhaulakaun, Mallan, Almora and Karnal
Karnal bunt: Delhi, Dhaulakaun, Pantnagar, and Ludhiana; for leaf blight: Ayodhya, Varanasi, Coochbehar, Sabour, Hisar, andKalyani; for
Head scab: Delhi, Dhaulakuan, Gurdaspur
Flag smut: Hisar, Ludhiana and Durgapura, Delhi
Powdery mildew: Dhaulakaun, Malan, Jammu, Pantnagar, and Mallan
Cereal cyst nematode: Durgapura, Hisar and Ludhiana

The stem rust data of Niphad, Leaf rust (S) data of Dharwad and Leaf rust (N) data of Karnal was not considered due to erratic disease.

Based on the rusts ACI up to 10.0, Karnal bunt (KB) up to 5.0%, Flag smut (FS) up to 5%, powdery mildew (PM) up to 3, head scab (FHB) upto 2, and leaf blight (LB) up to average score upto 35 and highest score upto 57 entries were categorized resistant (Table 9.1). Following entries were found to possess multiple disease resistance:

Total entries: 59

Resistant sources identified

A. Resistant to stem, leaf and stripe rusts +

Resistant to all three rusts + KB + FS + PM:
HI8846, HI 8830 (d), WHD 965 (d), HI 8827 (d), HI8839(d), WH1403, HI8847
Resistant to all three rusts + KB + PM:
PBW870
Resistant to all three rusts + FS + PM:
PBW902, VL3029, HD3407*, HPW 489, HPW 495
Resistant to all rusts+ LB+ FS+PM
HPW493

B. Resistant to yellow rust +

Resistant to yellow rust+ leaf rust + KB+ PM+FS:
HPW484, VL3028

Resistant to yellow rust+ stem rust + FS +PM:
HPW487

Resistant to yellow rust+ leaf rust + FS:
HD3440

Resistant to yellow rust + leaf rust:
VL3028, HPW 484, B2011\CIMCOG\18, 41st ESWYT 141

Resistant to yellow rust+ KB+ PM+FS:
HS694

Resistant to yellow rust+ PM + FS:
VL2043, HD3402

C. Resistant to leaf rust +

Resistant to leaf rust + stem rust + KB+ PM + FS:
CG 1036, WH1402, HPW 496
Resistant to leaf rust + stem rust + PM + FS:
HI1654*, HD3438, HD3437
Resistant to leaf rust + stem rust + PM:
GW547[B], NIAW4028, GW532, HI1655Q*, MACS6795, HI 1651

Resistant to leaf rust + stem rust:
HI1665, WH1403, HD3407*, HI8847, 41st ESWYT 113, EC 0529881, IC 624342

E. Resistant to stem rust +

Resistant to stem rust+ PM+FS:
HD3392

F. Resistant to other than rust diseases

Resistant to KB+FS+PM:
VL2044

Resistant to FS + PM:
HPW 497

Table 9.1: Entries tested in elite multiple disease screening nursery (2022-23)

S. No.	Entry	Stem Rust		Leaf Rust (S)		Leaf Rust (N)		Stripe Rust		LB (dd)		KB (%)		PM (0-9)		FS (%)	FHB (%)	CCN
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AV	HS	AV	HS	AV	HS			
1	PBW870	4.6	10S	4.3	20S	3.2	20S	3.3	20MR	45	57	3.6	8.3	2	5	5.6	4	HS
2	HI8846	1.6	10S	1.2	20MR	2	15S	3.8	20MS	34	89	1.9	3.5	2	3	3.9	5	S
3	PBW902	3.1	10MS	4	40MS	3.8	20S	3	20MS	45	79	12.1	36.8	2	5	4.5	4	S
4	HI 8830 (d)	3	10S	1.9	10MS	4.1	20S	9.9	20MS	56	89	2	3.6	2	4	1.5	5	S
5	WHD 965 (d)	7.5	20S	2.3	20MS	1.9	15S	3.2	10MS	56	78	1.4	3.1	1	3	0	4	S
6	HI 8827 (d)	3.8	20MS	1.6	20MR	3	10S	9.5	40MS	56	89	2.3	4.7	1	1	0	5	HS
7	VL3029	1.1	5MS	3.1	10MS	6.7	20S	2.8	10S	67	79	8.5	24.3	1	2	5	4	S
8	HI8839(d)	1.6	5MS	2.6	10MS	2.6	10S	2	20MR	46	68	2.2	4.3	3	5	0	5	S
9	GW547[B]	1.3	10MR	0.5	5MS	1.3	5S	28.4	70S	56	78	9.5	28.4	2	4	6.6	5	S
10	HI1665	1.3	5MS	0.4	5MR	4.4	20S	57	100S	67	89	14.4	44	4	5	12.7	5	S
11	NIAW4028	0.9	5S	0.3	5MR	3.8	20S	53.4	90S	56	89	11.4	38.9	2	5	5.3	4	HS
12	GW532	1.3	10MR	0.3	5MR	1.3	10S	31.4	60S	56	79	5.9	11.6	2	3	5.6	3	S
13	HI1655[Q]*	0.8	10MR	0.7	5S	2.6	20S	30.8	80S	56	99	11.2	31.1	1	2	11.3	4	HS
14	MACS6795	5	20MS	3.3	20S	3.8	30S	64.4	100S	56	79	8.1	19.2	3	6	6.3	4	S
15	HI1654*	4.9	20MS	1.3	10MS	1.9	10S	13.7	60S	56	89	9.8	30.8	2	4	3.3	5	HS
16	WH1403	5	15MS	4.6	20S	1.9	10S	1	20MR	56	89	4.2	9.5	2	3	4.5	5	S
17	HD3438	4	20MS	0.5	5MR	4.4	20S	61	100S	45	79	12.1	40.9	3	7	5	4	S
18	HD3407*	2	20MR	0.5	5MR	2.5	10S	4.1	15S	35	79	16	52.4	3	7	4.5	5	HS
19	HI8847	1.5	10MR	0.3	5MR	3.1	20S	8.3	60S	56	99	0.9	2.5	3	5	0	5	HS
20	CG 1036	5.5	20MS	0.8	5MS	7.5	40S	61.5	100S	56	79	4.4	12	3	7	1.8	5	S
20A	Infector (for rust)	55	80S	62.5	80S	78.8	100S	73.8	90S	89	99	20.7	42.5	5	5	16.6	4	-
20B	HD 2967(for KB)	32.6	80S	41.4	80S	46.7	80S	55	100S	89	99	20.1	30.5	5	5	22.2	5	-
20C	PBW 343(for PM)	16.3	40S	17.9	60S	66.7	80S	40	60S	67	79	15.9	22.5	3	3	18.8	3	-
20D	WH147 (for LB)	15.1	40S	25.1	80S	36.7	80S	55	80S	68	89	15.4	18.5	6	7	20	4	-
20E	Infector (FHB)	25.7	60S	40	80S	60	80S	50	80S	67	79	18.9	30.5	6	7	22.2	5	-
21	HI 1651	3.5	20S	3.3	20S	3.6	20S	33.5	80S	56	79	14.3	35.5	3	5	12.5	5	HS
22	WH1402	4.8	20MS	6	20MS	6.5	40S	11.9	60S	56	79	4.6	9.1	2	3	4.5	5	HS
23	HD3440	22.5	40S	3	10MS	7.1	40S	7.8	60S	56	68	16.5	55.2	5	9	4.5	3	HS
24	HD3437	9.1	40S	6.3	40S	2.9	10S	14	80S	46	79	7.8	17.6	2	3	3.5	3	HS
25	VL2043	8	20S	13.8	40S	19.8	60S	16.8	80S	56	78	7.4	13.2	3	4	5	5	S
26	VL2044	12.2	40S	10.5	40MS	3.8	10S	15	80S	56	79	3.8	5.2	2	3	4.6	5	HS
27	HD3402	11.5	20S	13.6	40S	6.3	20S	1.8	20MR	56	89	7.3	20.4	3	5	3.6	5	S
28	HS694	10.9	40S	11.3	20S	11.6	20S	3.6	20MS	56	99	3.2	5.8	2	3	5	4	S
29	VL3028	10.1	40S	4.6	10MS	7.1	40S	4.2	20MS	45	67	4.3	6.9	1	1	6.6	3	HS

30	HD3392	8.0	20S	21.3	40S	16.5	40S	10.9	60S	56	78	9.1	21.9	2	5	5	5	HS
31	HPW 484	20.9	60S	7.4	20S	7.5	40S	6.1	20S	56	89	4.7	6.5	3	5	3.5	4	S
32	HPW 487	2.3	10MS	4.3	20S	12.5	40S	6.8	40MS	67	89	7.3	16	1	3	4.3	5	S
33	HPW 489	2.7	10S	1.5	10S	2.2	15S	2.3	10S	34	67	8.4	25.2	1	3	5	5	S
34	HPW 493	4.1	15MS	2.4	10S	6	30S	8.3	40S	35	57	5.6	8.8	1	1	4.6	5	S
35	HPW 495	8.8	30S	4.9	10S	8.7	40S	6.6	20S	56	78	13.8	45.7	2	3	3.3	5	S
36	HPW 496	4.7	20MS	4	20MS	3.1	20S	12.7	60S	56	68	4.2	4.9	1	3	5	5	S
37	HPW 497	19.9	40S	10.5	20S	18.5	40S	11	60S	45	67	6.8	14.1	2	3	4.5	3	S
38	HPW 498	8	20S	3.8	10S	15	40S	20.9	60S	46	79	13.2	44.4	4	7	18.6	5	S
39	EC 0597893	2.9	10S	3.6	20MS	11.6	40S	22.3	80S									
40	EC 933775	0	R	1.9	10S	5.1	20S	7.3	30S									
40A	INFECTOR	61.3	80S	62.1	80S	78.8	100S	70	80S									
41	B2011\CIMCOG\18	13.5	40S	7.4	20S	4.2	15S	7.7	40S									
42	B2011\CIMCOG\21	9.9	40S	7.6	20S	3.4	20S	4.3	10MS									
43	CWI 13118	20.3	40S	35.7	80S	47.1	100S	12.6	60S									
44	BW 35109	15.7	40S	9.3	20S	18.5	90S	13.9	80S									
45	BW 35110	17.3	40S	7	20S	20.6	90S	8.4	40MS									
46	BW 35112	16.8	40S	11.9	60S	25.7	80S	8.1	60S									
47	BW 35114	21.8	60S	16.4	80S	20.1	80S	8.6	60S									
48	BW 35116	8.8	20S	9.4	20S	26.3	80S	5.5	20MS									
49	CWI 99449	30	60S	22.9	60S	45.7	100S	10.4	60S									
50	CWI 41166	5.3	20MS	17.1	40S	25.7	60S	7	40S									
51	41st ESWYT 113	9.2	60S	6.7	20S	5.6	15S	13.1	40S									
52	41st ESWYT 141	17.8	40S	9	40MS	5.9	15S	6.4	40S									
53	41st ESWYT 142	9.8	40S	3.9	15MS	4.4	10S	9.3	60S									
54	EC 0631997	5.6	20S	3.7	10MS	0.3	5MR	7.8	40S									
55	EC 0529881	1	10MS	6.9	20S	4.3	20S	28.1	80S									
56	EC 933808	25.8	60S	6.6	20S	2.6	10S	25.6	60S									
57	IC 624779	11.5	60S	7.1	20S	3.3	20S	21.3	60S									
58	IC 624342	4.3	20S	3.1	20S	3.3	20S	36.6	60S									
59	E 4035	5.7	40S	4.3	20S	20	40S	35.6	80S									
59A	Infector (for rust)	62.5	80S	62.9	80S	77.5	100S	68.8	90S									

Abbreviations: LB- leaf blight; KB- Karnal bunt; FS- Flag smut; PM - powdery mildew; FHB- head scab; CCN- Cereal cyst nematode; HS=highly susceptible; S= Susceptible

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II. Screening of MDSN 2020-21 entries against loose smut

Thirty one entries of EMDSN (2020-21) were inoculated with loose smut during 2021-22 crop season and expression of loose smut was observed during 2022-23 season at Almora, Durgapura Hisar, 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 9.2).

Total entries: 31

Loose smut resistant sources identified:

Free: Nil

Loose smut resistant entries:
DDW47 (d), HI 8627(d), NIAW 3170

Table 9.2. Performance of multiple disease screening nursery (2021-22) against loose smut during 2022-23 crop season

S. No.	Entry	Loose smut (%)					
		Almora	Durgapura	Hisar	Ludhiana	AV	HS
1	HS 507	29.19	4.26	26.6	4.26	16.1	29.19
2	HS 679	37.5	0.00	86.6	0	31.0	86.6
3	UAS 472(d)	0.71	1.69	45	0	11.9	45
4	DDW47 (d)	0	0.00	20	0	5.0	20
5	HD 3334	25.55	7.14	36	16.13	21.2	36
6	HS 681	43.36	3.92	30	3.85	20.3	43.36
7	MPO 1357(d)	0	1.79	35	0	9.2	35
8	DDK 1058 (dic.)	0	0.00	28.6	NI	9.5	28.6
9	HD 3377	47.41	7.41	60	8.33	30.8	60
10	HI 1636	34.25	14.29	73.3	19.35	35.3	73.3
11	HUW 838	36.87	0.00	83.33	0	30.1	83.33
12	RAJ 4541	44.19	1.03	30	0	18.8	44.19
13	VL 2036	48.55	19.51	66.6	25.64	40.1	66.6
14	HI8823 (d)	0	0.00	45	Miss	15.0	45
15	CG 1029	77.25	7.21	65	4.62	38.5	77.25
16	DDK 1059 (dic.)	NS	0.00	16	0	5.3	16
17	GW513	26.86	12.5	45	12.73	24.3	45
18	HD 2864	NS	7.63	56.4	7.69	23.9	56.4
19	HI 1544	20.44	11.4	46.6	5.77	21.1	46.6
20	HI 1633	66.49		85	0	50.5	85
20A	Infector (Sonalika)	38.18	35.05	83.3	24.32	45.2	83.3
21	HI 1634	69.31	4.17	66.6	0	35.0	69.31
22	HI 8627(d)	0.53	0.00	0	0	0.1	0.53
23	NIAW 3170	1.01	5.1	0	4.65	2.7	5.1
24	HD 3249	15.45	18.1	23.3	23.73	20.1	23.73
25	HI 8805 (d)	13.13	0.00	15	0	7.0	15.0

26	HI 8818 (d)	1.17	1.22	20	0	5.6	20.0
27	UAS 466(d)	0	0.00	45	0	11.3	45.0
28	VL 3024	45.55	5.17	24	4.84	19.9	45.55
29	DBW 48 (d)	0	1.39	35	2.22	9.7	35
30	DBW 49 (d)	5.39	0.00	45	0	12.6	45
31	DBW 329	14.09	6.1	80	13.56	28.4	80

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III. National Genetic Stock Nursery (NGSN), 2022-23

The NGSN comprising 15 entries with confirmed sources of high level of disease resistance were shared with16 breeding centers across different agro climatic zones of country for their utilization in breeding for resistance to biotic stresses. The 14 entries were utilized in the range of 6.67 – 60% by different breeding centers (Fig. 9.1). The most utilized entries at many centers were HI 1544, HS 681, RAJ4541 and DBW 342 (Table 9.3). Durgapura center, utilized maximum 9 entries in their breeding programme followed by Coochhbehar (Fig. 9.2).

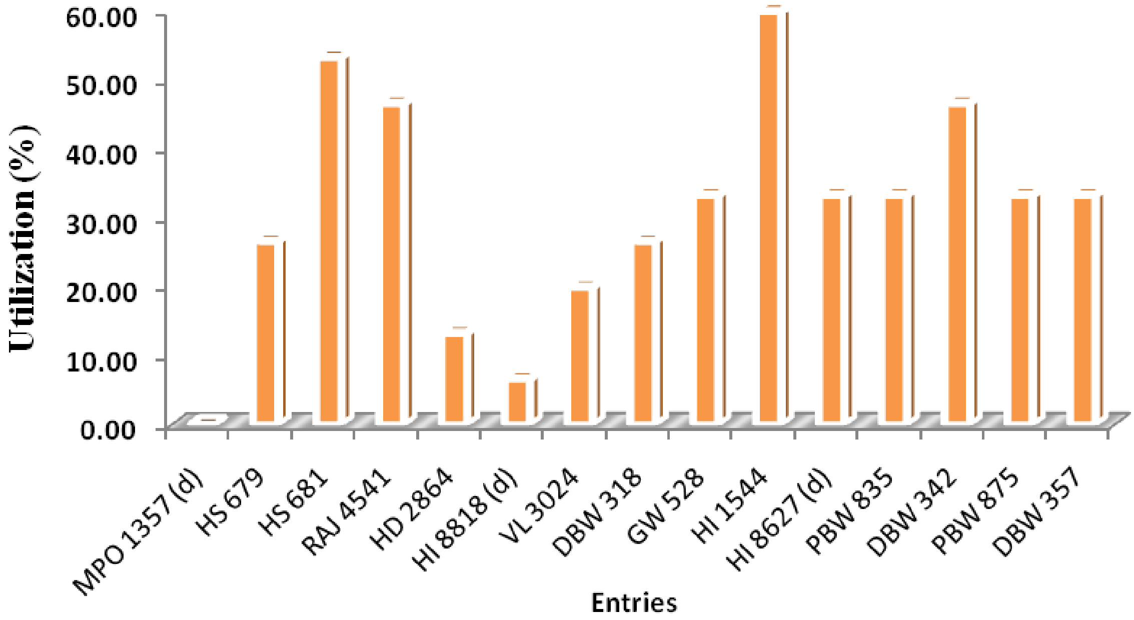

Fig.9.1. Percent utilization of promising resistant genotypes at different breeding centres in NGSN, 2022-23

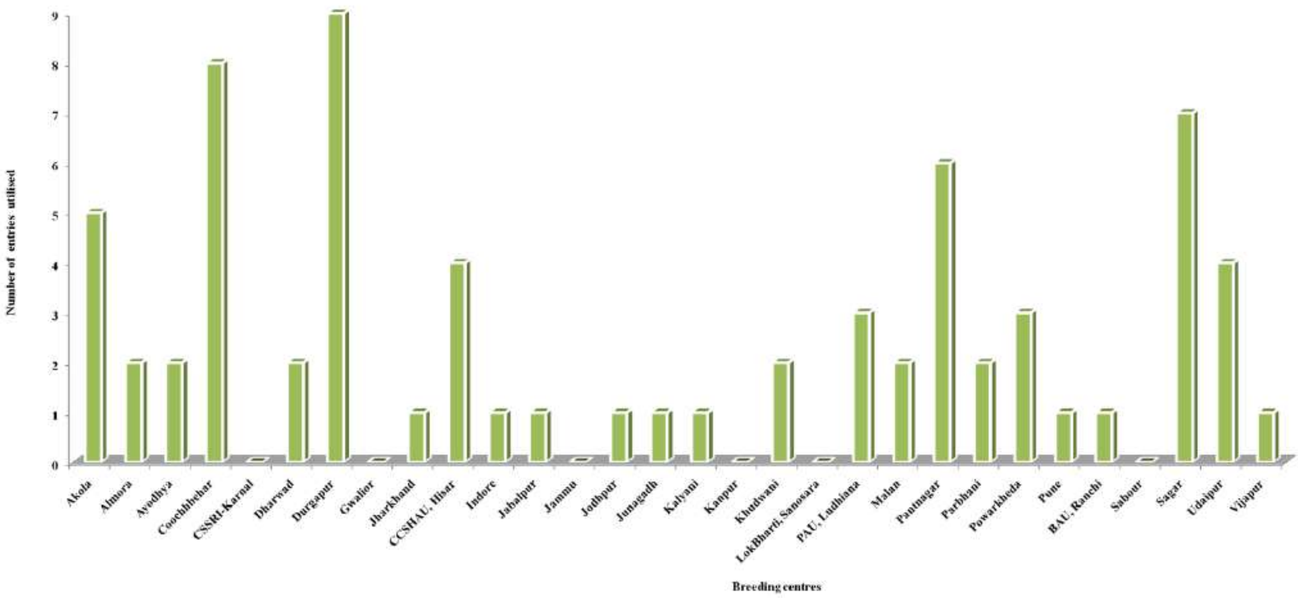

Fig. 9.2. Centre wise utilization of promising resistant genotypes from NGSN, 2022-23

Table 9.3. National genetic stock nursery (NGSN), 2022-23

S. No.	Entries	Akola	Almora	Ayodhya	Coochbehar	CSSRI-Karnal	Dharwad	Durgapur	Gwalior	Jharkhand	CCSHAU, Hisar	Indore	Jabalpur	Jammu	Jodhpur	Junagadh	Kalyani	Kanpur	Khudwani	LokBharti, Sanosara	PAU, Ludhiana	Malan	Pantnagar	Parbhani	Powarkheda	Pune	BAU, Ranchi	Sabour	Sagar	Udaipur	Vijapur	TOTAL
1	MPO 1357 (d)																															**0**
2	HS 679		1					1															1						1			**4**
3	HS 681		1		1			1			1					1			1				1						1			**8**
4	RAJ 4541				1		1	1				1			1								1						1			**7**
5	HD 2864						1																		1							**2**
6	HI 8818 (d)																												1			**1**
7	VL 3024							1			1										1											**3**
8	DBW 318										1		1										1							1		**4**
9	GW 528			1	1			1															1						1			**5**
10	HI 1544	1			1					1	1											1	1	1	1				1			**9**
11	HI 8627 (d)	1						1																	1	1			1			**5**
12	PBW 835			1	1																1			1						1		**5**
13	DBW 342	1			1			1									1					1								1	1	**7**
14	PBW 875	1			1			1													1									1		**5**
15	DBW 357	1			1			1											1								1					**5**
	Total	**5**	**2**	**2**	**8**	**0**	**2**	**9**	**0**	**1**	**4**	**1**	**1**	**0**	**1**	**1**	**1**	**0**	**2**	**0**	**3**	**2**	**6**	**2**	**3**	**1**	**1**	**0**	**7**	**4**	**1**	

Cooperators: Sudheer Kumar, Prem Lal Kashyap, Ravindra Kumar, Arun Kumar Gupta

9.2 Management of Diseases: Chemical Control

Leaf rust

A) Ayodhya

Field trials were performed during the crop season 2022-23 to test the 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%)] towards leaf rust disease in wheat. The study was laid out in randomized block design with three replications. The tested fungicides resulted in significantly low ACI in comparison to the unsprayed plot i.e. 59.50 (Table 9.4). Highest level of protection (91.88%) from leaf rust disease was attained with the foliar application of Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% at disease initiation followed by second spray at 14 days intervals and showed superior in comparison to standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)]. Similarly, per cent yield gains were recorded higher in the plots treated with fungicides in comparison to unsprayed plots (Table 9.4). No phytotoxicity was recorded with any of the tested concentrations of the fungicides on wheat plants.

Table 9.4 : Chemical control of leaf rust of wheat at Ayodhya during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	11.17	81.23	34.12	14.29
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	11.83	80.11	34.65	16.08
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	4.83	91.88	42.92	43.76
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	10.17	82.91	33.50	12.22
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	15.50	73.95	32.25	8.04
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	8.17	86.27	38.21	27.98
T_7	Propiconazole 25 % EC	0.1	12.83	78.43	34.57	15.79
T_8	Tebuconazole 25.9 % EC	0.1	9.33	84.31	36.34	21.74
T_9	Control	-	59.50	81.23	29.85	
	CD (P=0.05)		3.77		4.67	

ACI: Average coefficient of infection

B) Pantnagar

Field evaluation of six fungicide combinations (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 two standard check fungicides (Propiconazole 25 % EC @0.1% and & Tebuconazole 25.9 % EC @0.1%) was made under field conditions during 2022-23 crooping season at Pantnagar location for the management of leaf rust of wheat. The experiment was arranged in randomized block design with three replications (Table 9.5). All the six tested fungicide combinations showed significantly low ACI (< 7.67) along with standard recommended fungicides [i.e. Tebuconazole (0.1%) and Propiconazole (0.1%], when compared with unsprayed plot. It has been observed that application of fungicides at disease initiation followed by second spray at two weeks intervals on wheat foliage results in significant level of disease reduction. Remaining all the fungicide treatments provided more than 88% disease protection in comparison to unsprayed check as significant low ACI (<8.0) is observed in the plots treated with this fungicides. Similarly, per cent yield gains were recorded higher in the plots treated with fungicides in comparison to unsprayed plots (Table 9.5). No phytotoxicity was recorded with any of the tested concentrations of the fungicides on wheat plants.

Table 9.5: Chemical control of leaf rust of wheat at Pantnagar during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	7.67	88.47	43.83	39.97
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	5.68	91.45	45.75	46.09
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	3.40	94.89	48.05	53.43
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	4.38	93.41	47.67	52.21
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	5.20	92.18	47.18	50.66
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	5.17	92.23	46.92	49.81
T_7	Propiconazole 25 % EC	0.1	6.45	90.30	45.42	45.02
T_8	Tebuconazole 25.9 % EC	0.1	6.42	90.34	45.35	44.81
T_9	Control	-	66.48		31.32	
	CD (P=0.05)		1.10		1.96	

ACI: Average coefficient of infection

C) Indore

The 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 conducted for the management of leaf rust disease of wheat during the crop season 2022-23 under field conditions at Indore location. The experiment was laid out in randomized block design with three replications. All the tested fungicides resulted in significantly low ACI (<5.0) in comparison to the unsprayed plot i.e. 49.33.0 (Table 9.6). Four fungicides viz., Picoxystrobin 7.05% + Propiconazole 11.7% SC @ 0.1%, Tebuconazole 50% + Trifloxystrobin 25% WG@0.06%, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @0.1%, Azoxystrobin 11% + Tebuconazole 18.3% w/w SC@0.1% showed highest and better level of protection than standard recommended fungicide (Propiconazole @ 0.1%) and Tebuconazole 25.9 % EC (0.1%) . It has been recorded that all the fungicide treatments showed significant higher per cent gain in yield over control when compared with recommend standard fungicides [i.e. Tebuconazole (0.1%) and Propiconazole (0.1%)]. Highest level of protection from leaf rust disease was obtained with the foliar application of fungicides at disease initiation followed by second spray at 14 days intervals. No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.6: Chemical control of leaf rust of wheat at Indore during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	8.55	82.66	38.96	56.90
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	0.53	98.92	43.81	76.41
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	0.32	99.35	44.58	79.52
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	0.60	98.78	41.15	65.72
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	4.12	91.65	40.22	61.97
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	0.40	99.19	41.55	67.32
T_7	Propiconazole 25 % EC	0.1	15.57	68.45	36.03	45.10
T_8	Tebuconazole 25.9 % EC	0.1	1.58	96.80	36.59	47.34
T_9	Control	-	49.33		24.83	
	CD (P=0.05)		8.55		3.76	

ACI: Average coefficient of infection

D) Kanpur

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%)] for the management of leaf rust disease of wheat was executed during 2022-23 at Kanpur location. The experiment was laid out in randomized block design with three replications. All the tested fungicides resulted in significantly low ACI (<5.0) in comparison to the unsprayed plot i.e. 49.33.0 (Table 9.7). Two fungicide combinations viz., Tebuconazole 50% + Trifloxystrobin 25% WG@0.06% and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC @0.1% showed highest and better level of protection (>90% leaf rust control) than standard recommended fungicide (Propiconazole @ 0.1%) and Tebuconazole 25.9 % EC (0.1%) . It has been recorded that all the fungicide treatments showed significant higher per cent gain in yield over control when compared with recommend standard fungicides [i.e. Tebuconazole (0.1%) and Propiconazole (0.1%)]. Highest level of protection from leaf rust disease was obtained with the foliar application of fungicides at disease initiation followed by second spray at 14 days intervals. No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.7: Chemical control of leaf rust of wheat at Kanpur during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	36.67	50.00	33.17	22.99
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	13.33	81.82	37.13	37.70

T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	6.67	90.91	44.40	64.65
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	16.67	77.27	37.33	38.44
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	16.67	77.27	35.87	33.00
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	6.67	90.91	42.57	57.85
T_7	Propiconazole 25 % EC	0.1	30.00	59.09	36.60	35.72
T_8	Tebuconazole 25.9 % EC	0.1	30.00	59.09	35.13	30.28
T_9	Control	-	73.33		26.97	
	CD (P=0.05)		11.95		2.84	

ACI: Average coefficient of infection

E) Mahabaleshwar

Field experiments were conducted to check the 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%)] for the management of leaf rust disease of wheat during Rabiseason 2022-23 at Mahabaleshwar. The experiment was arranged in randomized block design with three replications. All the tested fungicides resulted in significantly low ACI in comparison to the unsprayed plot i.e. 76.0 (Table 9.8). Two fungicide combinations viz., Tebuconazole 50% + Trifloxystrobin 25% WG@0.06% showed significant high and 88.60 % reduction in the leaf rust disease when compared with unsprayed check. This treatment also showed better results than standard recommended fungicide (Propiconazole @ 0.1%) and Tebuconazole 25.9 % EC (0.1%).In general, all the fungicide treatments showed significant higher per cent gain in yield over control when compared with recommend standard fungicides [i.e. Tebuconazole (0.1%) and Propiconazole (0.1%)]. Highest level of protection from leaf rust diseases was obtained with the foliar application of fungicides at disease initiation followed by second spray at 14 days intervals. No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.8: Chemical control of leaf rust of wheat at Mahabaleshwar during 2022-23

Treatment	**Description**	**Dose (%)**	**ACI**	**Disease reduction over control (%)**	**Yield ($q\ ha^{-1}$)**	**Yield gain (%)**
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	17.33	77.19	30.62	32.85
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	13.67	82.02	31.77	37.84
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	8.67	88.60	36.30	57.49
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	20.67	72.81	29.71	28.91
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	24.00	68.42	28.48	23.56
T_6	Azoxystrobin 11% +	0.1	22.00	71.05	29.22	26.77

	Tebuconazole 18.3% w/w SC					
T_7	Propiconazole 25 % EC	0.1	24.67	67.54	28.72	24.63
T_8	Tebuconazole 25.9 % EC	0.1	25.33	66.67	28.56	23.92
T_9	Control	-	76.00		23.05	
	CD (P=0.05)		4.81		3.60	

ACI: Average coefficient of infection

F). Niphad

Field experiments were conducted to check the 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%)] for the management of leaf rust disease of wheat during *Rabi* season 2022-23 at Nipahd. The experiment was arranged in randomized block design with three replications. All the tested fungicides resulted in significantly low ACI in comparison to the unsprayed plot i.e. 81.33 (Table 9.9) and found significantly superior with ACI ranging from 7.00 - 23.33. Tebuconazole 50% + Trifloxystrobin 25% WG@0.06% showed significant high and >91% reduction in the leaf rust disease relative to unsprayed control check. This treatment also showed better results than standard recommended fungicide (Propiconazole @ 0.1% and Tebuconazole 25.9 % EC @0.1%. Moreover, all the treatments showed significant higher per cent gain in yield over control. Highest level of protection from leaf rust diseases was obtained with the foliar application of fungicides at disease initiation followed by second spray at 14 days intervals. No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.9: Chemical control of leaf rust of wheat at Niphad during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	17.67	78.28	36.61	72.67
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	12.33	84.84	33.36	57.36
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	7.00	91.39	42.63	101.10
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	9.67	88.11	37.10	74.99
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	13.00	84.02	34.19	61.27
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	16.33	79.92	36.39	71.67
T_7	Propiconazole 25 % EC	0.1	23.33	71.31	37.05	74.75
T_8	Tebuconazole 25.9 % EC	0.1	17.00	79.10	35.32	66.62
T_9	Control	-	81.33		21.20	
	CD (P=0.05)		6.03		5.43	

ACI: Average coefficient of infection

G. Ludhiana

The efficacy of six different fungicide combinations (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 SCalong with two standard check fungicides (Propiconazole 25 % EC @0.1% and & Tebuconazole 25.9 % EC @0.1%) were tested under field conditions for the management of leaf rust of wheat under randomized block design with three replications (Table 9.10). All the six tested fungicide combinations showed significantly low ACI along with standard recommended fungicides [i.e. Tebuconazole (0.1%) and Propiconazole (0.1%], when compared with unsprayed plot. It has been observed that application of fungicides at disease initiation followed by second spray at two weeks intervals on wheat foliage results in significant level of diseases reduction. Remaining all the fungicide treatments provided more than 80% disease protection in comparison to unsprayed check as significant low ACI (<8.0) is observed in the plots treated with this fungicides. Similarly, per cent yield gains were recorded higher in the plots treated with fungicides in comparison to unsprayed plots (Table 9.10). No phytotoxicity was recorded with any of the tested concentrations of the fungicides on wheat plants.

Table 9.10: Chemical control of leaf rust of wheat at Ludhiana during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	0.67	98.89	51.11	116.17
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	4.00	93.33	49.87	110.90
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	0.00	100.00	47.91	102.63
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	0.00	100.00	49.16	107.90
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	5.00	91.67	49.33	108.65
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	4.33	92.78	51.20	116.54
T_7	Propiconazole 25 % EC	0.1	7.67	87.22	48.09	103.38
T_8	Tebuconazole 25.9 % EC	0.1	6.00	90.00	50.13	112.03
T_9	Control	-	60.00		23.64	
	CD (P=0.05)		5.79		6.49	

ACI: Average coefficient of infection

I) Durgapura

The efficacy of six different fungicide combinations along with two standard check fungicides (Propiconazole 25 % EC@0.1% and and Tebuconazole 25.9 % EC@0.1%) was tested under field conditions for the management of leaf rust of wheat during 2022-2023 at RARI, Durgapura. The experiment was conducted in randomized block design with three replications. All the tested fungicides were found significantly superior in rust control over untreated check (65.83) with ACI ranging from 5.08 - 21.42 (Table 9.11). Although, the foliar spray of Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06 % was found significantly best among all the treatments when applied at disease initiation and repeated after 14 days. The yield was significantly more in all the tested fungicides over the untreated check. Highest yield gain (53.18%) was recorded with Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06 (53.18%) per cent followed by Azoxystrobin 11% + Tebuconazole 18.3% w/w SC @ 0.1% (51.24%) and Tebuconazole 25.9 % EC (standard check) (49.14%). Phytotoxic symptoms were not observed with any of the fungicides on wheat plants.

Table 9.11 : Chemical control of leaf rust of wheat at Durgapura during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	13.42	79.62	37.04	41.01
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	12.67	80.76	38.15	42.73
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	5.08	92.28	46.67	53.18
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	11.25	82.91	37.41	41.59
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	18.50	71.90	36.30	39.81
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	10.00	84.81	44.81	51.24
T_7	Propiconazole 25 % EC	0.1	21.42	67.47	35.93	39.19
T_8	Tebuconazole 25.9 % EC	0.1	11.00	83.29	42.96	49.14
T_9	Control	-	65.83		21.85	-
	CD (P=0.05)		5.38		7.20	

ACI: Average coefficient of infection

J). Powerkhera

Field experiments were conducted to test the 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%)] for the management of leaf rust disease of wheat during *Rabi* season 2022-23 at Powderkhera, Madhya Pradesh. The experiment was arranged in randomized block design with three replications. All the tested fungicides resulted in significantly low average coefficient of infection (ACI) in comparison to the unsprayed plot i.e. 80.00 (Table 9.12) and found significantly superior with ACI ranging from 5.00 - 20.00. Tebuconazole 50% + Trifloxystrobin 25% WG@0.06% showed significant high and >93% reduction in the leaf rust disease relative to unsprayed control check. This treatment also showed better results than standard recommended fungicide (Propiconazole @ 0.1% and Tebuconazole 25.9 % EC @0.1%. Moreover, all the treatments showed significant higher per cent gain in yield over control. Highest level of protection from leaf rust diseases was obtained with the foliar application of fungicides at disease initiation followed by second spray at 14 days intervals. 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 Powerkhera during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	13.33	83.33	39.09	58.30
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	20.00	75.00	33.17	34.33
T_3	Tebuconazole 50% +	0.06	5.00	93.75	42.61	72.55

	Trifloxystrobin 25% WG					
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	17.33	78.33	37.21	50.68
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	18.33	77.08	36.83	49.14
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	9.33	88.33	39.16	58.59
T_7	Propiconazole 25 % EC	0.1	13.33	83.33	36.47	47.69
T_8	Tebuconazole 25.9 % EC	0.1	11.67	85.42	38.91	57.56
T_9	Control	-	80.00		24.69	
	CD (P=0.05)		12.67		3.12	

Stem rust

A. Mahabaleshwar

Field experimentation was made to check 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 during 2022-23 at Mahabaleshwar. 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. 78.67 (Table 9.13). Five 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 (86.86%) from stem rust diseases was achieved with the foliar application of Tebuconazole 50% + Trifloxystrobin 25% WG @0.06 (T3) at disease initiation followed by second spray at 14 days interval. 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 9.13).

Table 9.13: Chemical control of stem rust of wheat at Mahabaleshwar during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	18.67	76.27	34.44	101.19
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	14.33	81.78	35.59	107.90
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	10.33	86.86	39.40	130.14
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	24.00	69.49	34.28	100.23
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	24.67	68.64	37.37	118.27
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w	0.1	25.33	67.80	32.14	87.73

	SC					
T_7	Propiconazole 25 % EC	0.1	26.67	66.10	32.55	90.13
T_8	Tebuconazole 25.9 % EC	0.1	27.33	65.25	32.80	91.59
T_9	Control	-	78.67		17.12	
	CD (P=0.05)		5.61		3.70	

ACI: Average coefficient of infection

B). Pune

Field experiment was conducted during *Rabi* crop season 2022-23 to evaluate the effeicacy 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%)] against stem rust of wheat at Pune 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. 66.67 (Table 9.14). Highest level of protection from stem rust disease was observed 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 9.14).

Table 9.14 : Chemical control of stem rust of wheat at Pune during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	11.00	83.50	41.00	1.233
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	10.67	84.00	35.39	3.038
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	4.33	93.50	41.92	2.714
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	10.67	84.00	38.17	2.756
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	14.67	78.00	35.14	2.683
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	16.67	75.00	41.76	2.012
T_7	Propiconazole 25 % EC	0.1	7.00	89.50	36.11	0.648
T_8	Tebuconazole 25.9 % EC	0.1	9.33	86.00	33.15	2.023
T_9	Control	-	66.67		27.98	2.6
	CD (P=0.05)		10.08		6.72	

ACI: Average coefficient of infection

C.) Vijapur

The efficacy of six different fungicide combinations along with two standard check fungicides (Propiconazole 25 % EC@0.1% and Tebuconazole 25.9 % EC@0.1%) were tested under field conditions for the management of stem rust of wheat during 2022-2023 at Vijapur location. The experiment was conducted in randomized block design with three replications. All the tested fungicides were found significantly superior in rust control over untreated check (56.67) with ACI ranging from 11.67- 26.67 (Table 9.15). The foliar spray of Tebuconazole 50% + Trifloxystrobin 25%

WG @ 0.06 % followed by Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE @0.1% was found significantly best among all the treatments when applied at disease initiation and repeated after 14 days. The yield was significantly more in all the tested fungicides over the untreated check. Highest yield gain (62.33%) was recorded with Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06 (53.18%) per cent followed by Picoxystrobin 7.05% + Propiconazole 11.7% SC @ 0.1% (47.96%) and Propiconazole 25 % EC @0.1% (standard check) (21.58%). Phytotoxic symptoms were not observed with any of the fungicides on wheat plants.

Table 9.15: Chemical control of stem rust of wheat at Vijapur during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	15.00	73.53	23.95	47.96
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	13.33	76.47	22.01	35.95
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	11.67	79.41	26.28	62.33
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	16.67	70.59	23.10	42.71
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	23.33	58.82	20.27	25.22
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	26.67	52.94	19.30	19.23
T_7	Propiconazole 25 % EC	0.1	26.67	52.94	19.68	21.58
T_8	Tebuconazole 25.9 % EC	0.1	20.00	64.71	21.45	32.51
T_9	Control	-	56.67		16.19	
	CD (P=0.05)		10.69		4.96	

ACI: Average coefficient of infection

D). Dharwad

Field experiments were conducted to evaluate the potential efficacy of six different fungicide combinations along with two standard check fungicides (Propiconazole 25 % EC@0.1% and Tebuconazole 25.9 % EC@0.1%) were tested under field conditions for the management of stem rust of wheat at Dharwad during *Rabi* 2022-2023. The experiment was conducted in randomized block design with three replications. All the tested fungicides were found significantly superior in rust control over untreated check (60.0) with ACI ranging from 11.33- 29.33 (Table 9.16). The foliar spray of Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06 % followed by Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE @0.1% was found significantly best among all the treatments when applied at disease initiation and repeated after 14 days. The yield was significantly more in all the tested fungicides over the untreated check. Highest yield gain (40.78%) was recorded with Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06 per cent followed by Azoxystrobin 11% + Tebuconazole 18.3% w/w SC (31.99%) and Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE (31.89%). Significant per cent yield gain was attained with the foliar application of fungicidal treatments in comparison to unsprayed control check. Phytotoxic symptoms were not observed with any of the fungicides on wheat plants.

Table 9.16: Chemical control of stem rust of wheat at Dharwad during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	16.33	72.78	29.70	30.22
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	13.67	77.22	30.08	31.89
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	11.33	81.11	32.11	40.78
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	16.67	72.22	28.73	25.95
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	29.33	51.11	27.06	18.65
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	15.00	75.00	30.11	31.99
T_7	Propiconazole 25 % EC	0.1	25.00	58.33	27.78	21.79
T_8	Tebuconazole 25.9 % EC	0.1	18.67	68.89	28.10	23.19
T_9	Control	-	60.00		22.81	
	CD (P=0.05)		6.23		3.87	

ACI: Average coefficient of infection

E). Indore

Field efficacy of six different fungicide combinations along with two standard check fungicides (Propiconazole 25 % EC@0.1% and Tebuconazole 25.9 % EC@0.1%) were tested under field conditions for the management of stem rust of wheat at Indore location during 2022-2023. The experiment was arranged in randomized block design with three replications. All the tested fungicides were found significantly superior in stem rust control over untreated check (60.0) with ACI ranging from 3.37- 22.0 (Table 9.17). The foliar spray of Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06 % followed by Tebuconazole 25.9 % EC @0.1% was found significantly best among all the treatments when applied at disease initiation and repeated after 14 days. The yield was significantly more in all the tested fungicides over the untreated check. No phytotoxic symptoms were noticed with any of the fungicides on wheat plants.

Table 9.17: Chemical control of stem rust of wheat at Indore during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	15.27	74.56	41.36	151.49
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	18.00	70.00	35.95	118.60
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	3.37	94.38	54.61	232.04
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	9.85	83.59	44.85	172.68
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	22.00	63.33	39.68	141.28
T_6	Azoxystrobin 11% +	0.1	7.97	86.72	53.49	225.23

	Tebuconazole 18.3% w/w SC					
T_7	Propiconazole 25 % EC	0.1	11.53	80.78	46.47	182.53
T_8	Tebuconazole 25.9 % EC	0.1	6.11	89.82	53.82	227.23
T_9	Control	-	60.00		16.45	
	CD (P=0.05)		9.39		5.82	

ACI: Average coefficient of infection

F) Niphad

Field experiments were conducted to evaluate the potential efficacy of six different fungicide combinations along with two standard check fungicides (Propiconazole 25 % EC@0.1% and Tebuconazole 25.9 % EC@0.1%) were tested under field conditions for the management of stem rust of wheat at Nipahd location during *Rabi* 2022-2023. The experiment was conducted in randomized block design with three replications. All the tested fungicides were found significantly superior in rust control over untreated check (60.0) with ACI ranging from 6.67- 18.67 (Table 9.18). The foliar spray of Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06 % followed by Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC 0.1% was found significantly best among all the treatments when applied at disease initiation and repeated after 14 days. The yield was significantly more in all the tested fungicides over the untreated check. Highest yield gain (69.51%) was recorded with Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06 per cent followed by Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @0.1% (63.87%). Phytotoxic symptoms were not observed with any of the fungicides on wheat plants.

Table 9.18: Chemical control of leaf rust of wheat at Niphad during 2022-23

Treatment	Description	Dose (%)	ACI	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	16.00	80.80	22.86	42.34
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	13.67	83.60	22.49	40.06
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	6.67	92.00	27.22	69.51
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	7.67	90.80	26.32	63.87
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	17.67	78.80	22.03	37.19
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	9.67	88.40	24.52	52.70
T_7	Propiconazole 25 % EC	0.1	18.67	77.60	21.51	33.94
T_8	Tebuconazole 25.9 % EC	0.1	10.00	88.00	24.14	50.33
T_9	Control	-	83.33		16.06	
	CD (P=0.05)		2.71		4.49	

Head Scab

A. Gurdaspur

The 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 done during Cropping season 2022-23 at Guradpaur locations for the management of head scab of wheat. The experiment was done in randomized block design with three replications. All the tested fungicides resulted in significantly less disease severity in comparison to the unsprayed plots as well as standard recommended fungicides (Table 9.19). It has been noticed that Tebuconazole 50% + Trifloxystrobin 25% WG @0.06% and Picoxystrobin 7.05% + Propiconazole 11.7% SC @0.1% showed similar severity level of 2.0 in comparison to other fungicidal treatments and unsprayed check. Highest level of protection from head scab diseases was obtained with the foliar application of these fungicides at disease initiation followed by one more spray at 14 days interval. All the fungicide treatments showed significant gain in per cent yield in comparison to the unsprayed control (Table 9.19). No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.19: Chemical control of Head scab of wheat at Gurdaspur during 2022-23

Treatment	Description	Dose (%)	Disease Severity	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	2.00	70.00	50.67	19.87
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	2.33	65.00	50.67	19.87
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	2.00	70.00	51.64	22.19
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	2.67	60.00	51.47	21.77
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	2.67	60.00	50.40	19.24
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	3.00	55.00	50.22	18.82
T_7	Propiconazole 25 % EC	0.1	3.33	50.00	47.47	12.30
T_8	Tebuconazole 25.9 % EC	0.1	3.67	45.00	46.84	10.83
T_9	Control		6.67		42.27	
	CD (P=0.05)		1.05		4.24	

B. Ludhiana

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 tested in randomized block design with three replications evaluated conducted for the management of head scab disease of wheat during the crop season 2022-23 at Ludhiana location. All the tested fungicides resulted in significantly less disease severity) in comparison to the unsprayed plots (7.33) as well as standard recommended fungicides (4.33) (Table 9.20). It has been noticed that Tebuconazole 50% + Trifloxystrobin 25% WG @0.06%, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC @0.1% and Azoxystrobin 11% + Tebuconazole 18.3% w/w SC @0.1% showed severity level of 1.0 in comparison to other fungicidal treatments and unsprayed check. Highest level of protection from head scab diseases 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 9.20). No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.20: Chemical control of Head scab of wheat at Ludhiana during 2022-23

Treatment	Description	Dose (%)	Disease Severity	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	2.67	63.64	51.82	16.72
T_2	Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE	0.1	3.33	68.18	49.87	12.31
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	2.33	68.18	**49.24**	10.91
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	2.33	54.55	51.38	15.72
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	3.00	59.09	51.56	16.12
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	3.33	54.55	51.56	16.12
T_7	Propiconazole 25 % EC	0.1	4.33	40.91	52.44	18.12
T_8	Tebuconazole 25.9 % EC	0.1	4.33	40.91	49.42	11.31
T_9	Control		7.33		44.40	
	CD (P=0.05)		1.00		4.37	

C. Karnal

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 conducted for the management of head scab disease of wheat during the crop season 2022-23 at Karnal location. The experiment was conducted in randomized block design with three replications. All the tested fungicides showed less diseases severity of head scab disease in comparison to the unsprayed plot (Table 9.21). Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% (T3) found most effective fungicides in controlling the head scab disease, when applied at disease initiation stage followed by second spray at 14 days interval. However, remaining five fungicides *viz*., Picoxystrobin 7.05% + Propiconazole 11.7% SC @0.1%, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE @0.1%, 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% also showed better level of disease protection in comparison to standard recommended fungicide (Tebuconazole @0.1% and Propiconazole @ 0.1%) and unsprayed plots. Highest level of protection from head scab disease along with maximal increment in per cent yield gain over unsprayed check plot was observed, when Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% was applied as foliar spray at the time of disease onset followed by another spray at 14 days interval. No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.21: Chemical control of Head scab of wheat at Karnal during 2022-23

Treatment	Description	Dose (%)	Disease severity	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.1	2.33	72.00	51.85	31.23
T_2	Pyraclostrobin 133g/l +	0.1	2.67	67.99	48.71	23.29

	Epoxiconaxole 50g/l SE					
T_3	Tebuconazole 50% + Trifloxystrobin 25% WG	0.06	1.33	84.00	49.75	25.91
T_4	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC	0.1	2.00	76.00	51.37	30.02
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.1	2.67	67.99	49.91	26.32
T_6	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	0.1	3.00	64.00	49.63	25.61
T_7	Propiconazole 25 % EC	0.1	3.33	60.00	49.78	25.99
T_8	Tebuconazole 25.9 % EC	0.1	3.67	55.99	47.79	20.96
T_9	Control		8.33		39.51	
	CD (P=0.05)		1.18		2.81	

Leaf blight

A) Ayodhya

Field evaluation of different fungicides *viz.*, Tebuconazole 50% + Trifloxystrobin 25% @0.1%, Propiconazole 13.9% + Difenconazole 13.9% @ 0.1%, Azoxystrobin 12.5% + Tebuconazole 12.5% @ 0.1%, Picoxystrobin 7.05% + Propiconazole 11.7% @0.1%, Kresoxim Methyl 44.3% SC @0.1%, Tebuconazole (0.1%), Propiconazole (0.1%) and Mancozeb 75% @ 0.1% was made for the management of leaf blight of wheat during the crop season 2022-23 at Ayodhya location. The experiment was conducted in randomized block design with three replications. All the tested fungicides showed less mean disease score of leaf blight disease in comparison to the unsprayed plot i.e. 78 (Table 9.22). The results revealed that Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% (T1) is the most effective fungicides in controlling the leaf blight disease, when applied at disease initiation stage followed by second spray at 14 days interval. The other fungicide sprayed plots displayed varying levels of disease severity score 34-68. Highest level of protection from leaf blight disease along with maximal increment (29.07%) in per cent yield gain over unsprayed check plot was observed, when Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% was applied as foliar spray at the time of disease onset followed by another spray at 14 days interval. No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.22: Chemical control of leaf blight of wheat at Ayodhya during 2022-23

Treatment	Description	Dose (%)	Mean disease score (dd)	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Tebuconazole 50% + Trifloxystrobin 25%	0.1	23	70.51	40.38	29.07
T_2	Propiconazole 13.9% + Difenconazole 13.9%	0.1	45	42.31	38.19	22.09
T_3	Azoxystrobin 12.5% + Tebuconazole 12.5%	0.1	34	56.41	38.81	24.07
T_4	Picoxystrobin 7.05% + Propiconazole 11.7%	0.1	57	26.92	37.14	18.73
T_5	Kresoxim Methyl 44.3% SC	0.1	57	26.92	36.32	16.10
T_6	Propiconazole 25%	0.1	36	53.85	38.53	23.17
T_7	Tebuconazole 25.9%	0.1	46	41.03	38.05	21.62
T_8	Mancozeb 75%	0.1	68	12.82	33.02	5.55
T_9	Control	-	78		31.28	
	CD (P=0.05)				3.22	

B) Coochbehar

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% @ 0.1%, Picoxystrobin 7.05% + Propiconazole 11.7% @0.1%, Kresoxim Methyl 44.3% SC @0.1%, Tebuconazole (0.1%) and Propiconazole (0.1%) and Mancozeb 75% @ 0.1% was evaluated for the management of leaf blight of wheat during the crop season 2022-23 at Coochbehar location. The experiment was set up in randomized block design with three replications. All the tested fungicides showed less mean disease score of leaf blight disease (<36) in comparison to the unsprayed plot i.e. 67 (Table 9.23). The results revealed that Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% was the most effective fungicide combination in controlling the leaf blight disease, when applied at disease initiation stage followed by second spray at 14 days interval. The treatment of all the fungicides showed significant gain in per cent yield in comparison to unsprayed control plots. Highest level of protection from leaf blight disease along with maximal increment (43.75%) in per cent yield gain over unsprayed check plot was observed, when Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% was applied as foliar spray at the time of disease onset followed by another spray at 14 days interval. No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.23: Chemical control of leaf blight of wheat at Coochbehar during 2022-23

Treatment	Description	Dose (%)	Mean disease score (dd)	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Tebuconazole 50% + Trifloxystrobin 25%,	0.1	11	83.58	42.17	43.75
T_2	Propiconazole 13.9% + Difenconazole 13.9%	0.1	12	82.09	41.75	42.33
T_3	Azoxystrobin 12.5% + Tebuconazole 12.5%	0.1	14	79.10	41.35	40.97
T_4	Picoxystrobin 7.05% + Propiconazole 11.7%	0.1	13	80.60	41.83	42.61
T_5	Kresoxim Methyl 44.3% SC	0.1	25	62.69	36.83	25.57
T_6	Propiconazole 25%	0.1	14	79.10	40.50	38.07
T_7	Tebuconazole 25.9%	0.1	14	79.10	39.33	34.09
T_8	Mancozeb 75%	0.1	36	46.27	31.42	7.10
T_9	Control	-	67		29.33	
	CD (P=0.05)				1.66	

C) Sabour

The experiment was conducted at Sabore location during 2022-23 for the field evaluation of different fungicides *viz.*, Tebuconazole 50% + Trifloxystrobin 25% @0.1%, Propiconazole 13.9% + Difenconazole 13.9% @ 0.1%, Azoxystrobin 12.5% + Tebuconazole 12.5% @ 0.1%, Picoxystrobin 7.05% + Propiconazole 11.7% @0.1%, Kresoxim Methyl 44.3% SC @0.1%, Tebuconazole (0.1%), Propiconazole (0.1%) and Mancozeb 75% @ 0.1% for the management of leaf blight of wheat. The experiment was conducted in randomized block design with three replications. All the tested fungicides showed less mean disease score of leaf blight disease in comparison to the unsprayed plot i.e. 68 (Table 9.24). The results revealed that Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% (T1) and Azoxystrobin 12.5% + Tebuconazole 12.5% (T3) are the most effective fungicides in controlling the leaf blight disease, offering 66.18% disease protection over control check when applied at disease initiation stage followed by second spray at 14 days interval. The other fungicide sprayed plots displayed varying levels of disease severity score ranged from 36-67. Highest level of protection from leaf blight disease along with maximal increment (23.13%) in per cent yield gain over unsprayed check plot was observed, when Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% was applied as foliar spray at the time of disease onset followed by another spray at 14 days interval. No phytotoxic symptoms were observed with any of the tested concentrations of the fungicides on wheat plants.

Table 9.24 : Chemical control of leaf blight of wheat at Sabour during 2022-23

Treatment	Description	Dose (%)	Mean disease score (dd)	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Tebuconazole 50% + Trifloxystrobin 25%,	0.1	23	66.18	46.23	27.13
T_2	Propiconazole 13.9% + Difenconazole 13.9%	0.1	45	33.82	44.10	21.26
T_3	Azoxystrobin 12.5% + Tebuconazole 12.5%	0.1	23	66.18	44.87	23.37
T_4	Picoxystrobin 7.05% + Propiconazole 11.7%	0.1	36	47.06	44.70	22.91
T_5	Kresoxim Methyl 44.3% SC	0.1	67	1.47	38.07	4.67
T_6	Propiconazole 25%	0.1	57	16.18	43.30	19.06
T_7	Tebuconazole 25.9%	0.1	56	17.65	43.50	19.61
T_8	Mancozeb 75%	0.1	57	16.18	39.30	8.07
T_9	Control	-	68		36.37	
	CD (P=0.05)				4.65	

D) Pune

The experiment was conducted at Pune location during 2022-23 for the field evaluation of different fungicides *viz.*, Tebuconazole 50% + Trifloxystrobin 25% @0.1%, Propiconazole 13.9% + Difenconazole 13.9% @ 0.1%, Azoxystrobin 12.5% + Tebuconazole 12.5% @ 0.1%, Picoxystrobin 7.05% + Propiconazole 11.7% @0.1%, Kresoxim Methyl 44.3% SC @0.1%, Tebuconazole (0.1%), Propiconazole (0.1%) and Mancozeb 75% @ 0.1% for the management of leaf blight of wheat. The experiment was planned in randomized block design with three replications. All the tested fungicides showed less mean disease score of leaf blight disease in comparison to the unsprayed plot i.e. 99 (Table 9.25). The results revealed that Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% (T1) and Azoxystrobin 12.5% + Tebuconazole 12.5% (T3) are the most effective fungicides in controlling the leaf blight disease, offering 76.77% disease protection over control check when applied at disease initiation stage followed by second spray at 14 days interval. The other fungicide sprayed plots displayed varying levels of disease severity score ranged from 26-57. Highest level of protection from leaf blight disease along with maximal increment (48.28%) in per cent yield gain over unsprayed check plot was observed, when Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% was applied as foliar spray at the time of disease onset followed by another spray at 14 days interval. 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 Pune during 2022-23

Treatment	Description	Dose (%)	Mean disease score (dd)	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Tebuconazole 50% + Trifloxystrobin 25%	0.1	23	76.77	47.22	48.28
T_2	Propiconazole 13.9% + Difenconazole 13.9%	0.1	26	73.74	40.42	26.92
T_3	Azoxystrobin 12.5% + Tebuconazole 12.5%	0.06	36	63.64	45.06	41.48
T_4	Picoxystrobin 7.05% + Propiconazole 11.7%	0.1	26	73.74	42.49	33.41
T_5	Kresoxim Methyl 44.3% SC	0.1	57	42.42	45.17	41.83
T_6	Propiconazole 25%	0.1	24	75.76	44.92	41.04
T_7	Tebuconazole 25.9%	0.1	27	72.73	44.65	40.21
T_8	Mancozeb 75%	0.1	56	43.43	45.71	43.54
T_9	Control	-	99		31.85	
	CD (P=0.05)				8.66	

E) Kalyani

Field efficacy of nine different treatments including eight fungicides *viz.*, Tebuconazole 50% + Trifloxystrobin 25% @0.1%, Propiconazole 13.9% + Difenconazole 13.9% @ 0.1%, Azoxystrobin 12.5% + Tebuconazole 12.5% @ 0.1%, Picoxystrobin 7.05% + Propiconazole 11.7% @0.1%, Kresoxim Methyl 44.3% SC @0.1%, Tebuconazole (0.1%), Propiconazole (0.1%) and Mancozeb 75% @ 0.1% was evaluated for the management of leaf blight of wheat during the crop season 2022-23 at Kalyani location. The experiment was designed in randomized block design with three replications. All the tested fungicides showed less mean disease score of leaf blight disease (≤45) in comparison to the unsprayed plot i.e. 68 (Table 9.26). The results revealed that Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.06% was the most effective fungicide combination in controlling the leaf blight disease, when applied at disease initiation stage followed by second spray at 14 days interval. The treatment of all the fungicides showed significant gain in per cent yield in comparison to unsprayed control plots. Highest level of protection from leaf blight disease along with maximal increment (77.94%) in per cent yield gain over unsprayed check plot was observed, when Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% was applied as foliar spray at the time of disease onset followed by another spray at 14 days interval. 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 Kalyani during 2022-23

Treatment	Description	Dose (%)	Mean disease score (dd)	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Tebuconazole 50% + Trifloxystrobin 25%	0.1	15	77.94	39.37	18.82
T_2	Propiconazole 13.9% + Difenconazole 13.9%	0.1	24	64.71	38.13	15.09
T_3	Azoxystrobin 12.5% +	0.1	26	61.76	38.56	16.39

	Tebuconazole 12.5%					
T_4	Picoxystrobin 7.05% + Propiconazole 11.7%	0.1	35	48.53	37.47	13.09
T_5	Kresoxim Methyl 44.3% SC	0.1	45	33.82	34.28	3.46
T_6	Propiconazole 25%	0.1	26	61.76	38.13	15.09
T_7	Tebuconazole 25.9%	0.1	45	33.82	37.13	12.07
T_8	Mancozeb 75%	0.1	45	33.82	36.37	9.76
T_9	Control	-	68		33.13	
	CD (P=0.05)				0.97	

F) Dharwad

The experiment was conducted at Dharward location during 2022-23 for the field evaluation of different fungicides *viz.*, Tebuconazole 50% + Trifloxystrobin 25% @0.1%, Propiconazole 13.9% + Difenconazole 13.9% @ 0.1%, Azoxystrobin 12.5% + Tebuconazole 12.5% @ 0.1%, Picoxystrobin 7.05% + Propiconazole 11.7% @0.1%, Kresoxim Methyl 44.3% SC @0.1%, Tebuconazole (0.1%), Propiconazole (0.1%) and Mancozeb 75% @ 0.1% for the management of leaf blight of wheat. The experiment was conducted in randomized block design with three replications. All the tested fungicides showed less mean disease score of leaf blight disease in comparison to the unsprayed plot i.e. 56 (Table 9.27). The results revealed that Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% (T1) and Azoxystrobin 12.5% + Tebuconazole 12.5% (T3) are the most effective fungicides in controlling the leaf blight disease, offering 66.18% disease protection over control check when applied at disease initiation stage followed by second spray at 14 days interval. The other fungicide sprayed plots displayed varying levels of disease severity score ranged from 36-67. Highest level of protection from leaf blight disease along with maximal increment (23.13%) in per cent yield gain over unsprayed check plot was observed, when Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% was applied as foliar spray at the time of disease onset followed by another spray at 14 days interval. 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 Dharwad during 2022-23

T.no.	Description	Dose (%)	Mean disease score (dd)	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Tebuconazole 50% + Trifloxystrobin 25%	0.1	01	58.93	42.92	19.31
T_2	Propiconazole 13.9% + Difenconazole 13.9%	0.1	23	58.93	40.69	13.13
T_3	Azoxystrobin 12.5% + Tebuconazole 12.5%	0.1	23	98.21	41.60	15.64
T_4	Picoxystrobin 7.05% + Propiconazole 11.7%	0.1	23	58.93	41.11	14.29
T_5	Kresoxim Methyl 44.3% SC	0.1	12	78.57	44.59	23.96
T_6	Propiconazole 25%	0.1	24	57.14	39.10	8.69
T_7	Tebuconazole 25.9%	0.1	24	57.14	37.92	5.42
T_8	Mancozeb 75%	0.1	34	39.29	36.53	1.55
T_9	Control	-	56		35.97	
	CD (P=0.05)				4.35	

G) Karnal

Field evaluation of different fungicides *viz.*, Tebuconazole 50% + Trifloxystrobin 25% @0.1%, Propiconazole 13.9% + Difenconazole 13.9% @ 0.1%, Azoxystrobin 12.5% + Tebuconazole 12.5% @ 0.1%, Picoxystrobin 7.05% + Propiconazole 11.7% @0.1%, Kresoxim Methyl 44.3% SC @0.1%, Tebuconazole (0.1%), Propiconazole (0.1%) and Mancozeb 75% @ 0.1% was made for the management of leaf blight of wheat during the crop season 2022-23 at Karnal. The experiment was conducted in randomized block design with three replications. All the tested fungicides showed less mean disease score of leaf blight disease in comparison to the unsprayed plot i.e. 67 (Table 9.28). The results revealed that Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% (T1) followed by Propiconazole 13.9% + Difenconazole 13.9% @0.1% are the most effective fungicide treatments in controlling the leaf blight disease, when applied at disease initiation stage followed by second spray at 14 days interval. The other fungicide sprayed plots displayed varying levels of disease severity score 14-24. Highest level of protection from leaf blight disease along with maximal increment (50.51%) in per cent yield gain over unsprayed check plot was observed, when Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% was applied as foliar spray at the time of disease onset followed by another spray at 14 days interval. 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 2022-23

T.no.	Description	Dose (%)	Mean disease score (dd)	Disease reduction over control (%)	Yield (q ha^{-1})	Yield gain (%)
T_1	Tebuconazole 50% + Trifloxystrobin 25%	0.1	12	82.09	41.60	50.51
T_2	Propiconazole 13.9% + Difenconazole 13.9%	0.1	13	80.60	40.69	47.24
T_3	Azoxystrobin 12.5% + Tebuconazole 12.5%	0.1	23	65.67	40.25	45.64
T_4	Picoxystrobin 7.05% + Propiconazole 11.7%	0.1	23	65.67	40.11	45.13
T_5	Kresoxim Methyl 44.3% SC	0.1	23	65.67	42.25	52.89
T_6	Propiconazole 25%	0.1	24	64.18	39.43	42.67
T_7	Tebuconazole 25.9%	0.1	14	46.10	37.92	37.21
T_8	Mancozeb 75%	0.1	24	64.18	36.53	32.17
T_9	Control	-	67		27.64	
	CD (P=0.05)				2.62	

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PROGRAMME 10. WHEAT ENTOMOLOGY

RESULTS OF COORDINATED ENTOMOLOGICAL EXPERIMENTS

The wheat entomology program encompasses three key areas: host plant resistance, integrated pest management (IPM), and stored grain pest management. During 2022-23 crop season, research trials were conducted in these entire aforementioned entomological aspects. Under host plant resistance component, the trials were conducted on screening of nurseries against foliar and root aphids, shoot fly, brown wheat mites, and multiple pest screening nursery. The integrated pest management component encompassed activities such as surveying and monitoring insect pests and their natural enemies and evaluation of IPM modules against major insect pests of wheat. Furthermore, investigations were carried out on the influence of sowing timing on the prevalence and population growth of major insect pests in wheat, as well as the use of bio-pesticides and chemical insecticides to control foliar aphids and termites.The significant outcomes of the experiments conducted during the 2022-23 period at various AICRP centers are detailed below.

10.1(A) HOST PLANT RESISTANCE

The results are described here in the following paragraphs.

A1: Entomological Screening Nurseries (ESN)

(a) Shoot fly

Based on the average infestation of shoot fly at three locations viz., Ludhiana, Dharwad and Kanpur, the lowest infestation index of 5.42% of shoot fly entry was reported in entry NIAW4120. However, the highest shoot fly infestation index of 19.02% was recorded in entry UP3102. At Ludhiana centre, lowest infestation index of 4.26% reported on PBW891 and highest infestation index of 8.51% on Sonalika. At Dharwad location, the lowest shootfly index (1.56%) was recorded on entry HI1612(C) while highest infestation (37.88%) was observed on UP3102. At Kanpur location, lowest infestation 3.33 % was observed on MACS3949(d)(C) and highest infestation of 21.87% was recorded on entry MP1378 (Table A1-10.1a).

(b) Brown wheat mite

At Ludhiana, entry MP1386 recorded the minimum mite population of 8.33/10 cm2 area while maximum mite population of 17.33 /10 cm2 was recorded in entry Sonalika. This seasonal incidence of mite was very low at Durgapura and Kanpur locations; therefore data of mite 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 four locations; Ludhiana, Karnal, Niphad and Pusa, seven entries viz.,HI1612(C), HD3059(C), DBW252(C), MP3288(C), HI1655(I)(C), MACS6811 and DBW395 scored an average score of below 3.5 and were in moderately resistance category (grade 3). Location-wise, at Ludhiana centre three entries, HI1650 (I) (C), MP3288(C) & HI1655(I)(C) and eleven entries at Karnal centre viz., HD3249(C), PBW826(I)(C), DBW398, GW513(C), HI1650(I)(C), MP3288(C), DBW110(C), HI1655(I)(C), NIDW1149(d)(C), DBW380 and CG1044 were found to be moderately resistance category (grade 3).

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 Niphad, five entries, HD3171(C), HI1669, MP4010(C), HI1634(C) and NIAW4153 were found to be resistance category (grade 2) whereas at Pusa, twelve entries showed resistance response (grade2). Rest of entries was found to be either in susceptible (grade 4) or highly susceptible (grade 5) category. The infestation of aphids at Vijapur, Durgapura, Kharibari, Pantnagar, Khudwani was recorded to very low and therefore data was rejected.(Table A1-10.1b).

Root aphid: Out of total 134 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).

(A2) Multiple pest screening nurseries (MPSN)

(a)Shoot fly: The average infestation index of shootfly recorded at three locations (Ludhiana & Kanpur) was to be lowest (7.69%) in entry HD3392 and the maximum score of 18.50% was recorded for HI8839(d). The lowest population of 9.00 brown wheat mites/10 cm2 was recorded in entry HD3438 while Sonalika had highest population of 15.67 mites/10 cm2 at Ludhiana. (Table A2-10.1a).

(b)Brown wheat mite: The lowest population of 9.00 brown wheat mites/10 cm2 was recorded in entry HD3438 while Sonalika had highest population of 15.67 mites/10 cm^2 at Ludhiana (Table A2-10.1a).

(c) Foliar aphid: Based on average score of four locations (Ludhiana, Karnal, Pusa and Niphad), 8 entries NIAW4028, HI1655Q*, WHD 965 (d), PBW902, GW547B, GW532, VL2043 and HPW 489 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-2022-23)

AVT No.	Entry	Shoot fly incidence (%)				No. of brown wheat mites/10 cm sq area
		Ludhiana	Dharwad	Kanpur	Average	Ludhiana
1	HS691	6.08	11.11	16.00	11.06	9.67
2	HS692	5.70	3.70	16.00	8.47	11.00
3	VL3028	5.73	12.10	13.33	10.39	10.67
4	HPW484	5.86	18.31	16.66	13.61	12.67
5	VL907(C)	5.54	26.85	9.09	13.83	12.33
6	VL892(C)	6.66	26.00	14.28	15.65	14.00
7	HPW349(C)	5.60	11.59	13.36	10.18	11.00
8	HS562(C)	5.13	28.31	12.00	15.15	13.33
9	VL2041(I)(C)	5.23	9.66	9.37	8.09	13.33
10	PBW887	5.37	11.94	15.62	10.98	11.67
11	PBW889	5.42	14.79	15.00	11.74	8.67
12	HD3386	6.09	32.56	9.37	16.01	10.33
13	HD3470	5.09	21.88	16.00	14.32	11.67
14	HI1668	5.62	25.49	15.62	15.58	13.00
15	DBW386	5.40	29.00	11.76	15.39	13.00
16	UP3102	5.56	37.88	13.63	19.02	13.33
17	HD3428	4.94	22.22	11.11	12.76	12.00
18	PBW893	5.29	22.06	14.28	13.88	13.00
19	K2108	5.35	15.79	12.00	11.05	13.00
20	HD3059(C)	5.46	26.32	15.38	15.72	13.33
20A	Infector	7.74	16.67	18.18	14.20	15.67
21	DBW173(C)	6.11	25.00	19.04	16.72	13.00
22	PBW771(C)	5.70	23.21	18.18	15.70	12.67
23	JKW261(C)	5.98	7.50	15.78	9.75	13.33
24	WH1402	5.68	19.05	11.76	12.16	11.33
25	WH1311	5.33	19.57	15.38	13.43	12.67
26	UP3111	5.41	17.24	16.66	13.10	12.67

27	PBW899	5.19	7.50	10.71	7.80	11.67
28	PBW644(C)	5.73	12.16	21.05	12.98	11.67
29	DBW296(C)	4.54	23.08	7.14	11.59	12.67
30	HD3369(I)(C)	5.55	22.92	15.62	14.70	12.33
31	HI1653(I)(C)	5.86	12.79	13.63	10.76	13.67
32	HI1654(I)(C)	5.78	13.93	17.39	12.37	13.33
33	HD3388	6.31	15.79	12.00	11.37	11.67
34	HD3471	5.21	24.42	14.28	14.64	13.33
35	HD3249(C)	5.63	21.93	13.36	13.64	12.67
36	HD3086(C)	6.18	19.15	9.09	11.47	10.33
37	HD2967(C)	6.30	10.20	10.71	9.07	12.67
38	DBW222(C)	5.54	22.73	15.38	14.55	10.67
39	PBW826(I)(C)	5.44	26.79	13.04	15.09	12.33
40	DBW398	5.37	13.41	13.63	10.80	13.33
40A	Infector	7.73	14.29	16.00	12.67	17.33
41	HI1612(C)	5.88	1.56	12.50	6.65	11.33
42	K1317(C)	5.18	5.56	18.18	9.64	12.33
43	HD3171(C)	5.62	20.00	12.50	12.71	11.67
44	HD3293(C)	4.51	22.50	14.28	13.76	14.67
45	DBW252(C)	5.47	14.29	6.89	8.88	11.67
46	NWS2194	5.56	11.11	18.18	11.62	9.33
47	HI1669	4.92	27.27	8.00	13.40	13.67
48	HI1670	6.11	35.71	13.63	18.48	13.33
49	GW547	5.17	16.67	13.63	11.82	8.67
50	GW513(C)	5.53	25.00	9.09	13.21	14.00
51	HI1636 (C)	5.42	25.00	12.50	14.31	12.33
52	HI1650(I)(C)	5.65	1.72	13.63	7.00	14.33
53	MACS6768(I)(C)	4.92	3.21	10.00	6.04	11.33
54	HI1674	6.51	8.09	8.00	7.53	13.33
55	AKAW5104	6.38	6.73	12.50	8.54	9.33
56	HD2932(C)	5.65	13.21	14.28	11.05	13.67
57	MP4010(C)	5.69	12.50	11.11	9.77	13.00
58	HI1634(C)	5.42	10.42	13.63	9.82	12.67
59	CG1029(C)	6.76	13.04	5.55	8.45	12.33
60	DBW359	5.30	25.68	13.63	14.87	12.67
60A	Infector	7.80	16.65	14.28	12.91	16.33
61	DBW441	5.68	10.87	13.63	10.06	8.67
62	DBW442	4.84	8.57	11.11	8.17	14.00
63	CG1040	5.46	6.58	12.00	8.01	13.33
64	MP3288(C)	5.56	23.21	8.00	12.26	14.33
65	DBW110(C)	5.56	14.29	12.00	10.62	11.33
66	CG1036(I)(C)	4.82	17.19	13.79	11.93	13.33
67	HI1655(I)(C)	6.77	16.25	12.50	11.84	9.33
68	UAS3020	4.86	5.17	13.33	7.79	13.67
69	UAS3021	4.87	12.50	15.62	11.00	13.00
70	MACS6811	5.10	21.95	10.71	12.59	12.00
71	MACS6809	5.49	7.69	7.14	6.77	14.67
72	NIAW4183	5.14	5.36	9.09	6.53	13.33
73	NIAW4153	6.22	7.89	14.28	9.46	13.67
74	AKAW5314	5.87	6.82	15.38	9.36	12.33
75	AKAW5100	6.42	15.56	18.18	13.39	12.67
76	MP1378	5.29	10.29	21.87	12.48	13.33
77	MP1386	6.01	9.32	14.28	9.87	8.33
78	DBW443	5.52	9.59	18.18	11.10	10.00
79	DBW444	5.25	6.34	15.38	8.99	13.67
80	HD3469	6.18	6.49	14.28	8.98	11.00
80A	Infector	8.15	10.48	21.05	13.23	14.67
81	NWS2222	4.78	10.00	9.09	7.96	13.67

82	PWU15	6.34	10.94	13.79	10.36	13.67
83	WH1306	4.61	10.42	12.50	9.18	12.33
84	PBW891	4.26	21.28	15.38	13.64	11.00
85	HI8841(d)	6.21	25.00	15.62	15.61	11.33
86	UP3083	6.17	10.53	15.62	10.77	13.00
87	MACS3949(d)(C)	5.84	7.41	3.33	5.53	12.00
88	HI8826(d)(I)(C)	6.07	12.93	18.75	12.58	14.00
89	MACS4100(d)(I)(C)	6.88	7.00	11.53	8.47	13.33
90	MACS6222 (C)	5.92	12.50	20.00	12.81	14.33
91	HI1672	5.81	5.56	12.00	7.79	11.33
92	HI1673	6.21	15.38	20.00	13.86	13.33
93	HI1675	5.36	11.90	11.11	9.46	9.33
94	DBW394	6.11	13.04	10.52	9.89	13.67
95	DBW395	5.70	24.24	13.33	14.42	14.00
96	MACS6814	5.98	18.48	18.18	14.21	12.00
97	MACS6805	5.68	3.64	12.00	7.11	14.67
98	NIAW4114	5.33	15.52	14.28	11.71	13.33
99	NIAW4120	5.41	6.86	4.00	5.42	13.67
100	UAS3022	7.50	14.29	16.66	12.82	13.33
100A	Infector	7.81	16.45	13.33	12.53	16.00
101	UAS3023	6.09	9.42	16.66	10.72	13.67
102	MP3557	5.10	9.38	6.66	7.05	8.67
103	MP3556	4.82	8.59	13.63	9.01	14.00
104	PBW897	5.91	14.77	5.00	8.56	15.00
105	MP1388	5.50	11.32	12.00	9.61	14.33
106	GW542	5.73	8.33	11.42	8.49	11.33
107	GW538	4.54	6.00	9.09	6.54	13.00
108	WH1310	5.55	10.23	3.33	6.37	13.33
109	LOK79	5.86	13.83	8.00	9.23	12.67
110	RAJ4083(C)	5.78	3.64	11.42	6.95	10.33
111	HD3090(C)	6.31	4.11	12.00	7.47	12.67
112	HI1633(C)	5.21	8.89	10.71	8.27	14.67
113	UAS478(d)	6.27	18.75	10.71	11.91	11.67
114	UAS481(d)	5.72	24.07	10.71	13.50	9.33
115	HI1665	6.05	10.00	13.33	9.79	13.67
116	HI8840(d)	5.93	12.50	5.00	7.81	12.67
117	DBW397	5.07	14.58	12.00	10.55	13.00
118	DDW61(d)	6.00	15.45	7.40	9.62	13.00
119	NIAW4028	5.50	23.91	12.00	13.80	10.00
120	HI1605(C)	5.43	8.57	17.14	10.38	13.33
120A	Infector	7.90	13.64	19.23	13.59	15.67
121	NIAW3170(C)	5.47	10.00	11.11	8.86	12.00
122	UAS446(d)(C)	5.32	12.75	5.00	7.69	10.67
123	NIDW1149(d)(C)	6.03	5.66	11.11	7.60	9.67
124	DBW380	5.24	4.55	12.00	7.26	9.67
125	DBW370(I)(C)	4.93	6.56	14.28	8.59	11.00
126	DBW371(I)(C)	6.36	8.33	11.11	8.60	16.33
127	DBW372(I)(C)	5.26	9.82	6.66	7.25	13.33
128	PBW872(I)(C)	5.67	8.62	13.33	9.21	12.33
129	DBW377	5.27	11.36	6.66	7.76	14.00
130	CG1044	5.65	14.29	9.09	9.68	14.33
131	GW543	6.40	7.46	18.18	10.68	13.33
132	DBW187(C)	4.72	14.29	8.00	9.00	12.67
133	DBW303(C)	5.57	13.95	10.71	10.08	11.67
134	GW322(C)	5.63	13.64	17.85	12.37	10.67
134a	Infector	8.51	13.09	13.63	11.74	15.33

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

Table A1-10.1b: Screening of AVT lines against foliar wheat aphid and root aphid (Year-2022-23)

AVT No.	Entry	Foliar aphid score (1-5 scale)				Average score	Maximum Score	Root aphid (No./plant) Ludhiana Centre only
		Ludhiana	Karnal	Pusa	Niphad			
1	HS691	4	4	3	3	3.5	4	4
2	HS692	4	4	5	3	4.0	5	4
3	VL3028	5	5	5	4	4.8	5	4
4	HPW484	5	5	5	4	4.8	5	4
5	VL907(C)	5	5	5	4	4.8	5	4
6	VL892(C)	5	5	3	3	4.0	5	4
7	HPW349(C)	5	5	5	3	4.5	5	4
8	HS562(C)	4	5	4	3	4.0	5	4
9	VL2041(I)(C)	4	4	5	3	4.0	5	4
10	PBW887	4	5	4	3	4.0	5	4
11	PBW889	4	5	3	3	3.8	5	4
12	HD3386	4	5	3	3	3.8	5	4
13	HD3470	4	5	2	4	3.8	5	4
14	HI1668	4	5	3	5	4.3	5	4
15	DBW386	4	4	3	3	3.5	4	4
16	UP3102	5	5	5	4	4.8	5	4
17	HD3428	4	5	5	3	4.3	5	4
18	PBW893	5	4	5	4	4.5	5	4
19	K2108	5	4	5	3	4.3	5	4
20	HD3059(C)	4	4	2	3	3.3	4	4
20A	Infector- A 9-30-1 (C)	5	5	5	5	5.0	5	5
21	DBW173(C)	4	4	3	4	3.8	4	4
22	PBW771(C)	4	4	5	3	4.0	5	4
23	JKW261(C)	4	4	2	4	3.5	4	4
24	WH1402	4	5	5	3	4.3	5	4
25	WH1311	4	4	5	4	4.3	5	4
26	UP3111	4	4	5	4	4.3	5	4
27	PBW899	5	5	3	3	4.0	5	4
28	PBW644(C)	5	5	4	4	4.5	5	4
29	DBW296(C)	4	5	4	4	4.3	5	4
30	HD3369(I)(C)	4	4	5	4	4.3	5	4
31	HI1653(I)(C)	4	4	5	4	4.3	5	4
32	HI1654(I)(C)	4	5	3	4	4.0	5	4
33	HD3388	5	4	5	5	4.8	5	4
34	HD3471	4	5	4	3	4.0	5	4
35	HD3249(C)	4	3	3	5	3.8	5	5
36	HD3086(C)	5	4	3	5	4.3	5	4
37	HD2967(C)	4	5	5	5	4.8	5	5
38	DBW222(C)	4	5	3	5	4.3	5	4
39	PBW826(I)(C)	5	3	3	4	3.8	5	4
40	DBW398	5	3	3	4	3.8	5	4
40A	Infector- A 9-30-1 (C)	5	5	5	5	5.0	5	5
41	HI1612(C)	4	4	2	2	3.0	4	4
42	K1317(C)	4	4	5	3	4.0	5	4
43	HD3171(C)	4	4	5	3	4.0	5	4
44	HD3293(C)	4	4	5	3	4.0	5	5
45	DBW252(C)	4	4	3	2	3.3	4	4
46	NWS2194	4	4	5	5	4.5	5	5
47	HI1669	4	4	5	4	4.3	5	4

48	HI1670	5	4	4	4	4.3	5	4
49	GW547	4	4	5	3	4.0	5	4
50	GW513(C)	4	3	3	4	3.5	4	4
51	HI1636 (C)	4	4	3	4	3.8	4	4
52	HI1650(I)(C)	3	3	5	3	3.5	5	4
53	MACS6768(I)(C)	5	4	5	4	4.5	5	4
54	HI1674	4	4	5	4	4.3	5	4
55	AKAW5104	5	4	3	2	3.5	5	5
56	HD2932(C)	4	4	5	2	3.8	5	4
57	MP4010(C)	4	4	4	4	4.0	4	4
58	HI1634(C)	5	4	3	4	4.0	5	4
59	CG1029(C)	4	4	3	3	3.5	4	4
60	DBW359	4	4	3	3	3.5	4	4
60A	Infector- A 9-30-1 (C)	5	5	5	5	5.0	5	5
61	DBW441	4	4	4	4	4.0	4	4
62	DBW442	4	4	3	3	3.5	4	4
63	CG1040	4	4	5	3	4.0	5	4
64	MP3288(C)	3	3	3	4	3.3	4	5
65	DBW110(C)	4	3	3	4	3.5	4	4
66	CG1036(I)(C)	4	5	3	4	4.0	5	4
67	HI1655(I)(C)	3	3	4	3	3.3	4	4
68	UAS3020	4	4	3	3	3.5	4	4
69	UAS3021	4	4	3	4	3.8	4	4
70	MACS6811	4	4	3	2	3.3	4	4
71	MACS6809	5	4	5	3	4.3	5	4
72	NIAW4183	4	4	3	4	3.8	4	5
73	NIAW4153	4	4	5	4	4.3	5	4
74	AKAW5314	4	4	3	3	3.5	4	4
75	AKAW5100	4	4	3	4	3.8	4	4
76	MP1378	5	4	5	5	4.8	5	4
77	MP1386	5	4	3	5	4.3	5	4
78	DBW443	5	4	2	5	4.0	5	4
79	DBW444	4	4	3	4	3.8	4	4
80	HD3469	5	4	5	3	4.3	5	4
80A	Infector- A 9-30-1 (C)	5	5	5	5	4.8	5	5
81	NWS2222	4	4	4	4	4.0	4	4
82	PWU15	4	4	5	3	4.0	5	4
83	WH1306	4	4	5	4	4.3	5	4
84	PBW891	4	4	4	4	4.0	4	4
85	HI8841(d)	4	4	4	5	4.3	5	4
86	UP3083	4	4	4	4	4.0	4	4
87	MACS3949(d)(C)	4	4	4	5	4.3	5	4
88	HI8826(d)(I)(C)	4	4	3	3	3.5	4	4
89	MACS4100(d)(I)(C)	4	4	3	5	4.0	5	4
90	MACS6222 (C)	5	4	3	4	4.0	5	4
91	HI1672	4	4	3	3	3.5	4	4
92	HI1673	4	4	3	4	3.8	4	4
93	HI1675	5	4	5	3	4.3	5	4
94	DBW394	5	4	5	3	4.3	5	4
95	DBW395	4	4	2	3	3.3	4	4
96	MACS6814	4	4	5	3	4.0	5	4
97	MACS6805	4	4	4	3	3.8	4	4
98	NIAW4114	4	4	5	4	4.3	5	4
99	NIAW4120	4	4	3	3	3.5	4	4
100	UAS3022	4	4	3	3	3.5	4	4
100A	Infector- A 9-30-1 (C)	5	5	5	5	5.0	5	5
101	UAS3023	4	4	5	5	4.5	5	4
102	MP3557	5	4	4	5	4.5	5	4

103	MP3556	4	4	4	5	4.3	5	4
104	PBW897	4	4	4	4	4.0	4	4
105	MP1388	4	4	3	3	3.5	4	4
106	GW542	4	4	2	4	3.5	4	4
107	GW538	4	4	4	4	4.0	4	4
108	WH1310	5	4	3	5	4.3	5	4
109	LOK79	4	4	5	4	4.3	5	4
110	RAJ4083(C)	5	4	5	3	4.3	5	4
111	HD3090(C)	4	4	3	5	4.0	5	4
112	HI1633(C)	4	4	5	4	4.3	5	4
113	UAS478(d)	4	4	2	4	3.5	4	4
114	UAS481(d)	5	4	3	4	4.0	5	4
115	HI1665	4	4	3	4	3.8	4	4
116	HI8840(d)	4	4	5	5	4.5	5	4
117	DBW397	4	4	4	5	4.3	5	4
118	DDW61(d)	4	4	2	5	3.8	5	4
119	NIAW4028	4	4	2	4	3.5	4	4
120	HI1605(C)	4	4	3	4	3.8	4	4
120A	Infector-A 9-30-1 (C)	5	5	4	5	4.8	5	5
121	NIAW3170(C)	4	4	3	4	3.8	4	4
122	UAS446(d)(C)	4	4	3	3	3.5	4	4
123	NIDW1149(d)(C)	5	3	2	4	3.5	5	4
124	DBW380	4	3	3	5	3.8	5	4
125	DBW370(I)(C)	4	4	4	4	4.0	4	4
126	DBW371(I)(C)	4	4	4	4	4.0	4	4
127	DBW372(I)(C)	4	4	5	4	4.3	5	4
128	PBW872(I)(C)	4	4	4	3	3.8	4	4
129	DBW377	4	4	5	4	4.3	5	4
130	CG1044	4	3	3	5	3.8	5	4
131	GW543	4	4	5	4	4.3	5	4
132	DBW187(C)	4	4	5	4	4.3	5	4
133	DBW303(C)	4	4	5	4	4.3	5	4
134	GW322(C)	4	4	2	4	3.5	4	4
134a	Infector- A 9-30-1 (C)	5	5	5	5	5.0	5	5

**Data from Vijapur, Durgapura, Kharibari, Pantnagar, Khudwani rejected due to low aphid incidence*

Table A2-10.1a: Screening of MPSN nursery against shoot fly and brown wheat mite (Year-2022-23)

MPSN No.	Entry	Shoot fly incidence (%)			Average score	No. of brown wheat mites/10 cm sq area
		Ludhiana	Kanpur	Dharwad		Ludhiana
1	PBW870	6.79	23.33	14.74	14.95	10.67
2	HI8846	5.91	16.66	11.82	11.46	13.00
3	PBW902	6.63	15.00	23.40	15.01	12.00
4	HI 8830 (d)	6.00	16.66	20.00	14.22	12.67
5	WHD 965 (d)	4.88	10.00	8.47	7.78	9.67
6	HI 8827 (d)	5.75	13.33	19.51	12.86	12.33
7	VL3029	6.02	16.66	12.93	11.87	11.67
8	HI8839(d)	6.90	16.66	31.94	18.50	13.67
9	GW547B	6.07	13.33	8.09	9.16	13.33
10	HI1665	6.21	13.33	20.00	13.18	12.00
11	NIAW4028	5.91	15.00	23.08	14.66	13.00
12	GW532	5.80	11.11	12.79	9.90	13.67
13	HI1655Q*	6.40	14.66	18.57	13.21	12.67
14	MACS6795	6.04	10.52	24.29	13.62	12.67

15	HI1654*	6.13	5.55	14.29	8.66	11.33
16	WH1403	6.50	9.09	19.64	11.74	10.33
17	HD3438	6.49	10.52	13.27	10.09	9.00
18	HD3407*	5.90	13.33	19.57	12.93	13.00
19	HI8847	7.90	9.09	22.83	13.27	12.33
20	CG 1036	5.77	12.00	12.70	10.16	13.33
20A	Infector	8.14	18.75	19.30	15.40	15.67
21	HI 1651	4.34	10.00	24.44	12.93	14.00
22	WH1402	6.61	13.33	20.31	13.42	13.00
23	HD3440	4.82	16.00	14.29	11.70	13.33
24	HD3437	6.95	12.00	22.09	13.68	12.00
25	VL2043	5.28	10.00	27.27	14.18	11.33
26	VL2044	5.47	3.37	30.56	13.13	13.00
27	HD3402	5.53	9.09	20.93	11.85	13.33
28	HS694	5.14	9.37	28.38	14.30	13.00
29	VL3028	7.07	11.11	18.97	12.38	12.33
30	HD3392	4.65	11.11	7.32	7.69	9.67
31	HPW 484	6.22	12.00	26.56	14.93	10.33
32	HPW 487	5.76	10.71	8.06	8.18	12.00
33	HPW 489	6.96	13.63	11.22	10.60	13.00
34	HPW 493	6.40	15.00	7.89	9.76	13.00
35	HPW 495	6.76	18.11	13.46	12.78	11.33
36	HPW 496	6.92	12.50	18.33	12.58	12.67
37	HPW 497	6.28	14.28	27.94	16.17	12.00
38	HPW 498	6.13	12.50	20.65	13.09	13.67
38a	Infector	7.96	14.28	21.43	14.56	15.00

**Susceptible checks: SONALIKA (C) for shootfly & IWP (72) for Brown wheat mite*

Table A2-10.1b: Screening of MPSN nursery against foliar aphid and root aphid (Year-2022-23)

MPSN No.	Entry	Foliar aphid score (1-5 scale)				Average score	Maximum Score	Root Aphid Score (1-5)
		Ludhiana	Karnal	Pusa	Niphad			Ludhiana
1	PBW870	4	4	4	5	4.25	5	4
2	HI8846	5	5	3	4	4.25	5	5
3	PBW902	4	3	3	5	3.75	5	4
4	HI 8830 (d)	5	4	5	2	4.00	5	4
5	WHD 965 (d)	4	4	4	2	3.50	4	4
6	HI 8827 (d)	4	5	5	3	4.25	5	4
7	VL3029	4	4	4	4	4.00	4	4
8	HI8839(d)	4	5	4	4	4.25	5	4
9	GW547B	4	4	3	4	3.75	4	4
10	HI1665	4	4	4	4	4.00	4	4
11	NIAW4028	4	3	4	2	3.25	4	4
12	GW532	4	4	4	3	3.75	4	4
13	HI1655Q*	4	3	3	3	3.25	4	4
14	MACS6795	4	5	5	4	4.50	5	4
15	HI1654*	4	5	5	5	4.75	5	4
16	WH1403	4	4	4	5	4.25	5	4
17	HD3438	4	5	4	3	4.00	5	4
18	HD3407*	4	4	5	3	4.00	5	4
19	HI8847	4	4	4	4	4.00	4	4
20	CG 1036	4	4	3	5	4.00	5	4

20A	**Infector**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
21	HI 1651	4	4	3	5	4.00	5	4
22	WH1402	4	5	2	5	4.00	5	4
23	HD3440	4	5	4	5	4.50	5	4
24	HD3437	4	4	5	5	4.50	5	4
25	VL2043	4	4	4	3	3.75	4	4
26	VL2044	4	5	4	4	4.25	5	4
27	HD3402	4	5	2	5	4.00	5	4
28	HS694	4	5	5	4	4.50	5	4
29	VL3028	5	5	3	4	4.25	5	4
30	HD3392	5	4	5	5	4.75	5	4
31	HPW 484	5	4	5	4	4.50	5	4
32	HPW 487	4	5	4	3	4.00	5	4
33	HPW 489	4	4	4	3	3.75	4	4
34	HPW 493	4	4	5	5	4.50	5	4
35	HPW 495	4	5	5	5	4.75	5	4
36	HPW 496	4	5	5	5	4.75	5	4
37	HPW 497	4	4	5	5	4.50	5	4
38	HPW 498	4	5	5	5	4.75	5	4
38a	**Infector**	**5**	**5**	**5**	**5**	**5**	**5**	**5**

**Susceptible check is A- 9-30-1*

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 2022-23 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 2022-23 crop year except few minor infestations.

Centre: Niphad
In Maharashtra state, survey was carried out in the villages of Nashik viz., Talegaon, Avankhede, Ozarkhed, Ambaner, Sajola and Khirad of different wheat crop stages on farmer's field during the February 2023. There were 58 samples were observed, medium incidence of aphid was recorded during the survey. The Coccinellids larvae, beetles & Chrysoperla carnea predator adults were also observed. The incidence of stem borer and jassids were recorded to be of low intensity. (Table B1-10.2a).

Centre: Vijapur
In Gujarat state, surveys were conducted to insect pest situation in wheat crop during Rabi 2022-23. The termite damage in wheat fields was recorded below 1 % in the fields across the area surveyed. The incidence of aphid was observed to be 0.5 to 1% 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, Daleep Nagar, Magharwara, Kundi, Devpura, Jahanabad during 2022-23. Incidence of shootfly was recorded to be between 1 to 1.66 at these locations. The incidence of termite was observed 13 per cent on wheat varieties viz., PBW343 and HUW 234 of wheat at Daleep Nagar. However, it was 10% in locations Magharwara, Kundi, Devpura, Jahanabad on variety HD2967. High infestation (30-35 aphid/tiller) of foliar aphid was on barley variety namely, 'Barley Local' at surveyed locations. The higher incidence of pink stem of 13.3% borer was observed in irrigated crop one per cent in variety HD-2967 at Daleep Nagar (Table B1-10.2b).

Centre: Karnal
Moderate to severe incidence of foliar wheat aphid was observed in Karnal district of Haryana. The minor damage of termite and root aphids was also observed in early period of crop growth in Karnal as its nearby locations Kunjpura, Kathial, Racina and Hajwna.In some fields, incidence of pink stem borer was observed in early (December month) and alter in the season (March month). The grubs and adults of coccinellid beetles were seen frequently in fields infested with aphids. This year incidence of aphids, termites, pink stem borer and army worm was reported to be low (1-2%). Termites and root aphid was reported to be around 1-2% during November and December. Aphid infestation started appearing in the month of January and the population in the beginning was around 2-5 aphids/tiller but in February, higher infestation of aphids (20-25 aphids/tiller on an average) was observed 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 experiment on the influence of sowing time on incidence of insect-pests in wheat was conducted in the experimental area of Department of Plant Breeding and Genetics, PAU, Ludhiana. The wheat PBW 725 variety 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 2022-23. Each treatment was replicated four times. The data on major pests viz. foliage feeding aphids and termites 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 the 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).
1. Termite damage: The termite damage recorded at seedling stage in different dates of sowing indicated that early sown wheat crop (first fortnight of Nov 2022) suffered more termite damage as compared to timely, late and very late sown crop. At earing stage, again termite damage was highest (2.83%) in early sown crop followed by timely (2.70%) and late sown (2.09%) and very late sown (1.83%) crop.
2. Root Aphid incidence: Root aphid incidence was recorded by uprooting 10 tillers from each treatment 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 weeks old crop. Root aphid incidence in I, II, III and IV date of sowing ranged from 3.36-7.08, 2.67-5.51, 1.84-3.90 and 1.31-2.79 aphid/tiller.
3. Foliar aphid incidence: Foliar aphid incidence appeared in the first week of February in I, and II sowing dates whereas aphids were first recorded in second week of February in all sowing dates. 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 2023 in all sowing date (Table B2-10.2a).

Centre: Karnal: The experiment was conducted at the 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 first started appearing on wheat crop during 51st standard week. Root aphid incidence D1, D2, D3 and D4 date of sown crops ranged from 0.96-1.72, 0.85-1.19, 065-1.01 and 0.52-1.71 aphids/tiller. The incidence of foliar aphid first appeared during 5th standard week in D1 and D2 sowing dates and during 6th standard week in D3 and D4 sowing time. The population reached its peak during 9th Standard week on D1 (16.76 aphids/plant) and during 9th standard week on D2 sown crop (16.33 aphids/plant) in the month of February. The aphid

population reached peaked during 10th standard week on D3 and D4 sown crops, respectively with aphid incidence as 15.66 and 14.55 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 3.05, 2.73, 2.24 and 1.95%, respectively during 51th standard week. The early sown crop (first week of Nov 2022) 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 3.05, 2.73, 2.24 and 1.64% infesation on D1, D2, D3 and D4 date of sown crops, respectively during 51th standard week. The early sown crop (first week of Nov 2022) 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-187 was sown on 1st December'2022, 15th December'2022 and 01st January'2023. The experiment was laid out in Randomized Block Design with four replications 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 2022-23 (Centre: Niphad)

Locality and date of visit	Area surveyed (Rainfed/Irrigated)	No. of samples observed	Variety and Stage of growth	Crop pest			Natural enemy
				Name	Type of damage	Intensity	
Talegaon, Tal Dindori, Dist. Nashik 15.02.2023	Irrigated	02 01	Lok 1 , Booting stage 0.40 ha	Aphids S. Borer	Major Minor	Medium Low (1-2%)	*Coccinellids* Larvae and Beetles *Crysoperla carnia* Adults
Avankhede, Tal Dindori, Dist. Nashik 15.02.2023	Irrigated	02 01	Unknown Private Variety CRI- 0.20ha Flowering 0.60 ha Flowering stage	Aphids Aphids S. Borer	Major Minor	Medium Very Low	*Coccinellids* Larvae and Beetles *Crysoperla carnia* Adults
Ozarkhed, Tal Dindori, Dist. Nashik 15.02.2023	Irrigated	04 02	Ajeet 102 CRI-0.40 ha Booting Stage -0.60 ha Milk stage-0.40 ha	Aphids Jassids S. Borer	Major Minor Minor	Medium to Heavy Low Very Low	*Coccinellids* Larvae andBeetles *Crysoperla carnia* Adults
Ambaner, Tal Dindori, Dist. Nashik 15.02.2023	Irrigated	02 01	Kohinoor, Milk stage	Aphids S. Borer	Major Minor	Medium Low (1-2%)	*Coccinellids* Larvae and Beetles *Crysoperla carnia* Adults
Sajola, Tal Surgana, Post- Hatgad, Nashik 15.02.2023	Irrigated	02 01	Lok 1 , Dough stage 0.40 ha	Aphids S. Borer	Major Minor	Low Low (1-2%)	*Coccinellids* Larvae and Beetles
Khirad Tal Surgana, Nashik 15.02.2023	Irrigated	03 01	Lok 1 , Dough stage 0.30 ha 0.20 ha	Aphids Aphids S. Borer	Major Minor	Medium Low (1-2%)	*Coccinellids* Larvae and Beetles *Crysoperla carnia* Adults

Table B1-10.2b: Survey of wheat and barley pests and their natural enemies during 2022-23 (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
27.01.2023 Araul (Kanpur)	Irrigated	10	HD2967	Shootfly	Minor	1%	-	-
	irrigated	10	K1006 and HD2967	Termite	Minor	1.66%	-	Adult
	Irrigated	10	K1006	Pink Stem borer	Minor	1%	-	-
	Irrigated	10	K-551 (Barley)	Aphids	Major	35 aphids/tiller	*Coccinella-septumpuntata*	Adult
31.01.2023 Daleep Nagar (Kanpur Dehat)	Irrigated	10	1006	Shoot Fly	Minor	1%	-	-
	Irrigated	10	HD2967	Pink Stem Borer	Minor	1%	-	-
	Irrigated	10	Barley Local	Aphid	Major	35 aphids/tiller	*Coccinella-septumpuntata*	Adult
	Irrigated	10	HD2967	Termites	Major	13%	-	-
27.01.2023 Magharwara, Kundi,Devpura, Jahanabad	Irrigated	10	HD2967	Termite	Major	10.3%		Adult
	Irrigated	10	HD2967	Stemborer	Minor	1%	-	
	Irrigated	10	Barley-K551	Aphids	Major	35 aphids/tiller	*Coccinella-septumpuntata*	Adult
	Irrigated	10	HD2967	Pink stem borer	Minor	1%	-	-

Table B2-10.2a: Effect of sowing dates on population build of major insect-pests in wheat during 2022-23 (Centre-Ludhiana)

Standard Weeks	Rain-fall (mm)	Relative humidity (%)		Temperature (^{0}C)		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 (1Dec)	IVth DOS (16 Dec.)	Ist DOS (1 Nov)	IInd DOS (16 Nov.)	IIIrd DOS (1 Dec)	IVth DOS (16 Dec.)	Ist DOS (1 Nov)	IInd DOS (16 Nov.)	IIIrd DOS (1 Dec)	IVth DOS (16 Dec.)
50	0	91	33	23.6	7.9	-	-	-	-	-	-	-	-	-	-	-	-
51	0	95	66	17.3	7.5	-	-	-	-	3.95	3.63	3.14	2.85	7.08	5.51	3.90	2.79
52	0.6	95	67	15.6	6.6	-	-	-	-	3.73	3.48	3.19	2.69	6.55	5.02	3.65	2.45
1	0	93	70	13.3	5.5	-	-	-	-	3.37	3.01	2.86	2.60	3.36	2.67	1.84	1.31
2	0	95	72	14.8	7.9	0	0	0	0	-	-	-	-	-	-	-	-
3	0	89	37	18.1	4.3	0	0	0	0	-	-	-	-	-	-	-	-
4	18.1	90	56	19.4	7.6	0	0	0	0	-	-	-	-	-	-	-	-
5	14	93	57	20.3	8.6	1	1.5	0	0	-	-	-	-	-	-	-	-
6	0	87	45	23.0	10.0	5.5	4.74	3.68	3.31	-	-	-	-	-	-	-	-
7	0	87	38	24.6	9.2	13.13	11.69	9.54	7.50	-	-	-	-	-	-	-	-
8	0	90	43	27.5	12.1	13.95	12.01	10.56	8.47	2.83	2.70	2.09	1.83	-	-	-	-
9	2.8	88	43	26.8	13.7	16.76	16.33	14.82	12.98	-	-	-	-	-	-	-	-
10	0	89	40	28.5	13.6	13.07	14.70	15.66	14.55	-	-	-	-	-	-	-	-
11	19.2	87	46	28.2	15.8	9.57	10.61	12.32	12.96	-	-	-	-	-	-	-	-
12	33	88	53	25.5	14.7	1.2	2.4	2.6	3.4	-	-	-	-	-	-	-	-
13	10.4	87	49	26.5	15.7	0	0	0	1.2	-	-	-	-	-	-	-	-
14	14.6	81	41	28.0	14.4	0	0	0	0	-	-	-	-	-	-	-	-

Table B2-10.2b: Effect of sowing dates on population build of major insect-pests in wheat 2022-23 (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	00.0	24.2	08.5	70.9	-	-	-	-	-	-	-	-	-	-	-	-
51	00.0	18.3	07.5	88.2	0.96*	0.85*	0.65*	0.52*	3.05	2.73	2.24	1.95	2.98	1.11	1.42	1.64
52	01.2	16.0	06.8	84.6	1.72*	1.19*	1.01*	1.79*	2.83	2.58	2.29	1.79	2.06	1.60	1.12	1.25
1	00.0	13.1	06.1	89.7	-	-	-	-	2.47	2.11	1.96	1.70	1.09	2.64	1.29	1.09
2	03.8	15.5	08.6	90.2	0	0	0	0	-	-	-	-	0.54	0.82	0.42	0.32
3	10.6	17.0	04.5	72.9	0	0	0	0	-	-	-	-	-	-	-	-
4	00.0	19.4	07.4	82.8	0	0	0	0	-	-	-	-	-	-	-	-
5	08.2	20.1	07.8	83.5	1.0	1.5	0	0	-	-	-	-	-	-	-	-
6	00.0	23.9	09.3	73.0	4.6	3.84	2.78	2.41	-	-	-	-	-	-	-	-
7	00.0	23.8	08.1	69.5	12.23	10.79	8.64	6.6	1.23	1.02	0.99	0.85	-	-	-	-
8	00.0	27.4	11.2	73.2	13.05	11.11	9.66	7.57	1.96	1.52	1.22	1.23	-	-	-	-
9	00.0	28.2	12.1	70.4	15.86	15.43	13.92	12.08	-	-	-	-	-	-	-	-
10	00.0	27.9	12.9	72.2	12.17	13.8	12.76	11.65	-	-	-	-	-	-	-	-
11	00.5	30.4	14.4	70.4	8.67	9.71	11.42	12.06	-	-	-	-	-	-	-	-
12	81.2	25.2	14.3	79.0	0.3	1.5	1.7	2.5	-	-	-	-	-	-	-	-
13	14.5	28.1	14.5	67.7	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-

*** Root aphid/till**

Table B2-10.2c: Effect of sowing dates on population build of major insect-pests in wheat 2022-23 (Centre-Kharibari)

Standard Weeks		Relative humidity		Temperature ^{0}C		Aphid incidence (Aphids/tiller)					
	RAIN FALL IN mm	Max RH	Min RH	Max Temp	Min Temp	Date of sowing 01.12.22	Yield qt/ha	Date of sowing 16.12.22	Yield qt/ha	Date of sowing 01.01.23	Yield qt/ha
48	0	77.86	66.29	30.30	13.27	**0.00**	**29.50**	**0.00**	**22.15**	**0.00**	**20.25**
49	0	81.14	66.14	29.54	12.69	**0.00**		**0.00**		**0.00**	
50	0	81.71	77.29	27.79	12.63	**9.25**		**0.00**		**0.00**	
51	0	85.71	86.43	26.74	12.71	**13.45**		**0.00**		**0.00**	
52	0	88.43	84.00	23.67	11.00	**27.85**		**17.85**		**0.00**	
53	0	86.86	89.00	23.23	11.11	**52.65**		**60.25**		**0.00**	
1	0	89.71	89.14	21.87	9.13	**77.85**		**75.60**		**0.00**	
2	0	83.00	90.14	21.59	8.69	**110.35**		**85.75**		**12.50**	
3	0	76.29	86.14	24.21	9.06	**137.10**		**137.25**		**42.15**	
4	0	78.29	85.00	26.36	12.30	**159.85**		**175.85**		**87.95**	
5	0	75.86	82.14	23.96	13.59	**205.35**		**212.25**		**165.50**	
6	0	64.14	68.71	26.21	12.36	**189.45**		**225.35**		**232.50**	
7	0	64.00	78.57	27.64	16.39	**145.70**		**197.10**		**195.80**	
8	0.14	41.19	37.01	49.86	44.07	**95.25**		**152.20**		**160.25**	
9	0	30.39	15.64	57.57	73.43	**48.15**		**114.45**		**130.40**	
10	0.21	29.91	16.76	60.71	66.14	**22.35**		**92.35**		**115.80**	
11	15.36	26.40	17.56	77.14	84.57	**13.25**		**68.20**		**98.20**	
12	0	31.39	18.00	60.14	68.71	**7.15**		**42.75**		**60.20**	
13	0	30.41	19.14	61.29	67.71	**4.10**		**25.35**		**42.30**	
14	0	33.56	20.09	53.00	53.86	**1.50**		**12.10**		**22.10**	

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 presented in Table B3 revealed that pink stem borer incidence was significantly higher in all residue management conditions as compared to conventional tillage conditions (0.79-1.18%). It was highest in Rotavator sown wheat (1.20-2.45%) crop followed by Super seeder (1.15-2.28%) and Happy-Seeder sown crop (1.03-1.50) 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 (4.30-5.10 aphids/tiller). However, there was no difference in foliar aphid incidence and their coccinellid predators among all tillage conditions (Table B3-10.2a).

Centre: Karnal: The data indicated that the pink stem borer incidence was significantly higher in rotavator sown wheat with 1.94, 2.38, 2.54, 2.21 and 1.79% incidence after 3, 4, 5,6 & 7 weeks after sowing, respectively. However, it was lowest in conventionally sown wheat crop with 1.39, 1.64, 1.63, 1.64, and 1.33% 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 (3.75-4.96 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 19.44, 21.88 and 18.39 aphids/tiller during different observation time. Coccinellid population at peak period of their activity was significantly highest in Super Seeder conditions (4.68/sq m) and lowest (1.12/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).

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.

Table B3-10.2a: Population dynamics of insect-pests and natural enemies under different residue management scenarios in rice-wheat cropping system during 2022-23(Centre: Ludhiana)

Pink stem borer damage (%)					
	3 WAS	**4 WAS**	**5 WAS**	**6 WAS**	**7 WAS**
Happy Seeder	1.37	1.43	1.50	1.24	1.03
Super Seeder	1.74	1.89	2.28	1.61	1.15
Rotavator	1.81	2.16	2.45	1.70	1.20
Conventional tillage	1.11	1.16	1.18	1.07	0.79
CD (p=0.05)	0.09	0.17	0.16	0.19	0.16
Root aphid/tiller	**3 WAS**	**4 WAS**	**5 WAS**		
Happy Seeder	2.50 (1.82)*	2.30 (1.75)	2.00 (1.67)		
Super Seeder	2.90 (1.95)	3.20 (2.01)	3.10 (1.94)		
Rotavator	3.80 (2.17)	3.40 (2.03)	3.60 (2.06)		
Conventional tillage	4.40 (2.29)	5.10 (2.44)	4.30 (2.28)		
CD (p=0.05)	(0.31)	(0.44)	(0.42)		
Foliar aphid/tiller	**25-2.2023**	**4-3-2023**	**11-3-2023**		
Happy Seeder	11.20	12.60	12.60		
Super Seeder	10.40	12.00	12.40		
Rotavator	10.80	13.40	12.50		
Conventional tillage	11.20	12.50	12.40		
CD (p=0.05)	NS	NS	NS		
Coccinellids/sq m	**24-3-2023**				
Happy Seeder	3.40				
Super Seeder	3.20				
Rotavator	2.60				
Conventional tillage	2.20				
CD (p=0.05)	NS	-			

*** 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 2022-23(Centre: Karnal)

Pink stem borer damage (%)					
	3 WAS	**4 WAS**	**5 WAS**	**6 WAS**	**7 WAS**
Happy Seeder	1.66	1.98	2.05	1.83	1.60
Super Seeder	1.79	2.22	2.47	2.13	1.70
Rotavator	1.94	2.38	2.54	2.21	1.79
Conventional tillage	1.39	1.64	1.63	1.64	1.33
CD (p=0.05)	**0.60**	**0.59**	**0.64**	**0.58**	**0.63**
Root aphid/tiller	**3 WAS**	**4 WAS**	**5 WAS**		
Happy Seeder	2.94(1.98	2.54(1.88)	1.44(1.56)		
Super Seeder	3.34(2.08)	2.65(1.91)	1.40(1.55)		
Rotavator	3.24(2.06)	2.86(1.96)	2.84(1.96)		
Conventional tillage	4.74(2.40)	4.96(2.44)	3.75(2.18)		
CD (p=0.05)	(0.87)	(0.35)	(0.42)		
Foliar aphid/tiller	**27-2.2023**	**7-3-2023**	**13-3-2023**		
Happy Seeder	15.88(4.11)	20.05(4.59)	12.98(3.74)		
Super Seeder	15.68(4.08)	19.11(4.48)	13.98(3.87)		
Rotavator	17.00(4.24)	21.14(4.71)	16.30(4.16)		
Conventional tillage	19.44(4.52)	21.88(4.78)	18.39(4.40)		
CD (p=0.05)	(0.26)	(0.20)	(0.18)		
Coccinellids/sq m	**29-3-2023**				
Happy Seeder	3.99(2.23)				
Super Seeder	4.68(2.38)				
Rotavator	1.70(1.64)				
Conventional tillage	1.12(1.46)				
CD (p=0.05)	(0.22)				

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

Centre: Ludhiana: The observations indicated that 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 higher than foliar application of thiamethoxam 25WG (0.28-0.36 grubs/m2). The grain yield recorded in all silicon treatment was also significantly lower than foliar application of thiamethoxam 25WG (53.77-54.11 q/ha) (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 presented 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 where soil application of insecticides was made just before first irrigation and untreated check. There was no difference in insecticides seed treatments 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 (0.51-0.74%) after 3-6 weeks of sowing. Whereas among the soil application, it was minimum in goond Katira (5kg/ha) + fipronil 0.6% GR (8.75 kg/ha) applied before Ist irrigation recorded lower termite damage (0.38-0.86%) after 4-6 weeks of sowing. However, all the insecticide treated plots recorded significantly lower termite damage as compare to untreated check except.

The grain yield obtained was maximum in seed treatment with goond katira (100 g/kg) + jaggery (250 g/litre) + thiamethoxam 70WS @ 1 g/kg of seed) (46.61 q/ha) followed by goond katira (5kg/ha) + fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation (46.56 q/ha) and all treatments were at par with each other and better than untreated check (43.41 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 1.53, 1.59, 1.65 & 1.71 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 1.90-2.10 per cent damaged effective tillers/m row during different observation time.Highest grain yield (45.53 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 (45.47 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 24.01.2023 on wheat crop and it started rising and reached its peak on 28.02.2023. Thereafter population of wheat aphid started declining and it drastically decreased after 28.03.2023. The population of Coccinellid beetle remained low up to 14.02.2023 and thereafter it started rising and reach its peak on 21.03.2023 (four 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 17.01.2023 on barley crop and it started rising and reached its peak on 28.02.2023 (Table B6b). Thereafter aphid population started declining and became very low after 28.03.2023. The population of coccinellid beetles remained low up to 14.02.2023 and thereafter it started rising and reached its peak on 14.03.2023.

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: Karnal

Population dynamics of Wheat aphid: The aphid first appeared on 20.01.2023 on wheat crop and it started rising and reached its peak (13.4 aphids/plant) on 03.03.2023 (Table B6-10.2c.). Thereafter population of wheat aphid started declining. The population of Coccinellid beetle started from 03.02.2023 and reaches its peak (4.3 beetles/m^2) on 17.03.2023.

Population dynamics of barley aphid: The aphid population was higher as compared to wheat during the whole crop season (Table B6-10.2d). It first appeared on 13.01.2023 on barley crop and it started rising and reached its first peak 13.9 aphids/plant) on 17.02.2023. The population of coccinellid beetles remained low up to 27.01.2023 and thereafter it stated rising and reached its peak (4.30 beetles/m^2) on 03.03.2023. 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 2022-23(Centre: Ludhiana)

Treatments	Number of aphids/ earhead								Grain yield (q/ha)
	Before spray	After 1st spray			After 2nd spray			Coccinelli d/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	11.79	10.85	10.75	10.39	9.64	9.36	10.07	1.73	49.36
Two sprays of sodium meta-silicate @ 10g/litre at booting stage and 10 days after first spray	11.88	10.67	10.49	10.42	9.55	9.31	10.15	1.95	49.46
One spray of sodium meta-silicate @ 30g/litre at booting stage	11.95	10.09	9.98	9.87	9.48	9.09	10.19	1.93	49.67
Two sprays of sodium meta-silicate @ 30g/litre at booting stage and 10 days after first spray	11.91	9.98	9.84	9.84	9.25	9.08	10.04	1.89	49.97
One spray of sodium meta-silicate @ 50g/litre at booting stage	11.98	9.65	9.63	9.86	9.20	8.91	10.15	1.84	50.13
Two sprays of sodium meta-silicate @ 50g/litre at booting stage and 10 days after first spray	11.77	9.41	9.50	9.71	9.25	8.75	10.03	2.06	50.07
One spray of Actara (thiamethoxam 25 WG) @ 50g/ha at booting stage	11.79	1.52	1.39	1.03	0.85	0.81	1.01	0.36	53.77
Two sprays of Actara (thiamethoxam 25 WG) @ 50g/ha at booting stage and 10 days after first spray	11.96	1.36	1.22	0.89	0.64	0.73	1.21	0.28	54.11
Untreated Check	11.94	11.85	11.04	10.69	10.57	10.30	11.57	1.99	49.30
CD (p =0.05)	NS	0.57	0.33	0.64	0.49	0.68	0.75	0.51	1.50

Date of sowing	:	14.11.2022	Plot size	:	7.5 m^2
Date of treatments	:	24.02.2023&03.03.2023	Variety	:	PBW 725
Date of harvest	:	21. 04.2023	Replications	:	Three

Table B4-10.2b: Effect of sodium metasilicate application on aphid incidence in wheat during 2022-23(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	14.02	12.35	12.21	12.88	12.24	12.29	13.40	2.22	45.04
Two sprays of sodium meta-silicate @ 10g/litre at booting stage and 10 days after first spray	13.19	12.41	12.10	12.77	11.89	11.80	12.68	2.19	45.15
One spray of sodium meta-silicate @ 30g/litre at booting stage	13.86	11.96	11.73	12.40	11.52	11.69	12.80	2.28	45.17
Two sprays of sodium meta-silicate @ 30g/litre at booting stage and 10 days after first spray	13.25	11.92	11.34	12.01	11.13	11.31	12.19	2.11	46.38
One spray of sodium meta-silicate @ 50g/litre at booting stage	13.46	11.79	11.21	12.39	11.51	11.59	12.91	2.25	45.20
Two sprays of sodium meta-silicate @ 50g/litre at booting stage and 10 days after first spray	13.79	12.12	11.18	12.14	11.26	10.98	11.90	2.18	45.12
One spray of Actara (thiamethoxam 25 WG) @ 50g/ha at booting stage	14.16	1.70	0.84	1.09	1.02	1.19	4.07	0.71	47.27
Two sprays of Actara (thiamethoxam 25 WG) @ 50g/ha at booting stage and 10 days after first spray	14.07	1.42	0.97	1.17	0.51	0.36	0.50	0.39	48.46
Untreated Check	14.32	13.45	13.03	13.79	12.91	13.04	14.15	2.50	44.70
CD (p =0.05)	NS	0.72	0.45	0.51	0.69	0.45	0.54	0.12	1.85

Date of sowing	:	11.11.2022	Plot size	: 7.5 m^2
Date of treatments	:	10.03.2023 & 21.03.23	Variety	:HD2967
Date of harvest	:	21. 04.2023	Replications	: Three

Table B5-10.2a: Effect of insecticidal seed treatment on germination, termite damage and yield in wheat during 2022-23(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	41.68	0.77 (6.46)	0.66 (6.18)	0.76 (6.45)	0.54 (5.83)	46.61
2.	Goond Katira(100 g/kg) + Jaggery (250 g/litre)+ chlorpyriphos @ 4 ml/kg of seed)	Seed treatment	41.79	0.73 (6.37)	0.72 (6.34)	0.70 (6.27)	0.45 (5.57)	46.43
3.	Goond Katira (100 g/kg) + Jaggery (250 g/litre)+ Neonix @ 2 ml/kg of seed)	Seed treatment	41.87	0.63 (6.10)	0.64 (6.14)	0.74 (6.37)	0.51 (5.75)	46.11
4.	Thiamethoxam 70WS @ 1 g/kg of seed	Seed treatment	41.74	0.65 (6.13)	0.77 (6.45)	0.61 (6.03)	0.41 (5.44)	45.75
5.	Chlorpyriphos @ 4 ml/kg of seed	Seed treatment	41.80	0.71 (6.30)	0.72 (6.32)	0.63 (6.11)	0.40 (5.43)	46.28
6.	Neonix @ 2 ml/kg of seed	Seed treatment	41.91	0.80 (6.49)	0.71 (6.30)	0.53 (5.81)	0.45 (5.95)	46.50
7.	Goond Katira (5kg/ha)+ Fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation	Soil application	42.02	3.83 (11.99)	0.86 (6.69)	0.66 (6.17)	0.38 (5.36)	46.56
8.	Goond Katira (5kg/ha)+ Chlorpyriphos 20 EC(2.5 litres/ha) before Ist irrigation	Soil application	41.87	3.77 (11.90)	0.87 (6.70)	0.69 (6.24)	0.46 (5.59)	46.10
9.	Fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation	Soil application	41.95	4.04 (12.29)	0.80 (6.54)	0.73 (6.37)	0.36 (5.30)	45.86
10	Chlorpyriphos 20 EC(2.5 litres/ha) before Ist irrigation	Soil application	41.94	3.73 (11.86)	0.88 (6.73)	0.66 (6.17)	0.47 (5.63)	46.21
11.	Untreated seed+ no application of chemical (Control)	-	41.91	4.19 (12.50)	4.17 (12.47)	4.14 (12.29)	4.11 (12.39)	43.41
	CD (p=0.05)		NS	(0.97)	(0.70)	(0.83)	(1.01)	1.63

* Figures in parentheses are transformed means

Date of sowing	:	03-11-2022	Plot size	:	20 m^2
Date of insecticidal application	:	02-11-2022 & 25-11-22	Variety	:	PBW 660
Date of harvest	:	21-04-2023	Replications	:	Three

Table B5-10.2b: Effect of insecticidal seed treatment on germination, termite damage and yield in wheat during 2022-23(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	39.02	1.68 (7.44)	1.74 (7.58)	1.8 (7.71)	1.86 (7.84)	44.02
2.	Goond Katira(100 g/kg) + Jaggery (250 g/litre)+ chlorpyriphos @ 4 ml/kg of seed)	Seed treatment	40.56	1.70 (7.49)	1.76 (7.62)	1.82 (7.75)	1.88 (7.88)	44.96
3.	Goond Katira (100 g/kg) + Jaggery (250 g/litre)+ Neonix @ 2 ml/kg of seed)	Seed treatment	41.05	1.53 (7.10)	1.59 (7.24)	1.65 (7.38)	1.71 (7.51)	45.53
4.	Thiamethoxam 70WS @ 1 g/kg of seed	Seed treatment	40.22	1.68 (7.44)	1.74 (7.58)	1.80 (7.71)	1.86 (7.84)	43.66
5.	Chlorpyriphos @ 4 ml/kg of seed	Seed treatment	41.52	1.61 (7.28)	1.67 (7.43)	1.73 (7.56)	1.79 (7.69)	44.19
6.	Neonix @ 2 ml/kg of seed	Seed treatment	41.11	1.68 (7.44)	1.74 (7.58)	1.8 (7.71)	1.86 (7.84)	44.41
7.	Goond Katira (5kg/ha)+ Fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation	Soil application	40.24	1.92 (7.96)	1.98 (8.09)	2.04 (8.21)	2.10 (8.33)	45.47
8.	Goond Katira (5kg/ha)+ Chlorpyriphos 20 EC(2.5 litres/ha) before Ist irrigation	Soil application	41.26	1.95 (8.02)	2.01 (8.15)	2.07 (8.27)	2.13 (8.39)	44.01
9.	Fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation	Soil application	40.45	1.98 (8.08)	2.04 (8.21)	2.10 (8.33)	2.16 (8.45)	43.77
10	Chlorpyriphos 20 EC(2.5 litres/ha) before Ist irrigation	Soil application	41.85	1.93 (7.98)	1.99 (8.11)	2.05 (8.23)	2.11 (8.35)	44.13
11.	Untreated seed+ no application of chemical (Control)	-	40.98	5.17 (13.14)	5.23 (13.22)	5.29 (13.30)	5.35 (13.37)	41.32
CD (p=0.05)			NS	(0.93)	(0.81)	(0.89)	(0.91)	1.49

* Figures in parentheses are transformed means

Date of sowing	:	11-11-2022	Plot size	:	40 m^2
Date of insecticidal application	:	11-11-2022 & 27-11-22	Variety	:	HD2967
Date of harvest	:	21-04-2023	Replications	:	Three

Table B6-10.2a: Pest modeling for foliage aphids and their natural enemies during 2022-23 (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.
10.01.2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17.01.2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24.01.2023	0	0	0	0	1	0	1	0	0	0	0.2	2	0	0	0.7
31.01.2023	0	1	0	1	0	0	2	0	0	0	0.4	2	4	0	2.0
07.02.2023	1	0	0	2	3	0	0	0	0	0	0.6	4	8	7	6.3
14.02.2023	0	1	3	5	2	2	0	1	2	1	1.7	11	14	13	12.7
21.02.2023	3	4	8	7	2	6	8	8	6	7	5.9	14	16	17	15.7
28.02.2023	14	10	14	9	11	14	8	15	16	11	12.2	14	17	19	16.7
07.03.2023	7	6	8	9	7	14	9	8	10	11	8.9	16	9	10	11.7
14.03.2023	8	7	6	9	4	10	8	8	8	7	7.5	4	8	7	6.3
21.03.2023	4	0	0	0	3	4	7	5	1	0	2.4	0	0	4	1.3
28.03.2023	2	5	5	0	0	2	0	0	0	1	1.5	0	0	2	0.7
03.04.2023	0	0	0	2	4	0	0	2	0	4	1.2	0	1	0	0.3
	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.
10.01.2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17.01.2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24.01.2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
31.01.2023	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.7
07.02.2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
14.02.2023	0	0	2	0	0	0	0	0	0	0	0.2	0	0	0	0.0
21.02.2023	0	0	0	2	0	0	1	0	0	0	0.3	1	2	0	1.0
28.02.2023	0	1	2	0	3	0	0	0	0	0	0.6	0	0	0	0.0
07.03.2023	2	0	0	4	2	0	2	4	6	4	2.4	0	0	4	1.3
14.03.2023	4	6	5	2	0	6	5	0	0	4	3.2	4	8	9	7.0
21.03.2023	7	5	9	0	4	6	8	7	0	8	5.4	4	6	2	4.0
28.03.2023	2	4	0	6	5	0	0	0	4	6	2.7	0	1	3	1.3
03.04.2023	0	0	0	0	0	1	1	1	0	0	0.3	0	0	0	0.0

Table B6-10.2b: Pest modeling for foliage aphids and their natural enemies during 2022-23 (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.
10.01.2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17.01.2023	0	0	0	1	0	0	1	1	2	0	0.5	0	0	0	0.0
24.01.2023	2	0	0	1	1	2	0	0	0	0	0.6	0	0	0	0.0
31.01.2023	2	4	0	0	3	5	0	0	4	4	2.2	0	1	0	0.3
07.02.2023	4	8	7	6	9	4	4	8	9	3	6.2	1	0	0	0.3
14.02.2023	11	14	13	10	14	10	9	15	10	8	11.4	0	1	3	1.3
21.02.2023	14	16	17	19	10	10	14	18	14	11	14.3	3	4	8	5.0
28.02.2023	14	17	19	14	22	25	19	10	15	18	17.3	14	10	14	12.7
07.03.2023	16	9	10	11	8	10	11	14	8	7	10.4	7	6	8	7.0
14.03.2023	4	8	7	6	4	5	8	0	3	4	4.9	8	7	6	7.0
21.03.2023	0	0	4	5	6	0	5	2	6	2	3	4	0	0	1.3
28.03.2023	0	0	2	1	0	0	0	0	0	0	0.3	2	5	5	4.0
03.04.2023	0	1	0	0	0	0	0	0	0	0	0.1	0	0	0	0.0
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.
10.01.2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17.01.2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24.01.2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
31.01.2023	0	0	2	0	0	0	0	0	0	0	0.2	0	0	0	0.0
07.02.2023	0	0	0	0	0	1	0	0	0	0	0.1	0	0	0	0.0
14.02.2023	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.7
21.02.2023	1	2	0	3	2	0	0	2	6	0	1.6	0	0	0	0.0
28.02.2023	0	0	0	0	0	2	4	6	5	0	1.7	0	1	2	1.0
07.03.2023	0	0	4	5	8	1	3	5	1	5	3.2	2	0	0	0.7
14.03.2023	4	8	9	6	8	10	11	5	9	7	7.7	4	6	5	5.0
21.03.2023	4	6	2	0	1	0	0	4	6	8	3.1	7	5	9	7.0
28.03.2023	0	1	3	0	0	0	0	0	0	0	0.4	2	4	0	2.0
03.04.2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0

Table B6-10.2c: Population dynamics of wheat aphid and Coccinellid beetle during 2022-23 (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.
05.01.2023	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**
13.01.2023	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**
20.01.2023	0	2	0	0	1	1	1	2	0	0	**0.7**	3	1	2	**2.0**
27.01.2023	2	1	2	2	2	3	2	0	0	0	**1.4**	2	5	0	**2.3**
03.02.2023	2	0	0	3	2	0	0	0	0	0	**0.7**	3	7	8	**6.0**
10.02.2023	0	3	5	5	4	4	0	1	3	2	**2.7**	12	16	15	**14.3**
17.02.2023	4	5	7	6	3	7	8	9	7	8	**6.4**	12	15	18	**15.0**
24.02.2023	8	7	7	8	6	13	9	7	10	13	**8.8**	15	17	16	**16.0**
03.03.2023	12	11	10	12	13	19	15	16	14	12	**13.4**	15	10	12	**12.3**
10.03.2023	6	8	5	7	6	11	8	8	8	9	**7.6**	4	7	5	**5.3**
17.03.2023	3	1	1	1	4	5	7	5	1	0	**2.8**	0	0	3	**1.0**
24.03.2023	3	7	6	1	0	1	0	0	0	2	**2.0**	0	0	1	**0.3**
31.03.2023	0	0	1	1	2	0	0	2	0	3	**0.9**	0	1	0	**0.3**
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.**
05.01.2023	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**
13.01.2023	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**
20.01.2023	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**
27.01.2023	0	0	0	0	0	0	0	0	0	0	**0.0**	1	2	1	**1.3**
03.02.2023	0	0	1	2	1	0	0	0	0	0	**0.4**	1	0	0	**0.3**
10.02.2023	0	0	2	0	0	0	0	0	0	0	**0.2**	1	0	1	**0.7**
17.02.2023	0	0	0	2	0	0	2	0	0	0	**0.4**	2	2	2	**2.0**
24.02.2023	0	2	3	1	4	0	0	0	0	0	**1.0**	0	0	0	**0.0**
03.03.2023	2	0	0	4	2	0	2	5	4	3	**2.2**	1	2	3	**2.0**
10.03.2023	4	5	5	2	0	6	5	0	0	5	**3.2**	5	7	6	**6.0**
17.03.2023	7	4	7	0	3	7	6	8	0	7	**4.9**	4	7	5	**5.3**
24.03.2023	2	5	0	7	5	0	0	0	4	5	**2.8**	1	1	3	**1.7**
31.03.2023	0	0	0	0	0	1	1	1	0	0	**0.3**	0	0	0	**0.0**

Table B6-10.2d: Population dynamics of barley aphid and Coccinellid beetle during 2022-23 (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.
05.01.2023	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**
13.01.2023	0	0	0	2	1	1	1	1	2	0	**0.8**	0	0	0	**0.0**
20.01.2023	3	1	2	1	1	1	0	0	0	0	**0.9**	0	0	0	**0.0**
27.01.2023	2	4	0	0	3	5	0	0	4	4	**2.2**	2	1	0	**1.0**
03.02.2023	5	6	7	8	9	10	6	7	8	7	**7.3**	1	1	2	**1.3**
10.02.2023	6	14	13	10	8	11	9	15	10	8	**10.4**	2	1	2	**1.7**
17.02.2023	10	16	17	19	10	10	14	18	14	11	**13.9**	3	4	5	**4.0**
24.02.2023	14	13	12	10	11	10	13	10	11	18	**12.2**	12	11	10	**11.0**
03.03.2023	10	9	10	11	8	10	11	12	5	6	**9.2**	6	6	7	**6.3**
10.03.2023	0	0	0	0	0	0	0	0	0	0	**0.0**	5	8	7	**6.7**
17.03.2023	0	0	0	2	1	1	1	1	2	0	**0.8**	1	3	1	**1.7**
24.03.2023	3	1	2	1	1	1	0	0	0	0	**0.9**	0	1	1	**0.7**
31.03.2023	2	4	0	0	3	5	0	0	4	4	**2.2**	0	0	0	**0.0**
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.**
05.01.2023	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**
13.01.2023	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**
20.01.2023	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**
27.01.2023	0	0	3	4	0	5	0	0	0	0	**1.2**	0	0	0	**0.0**
03.02.2023	1	0	1	2	0	2	3	2	2	0	**1.3**	0	0	0	**0.0**
10.02.2023	2	5	4	5	0	3	2	2	2	5	**3.0**	1	1	2	**1.3**
17.02.2023	3	5	2	6	8	3	2	3	5	2	**3.9**	2	0	0	**0.7**
24.02.2023	2	4	3	2	5	6	2	5	5	0	**3.4**	1	3	1	**1.7**
03.03.2023	2	5	5	6	5	6	2	5	5	2	**4.3**	2	0	0	**0.7**
10.03.2023	2	2	3	2	5	4	3	3	2	8	**3.4**	4	2	4	**3.3**
17.03.2023	0	3	3	0	2	4	5	3	2	0	**2.2**	5	4	9	**6.0**
24.03.2023	3	2	0	0	1	2	3	4	1	0	**1.6**	1	3	0	**1.3**
31.03.2023	0	0	0	0	0	0	0	0	0	0	**0.0**	0	0	0	**0.0**

B7. 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 3th Nov.2022 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 just crossed the economic threshold level wheat (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 tillers observations were recorded one day before spray and then 1, 3, 7 and 15 days after spray. Aphid population did not differ significantly among different treatments one day before spray (Table B7). When observed one day after spray, pymetrozine 50 WG @ 120 g/ha sprayed plots recorded minimum aphid population (1.65 aphids/earhead) and was at par all other treatments and significantly better than all other insecticidal treatments. A similar trend was observed three, seven days after treatment. Maximum Grain yield (q/ha) was also observed in plots treated with pymetrozine 50 WG @ 120 g/ha. However, all the insecticidal treatments recorded higher than grain yield than untreated check (52.48). (Table B7-10.2a).

Centre: Karnal

The data revealed that the aphid population did not differ significantly among all treatments one before spray. After day of spraying, treatment of Pymetrozine 50% WG @120 gm/ha recorded minimum number of aphids(2.63 aphids/tiller) followed by treatment of Thiamethoxam 25% WG@ 12.5 g/ha which recorded 2.64 aphids/tiller. After 2 days of spraing, again Pymetrozine 50% WG @120 gm/ha recorded minimum number of aphids (2.40 aphids/tiller) followed by treatment of Thiamethoxam 25% WG@ 12.5 g/ha which recorded 2.41 aphids/tiller. The same trend was seen after 7 and 15 days of spraing. The maximum grain yield recorded under treatment of Pymetrozine 50% WG @120 gm/ha (49.11 q/ha) treated plots followed by the treatment of Thiamethoxam 25% WG@ 12.5 g/ha (48.99 q/ha). However, all the insecticidal treatments recorded higher than grain yield than untreated check (43.64 q/ha) (Table B7-10.2b).

Centre: Niphad

The data presented that the average population of aphids before insecticidal application was non significant, it indicated that the uniform population of aphids were distributed in the experimental trial. Average survived population of aphids at 1st day after first insecticidal spray showing significance among the treatments. The treatment with pymetrozine 50 % EC @ 120 g a.i./ha was found significantly superior in controlling aphid population which was at par with treatments, pymetrozine 50 % EC @ 100 and 80 g a.i./ha. The data at 2 days after 1stsprayshowed that the treatment with pymetrozine 50 % EC @ 120 g a.i./ha significantly superior butagain all its lower doses i.e. pymetrozine 50 % EC @ 100 and 80 g a.i./ha and the treatment with thiamethoxam 25 % WG @ 12.5 g a.i./ha were found at par with it. At 7th and 15th days after 1st spray again the treatment with pymetrozine 50 % EC @ 120 g a.i./ha was found significantly superior treatment but all other treatments except untreated control were found at par with it.The per cent reduction of aphids over control after 1st insecticidal application was found in the range of 60.63 to 67.24 % in the treatment with pymetrozine 50 % EC @ 120 g a.i./ha followed by the treatment with pymetrozine 50 % EC @ 100 g a.i./ha range 53.02 to 66.16 %.The data of 2nd insecticidal application showed that at 1st days after 2nd application the treatment with pymetrozine 50 % EC @ 120 g a.i./ha was the significantly superior treatment in controlling wheat aphids but the treatment with pymetrozine 50 % EC @ 100 and 80 g a.i./ha and the treatment with thiamethoxam 25 % WG @ 12.5 g a.i./ha were found equally effective and found at par with it.

The similar trend was observed at 2nd, 7th and 15th days after 2nd insecticidal application. While, the per cent reduction of aphids over control after 2nd insecticidal application was found in the range of 65.12 to 76.11 % in the treatment with pymetrozine 50 % EC @ 120 g a.i./ha followed by the treatment with pymetrozine 50 % EC @ 100 g a.i./ha range 66.16 to 75.40 %

During the experiment the uniform population of Coccinellids predators were observed before insecticidal application and at 7th and 15th days after 1st and 2nd insecticidal application, except at 1st and 2nd days after 1st and 2nd insecticidal applications the treatment with imidacloprid 17.8 SL @ 20 g a.i./ha was showing significantly superiority i.e. was found unsafe to Coccinellids predators and the treatments with thiamethoxam 25 % WG @ 12.5 g a.i./ha and acetamiprid 20 SP @ 20 g a.i./ha were found at par with it.

The yield data showed that, the treatment with pymetrozine 50 % EC @ 120 g a.i./ha was found the significantly superior treatment with highest grain yield of 54.81 q/ha followed by the treatments with pymetrozine 50 % EC @ 100 g a.i./ha (53.70 q/ha), pymetrozine 50 % EC @ 80 g a.i./ha (50.74 q/ha) and thiamethoxam 25 WG @ 12.5 g a.i./ha (48.51 q/ha) which were found at par with it. The lowest yield of 38.51 q/ha was recorded in the untreated control. (Table B7-10.2c).

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 (1.7) were recorded in Acetamiprid 20SP@100g/ha followed by Pymetrozine 50% WG@120 gm/ha. More or less similar trend was observed on 3rd, 7th and 15th days after spray. The grain yield (q/ha) was highest in Acetamiprid 20SP @ 100g/ha i.e 35.49 q/ha followed by Pymetrozine 50% WG@120 gm/ha i.e. 34.76 q/ha(Table B7-10.2d).

Table B7-10.2a: Management of aphids through foliar application of new chemical molecules in wheat during 2022-23 (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	3 days	7 days	15 days	
1	Pymetrozine 50% WG	80 g	14.96	1.75 (1.65)	1.52 (1.59)	1.37 (1.54)	1.92 (1.70)	56.00
2	Pymetrozine 50% WG	100 g	15.16	1.69 (1.63)	1.46 (1.56)	1.31 (1.52)	1.84 (1.68)	56.13
3	Pymetrozine 50% WG	120 g	15.57	1.64 (1.62)	1.41 (1.55)	1.25 (1.50)	1.76 (1.66)	56.44
4	Thiamethoxam 25% WG	12.5 g	15.32	1.67 (1.63)	1.47 (1.57)	1.35 (1.53)	1.82 (1.68)	55.51
5	Imidacloprid 17.8 SL	100 ml	15.44	1.70 (1.64)	1.42 (1.55)	1.33 (1.52)	1.78 (1.66)	55.91
6	Acetamiprid 20SP	100 g	15.60	1.65 (1.62)	1.46 (1.58)	1.28 (1.51)	1.73 (1.65)	55.86
7	Untreated control	-	15.47	16.15 (4.14)	15.39 (4.04)	16.36 (4.16)	17.48 (4.29)	52.48
CD (p=0.05)			NS	(0.10)	(0.09)	(0.08)	(0.10)	1.84

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

Date of sowing	:	03.11.2022	Plot size	:	7.5 m^2
Date of insecticidal application	:	27.02.2023	Variety	:	PBW 725
Date of harvest	:	20. 04.2023	Replications	:	Three

Table B7-10.2b: Management of aphids through foliar application of new chemical molecules in wheat during 2022-23 (Centre: Karnal)

S. No.	Treatments	Dose ml or g / ha	Aphid population per earhead					Grain Yield (q/ha)
			Before spray	After spray				
			1 day	1 day	3 days	7 days	15 days	
1	Pymetrozine 50% WG	80 g	10.25	2.74 (1.93)	2.51 (1.87)	2.36 (1.83)	2.91 (1.98)	48.72
2	Pymetrozine 50% WG	100 g	10.99	2.68 (1.92)	2.45 (1.86)	2.30 (1.82)	2.83 (1.96)	48.46
3	Pymetrozine 50% WG	120 g	10.67	2.63 (1.90)	2.40 (1.84)	2.24 (1.80)	2.75 (1.94)	49.10
4	Thiamethoxam 25% WG	12.5 g	10.78	2.64 (1.90)	2.41 (1.85)	2.27 (1.81)	2.72 (1.93)	48.99
5	Imidacloprid 17.8 SL	100 ml	11.00	2.69 (1.92)	2.45 (1.80)	2.32 (1.82)	2.77 (1.94)	48.77
6	Acetamiprid 20SP	100 g	11.21	2.69 (1.92)	2.46 (1.86)	2.34 (1.83)	2.81 (1.95)	48.53
7	Untreated control	-	11.24	17.14 (4.26)	16.38 (4.17)	17.35 (4.28)	18.47 (4.41)	43.64
CD (p=0.05)			**NS**	**(0.11)**	**(0.09)**	**(0.12)**	**(0.11)**	**1.45**

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

Date of sowing	:	11.11.2022	Plot size	:	7.5 m^2
Date of insecticidal application	:	27.02.2023	Variety	:	HD2967
Date of harvest	:	15. 04.2023	Replications	:	Three

Table B7-10.2c: Management of aphids through foliar application of new chemical molecules in wheat during 2022-23 (Centre: Niphad)

T.N	Treatments	Formal Dose g or ml ai/ha	Av population of aphids/shoot (1s Spray)					Av population of aphids/shoot (2nd Spray)				Yield q/ha
			Pre count	1 DAS	2DAS	7 DAS	15 DAS	1 DAS	2DAS	7 DAS	15 DAS	
1	Pymetrozine 50 % EC	80 g	20.87 (4.65)*	15.60 (4.07)	16.33 (4.16)	12.53 (3.66)	11.60 (3.54)	13.07 (3.74)	11.07 (3.47)	10.87 (3.43)	10.27 (3.35)	50.74
2	Pymetrozine 50 % EC	100 g	25.47 (5.09)	14.00 (3.83)	13.93 (3.84)	11.20 (3.49)	10.40 (3.38)	11.73 (3.57)	9.80 (3.29)	9.60 (3.25)	9.27 (3.20)	53.70
3	Pymetrozine 50 % EC	120 g	15.93 (4.09)	11.73 (3.57)	11.13 (3.48)	10.13 (3.34)	10.07 (3.30)	11.47 (3.50)	9.67 (3.24)	8.80 (3.13)	9.00 (3.14)	54.81
4	Thiamethoxam 25% WG	12.5 g	22.73 (4.86)	19.87 (4.57)	16.40 (4.16)	11.93 (3.60)	13.87 (3.84)	17.07 (4.25)	17.13 (4.24)	10.33 (3.37)	15.80 (4.09)	48.51
5	Imidacloprid 17.8 SL	100ml	26.87 (5.21)	20.00 (4.58)	19.67 (4.54)	13.53 (3.81)	14.80 (3.93)	21.73 (4.76)	18.60 (4.38)	12.73 (3.70)	17.07 (4.20)	44.44
6	Acetamiprid 20SP	100 g	28.53 (5.38)	21.40 (4.71)	21.20 (4.69)	13.47 (3.79)	15.60 (4.02)	22.13 (4.77)	19.47 (4.46)	12.53 (3.67)	17.67 (4.26)	45.92
7	Untreated Check	-	29.73 (5.52)	29.80 (5.55)	29.93 (5.55)	30.67 (5.62)	30.73 (5.62)	32.87 (5.81)	35.13 (6.00)	37.27 (6.18)	37.67 (6.20)	38.51
SE+			NS	0.228	0.221	0.184	0.315	0.270	0.339	0.162	0.329	2.803
CD 0.5%			NS	0.704	0.682	0.566	0.970	0.831	1.046	0.499	1.016	8.641
CV%			15.319	8.974	8.860	8.158	13.806	10.755	14.150	7.345	14.044	10.095

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

Table B7-10.2d: Efficacy of various insecticides and their combinations against foliar aphid during 2022-23 (Centre: Vijapur)

Sr. No.	Treatments	Doses g or ml / ha	Aphid population per shoot					Grain yield q/ha
			Before spray	After spray				
				1 day	2 day	7 day	15 day	
1.	Pymetrozine 50% WG	80 g	11.10 (4.14)	3.2 (2.05)	2.0 (1.73)	1.1 (4.07)	0.7 (1.30)	30.76
2.	Pymetrozine 50% WG	100 g	11.90 (3.99)	2.8 (1.95)	2.0 (1.73)	1.0 (1.41)	0.5 (1.22)	32.33
3.	Pymetrozine 50% WG	120 g	11.7 (3.56)	1.8 (1.67)	1.1 (1.45)	0.6 (1.26)	0.3 (1.14)	34.76
4.	Thiamethoxam 25% WG	12.5 g	11.5 (3.54)	2.6 (1.90)	1.9 (1.70)	1.0 (1.41)	0.6 (1.26)	31.58
5.	Imidacloprid 17.8 SL	100 ml	11.5 (3.54)	2.6 (1.90)	1.8 (1.67)	1.0 (1.41)	0.7 (1.30)	28.91
6.	Acetamiprid 20SP	100 g	13.1 (3.75)	1.7 (1.64)	1.0 (1.41)	0.5 (1.22)	0.2 (1.10)	35.49
7.	Untreated Check	-	12.5 (3.67)	11.6 (3.55)	10.0 (3.32)	8.1 (3.02)	6.1 (2.66)	21.16
	C.D. at 5% C.V.%		NS 8.53	0.63 9.35	0.57 11.3	0.34 9.86	0.22 9.67	2.61 4.78

*Figures in parentheses indicate Vn+1 transformed value.

B8. 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, Dept. of Plant Breeding and Genetics, PAU Ludhiana. The wheat variety PBW 725 was sown on 9th Nov 2022. The treatments included foliar application of chlorantraniliprole 18.5 SC @ 100,125 & 150 ml/ha, soil applications fipronil 0.6% GR @6, 7 and 8 kg/ha and soil application of chlorpyriphos 20EC @ 2, 2.5 and 3 l/ha along with untreated check. Each treatment was replicated thrice. Pink stem borer (PSB) damage was recorded from five spots of 1 meter row length in each plot by counting damaged tiller and total tillers.

The data presented 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 soil application of fipronil 0.6% GR @ 8 kg/ha (0.86%) followed by foliar application of chlorantraniliprole 18.5 SC @ 150 ml/ha (0.89%). Seven days after treatment, the lowest PSB damage was recorded in fipronil 0.6% GR @ 8 kg/ha (0.73%) followed by soil application of chlorpyriphos 20EC @ l/ha (0.83%) and it was at par with all other treatments except lower dosages of fipronil 0.6% GR @ 6 kg/ha (1.61%), chlorpyriphos @ 2 l/ha (1.66%) and chlorantraniliprole 18.5 SC @ 100 ml/ha (1.86%). However all insecticidal treatments were significantly better than untreated control (2.82%). Similar trend was recorded 15 days after treatment.

The grain yield (q/ha) obtained was maximum in plot treated with fipronil 0.6% GR @ 8 kg/ha (48.94) followed by foliar spray of chlorantraniliprole 18.5 SC @ 150 (48.83) and it was at par with all treatment except lower dosage of chlorantraniliprole 18.5 SC, chlorpyriphos and fipronil 0.6 GR and the untreated check (45.98 q/ha) (Table B8-10.2a).

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 fipronil 0.6% GR @8 kg/ha (0.75%) followed by fipronil 0.6% GR @7 kg/ha (0.79%) and by chlorantraniliprole 18.5 SC @ 150 ml (0.80%). Similar trends were seen after seven days and fifteen days after treatment. Avearge mean PSB damage was recorded after 15 of treatment was lowest in in fipronil 0.6% GR @8 kg/ha (0.52%) followed by fipronil 0.6% GR @7 kg/ha 0.6% GR (0.57%) and by chlorantraniliprole 18.5 SC @ 150 (0.59%).

The grain yield (q/ha) obtained was maximum in plot treated with fipronil 0.6% GR @8 kg/ha (48.05) followed by chlorantraniliprole 18.5 SC @ 150 (47.62) and fipronil 0.6% GR @7 kg/ha (47.42%). Lowest yield was recorded in the untreated check (43.23 q/ha)(Table B8-10.2b).

Table B8-10.2a: Efficacy of various insecticides and biopesticides against lepidopterous pests pink stem borer, army worm & cutworms) of wheat during 2022-23 (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	2.83	1.76	1.86	1.40	47.00
2	Coragen 18.5 SC (chlorantraniliprole)	125 ml	2.80	0.96	0.93	0.72	48.29
3	Coragen 18.5 SC (chlorantraniliprole)	150 ml	2.88	0.89	0.85	0.67	48.83
4	Soil application of fipronil 0.6 GR	6 kg	2.86	1.66	1.61	1.40	47.16
5	Soil application of fipronil 0.6 GR	7 kg	2.78	0.90	0.80	0.68	48.64
6	Soil application of fipronil 0.6 GR	8 kg	2.85	0.86	0.73	0.65	48.94
7	Soil application of chlorpyriphos 20EC	2 l	2.88	1.77	1.66	1.45	47.06
8	Soil application of chlorpyriphos 20EC	2.5 l	2.83	1.12	0.89	0.69	48.78
9	Soil application of chlorpyriphos 20EC	3.0 l	2.86	1.20	0.83	0.63	48.80
10	Untreated Control	-	2.79	2.82	2.93	2.20	45.98
CD (p=0.05)		-	NS	0.23	0.19	0.17	0.63

* Figures in parentheses are transformed means

Date of sowing	:	09-11-2022	Plot size	:	25 m^2
Date of insecticidal application	:	01-12-2023	Variety	:	PBW 725
Date of harvest	:	26-04-2023	Replications	:	Three

Table B8-10.2b: Efficacy of various insecticides and biopesticides against lepidopterous pests pink stem borer, army worm & cutworms) of wheat during 2022-23 (Centre: Karnal)

S. No	Treatments	Dosage	Per cent damage before treatment	Per cent damaged tillers			Mean per cent damaged tillers	Grain yield (q/ha)
				3	7	15		
1	Coragen 18.5 SC (chlorantraniliprole)	100 ml	1.65	1.67	1.37	1.47	1.50	44.91
2	Coragen 18.5 SC (chlorantraniliprole)	125 ml	1.60	0.87	0.57	0.54	0.66	47.62
3	Coragen 18.5 SC (chlorantraniliprole)	150 ml	1.62	0.80	0.50	0.46	0.59	46.02
4	Soil application of fipronil 0.6 GR	6 kg	1.61	1.56	1.27	1.22	1.35	47.42
5	Soil application of fipronil 0.6 GR	7 kg	1.72	0.79	0.51	0.41	0.57	47.32
6	Soil application of fipronil 0.6 GR	8 kg	1.69	**0.75**	0.47	0.34	0.52	48.05
7	Soil application of chlorpyriphos 20EC	2 litre	1.79	1.63	1.38	1.27	1.43	45.85
8	Soil application of chlorpyriphos 20EC	2.5 llitre	1.76	0.90	0.73	0.5	0.71	45.99
9	Soil application of chlorpyriphos 20EC	3.0 litre	1.76	0.89	0.81	0.44	0.71	44.92
10	Untreated Control	-	1.78	2.65	2.43	2.54	2.54	43.23
CD (p=0.05)		-	NS	0.48	0.50	0.48	0.63	0.49

* Figures in parentheses are transformed means

Date of sowing	:	11-11-2022	Plot size	:	25 m^2
Date of insecticidal application	:	09-12-2022	Variety	:	HD2967
Date of harvest	:	12-04-2023	Replications	:	Three

B9. Management of termites wheat through seed treatment and soil application of chemical molecules combinations (Centres: Ludhiana, Vijapur and Kanpur)

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 revealed that plant population/m row recorded after 3 weeks of germination was non-significant among all the treatments. Hence, none of the 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 B9-10.2a).

Centre: Vijapur

The data revealed that after 3 weeks of sowing no infestation of tremites were observed in treatments of Neonix@1.5 & 2 ml /kg seed, thiamethoxam@1 & 1.5 ml/kg seed and soil application of fipronil 0.3 GR@15 kg. Similar trend was observed after 4 and 5 weeks of sowing. The percentage of damaged effective tillers/m row was also recorded less in these treatements as compared to untreated check. The grain yield (q/ha) obtained was maximum in plot treated with thiamethoxam@1.5 ml/kg seed (47.55 q/ha) and lowest in the untreated check (35.02 q/ha) (Table B9-10.2b).

Centre: Kanpur

The data revealed that after 3 weeks of sowing no infestation of tremites were observed in any of the treatments. After 4 weeks lowest infestation was recorded in thiamethoxam@1 & 1.5 ml/kg seed i.e 0.44 and 0.49% Similar trend was observed after 5 weeks of sowing. The percentage of damaged effective tillers/m row was also recorded less in these treatments i.3 1.53 and 1.59% as compared to untreated check. The grain yield (q/ha) obtained was maximum in plot treated with thiamethoxam@1.5 ml/kg seed (28.08 q/ha) and lowest in the untreated check (13.01 q/ha) (Table B9-10.2c).

Table B9-10.2a: Management of termites through seed treatment and soil treatemnt 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	Neonix (Imidacloprid 18.5% + Hexaconazole 1.5% FS)	1.5 ml	44.33	1.11 (7.28)	1.07 (7.19)	1.02 (7.05)	1.24 (7.56)	11833 (108.76)	45.04
2	Neonix (Imidacloprid 18.5% + Hexaconazole 1.5% FS)	2 ml	44.46	0.91 (6.81)	0.93 (6.86)	0.88 (6.75)	1.16 (7.38)	11166 (105.65)	45.62
3	Cruiser 70 WS (thiamethoxam)	1.0 ml	44.44	1.00 (7.03)	0.90 (6.78)	0.94 (6.90)	1.16 (7.40)	11583 (107.60)	44.45
4	Cruiser 70 WS (thiamethoxam)	1.5 ml	44.67	0.92 (6.84)	0.84 (6.65)	0.83 (6.63)	0.97 (6.95)	10750 (103.66)	45.83
5	Soil application of fipronil 0.3 GR	15 kg15 Kg	44.64	1.82 (8.76)	1.86 (8.84)	1.58 (8.29)	1.95 (9.00)	12083 (109.91)	43.83
6	Soil application of fipronil 0.3 GR	17.5 kg15 Kg	44.52	1.26 (7.63)	1.10 (7.26)	0.96 (6.93)	1.22 (7.53)	11000 (104.84)	45.79
7	Soil application of fipronil 0.3 GR	20 kg15 Kg	44.82	1.08 (7.21)	0.88 (6.75)	0.85 (6.68)	1.21 (7.50)	10333 (101.65)	46.04
8	Soil application of chlorpyriphos 20EC	2 l	44.76	1.76 (8.63)	1.84 (8.79)	1.68 (8.49)	2.07 (9.21)	12250 (110.65)	44.41
9	Soil application of chlorpyriphos 20EC	2.5 l	44.71	1.17 (7.43)	1.10 (7.24)	1.17 (7.42)	1.13 (7.32)	11250 (106.05)	45.58
10	Soil application of chlorpyriphos 20EC	3.0 l	44.54	0.98 (6.99)	1.03 (7.09)	0.94 (6.89)	1.09 (7.23)	11000 (104.78)	45.79
11	Untreated control	-	44.55	3.35 (11.89)	4.08 (12.35)	3.68 (11.78)	3.35 (11.31)	19500 (139.62)	41.95
CD (p=0.05)			NS	(0.51)	(0.76)	(0.63)	(0.78)	(5.27)	1.42

* Figures in parentheses are transformed means

Date of sowing	:	03-11-2022	Plot size	:	40 m^2
Date of insecticidal application	:	02-11-2022 & 25-11-22	Variety	:	PBW 660
Date of harvest	:	26-04-2023	Replications	:	Three

Table B9-10.2b: Management of termites through seed treatment and soil application of chemical molecules combinations during 2022-23 (Location: Vijapur)

Sr. No	Treatment	Dose g/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.	Seed treatment with Neonix (Imidacloprid 18.5%+ Hexaconazole 1.5% FS)	1.5 ml	59	78.67	0.00 (0.70)	0.07 (0.75)	0.13 (0.79)	0.20 (0.83)	45.18
2.	Seed treatment with Neonix (Imidacloprid 18.5%+ Hexaconazole 1.5% FS)	2 ml	65	86.67	0.00 (0.70)	0.00 (0.70)	0.03 (0.72)	0.07 (0.75)	46.48
3.	Cruiser 70 WS (thiamethoxam)	1 ml	61	81.69	0.00 (0.70)	0.03 (0.73)	0.07 (0.75)	0.13 (0.78)	46.52
4.	Cruiser 70 WS (thiamethoxam)	1.5 ml	63	83.64	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	47.55
5.	Soil application of fipronil 0.3 GR	15 Kg	60	80.00	0.00 (0.70)	0.20 (0.83)	0.37 (0.92)	1.27 (1.35)	38.05
6.	Soil application of fipronil 0.3 GR	17.5 Kg	58	77.33	0.10 (0.77)	0.27 (0.87)	0.53 (1.00)	0.73 (1.10)	43.33
7.	Soil application of fipronil 0.6 GR	20 Kg	63	83.69	0.07 (0.75)	0.17 (0.81)	0.27 (0.87)	0.40 (0.94)	44.30
8.	Soil application of chlorpyriphos 20EC	2.0 l	62	82.89	0.10 (0.77)	0.20 (0.83)	0.40 (0.94)	0.57 (1.02)	44.32
9.	Soil application of chlorpyriphos 20EC	2.5 l	67	89.33	0.07 (0.75)	0.13 (0.79)	0.27 (0.87)	0.40 (0.94)	45.62
10.	Soil application of chlorpyriphos 20EC	3.0 l	62	82.67	0.03 (0.72)	0.07 (0.75)	0.20 (0.83)	0.33 (0.90)	45.97
11.	Untreated control	-	60	80.00	1.53 (1.41)	2.47 (1.71)	3.37 (1.95)	4.40 (2.21)	35.02
	C.D. at 5%				**0.11**	**0.17**	**0.18**	**0.17**	**5.45**
	C.V.%				**8.09**	**12.3**	**11.69**	**10.03**	**7.3**

*Figures in the parenthesis are square root transformation value (√X+0.5)

Table B9-10.2c: Management of termites through seed treatment of chemical molecules combinations during 2022-23 (Location: Kanpur)

S. No.	Treatments	Actual Dose gm/ ml/kg of seed.	Plant population/m row	Per cent damaged shoots/m row			Per cent damaged effective tillers/m row at crop maturity	No. of damaged effective tillers/ha at harvest	Grain yield	
				3 weeks	4 weeks	5 weeks			g/m row	q/ha
1.	Seed treatment with neonix	1.5ml	28.60	0	0.82 (5.20)	1.76 (7.49)	1.83 (7.71)	9444.44 (97.18)	60.30	19.32
2.	Seed treatment with neonix	2.0ml	29.60	0	0.80 (5.13)	1.75 (7.49)	1.80 (7.71)	9074.07 (95.26)	61.60	19.56
3.	Cruiser 70WS Thiamethoxam	1.0ml	30.50	0	0.44 (3.80)	1.43 (6.80)	1.53 (7.04)	3333.33 (57.73)	78.60	28.08
4.	Cruiser 70WS Thiamethoxam	1.5ml	33.00	0	0.49 (4.01)	1.50 (7.04)	1.59 (7.04)	3888.70 (62.36)	73.10	25.92
5.	Soil application of Fipronil 0.3GR	15kg./ha	30.00	0	0.78 (5.07)	1.69 (7.27)	1.76 (7.49)	8148.14 (90.27)	65.93	21.45
6.	Soil application of Fipronil 0.3GR	17.5kg./ha	29.80	0	0.73 (4.90)	1.57 (7.04)	1.64 (4.59)	5185.18 (72.00)	70.98	22.40
7.	Soil application of Fipronil 0.3GR	20kg./ha	31.40	0	0.69 (4.76)	1.53 (7.04)	1.62 (7.27)	4814.81 (69.39)	72.97	24.06 C
8.	Soil application of Chlorpyriphos 20EC	2.0lit./ha	28.40	0	0.79 (5.10)	1.71 (7.49)	1.78 (7.49)	8703.69 (93.29)	63.43	20.22
9.	Soil application of Chlorpyriphos 20EC	2.5lit./ha	31.00	0	0.76 (5.00)	1.66 (1.27)	1.72 (7.49)	7222.22 (84.98)	69.11	21.72
10.	Soil application of Chlorpyriphos 20EC	3.0lit./ha	29.20	0	0.74 (4.93)	1.60 (7.27)	1.70 (7.49)	6111.10 (78.17)	69.75	22.20
11.	Control	--	30.00	3.0 (9.98)	3.13 (10.14)	3.83 (11.24)	4.69 (12.39)	22407.40 (149.69)	48.34	13.01
	SEm±				0.149	0.281	0.236	2.677	1.346	0.228
	CD at 5%				0.442	0.835	0.700	7.953	3.998	0.677

* Arcsin transformed values and in parentheses are actual mean values

Date of sowing : 24/11/2022 | Date of insecticide application : 23/11/2022

Date of harvesting : 21/11/2023 | 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 6.1 to 25.2 insects being highest in Jute bags and lowest in BOPP bags.
Similarly, the % infestation and % weight loss was also lowest in BOPP bags i.e. 1.9% and 0.6%, respectively. The next best bags were High Density Polyethylene Woven (HDPE) bags and recorded 12.0 insects, 3.8 per cent infesatation and 1.2 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 9.83 to 29.80 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. 2.73 % and 1.65%, respectively. The next best bags were High Density Polyethylene Woven (HDPE) bags and recorded 13.43 insects, 5.79 per cent infestations and 2.93 per cent weight loss. Quality parameters are yet to be determined for the samples (Table C1-10.3b).

C2: Evaluation of seed protectants for management of storage insect pests of wheat during 2022-23 (Centre: 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: Niphad: The data revealed that the mean adult mortality and repellency of *S. oryzae* was maximum in the treatment with Karanj oil (*Pongamia pinnata*) 35.33% and 16.33% respectively. The data regarding per cent grain damage the treatment with Karanj oil (*Pongamia pinnata*) @ 15 ml/kg seed was found significantly superior which was at par with treatments Sweet flag (Vekhand) powder (*Acorus calamus*) @ 5 g, Castor oil (*Ricinus cumunis*) @ 15 ml, Blue gum oil (*Eucalyptus globulus*) @ 15 ml, Neem oil (*Azadiracta indica*) @ 15 ml, Diatomaceous earth @ 5 g and Turmeric Powder (*Curcuma longa*) at par with it, while, the data in respect of per cent 5 g/kg seed. The data in respect of germination was statistically non significant. Highest seedling vigour index of 1417.40 was recorded in the treatment with Karanj oil @ 15 ml/kg seed, Table 3(a).3. The data regarding percent wheat grain weight loss the data was found non significant at 30 and 60 days after insect inoculation. At 90 to 180 days after insect inoculation revealed that the treatment with Karanj oil (Pongamia pinnata) @ 15 ml/kg seed was found significantly superior treatment but the treatments with neem oil, blue gum oil @ 15 ml/kg seed and the treatment with Sweet flag (Vekhand) powder (*Acorus calamus*) @ 5 g/kg seed were found equally effective and at par with it. (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 (16.99%) and Sweet flag (16.99%) after one of treatment. After 7 days of treatment with Karanj oil (*Pongamia pinnata*) treatment recorded 33.66% of mortality followed by treatments with Castor oil (16.99%) and Sweet flag (16.99%). Mean adult mortality after 10 days after treatment was highest in Karanj oil (29.69%) followed by Sweet flag (19.99%) and Castor oil (15.09%) (Table C2-10.3g).

Table C1-10.3a: Evaluation of different packaging bags for storage insect-pest infestation during 2022-23 (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	9.0	14.3	19.6	24.8	**16.9**	2.9	5.6	6.3	8.0	**5.7**	0.6	2.9	3.9	4.9	**3.1**
Jute bags	16.5	25.0	27.1	32.3	**25.2**	5.0	9.6	8.4	10.1	**8.3**	3.0	5.3	6.3	7.3	**5.5**
High Density Polyethylene Woven (HDPE) bags	3.6	11.3	13.9	19.2	**12.0**	1.2	2.9	4.6	6.3	**3.8**	1.0	2.5	0.3	1.2	**1.2**
Biaxially Oriented Polypropylene (BOPP) bags	0.6	2.6	7.9	13.2	**6.1**	-0.6	1.0	2.7	4.4	**1.9**	0.0	0.2	0.6	1.6	**0.6**

*after different months of storage

Table C1-10.3b: Evaluation of different packaging bags for storage insect-pest infestation during 2022-23 (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	10.5	22.7	32.5	37.8	**25.88**	6.5	9.5	10.5	12.5	**9.75**	2.5	4.8	6.5	7.5	**5.33**
Jute bags	18.5	26.4	34.5	39.8	**29.80**	7.8	10.5	12.2	14.5	**11.25**	4.9	7.6	8.9	10.5	**7.98**
High Density Polyethylene Woven (HDPE) bags	6.5	10.5	15.2	21.5	**13.43**	2.6	4.54	6.8	9.2	**5.79**	1.2	2.2	3.5	4.8	**2.93**
Biaxially Oriented Polypropylene (BOPP) bags	4.1	6.5	12.4	16.3	**9.83**	0	1.5	3.8	5.6	**2.73**	0	0.8	2.4	3.4	**1.65**

Table C2-10.3c: Evaluation seed protectants for management of storage insect pests of wheat 2022-23 (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	6.67	10.00	13.33	13.33	20.00	20.00	6.67	3.33	3.33	0.00	**9.67**
2	Blue gum oil (*Eucalyptus globulus*)	15 ml	6.67	6.67	6.67	3.33	13.33	16.67	10.00	6.67	6.67	3.33	**8.00**
3	Karanj oil (*Pongamia pinnata*)	15 ml	3.33	26.67	43.33	43.33	50.00	53.33	50.00	33.33	26.67	23.33	**35.33**
4	Castor oil (*Ricinus cumunis*)	15 ml	13.33	13.33	23.33	23.33	20.00	26.67	16.67	16.67	16.67	3.33	**17.33**
5	Sweet flag (Vekhand) powder (*Acorus calamus*)	5 g	13.33	20.00	33.33	33.33	30.00	30.00	16.67	10.00	6.67	3.33	**19.67**
6	Turmeric Powder (*Curcuma longa*)	5 g	10.00	13.33	23.33	23.33	20.00	33.33	13.33	13.33	6.67	3.33	**16.00**
7	Diatomaceous earth	500 ppm	13.33	13.33	20.00	16.67	16.67	20.00	13.33	10.00	6.67	3.33	**13.33**
8	Untreated control	-	0.00	0.00	0.00	0.00	3.33	3.33	0.00	0.00	0.00	0.00	**0.67**

Table C2-10.3d: Evaluation seed protectants for management of storage insect pests of wheat 2022-23 (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	**Mean**
1	Neem oil (*Azadiracta indica)*	15 ml	6.67	16.67	6.67	6.67	0.00	10.00	3.33	10.00	6.67	3.33	**7.00**
2	Blue gum oil (*Eucalyptus globulus*)	15 ml	10.00	13.33	10.00	3.33	0.00	6.67	6.67	6.67	6.67	3.33	**6.67**
3	Karanj oil (*Pongamia pinnata*)	15 ml	50.00	33.33	20.00	0.00	0.00	13.33	13.33	16.67	10.00	6.67	**16.33**
4	Castor oil (*Ricinus cumunis*)	15 ml	16.67	10.00	6.67	6.67	0.00	3.33	6.67	6.67	6.67	3.33	**6.67**
5	Sweet flag (Vekhand) powder (*Acorus calamus*)	5 g	10.00	13.33	13.33	13.33	13.33	6.67	13.33	3.33	10.00	6.67	**10.33**
6	Turmeric Powder (*Curcuma longa*)	5 g	20.00	10.00	16.67	10.00	3.33	6.67	13.33	0.00	3.33	3.33	**8.67**
7	Diatomaceous earth	500 ppm	3.33	10.00	13.33	6.67	6.67	6.67	6.67	3.33	3.33	3.33	**6.33**
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 2022-23 (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	28.73 *(32.30)	88.67 (70.44)	1216.80
2	Blue gum oil (*Eucalyptus globulus*)	15 ml	26.70 (31.10)	86.67 (69.44)	1216.20
3	Karanj oil (*Pongamia pinnata*)	15 ml	23.33 (28.88)	92.00 (74.10)	1417.40
4	Castor oil (*Ricinus cumunis*)	15 ml	24.07 (29.18)	86.00 (68.34)	1241.13
5	Sweet flag (Vekhand) powder (*Acorus calamus*)	5 g	23.77 (29.18)	88.00 (69.91)	1318.60
6	Turmeric Powder (*Curcuma longa*)	5 g	29.87 (33.08)	87.33 (69.55)	1147.53
7	Diatomaceous earth	500 ppm	29.27 (32.70)	86.67 (69.62)	1161.53
8	Untreated control	-	40.83 (39.71)	86.00 (68.34)	881.73
		SE±	**1.462**	**NS**	
		CD @5%	**4.425**	**NS**	
		C.V.	**7.909**	**8.498**	

Table C2-10.3f: Evaluation seed protectants for management of storage insect pests of wheat 2022-23 (Centre: Niphad)

Tr.No.	Treatments	Doses/kg seed	Percent 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	1.27 *(6.43)	2.87 (9.68)	4.00 (11.48)	5.07 (12.92)	6.40 (14.60)	7.60 (15.96)	4.53 (12.25)
2	Blue gum oil (*Eucalyptus globulus*)	15 ml	1.47 (6.63)	2.80 (9.57)	3.13 (10.14)	3.93 (11.36)	5.27 (13.23)	6.53 (14.79)	3.86 (11.29)
3	Karanj oil (*Pongamia pinnata*)	15 ml	1.07 (5.89)	1.67 (7.02)	2.93 (9.78)	3.87 (11.28)	5.20 (13.15)	6.47 (14.71)	3.53 (10.80)
4	Castor oil (*Ricinus cumunis*)	15 ml	1.87 (7.84)	3.33 (10.40)	5.20 (13.15)	6.60 (14.89)	7.80 (16.22)	9.00 (17.46)	5.63 (13.73)
5	Sweet flag (Vekhand) powder (*Acorus calamus*)	5 g	2.00 (7.78)	2.93 (9.81)	4.13 (11.73)	5.93 (14.06)	7.13 (15.46)	8.33 (16.76)	5.08 (13.01)
6	Turmeric Powder (*Curcuma longa*)	5 g	1.87 (7.78)	4.33 (11.92)	5.13 (13.04)	7.33 (15.69)	8.53 (16.97)	9.73 (18.16)	6.16 (14.34)
7	Diatomaceous earth	5 g	2.00 (7.95)	4.00 (11.92)	4.33 (12.00)	7.80 (15.95)	9.00 (17.24)	10.20 (18.45)	6.22 (14.34)
8	Untreated control	-	2.73 (9.47)	4.73 (12.53)	5.53 (13.55)	8.87 (17.23)	10.07 (18.42)	11.27 (19.55)	7.20 (15.53)
		SE±	**NS**	**NS**	**0.755**	**0.988**	**0.897**	**0.839**	**0.684**
		CD @5%	**NS**	**NS**	**2.284**	**2.991**	**2.715**	**2.539**	**2.070**
		C.V.	**18.635**	**17.579**	**11.021**	**12.077**	**9.923**	**8.557**	**9.001**

**Figures in parentheses indicate Arcsine transformed values.*

Table C2-10.3g: Evaluation seed protectants for management of storage insect pests of wheat 2022-23 (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	6.99	10.33	13.66	13.66	16.99	10.33	6.99	3.66	3.66	3.66	**8.99**
2	Blue gum oil (*Eucalyptus globulus*)	15 ml	5.66	6.99	6.99	3.66	13.66	10.33	10.33	6.99	6.99	6.99	**7.86**
3	Karanj oil (*Pongamia pinnata*)	15 ml	7.33	26.99	50.33	43.66	50.33	50.33	33.66	16.99	10.33	6.99	**29.69**
4	Castor oil (*Ricinus cumunis*)	15 ml	16.99	13.66	16.99	23.66	20.33	16.99	16.99	13.66	10.33	1.33	**15.09**
5	Sweet flag (Vekhand) powder (*Acorus calamus*)	5 g	16.99	20.33	30.33	30.33	30.33	26.99	16.99	10.33	6.99	1.33	**19.09**
6	Turmeric Powder (*Curcuma longa*)	5 g	10.33	13.66	19	20.33	20.33	20.33	13.66	10.33	6.99	6.99	**14.20**
7	Diatomaceous earth	500 ppm	13.66	16.99	16.99	15	16.99	16.99	13.66	10.33	6.99	6.99	**13.46**
8	Untreated control	-	0.00	0.00	0.00	0.00	3.33	0.00	2.33	0.00	0.00	0.00	**8.99**
	CD @5%		0.43	0.65	0.87	1.04	0.98	0.42	1.07	0.74	0.52	0.63	**1.19**

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PROGRAMME 11: NEMATOLOGY

11.1 Crop Health Survey

Rajasthan

Survey was conducted in the different farmers' fields of six 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 rhizosphere 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 i.e., Alwar, Ajmer, 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 years, ECN was not found in collected grain sample of wheat.

Haryana

Crop health monitoring survey of wheat and barley was done in March, 2023. A total of 27 soil and root samples were collected from Rewari district and around 15 soil samples were received from Hisar district during the season. Out of 42 samples, cereal cyst nematode (CCN) was reported from 18 samples. Number of cysts ranged from 2-22 per 200 cc soil (Table 11.1). Plant parasitic nematodes present in 200 cc soil samples were *Pratylenchus* sp., *Tylenchorhynchus* sp., *Hoplolaimus* sp., *Helicotylenchus* sp., Criconematids etc. Wheat seed gall nematode (*Anguina tritici*) and rice root-knot nematode (*Meloidogyne graminicola*) was not recorded from the samples.

Table 11.1: Infestation of plant parasitic nematodes associated with wheat in Rewari district

Nematode species	No. of infested samples	Frequency of occurrence (%)	No of cysts/200 cc soil	No of nematodes/ 200 cc soil
Heterodera avenae	18/42	42.85	02-22	-
Tylenchorhynchus sp.	23/42	54.76	-	11-49
Pratylenchus sp.	11/42	26.19	-	02-32
Helicotylenchus sp.	07/42	16.16	-	04-16
Hoplolaimus sp.	15/42	35.71	-	03-41
M. graminicola	Nil	-	-	-
Criconematids sp.	10/42	23.80	-	01-26
Dorylaimids sp.	41/42	97.61	-	23-168

11.2. Studies of Pathotypes of *Heterodera avenae*:

The pathotypes studies of cereal cyst nematode were carried out during the crop season 2022-23 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	25	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 thirty-four 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 was found resistant or moderately resistant across all the centers however three entries *viz.*, VL2041(I)(C), PBW887, DBW377 at Durgapura was found moderately resistant, whereas at Hisar center one entry *viz*., VL907(C) was found resistant and five entries *viz*., HS 692, UP3111, HI1634(C), NIAW4114, LOK79 were found with moderate level of resistance (Table 11.3).

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

S. No.	Entry code	Durgapura	Hisar	Highest reaction
1	HS691	S	S	S
2	HS692	S	MR	S
3	VL3028	S	S	S
4	HPW484	S	S	S
5	VL907(C)	S	R	S
6	VL892(C)	S	HS	HS
7	HPW349(C)	S	S	S
8	HS562(C)	S	HS	HS
9	VL2041(I)(C)	MR	S	S
10	PBW887	MR	S	S
11	PBW889	S	HS	HS

12	HD3386	HS	S	HS
13	HD3470	HS	HS	HS
14	HI1668	HS	HS	HS
15	DBW386	S	S	S
16	UP3102	S	S	S
17	HD3428	S	S	S
18	PBW893	HS	S	HS
19	K2108	S	S	S
20	HD3059(C)	S	S	S
21	DBW173(C)	S	HS	HS
22	PBW771(C)	S	S	S
23	JKW261(C)	S	S	S
24	WH1402	S	HS	HS
25	WH1311	S	S	S
26	UP3111	S	MR	S
27	PBW899	S	S	S
28	PBW644(C)	S	S	S
29	DBW296(C)	S	HS	HS
30	HD3369(I)(C)	S	S	S
31	HI1653(I)(C)	S	S	S
32	HI1654(I)(C)	S	HS	HS
33	HD3388	S	S	S
34	HD3471	S	S	S
35	HD3249(C)	S	HS	HS
36	HD3086(C)	S	HS	HS
37	HD2967(C)	S	S	S
38	DBW222(C)	S	S	S
39	PBW826(I)(C)	S	HS	HS
40	DBW398	S	S	S
41	HI1612(C)	HS	S	HS
42	K1317(C)	HS	S	HS
43	HD3171(C)	HS	S	HS
44	HD3293(C)	S	S	S
45	DBW252(C)	S	S	S
46	NWS2194	HS	S	HS
47	HI1669	S	S	S
48	HI1670	S	S	S
49	GW547	HS	S	HS

50	GW513(C)	S	S	S
51	HI1636 (C)	S	S	S
52	HI1650(I)(C)	S	HS	HS
53	MACS6768(I)(C)	S	HS	HS
54	HI1674	S	S	S
55	AKAW5104	S	HS	HS
56	HD2932(C)	HS	HS	HS
57	MP4010(C)	S	HS	HS
58	HI1634(C)	S	MR	S
59	CG1029(C)	HS	S	HS
60	DBW359	S	S	S
61	DBW441	S	S	S
62	DBW442	S	HS	HS
63	CG1040	S	HS	HS
64	MP3288(C)	S	S	S
65	DBW110(C)	S	S	S
66	CG1036(I)(C)	S	HS	HS
67	HI1655(I)(C)	S	S	S
68	UAS3020	S	HS	HS
69	UAS3021	S	HS	HS
70	MACS6811	S	S	S
71	MACS6809	S	HS	HS
72	NIAW4183	S	S	S
73	NIAW4153	S	S	S
74	AKAW5314	HS	HS	HS
75	AKAW5100	S	HS	HS
76	MP1378	S	S	S
77	MP1386	S	S	S
78	DBW443	S	S	S
79	DBW444	S	S	S
80	HD3469	S	S	S
81	NWS2222	HS	HS	HS
82	PWU15	HS	S	HS
83	WH1306	HS	S	HS
84	PBW891	HS	HS	HS
85	HI8841(d)	HS	HS	HS
86	UP3083	HS	HS	HS
87	MACS3949(d)(C)	S	S	S

88	HI8826(d)(I)(C)	S	S	S
89	MACS4100(d)(I)(C)	S	HS	HS
90	MACS6222 (C)	HS	HS	HS
91	HI1672	HS	S	HS
92	HI1673	S	S	S
93	HI1675	S	S	S
94	DBW394	S	S	S
95	DBW395	S	HS	HS
96	MACS6814	HS	HS	HS
97	MACS6805	S	HS	HS
98	NIAW4114	S	MR	S
99	NIAW4120	S	S	S
100	UAS3022	S	NG	S
101	UAS3023	S	S	S
102	MP3557	S	S	S
103	MP3556	HS	S	HS
104	PBW897	HS	NG	HS
105	MP1388	HS	HS	HS
106	GW542	S	HS	HS
107	GW538	S	S	S
108	WH1310	HS	S	HS
109	LOK79	S	MR	S
110	RAJ4083(C)	S	S	S
111	HD3090(C)	S	S	S
112	HI1633(C)	S	HS	HS
113	UAS478(d)	S	HS	HS
114	UAS481(d)	S	HS	HS
115	HI1665	S	HS	HS
116	HI8840(d)	S	HS	HS
117	DBW397	S	HS	HS
118	DDW61(d)	S	S	S
119	NIAW4028	S	S	S
120	HI1605(C)	S	HS	HS
121	NIAW3170(C)	S	S	S
122	UAS446(d)(C)	S	S	S
123	NIDW1149(d)(C)	S	NG	S
124	DBW380	S	S	S
125	DBW370(I)(C)	S	S	S

126	DBW371(I)(C)	S	HS	HS
127	DBW372(I)(C)	S	S	S
128	PBW872(I)(C)	S	HS	HS
129	DBW377	MR	HS	HS
130	CG1044	S	S	S
131	GW543	S	HS	HS
132	DBW187(C)	S	HS	HS
133	DBW303(C)	S	HS	HS
134	GW322(C)	S	S	S

11.4 Multiple Disease/ Pest Screening Nursery (MDSN)

Thirty-eight entries were screened against cereal cyst nematode at Durgapura and Hisar centers. 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. HI8846, MACS6795, HD3402 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. Inoculum level was 6.2 larvae/g soil. The experiment consisted of six treatments *viz* Fluensulfone 2% GR @0.5 Kg a.i./ha (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 (75 Kg formulation/ha), Fluensulfone 2% GR @2.0 Kg a.i./ha (100 Kg formulation/ha), Carbofuran @2 kg a.i/ ha at sowing and untreated check in a completely randomized block design with four 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 (25 Kg formulation/ha) gave 51.33 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 (25 Kg formulation/ha) (T1) gave higher yield in comparison to treated check, Carbofuran @2 kg a.i/ ha (66 Kg formulation/ha) and it is also found effective in wheat (Table 11.4). It can be concluded that Fluensulfone 2% GR @0.5 Kg a.i./ha (25 Kg formulation/ha) is effective control cereal cyst Nematode, *Heterodera avenae* in wheat.

Table 11.4: Effects of Fluensulfone on cereal cyst nematode in wheat under artificially created sick plot during crop season 2022-23

Treatments	Descriptions	Dose (kg a.i. per ha)	Mean number of cysts/plants (Avg. of 3 Replications)
T_1	Fluensulfone 2% GR	0.5 Kg a.i./ha at sowing	5.00
T_2	Fluensulfone 2% GR	1.0 Kg a.i./ha at sowing	4.33
T_3	Fluensulfone 2% GR	1.5 Kg a.i./ha at sowing	4.33
T_4	Fluensulfone 2% GR	2.0 Kg a.i./ha at sowing	4.66

T_5	Carbofuran	2.0 kg a.i/ha at sowing	7
T_6	Untreated Check	No chemical	34.66
		CD at 5 %	1.15

Phyto-toxicity: Nil

Hisar:

The experiment on evaluation of new chemical against cereal cyst nematode, *Heterodera avenae* was conducted in screen house in earthen pots using the chemical Fluensulfone 2% GR in wheat. Cereal cyst nematode-infested soil was filled after diluting with dune sand to make the initial inoculum 05 cysts per 200 cc soil. The experiment consisted of six treatments *viz*., Fluensulfone 2% GR @ 0.5 kg *a.i.*/ha at sowing, Fluensulfone 2% GR @ 1.0 kg *a.i.*/ha at sowing, Fluensulfone 2% GR @ 1.5 kg *a.i.*/ha at sowing, Fluensulfone 2% GR @ 2.0 kg *a.i.*/ha at sowing, Carbofuran @ 2 kg *a.i.*/ha at sowing and untreated check in a completely randomized design with three replications of each. Chemicals were mixed in soil at the time of sowing in their respective treatments. Observations on number of cysts/plant was recorded after 110 days of sowing. The minimum population of cysts/plant (5.3) was observed in Fluensulfone @ 2.0 kg *a.i./*ha followed by Carbofuran @ 2.0 kg *a.i.*/ha (7.3). The maximum population of cysts/plant (23.3) was observed in case of untreated Check (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/plants (Avg. of 3 Replications)
T_1	Fluensulfone 2% GR	0.5 Kg a.i./ha at sowing	16.7
T_2	Fluensulfone 2% GR	1.0 Kg a.i./ha at sowing	11.3
T_3	Fluensulfone 2% GR	1.5 Kg a.i./ha at sowing	8.7
T_4	Fluensulfone 2% GR	2.0 Kg a.i./ha at sowing	5.3
T_5	Carbofuran	2.0 kg a.i/ha at sowing	7.3
T_6	Untreated Check	No chemical	23.3
		CD at 5 %	2.43

Phyto-toxicity: Nil

Cooperators:

Name	**Center**
Priyanka Duggal	Hisar
S. P. Bisnoi	Durgapura

ANNEXURES

Annexure 1: Seedling response of AVT lines against the pathotypes of *Puccinia graminis* f. sp. *tritici* (black rust) during 2022-23 at ICAR-IIWBR, RS, Shimla

S. No.	Variety/line	Pathotype																						*Sr*-genes
		11	11A	14	15-1	21	21 A-2	24 A	34-1	40 A	40-1	40-2	40-3	42 B	117 A	117A-1	117-1	117-2	117-3	117-6	122	184	295	
1.	HS691	S	S	MR	S	R	R	R	R	MR	R	MS	S	MS	R	R	R	S	R	R	R	R	R	-*
2.	HS692	MR	MR	R	S	R	R	R	R	R	R	MR	S	R	R	R	R	R	R	R	R	R	R	-*
3.	VL3028	R	R	R	MS	R	R	R	R	R	MS	S	MS	R	R	R	R	R	R	R	R	R	R	*Sr30+5+11+*
4.	HPW484	MS	S	R	S	R	R	R	R	R	S	R	S	MR	R	R	R	R	R	R	R	R	R	*Sr30+5+11+*
5.	VL907(C)	R	R	R	MS	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	-*
6.	VL892(C)	MS	R	R	MS	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	S	R	R	*Sr30+11+*
7.	HPW349(C)	MR	MR	R	S	R	R	R	R	R	MR	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr7b+2+*
8.	HS562(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr8a+9b+11+*
9.	VL2041(I)(C)	MR	R	R	R	R	R	R	R	R	S	R	S	R	R	R	R	R	R	R	R	R	R	*Sr30+5+11+*
10.	PBW887	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
11.	PBW889	S	R	R	MR	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr30+5+*
12.	HD3386	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R*
13.	HD3470	R	MR	R	MR	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr5+13+7b+*
14.	HI1668	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
15.	DBW386	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
16.	UP3102	MR	S	R	S	R	R	R	R	R	R	MR	S	MR	R	R	R	R	R	R	R	R	R	*Sr5+9b+7b+*
17.	HD3428	S	S	R	MS	R	R	R	R	R	R	S	S	MS	R	R	R	MS	MS	R	R	R	R	*Sr13+7b+*
18.	PBW893	MR	R	R	MR	R	R	R	R	R	R	R	MR	R	R	R	R	MR	R	R	R	R	R	*Sr13+7b+*
19.	K2108	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
20.	HD3059(C)	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr11+2+*
21.	DBW173(C)	MS	MS	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr30+2+**
22.	PBW771(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R*
23.	JKW261(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr11+*
24.	WH1402	MS	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr30+5+**
25.	WH1311	R	R	R	MS	R	R	R	R	R	R	R	SR	R	R	R	R	R	R	R	R	R	R	*Sr30+5+*
26.	UP3111	S	R	R	NG	R	R	R	R	R	R	R	MS	R	R	NG	NG	R	MR	R	R	R	R	*Sr13+9b+11+*
27.	PBW899	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
28.	PBW644(C)	MR	R	R	S	R	R	R	R	R	R	R	S	MR	R	R	R	R	R	R	R	R	R	*Sr11+2+*
29.	DBW296(C)	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr13+7b+*
30.	HD3369(I)(C)	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr13+*
31.	HI1653(I)(C)	R	R	R	S	R	R	R	R	MR	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr7b+*
32.	HI1654(I)(C)	S	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr13+*
33.	HD3388	MR	R	R	S	R	R	R	R	R	S	R	S	R	R	R	R	R	R	R	R	R	R	*Sr13+7b+*
34.	HD3471	S	S	R	S	R	R	R	R	MR	S	S	S	S	MR	R	R	S	MS	R	R	R	R	*Sr7b+*
35.	HD3249(C)	S	S	R	S	R	R	R	MR	R	S	R	S	S	R	R	R	R	S	R	R	R	NG	*Sr7b+2+**
36.	HD3086(C)	R	R	R	MR	R	R	R	R	R	R	MS	S	MS	R	R	R	R	R	R	R	R	R	*Sr7b+2+*
37.	HD2967(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr8a+11+2+*
38.	DBW222(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R*
39.	PBW826(I)(C)	R	R	R	R	R	R	R	R	R	R	MS	MS	R	R	R	R	R	R	R	R	R	R	*Sr30+8a+2+*
40.	DBW398	MR	S	R	MS	R	R	R	R	R	R	S	MS	R	R	R	R	MR	R	R	R	R	R	*Sr9b+7b+*

41.	HI1612(C)	S	R	R	R	R	R	R	R	R	R	R	MR	R	NG	R	R	S	NG	R	R	R	R	*Sr7b+2+*
42.	K1317(C)	MR	S	R	S	R	R	R	R	R	S	R	R	R	R	R	R	MR	R	R	R	R	R	-*
43.	HD3171(C)	R	MR	R	MR	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr11+7b+2+*
44.	HD3293(C)	S	R	R	S	R	R	R	R	R	R	R	MR	R	R	R	R	R	MR	R	R	R	R	*Sr13+2+*
45.	DBW252(C)	S	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	*Sr8a+5+11+2+*
46.	NWS2194	S	S	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	*Sr30+11+*
47.	HI1669	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	*Sr8b+9e+*
48.	HI1670	MR	R	R	S	R	R	R	R	MR	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr9b+7b+*
49.	GW547	MR	R	R	MR	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	MR	R	R	R	*Sr30+**
50.	GW513(C)	MR	S	R	MS	R	R	R	R	R	R	R	MR	MR	R	R	R	MR	R	R	R	MR	R	-*
51.	HI1636 (C)	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr24+2+*
52.	HI1650(I)(C)	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	-*
53.	MACS6768(I)(C)	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-*
54.	HI1674	MR	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	*Sr9b+7b+2+*
55.	AKAW5104	S	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	*Sr13+8b+7b+*
56.	HD2932(C)	MR	MS	R	R	R	R	MS	R	MR	R	R	MR	S	R	R	R	R	R	R	R	R	R	*Sr11+*
57.	MP4010(C)	MR	R	R	MS	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	-*
58.	HI1634(C)	R	R	R	S	R	R	R	R	R	MR	R	S	R	R	R	R	R	R	R	R	R	R	-*
59.	CG1029(C)	R	R	NG	R	R	R	R	R	R	R	R	S	R	R	R	R	R	MS	MS	R	R	R	-*
60.	DBW359	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	MR	R	R	R	R	R	*Sr9b+7b+*
61.	DBW441	MS	S	R	S	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr13+9b+7b+*
62.	DBW442	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr5+30+*
63.	CG1040	R	R	R	R	R	R	NG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
64.	MP3288(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24+*
65.	DBW110(C)	R	R	R	S	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	-*
66.	CG1036(I)(C)	MS	S	R	S	R	R	R	R	R	R	MR	MS	MS	R	MR	R	R	R	R	MR	R	R	*Sr7b+2+*
67.	HI1655(I)(C)	MR	R	R	S	R	R	R	R	R	R	R	MR	S	R	R	R	MR	R	R	R	R	R	-*
68.	UAS3020	S	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	*Sr13+9b+7b+*
69.	UAS3021	S	S	R	MS	R	R	R	R	R	MR	R	S	MR	R	R	R	MS	R	R	R	R	R	*Sr13+7b+*
70.	MACS6811	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
71.	MACS6809	MS	S	R	R	R	MS	R	R	R	R	S	S	R	R	R	R	S	MS	R	S	R	R	*Sr13+9b+7b+*
72.	NIAW4183	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
73.	NIAW4153	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
74.	AKAW5314	R	R	R	R	R	R	R	R	R	MR	R	S	R	R	R	R	R	R	R	R	R	R	*Sr5+30+*
75.	AKAW5100	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr5+30+*
76.	MP1378	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R*
77.	MP1386	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
78.	DBW443	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
79.	DBW444	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
80.	HD3469	R	R	NG	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	*Sr5+30+*
81.	NWS2222	R	R	R	MR	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr30+*
82.	PWU15	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
83.	WH1306	R	R	R	MS	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr5+30+*
84.	PBW891	MR	R	R	S	R	R	R	R	S	R	MR	MR	R	R	R	R	R	R	R	MR	R	R	*Sr9b+7b+*
85.	HI8841(d)	R	R	R	S	R	R	R	R	R	R	MR	S	R	R	R	R	R	R	R	R	R	R	*Sr9e+7b+*
86.	UP3083	R	R	R	MS	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	-
87.	MACS3949(d)(C)	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	*Sr7b+2+*
88.	HI8826(d)(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*
89.	MACS4100(d)(I)(C)	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	-

90.	MACS6222 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr24*+R
91.	HI1672	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr31+*
92.	HI1673	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
93.	HI1675	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
94.	DBW394	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
95.	DBW395	R	R	R	S	R	R	R	R	MR	R	MR	MR	R	R	R	R	R	R	R	R	R	R	*Sr8b+9e+7b+*
96.	MACS6814	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
97.	MACS6805	S	R	R	R	R	R	R	R	S	R	R	R	MR	R	R	R	R	MR	R	S	R	R	*Sr9b+11+7b+*
98.	NIAW4114	MS	R	R	MS	R	R	R	R	R	R	R	MS	R	R	R	R	R	MR	R	R	R	R	*Sr9b+11+7b+*
99.	NIAW4120	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
100.	UAS3022	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
101.	UAS3023	S	R	R	MS	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr13+11+7b+*
102	MP3557	S	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	R	R	MS	R	R	R	R	*Sr13+11+9b+*
103.	MP3556	MR	R	R	S	R	R	MR	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr13+11+7b+*
104.	PBW897	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
105.	MP1388	R	S	R	S	R	R	R	R	R	R	R	MS	R	R	R	R	R	MR	R	R	R	R	*Sr13+9b+7b+*
106.	GW542	R	R	R	R	MR	R	R	R	MR	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr7b+*
107.	GW538	MR	R	R	S	R	R	R	R	MR	MR	R	S	R	R	R	R	R	R	R	R	R	R	*Sr9b+7b+*
108.	WH1310	R	R	R	R	R	R	R	R	MR	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr7b+2+*
109.	LOK79	MS	R	R	MR	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	*Sr9b+7b+*
110.	RAJ4083(C)	R	R	R	MS	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr11+*
111.	HD3090(C)	S	S	R	S	R	R	MS	R	MR	MS	MS	MS	MS	MR	MS	R	MR	MS	MS	MS	R	MR	-*
112.	HI1633(C)	S	R	R	MR	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	MR	R	R	-*
113.	UAS478(d)	S	S	R	S	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	*Sr7b+2+*
114.	UAS481(d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
115.	HI1665	MS	R	R	S	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R*
116.	HI8840(d)	S	R	R	R	R	R	R	R	R	R	R	MS	R	R	R	R	R	S	R	R	R	MS	*Sr13+7b+*
117.	DBW397	MS	R	R	MS	R	R	R	R	MR	R	R	MS	R	R	R	R	R	MS	R	R	R	R	*Sr13+9b+7b+*
118.	DDW61(d)	MR	MR	R	S	R	R	R	R	R	R	MS	S	R	R	R	R	R	R	R	S	R	MS	*Sr9b+7b+*
119.	NIAW4028	MR	R	R	S	R	R	R	R	S	MR	R	S	R	R	R	R	R	R	R	R	R	MR	*Sr5+30+2+*
120.	HI1605(C)	R	R	R	S	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr11+*
121.	NIAW3170(C)	MS	R	R	S	R	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	*Sr8a+2+*
122.	UAS446(d)(C)	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MS	R	R	MR	*Sr11+2+*
123.	NIDW1149(d)(C)	R	R	R	S	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr11+2+*
124.	DBW380	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
125.	DBW370(I)(C)	S	S	R	MR	R	MR	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Sr7b+*
126.	DBW371(I)(C)	R	R	R	S	R	R	R	S	S	MR	R	MR	R	R	MR	R	R	R	R	R	R	R	*Sr8a+2+*
127.	DBW372(I)(C)	S	S	R	S	R	R	R	R	R	R	R	MS	R	R	R	R	R	R	MR	R	R	R	*Sr28+*
128.	PBW872(I)(C)	S	R	R	S	R	R	R	R	R	R	R	S	R	R	R	R	R	MR	R	R	R	R	-*
129.	DBW377	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R
130.	CG1044	R	S	R	R	R	R	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R	*Sr9b+7b+*
131.	GW543	S	S	R	R	R	R	R	R	R	MS	R	MS	MS	R	R	R	R	R	R	R	R	R	*Sr7b+*
132.	DBW187(C)	S	S	R	MS	R	R	R	R	R	S	S	MR	R	R	R	R	R	R	R	R	R	R	*Sr5+11+*
133.	DBW303(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
134.	GW322(C)	R	R	R	S	R	R	R	R	R	S	S	MR	R	R	R	R	R	R	R	R	R	R	*Sr11+2+*

* 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 2022-23 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	162-A	162-1	
1.	HS691	R	R	S	MX**	S	R	S	S	S	S	S	S	S	S	S	MS	S	S	R	MR	S	MS	S	-*
2.	HS692	R	S	R	R	S	R	R	R	S	R	S	S	S	S	R	MX	S	S	R	R	MX	MX	R	*Lr13+10+ **
3.	VL3028	R	R	R	MR	S	R	R	R	MS	MS	S	R	S	S	R	R	S	R	R	R	R	R	R	*Lr13+ 10+ **
4.	HPW484	R	R	R	S	R	R	R	S	S	MS	R	R	S	S	S	MX	R	S	R	MX	MX	R	R	*Lr13+**
5.	VL907(C)	R	S	R	R	R	R	R	R	S	R	R	R	MS	R	S	MR	S	S	R	S	R	MX	R	-*
6.	VL892(C)	R	R	R	R	MR	R	R	S	S	MR	R	MR	S	S	R	R	R	R	R	R	R	R	R	*Lr13+10+*
7.	HPW349(C)	R	R	R	MR	S	R	R	R	R	S	R	R	S	MS	R	R	R	R	R	R	R	R	R	*Lr23+10+*
8.	HS562(C)	R	R	R	MR	S	R	MR	S	MR	S	S	R	S	S	R	R	R	R	R	R	R	R	R	*Lr23+10+3+*
9.	VL2041(I)(C)	R	R	R	R	MS	R	R	S	S	S	R	R	S	S	R	R	R	R	R	R	R	R	MS	*Lr13+*
10.	PBW887	R	R	R	MS	S	R	R	R	R	S	S	R	S	S	R	R	MR	MS	R	R	R	R	R	*Lr13+*
11.	PBW889	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
12.	HD3386	R	R	R	R	MR	R	R	MR	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	-*
13.	HD3470	R	R	R	R	R	R	S	S	S	S	S	S	S	S	S	R	R	R	R	R	R	R	R	*Lr13+1+*
14.	HI1668	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*
15.	DBW386	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
16.	UP3102	R	R	R	R	R	R	R	S	R	S	R	R	S	S	S	R	R	R	R	R	R	R	R	*Lr13+1+*
17.	HD3428	R	R	R	R	R	NG	R	MS	S	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	*Lr23+1+*
18.	PBW893	R	R	R	R	S	R	R	R	R	MX	R	MS	S	S	R	R	S	S	R	R	R	R	R	*Lr23+10+*
19.	K2108	R	R	R	R	R	R	R	S	R	S	S	R	MS	MS	R	R	MR	S	R	R	R	R	R	*Lr26+1+*
20.	HD3059(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**
21.	DBW173(C)	R	R	R	R	R	R	R	MR	R	MS	R	R	S	S	R	R	R	R	R	R	R	R	R	*Lr23+10+1+**
22.	PBW771(C)	NG	S	R	R	R	R	S	S	S	S	R	R	S	R	S	S	S	S	R	R	R	S	MX	Lr13+*
23.	JKW261(C)	R	S	NG	MS	MR	R	S	S	MR	S	R	MS	S	S	S	MR	S	S	R	R	R	R	R	*Lr13+**
24.	WH1402	R	R	R	R	R	R	S	S	S	S	R	R	S	S	S	R	R	S	R	R	R	R	R	*Lr13+1+*
25.	WH1311	R	S	R	S	S	MR	R	MR	S	S	S	R	S	S	R	S	S	S	R	R	R	S	R	*Lr23+*
26.	UP3111	NG	R	NG	R	S	NG	NG	S	R	S	R	R	S	S	R	NG	R	NG	NG	R	NG	R	R	*Lr13+10+*
27.	PBW899	R	R	R	R	R	R	R	R	R	MS	R	R	S	MS	R	R	R	R	R	R	R	R	NG	*Lr23+10+1+*
28.	PBW644(C)	R	R	R	R	R	R	R	R	MS	MS	MS	R	S	MS	R	R	R	R	R	R	R	R	R	*Lr13+1+*
29.	DBW296(C)	R	S	R	R	S	R	R	R	S	S	S	R	S	S	R	S	S	S	R	R	R	R	R	*Lr23+13+10+*
30.	HD3369(I)(C)	R	R	R	S	S	R	R	R	S	S	R	R	S	S	R	R	S	S	R	R	R	R	R	*Lr13+*
31.	HI1653(I)(C)	R	R	R	R	S	R	R	S	S	S	R	S	S	S	R	R	R	R	R	R	R	R	R	*Lr13+10+3+*
32.	HI1654(I)(C)	R	R	R	S	S	R	R	R	MS	S	R	R	S	S	R	R	MR	S	NG	R	R	R	R	*Lr13+*
33.	HD3388	R	S	R	S	S	R	S	S	S	S	S	S	S	S	S	MS	S	R	R	R	R	R	R	*Lr13+3+**
34.	HD3471	R	M	R	R	S	R	R	S	S	S	S	MR	S	S	R	S	S	MS	R	R	R	MS	R	*Lr13+10+*
35.	HD3249(C)	R	R	R	S	S	R	R	S	R	R	R	R	S	MR	R	R	MR	S	R	R	MX	R	R	*Lr13+**
36.	HD3086(C)	R	R	R	R	R	R	R	R	MS	MS	R	R	MR	S	R	R	R	R	R	R	R	R	R	*Lr13+10+3+*
37.	HD2967(C)	R	R	NG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	NG	R	R	*R**
38.	DBW222(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**
39.	PBW826(I)(C)	R	R	R	R	S	R	R	S	S	S	S	S	S	S	S	R	S	MS	R	R	R	R	S	*Lr13+10+**
40.	DBW398	R	R	R	R	S	R	MX	S	R	S	R	R	S	S	R	R	MS	S	R	R	R	R	R	*Lr13+10+*
41.	HI1612(C)	R	R	R	MS	MS	R	R	R	R	S	R	R	S	S	R	R	R	R	R	R	R	R	R	*Lr23+*
42.	K1317(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	NG	R	R	*Lr28+**

43.	HD3171(C)	R	R	R	R	R	R	MR	S	MR	MS	R	MS	S	S	S	R	R	MR	R	R	R	R	R	*Lr23+13+10+*
44.	HD3293(C)	R	R	R	R	R	R	R	R	R	MS	R	MS	S	MX	R	R	R	R	R	R	R	R	R	*Lr13+10+*
45.	DBW252(C)	R	R	R	R	MR	R	R	S	S	S	MS	S	S	S	R	R	R	MS	R	R	R	R	MS	*Lr13+10+*
46.	NWS2194	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R*
47.	HI1669	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	*Lr28+*
48.	HI1670	R	R	R	R	S	R	R	S	S	S	S	R	S	S	R	R	MR	S	R	R	R	R	R	*Lr13+10+*
49.	GW547	R	R	R	R	M	R	S	S	S	S	S	S	S	S	S	R	R	R	R	R	R	R	R	*Lr13+**
50.	GW513(C)	R	S	R	S	S	MS	MS	R	S	S	R	R	S	S	R	S	S	S	R	R	R	MS	R	*Lr23+ **
51.	HI1636 (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+*
52.	HI1650(I)(C)	R	R	R	MS	MR	R	R	R	MS	MS	R	R	S	S	R	R	R	MS	R	R	R	R	R	-*
53.	MACS6768(I)(C)	S	R	MX	S	R	R	S	S	S	S	S	S	S	S	M	R	R	S	R	MR	S	R	MS	-*
54.	HI1674	R	R	R	R	R	R	R	MS	S	S	R	R	S	S	R	R	R	R	R	R	R	R	R	*Lr13+10+ 1+*
55.	AKAW5104	R	R	R	MS	R	R	S	S	M	S	R	R	S	S	MR	R	R	S	R	MR	R	R	R	*Lr13+*
56.	HD2932(C)	R	R	R	R	R	R	NG	S	M	S	S	R	S	S	S	R	S	NG	R	R	R	R	R	*Lr13+*
57.	MP4010(C)	R	R	R	R	R	R	R	S	S	S	R	S	R	R	R	R	R	R	R	R	R	R	R	*Lr13+1+**
58.	HI1634(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*
59.	CG1029(C)	R	R	S	R	S	R	S	S	S	S	R	S	S	S	S	MS	S	S	R	R	NG	R	R	-*
60.	DBW359	R	R	R	MR	S	R	R	S	M	S	R	R	S	S	MS	R	MS	S	R	R	R	R	R	*Lr13+10+*
61.	DBW441	R	R	R	R	MS	R	S	S	S	S	R	S	S	S	S	R	R	MS	R	R	R	R	R	*Lr13+*
62.	DBW442	R	R	R	MS	S	R	R	S	S	S	S	R	S	S	R	MS	R	R	R	R	R	R	R	*Lr13+*
63.	CG1040	R	R	R	R	MR	R	S	S	MR	MS	R	MS	S	S	R	R	R	R	R	R	R	R	R	*Lr13+*
64.	MP3288(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+*
65.	DBW110(C)	R	MS	S	S	S	R	MS	S	S	S	R	S	S	S	S	R	S	S	R	R	R	MS	S	-*
66.	CG1036(I)(C)	R	MS	R	R	S	R	R	S	S	S	S	S	S	S	MS	R	MS	R	R	R	R	R	S	*Lr13+*
67.	HI1655(I)(C)	R	R	R	R	R	R	R	R	S	S	R	S	MS	R	R	R	R	S	R	R	R	R	R	*Lr13+* 10+1+
68.	UAS3020	R	R	MS	MR	MS	R	R	R	S	R	R	R	S	S	R	R	R	MR	R	R	R	R	R	*Lr13+10+*
69.	UAS3021	R	R	R	MR	MS	R	R	R	R	R	R	R	S	MR	R	R	MR	S	R	R	R	R	R	-
70.	MACS6811	R	R	R	R	S	R	R	S	R	S	R	R	R	R	R	R	S	R	R	R	R	R	R	*Lr26+10+*
71.	MACS6809	R	R	R	R	S	R	R	R	S	S	R	R	S	S	R	R	S	R	R	R	R	R	R	*Lr13*+10+
72.	NIAW4183	R	R	R	R	M	R	R	R	R	S	MR	R	S	S	R	R	R	R	R	R	NG	R	R	*Lr13+10+*
73.	NIAW4153	R	R	R	R	S	R	R	R	R	R	R	R	MR	MR	R	R	S	S	R	R	R	R	R	*Lr26*+23+10+
74.	AKAW5314	R	R	R	R	R	R	R	R	R	MS	R	R	S	S	R	R	R	R	R	R	R	R	R	*Lr23+10+1+*
75.	AKAW5100	R	R	R	R	R	R	MR	MS	R	S	R	R	S	S	R	R	R	R	R	R	R	R	R	*Lr13+10+1+*
76.	MP1378	R	R	R	MS	R	R	MS	S	S	S	R	S	S	S	S	R	R	R	R	R	R	R	R	*Lr13+**
77.	MP1386	R	R	R	R	MS	R	R	S	R	S	S	R	R	R	R	R	R	S	R	R	R	R	R	*Lr26+10+*
78.	DBW443	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*
79.	DBW444	R	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
80.	HD3469	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	*Lr28+*
81.	NWS2222	R	R	R	MS	S	R	S	S	S	S	R	S	S	S	S	R	R	R	R	R	R	R	R	*Lr13+*
82.	PWU15	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.	WH1306	R	R	R	R	S	R	R	MS	R	R	R	R	S	S	R	R	MR	S	R	R	R	R	R	*Lr23+10+*
84.	PBW891	R	MX	R	R	S	R	MX	MX	S	S	R	MS	S	S	MX	R	MS	S	R	S	MX	S	MX	*Lr13+10+*
85.	HI8841(d)	R	R	R	R	R	R	S	S	R	S	MS	S	S	S	MR	R	S	R	R	R	R	R	R	*Lr13*+1+
86.	UP3083	R	S	R	S	R	R	MS	S	S	S	R	MS	S	S	S	MS	S	S	R	R	R	R	R	-
87.	MACS3949(d)(C)	R	MS	MS	R	S	R	R	S	S	S	R	S	S	S	R	MS	S	S	R	R	R	MS	S	-*
88.	HI8826(d)(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R**
89.	MACS4100(d)(I)(C)	R	R	R	R	R	R	S	S	S	S	R	S	S	S	S	R	R	S	R	R	R	R	R	*Lr13*+1+
90.	MACS6222 (C)	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	*Lr24+R*
91.	HI1672	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*

92.	HI1673	R	NG	R	R	R	R	R	R	R	R	R	R	R	NG	R	R	R	NG	R	R	NG	R	R	*R*
93.	HI1675	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.	DBW394	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.	DBW395	R	S	R	S	S	R	S	S	S	S	MS	R	R	R	S	S	S	S	R	R	R	S	R	-
96.	MACS6814	R	R	R	R	S	R	R	S	R	S	R	S	S	S	MS	R	R	MR	R	R	R	R	R	*Lr13+10+*
97.	MACS6805	R	S	R	S	S	R	S	S	S	S	MS	MX	S	S	S	MS	S	S	R	S	R	MS	S	-
98.	NIAW4114	R	R	R	R	S	R	R	S	S	S	R	S	S	S	R	R	MS	R	R	R	R	R	S	*Lr13+10+*
99.	NIAW4120	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
100.	UAS3022	R	S	R	R	S	R	R	R	S	S	R	R	S	S	R	R	S	S	R	R	R	R	R	*Lr23+10+*
101.	UAS3023	R	R	R	R	R	R	S	S	S	S	MS	R	S	S	S	R	MR	S	R	MR	MS	R	R	*Lr13+1+*
102	MP3557	R	R	R	R	MS	R	S	S	S	S	S	R	S	S	S	R	S	S	R	MR	R	R	R	*Lr13+*
103.	MP3556	R	R	R	R	S	R	NG	MR	MS	S	S	R	S	MS	R	R	R	R	R	R	R	R	R	*Lr23+10+*
104.	PBW897	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
105.	MP1388	R	S	R	R	S	R	R	S	MS	R	R	R	S	S	R	MS	S	S	R	R	R	S	R	*Lr13+10+*
106.	GW542	R	R	R	R	R	R	R	R	S	MS	R	R	S	MS	S	R	MR	R	R	R	R	R	R	*Lr13+*
107.	GW538	R	R	R	R	S	R	R	S	MS	S	R	R	S	S	S	R	R	MR	R	R	R	R	R	*Lr13+*
108.	WH1310	R	S	S	S	S	S	S	S	S	S	S	R	S	S	S	S	S	S	R	S	S	S	S	-*
109.	LOK79	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
110.	RAJ4083(C)	R	R	R	R	R	R	R	MS	MS	S	R	R	S	S	R	R	MS	MS	R	R	R	R	R	*Lr13+*
111.	HD3090(C)	R	S	R	R	S	MR	R	S	S	S	R	R	S	S	R	S	S	S	R	MS	R	MS	MS	*Lr13+10+ **
112.	HI1633(C)	R	R	R	R	R	R	R	MX	R	MS	R	R	S	S	S	R	MS	MS	R	R	R	R	R	*Lr13+10+**
113.	UAS478(d)	R	R	R	MS	S	R	R	R	S	R	R	R	S	MS	R	R	S	S	R	R	R	R	R	*Lr23+*
114.	UAS481(d)	R	S	R	R	R	R	MS	S	S	S	R	R	MS	MR	S	S	S	S	R	R	R	S	R	*Lr13+*
115.	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*
116.	HI8840(d)	R	R	R	R	R	R	R	R	MR	MS	R	R	MX	R	R	R	R	NG	R	R	R	NG	R	*Lr23+ 10+1+*
117.	DBW397	R	R	R	R	MS	R	R	S	S	S	R	S	S	S	R	R	R	MS	R	R	R	R	MS	*Lr13+10+*
118.	DDW61(d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
119.	NIAW4028	R	R	R	R	R	R	R	R	R	R	R	R	MS	MS	R	R	R	R	R	R	R	R	R	-
120.	HI1605(C)	R	R	R	R	R	R	R	S	R	R	S	R	S	S	R	R	R	R	R	R	R	R	R	*Lr13+*
121.	NIAW3170(C)	R	R	R	R	R	R	R	R	MS	S	R	MR	S	S	R	R	MR	MS	R	R	R	R	R	*Lr13+10+1+*
122.	UAS446(d)(C)	R	R	R	R	R	R	R	S	MS	S	R	S	S	S	R	R	R	MS	R	R	R	R	R	*Lr13*+10+*
123.	NIDW1149(d)(C)	R	R	MS	MR	R	R	R	MX	MS	S	R	R	S	S	R	R	MS	MR	R	R	R	R	R	*Lr23+10+*
124.	DBW380	R	R	MX	MX	S	R	R	S	R	S	R	R	S	S	R	MS	S	S	R	R	R	MS	R	*Lr13+10+*
125.	DBW370(I)(C)	R	R	R	R	R	R	MR	S	R	S	R	R	S	S	R	R	R	MS	R	R	MS	R	R	*Lr13+1+*
126.	DBW371(I)(C)	R	S	R	R	S	R	R	S	S	S	MS	R	S	S	R	R	S	S	R	R	R	R	R	*Lr23+ 1+*
127.	DBW372(I)(C)	R	R	R	R	M	R	MS	S	S	S	MS	MS	S	S	S	R	MR	R	R	R	R	R	R	*Lr13+**
128.	PBW872(I)(C)	R	R	R	R	MR	R	R	S	S	S	R	R	S	S	S	R	R	R	NG	R	R	R	R	*Lr13+1+**
129.	DBW377	R	R	R	R	R	R	MS	S	S	S	S	R	S	S	S	R	R	R	R	R	R	R	R	*Lr13+1+**
130.	CG1044	R	S	NG	R	S	R	S	S	MS	S	R	MS	S	S	S	MS	S	S	NG	R	NG	R	R	-
131.	GW543	R	R	R	MS	R	R	MS	S	S	S	R	R	S	S	MR	R	R	R	R	R	NG	R	R	*Lr13+10+*
132.	DBW187(C)	R	MX	R	S	S	R	R	S	MX	S	S	R	S	S	R	MX	S	S	R	R	R	R	R	*Lr13+**
133.	DBW303(C)	NG	R	R	R	S	R	R	S	S	S	S	MS	S	S	R	R	S	MX	R	R	R	R	R	*Lr13+*
134.	GW322(C)	S	R	MR	S	S	R	S	S	S	S	R	MS	S	S	S	R	S	S	MS	MS	S	MS	S	-*

* Different seed lot to that of previous cropping season, ** MX: mix infection types; -: 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 2022-23 at ICAR-IIWBR, RS, Shimla

S. No.	Variety/line	Pathotype															*Yr*-gene
		46 S 119	110 S 119	238 S 119	78 S 84	110 S 84	P	T	111 S 68	79 S 68	79 S 4	K	N	14S 64	6 S 0	7 S 0	
1.	HS691	R	S	S	R	R	S	R	R	R	R	R	R	R	R	R	-
2.	HS692	S	S	S	MS	S	S	S	S	S	MS	S	S	S	R	R	*Yr2+**
3.	VL3028	MS	S	S	R	R	S	MS	S	S	R	S	S	R	R	R	*Yr2+*
4.	HPW484	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R**
5.	VL907(C)	R	MR	R	MS	MR	S	MS	R	MS	R	S	MS	R	R	R	*Yr2+**
6.	VL892(C)	R	MS	S	R	R	S	S	R	R	R	S	S	R	R	R	*Yr2+*
7.	HPW349(C)	R	MR	S	R	R	R	R	R	R	R	S	MS	R	R	R	*Yr2+*
8.	HS562(C)	R	R	S	MS	R	MS	R	R	R	R	S	R	R	R	R	*Yr2+*
9.	VL2041(I)(C)	MS	MS	S	MS	R	MS	R	R	R	R	S	R	R	R	R	*Yr2+*
10.	PBW887	R	S	S	R	R	MS	S	R	R	R	MS	R	R	R	R	*YrA+*
11.	PBW889	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
12.	HD3386	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R**
13.	HD3470	R	S	S	S	S	MS	R	R	R	R	S	MR	R	R	R	*Yr2+*
14.	HI1668	R	MS	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+A+*
15.	DBW386	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
16.	UP3102	R	S	S	MS	MS	R	R	S	R	R	MS	R	R	R	R	*Yr2+*
17.	HD3428	S	S	S	MS	MS	S	MS	R	R	R	S	S	MS	R	R	*Yr2+*
18.	PBW893	MS	MS	S	MS	MS	S	MS	R	R	R	S	MR	R	R	R	*Yr2+*
19.	K2108	MS	S	R	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+A+*
20.	HD3059(C)	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-
21.	DBW173(C)	R	S	S	R	S	MR	R	S	R	R	MS	MS	R	R	R	*Yr2+**
22.	PBW771(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R**
23.	JKW261(C)	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	-
24.	WH1402	R	S	S	R	R	R	MS	R	R	R	MS	R	R	R	R	*YrA+**
25.	WH1311	S	S	S	S	S	S	S	S	R	MS	S	S	R	S	MS	-
26.	UP3111	S	_	S	R	S	R	R	R	MS	R	R	R	R	R	MS	-
27.	PBW899	R	R	S	R	R	R	R	MIX	R	R	R	R	R	R	R	-
28.	PBW644(C)	R	S	S	MS	R	S	S	R	R	R	S	S	R	R	R	*Yr2+*
29.	DBW296(C)	S	S	S	MS	S	S	S	S	R	R	S	S	R	R	R	*Yr2+*
30.	HD3369(I)(C)	R	S	S	R	R	MS	R	R	R	R	R	R	R	R	R	*Yr2+*
31.	HI1653(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R**
32.	HI1654(I)(C)	R	S	S	R	R	R	S	R	R	R	R	R	R	R	R	*Yr2+*
33.	HD3388	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R**
34.	HD3471	S	S	S	R	MS	S	S	R	R	R	S	S	R	R	R	*Yr2+*
35.	HD3249(C)	R	S	S	R	R	MR	MS	R	R	R	MS	MR	R	R	R	-
36.	HD3086(C)	MS	S	S	R	R	R	R	R	R	R	S	MIX	R	R	R	*Yr2+*
37.	HD2967(C)	S	S	MS	R	R	R	R	R	S	MR	MIX	MS	R	R	R	*Yr2+*
38.	DBW222(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R**
39.	PBW826(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R**
40.	DBW398	R	S	S	R	R	R	MS	R	R	R	R	R	R	R	R	*Yr2+*
41.	HI1612(C)	MS	S	S	MS	R	MS	S	MS	R	R	R	S	R	R	R	*Yr2+*

42.	K1317(C)	MS	S	S	S	S	S	S	S	S	S	S	S	R	R	R	-*
43.	HD3171(C)	MS	S	S	R	R	S	S	R	MR	R	S	S	R	R	R	*Yr2+*
44.	HD3293(C)	R	S	S	S	R	S	MS	MR	S	R	MIX	S	R	R	S	-
45.	DBW252(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R**
46.	NWS2194	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	-
47.	HI1669	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
48.	HI1670	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
49.	GW547	R	S	MR	S	R	S	R	R	R	R	R	MR	R	R	R	*Yr2+*
50.	GW513(C)	S	S	MS	R	S	MS	S	S	R	R	S	S	R	R	R	*Yr2+*
51.	HI1636 (C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
52.	HI1650(I)(C)	S	S	S	R	R	MS	R	S	MS	R	R	S	R	R	R	*Yr2+**
53.	MACS6768(I)(C)	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
54.	HI1674	MR	S	MS	R	R	MS	MR	R	R	R	R	R	R	R	R	*Yr2+*
55.	AKAW5104	R	R	S	R	R	MS	R	R	R	R	R	R	R	R	R	*YrA+*
56.	HD2932(C)	MS	S	S	MS	S	S	R	MS	S	MS	S	R	R	MS	R	-
57.	MP4010(C)	R	S	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
58.	HI1634(C)	S	S	S	MS	MS	S	S	S	R	R	S	S	R	R	R	*Yr2+*
59.	CG1029(C)	MS	S	S	S	S	R	MS	S	S	R	R	R	R	R	R	*Yr2+*
60.	DBW359	R	S	S	R	R	MS	R	R	R	R	R	R	R	R	R	*Yr2+*
61.	DBW441	MS	S	S	R	R	S	R	S	R	R	S	S	R	MS	R	-
62.	DBW442	S	S	S	R	MR	S	R	S	R	R	R	MS	R	R	R	*Yr2+*
63.	CG1040	R	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	-
64.	MP3288(C)	S	MS	S	R	S	S	S	S	S	R	S	S	R	R	R	*Yr2+*
65.	DBW110(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R**
66.	CG1036(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
67.	HI1655(I)(C)	R	MR	MR	R	R	R	R	R	R	R	R	R	R	R	R	-
68.	UAS3020	R	S	S	R	R	R	R	S	R	R	R	R	R	R	R	*Yr2+*
69.	UAS3021	R	S	S	MR	R	R	R	R	R	R	S	R	R	R	R	*Yr2+*
70.	MACS6811	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr9+*
71.	MACS6809	S	S	S	S	MS	MR	R	S	S	S	MR	MS	R	MS	R	-
72.	NIAW4183	S	S	S	S	S	R	R	S	S	S	MR	S	R	R	R	-
73.	NIAW4153	R	S	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr9+*
74.	AKAW5314	S	S	S	R	R	S	S	R	R	R	S	S	R	R	R	*YrA+*
75.	AKAW5100	MS	S	S	R	R	R	R	R	R	R	R	MS	R	R	R	-
76.	MP1378	MS	S	S	MR	R	MS	MS	MS	R	R	S	R	R	R	R	*Yr2+**
77.	MP1386	S	S	S	MS	R	R	R	R	R	R	R	R	R	R	R	*Yr9+*
78.	DBW443	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr9+*
79.	DBW444	S	S	S	S	S	S	S	S	R	R	S	S	R	R	R	*Yr2+*
80.	HD3469	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
81.	NWS2222	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
82.	PWU15	R	S	S	R	R	R	R	R	R	R	MS	R	R	R	R	-
83.	WH1306	MR	S	S	S	S	S	S	S	R	R	S	MS	R	S	R	-
84.	PBW891	S	S	S	R	S	S	S	S	R	R	S	S	R	R	R	-
85.	HI8841(d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
86.	UP3083	S	S	S	S	S	R	S	S	R	R	MR	MS	R	R	R	*Yr2+*
87.	MACS3949(d)(C)	MR	S	S	S	R	R	R	R	R	R	S	R	R	R	R	*Yr2+*
88.	HI8826(d)(I)(C)	S	S	S	S	S	R	R	S	S	S	S	S	MR	MS	MS	-
89.	MACS4100(d)(I)(C)	S	S	S	MS	R	MS	MS	MS	R	R	S	S	R	R	R	*Yr2+*
90.	MACS6222 (C)	S	S	S	S	S	S	S	S	R	R	S	S	R	R	R	*Yr2+*

91.	HI1672	MS	S	S	S	S	R	R	R	R	R	R	R	R	R	R	*Yr9+*
92.	HI1673	S	S	S	MS	S	S	MS	S	R	R	S	R	R	R	R	*Yr2+*
93.	HI1675	S	S	S	S	S	S	S	S	S	S	S	S	R	R	R	-
94.	DBW394	MS	MS	S	R	R	S	R	R	R	R	R	R	R	R	R	*YrA+*
95.	DBW395	S	S	S	S	MS	S	S	S	MS	R	R	S	R	S	S	-
96.	MACS6814	S	MS	S	R	R	S	S	MS	R	R	S	S	R	S	R	-
97.	MACS6805	S	S	S	S	S	S	S	S	S	S	S	S	S	R	R	-
98.	NIAW4114	MS	S	S	R	R	R	R	R	R	R	S	R	R	R	R	*Yr2+*
99.	NIAW4120	S	S	S	S	R	S	S	S	R	R	S	S	R	R	R	*Yr2+*
100.	UAS3022	R	MS	MS	R	MS	MS	MS	MS	MR	R	S	S	R	R	R	*Yr2+*
101.	UAS3023	S	S	S	R	R	MS	R	S	S	R	R	S	R	R	R	*YrA+*
102.	MP3557	S	S	S	S	S	S	S	S	MR	R	S	MS	S	MR	MR	-
103.	MP3556	S	S	S	R	MR	S	R	R	R	R	S	S	R	R	R	*Yr2+*
104.	PBW897	S	S	S	S	S	MS	R	R	R	R	R	R	R	R	R	-
105.	MP1388	S	S	S	S	S	S	S	S	S	MR	MS	S	S	R	S	-
106.	GW542	MS	MS	S	S	R	MR	R	R	R	R	S	MR	R	R	R	*Yr2+*
107.	GW538	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
108.	WH1310	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
109.	LOK79	MS	S	MS	S	R	S	R	S	MS	R	S	S	R	R	MR	-
110.	RAJ4083(C)	R	S	S	R	R	S	MS	R	R	R	S	S	R	R	R	*Yr2+*
111.	HD3090(C)	MS	S	S	R	R	MS	R	R	R	R	S	S	R	R	R	*Yr2+**
112.	HI1633(C)	R	S	MS	R	MR	MR	MS	R	R	R	S	MS	R	R	R	*Yr2+**
113.	UAS478(d)	MS	S	S	R	R	S	S	R	R	R	S	S	R	R	R	*Yr2+*
114.	UAS481(d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
115.	HI1665	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R**
116.	HI8840(d)	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
117.	DBW397	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
118.	DDW61(d)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
119.	NIAW4028	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	*R*
120.	HI1605(C)	MS	R	S	R	R	R	MS	R	R	R	R	MS	R	R	R	*Yr2+*
121.	NIAW3170(C)	MR	S	S	R	MR	S	S	R	R	R	S	S	R	R	R	*Yr2+*
122.	UAS446(d)(C)	R	S	S	R	MS	S	S	R	R	R	S	S	R	R	R	*Yr2+*
123.	NIDW1149(d)(C)	R	R	R	MS	R	R	R	R	R	R	R	R	R	R	R	*Yr2+*
124.	DBW380	S	S	S	S	S	S	S	S	R	MS	S	S	R	MR	MS	-
125.	DBW370(I)(C)	S	MS	S	R	MS	S	S	MS	R	R	S	S	R	MR	R	-
126.	DBW371(I)(C)	S	S	S	MS	R	S	S	S	R	R	S	S	R	MS	MS	-
127.	DBW372(I)(C)	S	S	S	R	MR	S	S	R	R	R	S	S	R	R	R	*Yr2+*
128.	PBW872(I)(C)	R	S	S	R	R	S	MS	R	R	R	R	MS	R	R	R	*Yr2+*
129.	DBW377	R	S	S	R	R	S	R	R	R	R	R	R	R	R	R	*Yr2+*
130.	CG1044	S	S	S	R	MS	S	S	R	MS	R	S	S	R	R	R	*Yr2+*
131.	GW543	S	S	S	R	R	S	S	R	R	R	MS	MS	R	R	R	*Yr2+*
132.	DBW187(C)	R	S	S	R	R	S	R	R	R	R	R	R	R	R	R	*Yr2+*
133.	DBW303(C)	R	S	S	S	R	MR	R	R	MR	R	R	S	R	R	R	*Yr2+*
134.	GW322(C)	R	MS	S	R	R	R	R	R	R	R	R	R	R	R	R	*Yr9+**

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

Annexure 4: Seedling response of AVT lines against the pathotypes of *Puccinia graminis* f. sp. *tritici* (black rust) during 2022-23 at Mahabaleshwar

S. No.	Entry	Pt 11	Pt 17	Pt 40-1	Pt 42B	Pt 21-1	Pt 117-1	Pt 117-3	Pt 117-6	Pt 122	Pt 295	Pt 40A	Pt 21A2
1	HS691	R	R	R	S	R	R	R	R	R	R	R	R
2	HS692	R	R	R	R	R	R	R	R	R	R	R	R
3	VL3028	R	R	R	S	R	R	R	R	R	R	S	S
4	HPW484	R	R	R	S	R	R	S	R	R	R	S	S
5	VL907(C)	R	R	S	NG	R	R	R	R	R	R	R	R
6	VL892(C)	S	R	R	R	R	R	R	S	R	R	S	S
7	HPW349(C)	S	R	R	R	R	R	R	R	R	R	S	S
8	HS562(C)	S	R	S	S	R	R	R	R	R	R	S	R
9	VL2041(I)(C)	S	R	R	R	R	S	R	R	R	R	S	S
10	PBW887	R	R	R	R	R	R	R	R	R	R	R	R
11	PBW889	R	R	R	R	R	R	S	R	R	R	R	R
12	HD3386	R	R	R	R	R	R	R	R	R	R	R	R
13	HD3470	S	R	R	S	R	R	R	R	R	R	S	S
14	HI1668	S	R	R	R	R	R	R	R	R	R	R	R
15	DBW386	R	R	R	R	R	R	R	R	R	R	R	R
16	UP3102	S	R	R	R	R	S	R	R	R	R	S	S
17	HD3428	R	R	R	S	R	R	R	R	S	R	R	R
18	PBW893	R	R	R	S	R	R	R	S	R	R	R	R
19	K2108	R	R	R	R	R	R	R	R	R	R	R	R
20	HD3059(C)	R	R	R	R	R	R	R	R	R	R	R	R
21	DBW173(C)	R	R	R	R	R	R	R	R	R	R	R	R
22	PBW771(C)	R	R	R	R	R	R	R	R	R	R	R	R
23	JKW261(C)	S	R	R	S	R	R	R	R	R	R	R	R
24	WH1402	S	R	R	S	R	R	R	R	R	R	R	R
25	WH1311	S	R	R	R	R	S	R	R	R	R	R	R
26	UP3111	S	R	R	S	R	R	R	R	R	R	R	R
27	PBW899	R	R	R	R	R	R	R	R	R	R	R	R
28	PBW644(C)	R	R	S	R	R	R	R	R	R	R	R	R
29	DBW296(C)	R	S	R	R	R	R	R	R	R	R	R	R
30	HD3369(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R
31	HI1653(I)(C)	R	R	R	R	R	R	R	S	R	R	S	R
32	HI1654(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R
33	HD3388	R	R	S	S	R	R	R	R	R	R	R	R
34	HD3471	S	S	S	S	R	R	R	R	R	R	R	R
35	HD3249(C)	S	S	S	S	R	R	R	S	R	R	S	R
36	HD3086(C)	S	S	R	R	R	S	R	R	R	R	R	R
37	HD2967(C)	R	S	R	R	R	R	R	R	R	R	R	R
38	DBW222(C)	R	R	R	R	R	R	R	R	R	R	R	R
39	PBW826(I)(C)	R	R	R	R	R	S	R	R	R	R	R	R
40	DBW398	R	R	R	R	R	R	R	R	R	R	R	R
41	HI1612(C)	S	R	R	R	R	R	R	R	R	R	R	R
42	K1317(C)	R	R	R	R	R	S	R	R	R	R	R	R

43	HD3171(C)	R	S	R	R	R	S	R	R	R	R	R	R
44	HD3293(C)	R	R	R	R	R	R	R	R	R	S	S	R
45	DBW252(C)	S	R	R	S	R	R	R	R	R	R	R	R
46	NWS2194	R	R	R	R	R	R	R	R	R	R	R	R
47	HI1669	R	R	S	R	R	R	R	R	S	S	R	R
48	HI1670	R	R	R	S	R	R	R	R	S	R	R	R
49	GW547	R	R	S	R	S	S	S	R	R	NG	R	R
50	GW513(C)	R	R	R	R	R	R	R	S	R	R	S	R
51	HI1636 (C)	R	R	R	R	R	R	R	R	R	R	R	R
52	HI1650(I)(C)	R	R	S	R	R	R	R	R	R	S	R	R
53	MACS6768(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R
54	HI1674	R	R	R	R	R	R	R	R	R	R	R	R
55	AKAW5104	R	R	R	R	R	R	R	R	R	R	R	R
56	HD2932(C)	R	R	S	S	R	R	R	R	S	R	R	R
57	MP4010(C)	R	R	R	R	R	R	R	R	S	R	R	R
58	HI1634(C)	R	R	S	R	R	S	R	R	S	R	R	R
59	CG1029(C)	S	R	R	R	R	S	R	S	NG	R	S	R
60	DBW359	S	R	R	R	R	R	R	S	R	R	R	R
61	DBW441	R	S	R	R	R	S	R	S	R	R	R	R
62	DBW442	S	R	S	R	R	R	R	R	R	S	R	R
63	CG1040	R	R	R	R	R	S	R	R	R	R	R	R
64	MP3288(C)	S	R	S	S	S	R	S	R	R	R	R	R
65	DBW110(C)	R	R	R	S	S	R	S	R	R	R	R	R
66	CG1036(I)(C)	R	R	S	R	R	S	R	R	R	R	R	R
67	HI1655(I)(C)	R	R	R	S	R	R	R	R	R	R	R	R
68	UAS3020	S	R	R	R	R	S	R	R	S	R	S	R
69	UAS3021	R	R	R	S	R	S	R	R	R	R	R	R
70	MACS6811	S	R	R	R	R	R	R	R	R	R	R	R
71	MACS6809	R	R	R	R	R	R	R	R	R	R	R	R
72	NIAW4183	R	R	R	R	R	R	R	R	R	R	R	R
73	NIAW4153	S	R	R	R	R	R	R	R	R	R	R	R
74	AKAW5314	S	R	R	S	R	R	R	S	R	R	R	R
75	AKAW5100	R	R	R	R	R	R	R	S	R	R	R	R
76	MP1378	S	R	R	R	R	R	R	R	R	R	R	R
77	MP1386	S	R	R	R	R	R	R	R	R	R	S	S
78	DBW443	S	R	R	R	R	R	R	S	R	R	R	R
79	DBW444	R	R	R	R	R	R	R	R	R	R	R	R
80	HD3469	R	R	R	R	R	R	R	R	R	R	R	R
81	NWS2222	R	S	R	S	R	R	R	R	R	S	R	R
82	PWU15	R	R	R	R	R	S	R	R	R	S	R	R
83	WH1306	R	R	R	R	R	S	R	S	R	R	S	R
84	PBW891	S	S	R	R	R	R	R	S	R	R	S	R
85	HI8841(d)	R	R	R	R	R	S	R	R	R	R	R	R
86	UP3083	R	R	R	R	R	R	R	R	R	R	R	R
87	MACS3949(d)(C)	R	R	R	R	R	R	R	R	R	R	R	R
88	HI8826(d)(I)(C)	S	R	R	R	R	R	R	S	R	R	R	R

89	MACS4100(d)(I)(C)	S	R	R	R	R	R	R	R	R	R	R	R
90	MACS6222 (C)	S	R	R	R	R	R	R	R	R	R	R	R
91	HI1672	R	R	R	R	R	R	R	S	R	R	R	R
92	HI1673	S	R	R	R	R	R	R	S	R	R	R	R
93	HI1675	R	NG	R	R	R	R	R	S	R	R	R	R
94	DBW394	R	R	R	R	R	R	R	R	R	R	R	R
95	DBW395	R	R	R	R	R	R	R	R	R	R	R	R
96	MACS6814	R	R	R	R	R	R	R	R	R	S	R	R
97	MACS6805	R	R	S	R	R	R	R	S	R	R	R	R
98	NIAW4114	S	R	R	R	R	R	R	R	R	R	R	R
99	NIAW4120	R	R	R	R	R	R	R	S	R	R	S	R
100	UAS3022	R	R	R	R	R	R	R	R	R	R	R	R
101	UAS3023	R	R	R	R	S	R	R	S	R	R	R	R
102	MP3557	R	R	R	R	R	R	R	R	R	R	R	R
103	MP3556	R	R	R	R	R	R	R	R	R	R	R	R
104	PBW897	S	R	R	R	R	R	R	S	R	R	S	R
105	MP1388	R	R	R	R	R	R	R	R	S	R	R	R
106	GW542	S	R	R	R	R	R	R	R	R	R	R	R
107	GW538	S	R	R	S	R	R	R	R	R	R	R	R
108	WH1310	R	R	R	R	R	R	R	R	R	R	R	R
109	LOK79	S	R	R	R	R	R	R	R	S	R	R	R
110	RAJ4083(C)	S	R	R	R	R	R	R	S	R	R	R	R
111	HD3090(C)	R	R	R	R	R	R	R	S	R	R	R	R
112	HI1633(C)	R	R	R	R	R	R	R	S	R	R	R	R
113	UAS478(d)	R	R	R	R	R	R	R	S	S	R	R	R
114	UAS481(d)	R	R	R	R	R	R	R	S	R	R	S	R
115	HI1665	R	R	R	R	R	R	R	R	R	R	R	R
116	HI8840(d)	R	R	R	R	R	S	R	R	R	R	S	S
117	DBW397	R	R	R	R	R	R	R	R	R	R	R	R
118	DDW61(d)	R	R	R	R	R	S	R	R	R	R	R	R
119	NIAW4028	R	R	R	R	R	R	R	R	R	R	R	R
120	HI1605(C)	R	R	R	R	R	R	R	R	R	R	R	R
121	NIAW3170(C)	R	R	S	R	R	R	R	R	R	R	R	R
122	UAS446(d)(C)	R	R	S	S	S	S	S	R	S	R	S	R
123	NIDW1149(d)(C)	R	R	R	R	R	S	R	R	R	R	R	R
124	DBW380	S	R	R	R	R	R	R	R	R	R	R	R
125	DBW370(I)(C)	R	S	R	S	R	S	NG	R	R	R	S	R
126	DBW371(I)(C)	R	S	R	R	R	R	R	R	R	R	R	R
127	DBW372(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R
128	PBW872(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R
129	DBW377	R	R	R	S	R	R	R	R	R	R	R	R
130	CG1044	R	R	R	R	R	R	R	R	R	R	R	R
131	GW543	R	S	R	R	R	R	R	R	R	R	R	R
132	DBW187(C)	R	R	R	R	R	R	R	R	R	S	R	S
133	DBW303(C)	R	R	R	R	R	R	R	R	R	R	R	R
134	GW322(C)	R	R	R	R	R	R	R	R	R	R	R	R

Annexure 5: Seedling response of AVT lines against the pathotypes of *Puccinia triticina* (brown rust) during 2022-23 at Mahabaleshwar

S. No.	Entry	Pt 12-3	Pt 12-5	Pt 77A	Pt 77-1	Pt 77-2	Pt 77-3	Pt 77-5	Pt 77-6	Pt 77-8	Pt 77-9	Pt 104-2	Pt 162A
1	HS691	R	R	R	S	R	R	R	S	R	S	R	R
2	HS692	R	R	R	S	R	S	R	R	R	R	R	R
3	VL3028	R	R	R	R	R	R	R	R	R	S	R	R
4	HPW484	R	R	R	R	R	R	R	R	R	S	R	R
5	VL907(C)	R	R	R	R	R	R	R	S	R	S	R	S
6	VL892(C)	R	R	R	R	R	R	R	S	S	S	R	S
7	HPW349(C)	R	R	R	R	R	R	R	R	R	R	R	R
8	HS562(C)	S	R	R	R	R	R	S	R	R	S	R	R
9	VL2041(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R
10	PBW887	R	R	R	R	R	R	R	R	R	R	R	R
11	PBW889	R	R	R	R	R	R	R	R	R	R	R	R
12	HD3386	R	R	R	R	R	R	R	R	R	R	R	R
13	HD3470	S	R	R	S	R	S	R	R	R	S	R	R
14	HI1668	R	R	R	R	R	R	R	R	R	R	R	R
15	DBW386	S	R	R	R	R	R	R	R	R	R	R	R
16	UP3102	R	R	R	R	R	R	R	R	R	S	R	R
17	HD3428	R	R	R	R	R	R	R	R	R	R	R	R
18	PBW893	R	R	R	R	R	R	R	R	R	R	R	R
19	K2108	R	R	R	R	R	R	R	R	R	R	R	R
20	HD3059(C)	R	R	R	R	R	R	R	R	R	R	R	R
21	DBW173(C)	R	R	R	R	R	R	R	R	R	R	R	R
22	PBW771(C)	R	R	R	R	R	R	R	S	R	S	R	R
23	JKW261(C)	R	R	R	R	R	R	R	R	R	R	R	R
24	WH1402	R	R	R	R	R	R	R	R	R	R	R	R
25	WH1311	R	R	R	R	R	R	R	R	R	S	R	R
26	UP3111	R	R	R	R	S	S	S	R	R	S	R	R
27	PBW899	R	R	R	R	R	R	R	R	R	R	R	R
28	PBW644(C)	R	R	R	R	R	R	R	R	R	R	R	R
29	DBW296(C)	R	R	R	R	R	R	R	R	R	S	R	R
30	HD3369(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R
31	HI1653(I)(C)	R	R	R	R	R	R	R	S	R	S	R	R
32	HI1654(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R
33	HD3388	S	R	R	R	S	R	S	S	S	S	R	R
34	HD3471	S	R	R	R	R	R	S	S	R	S	S	R

35	HD3249(C)	R	R	R	R	R	R	R	R	R	S	R	R
36	HD3086(C)	R	R	R	R	R	R	R	R	R	R	R	R
37	HD2967(C)	R	R	R	R	R	R	R	R	R	R	R	R
38	DBW222(C)	R	R	R	R	R	R	R	R	R	R	R	R
39	PBW826(I)(C)	S	R	S	R	R	R	S	R	R	S	R	R
40	DBW398	R	R	R	R	R	R	R	R	R	S	R	R
41	HI1612(C)	R	R	R	R	R	R	R	R	R	R	R	R
42	K1317(C)	R	R	R	R	R	R	R	R	R	R	R	R
43	HD3171(C)	R	S	S	R	R	R	S	R	R	R	R	R
44	HD3293(C)	R	R	S	R	R	R	R	R	R	S	R	R
45	DBW252(C)	R	R	R	R	R	R	R	R	R	R	R	R
46	NWS2194	R	R	R	R	R	R	R	R	R	R	R	R
47	HI1669	R	R	R	R	R	R	R	R	R	R	R	R
48	HI1670	R	R	R	R	R	R	R	R	R	R	R	R
49	GW547	R	R	R	R	R	R	R	R	R	R	R	R
50	GW513(C)	R	R	R	R	R	R	R	R	R	R	R	R
51	HI1636 (C)	R	R	R	R	R	R	R	S	R	S	R	R
52	HI1650(I)(C)	R	R	R	R	R	R	R	R	R	S	R	R
53	MACS6768(I)(C)	R	S	R	R	R	R	R	R	R	S	R	R
54	HI1674	R	R	R	R	R	R	R	R	R	S	R	R
55	AKAW5104	R	R	R	S	R	S	R	R	R	S	R	R
56	HD2932(C)	R	R	R	R	R	R	R	R	R	S	R	R
57	MP4010(C)	R	R	R	R	R	R	R	R	R	R	R	R
58	HI1634(C)	R	R	R	R	R	R	R	R	R	R	R	R
59	CG1029(C)	R	R	S	R	R	R	R	R	R	S	R	R
60	DBW359	R	R	S	R	R	R	R	S	R	R	R	R
61	DBW441	R	S	S	R	S	R	R	R	R	S	R	R
62	DBW442	R	R	S	R	S	R	R	R	R	S	R	R
63	CG1040	R	R	S	R	R	S	R	R	R	S	R	R
64	MP3288(C)	R	R	R	R	R	R	R	R	R	R	R	R
65	DBW110(C)	S	S	S	S	R	R	R	S	R	S	S	R
66	CG1036(I)(C)	R	R	S	R	R	R	R	R	R	S	R	R
67	HI1655(I)(C)	R	R	R	S	R	R	R	S	R	R	R	R
68	UAS3020	R	R	R	R	R	R	R	R	R	R	R	R
69	UAS3021	R	R	R	R	R	R	R	R	R	R	R	R
70	MACS6811	S	R	S	R	R	R	R	S	R	S	S	R
71	MACS6809	R	R	R	R	R	R	R	R	R	R	R	R

72	NIAW4183	R	R	R	R	R	R	R	R	R	R	R	R
73	NIAW4153	R	R	S	R	R	R	S	S	R	S	R	R
74	AKAW5314	R	R	S	R	R	R	R	R	R	R	R	R
75	AKAW5100	R	R	S	R	R	S	R	R	R	R	R	R
76	MP1378	S	R	S	R	R	R	R	R	R	S	R	R
77	MP1386	R	R	S	R	R	R	R	S	R	R	R	R
78	DBW443	R	R	R	R	R	R	R	R	R	R	R	R
79	DBW444	R	R	R	R	R	R	R	R	R	R	R	R
80	HD3469	R	R	S	R	R	R	R	R	R	R	R	R
81	NWS2222	S	S	S	S	R	R	S	S	R	S	R	R
82	PWU15	R	R	R	R	R	R	R	R	R	R	R	R
83	WH1306	R	R	S	R	R	R	R	R	R	S	R	R
84	PBW891	S	R	R	R	R	R	R	R	R	S	R	R
85	HI8841(d)	R	R	S	R	R	R	R	R	R	S	R	R
86	UP3083	R	R	S	S	R	R	R	S	R	S	R	R
87	MACS3949(d)(C)	R	R	R	R	S	R	R	S	S	S	R	R
88	HI8826(d)(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R
89	MACS4100(d)(I)(C)	R	R	S	R	S	R	R	S	R	S	R	R
90	MACS6222 (C)	R	R	R	R	R	R	R	R	R	R	R	R
91	HI1672	R	R	R	R	R	R	R	R	R	R	R	R
92	HI1673	R	R	R	R	R	R	R	R	R	R	R	R
93	HI1675	R	R	R	R	R	R	R	R	R	R	R	R
94	DBW394	R	R	R	R	R	S	R	R	R	R	R	R
95	DBW395	R	R	S	R	R	R	R	R	S	S	S	R
96	MACS6814	R	R	S	R	R	R	S	R	R	S	R	R
97	MACS6805	R	S	S	R	R	R	S	S	R	S	R	S
98	NIAW4114	S	R	S	R	R	R	S	R	R	S	R	R
99	NIAW4120	R	R	R	R	R	R	R	R	R	R	R	R
100	UAS3022	R	R	R	R	R	R	R	R	R	R	R	R
101	UAS3023	R	S	S	S	S	S	S	R	R	S	R	R
102	MP3557	R	R	S	S	R	R	R	R	R	S	R	R
103	MP3556	R	R	R	R	R	R	R	R	R	S	R	R
104	PBW897	R	R	R	R	R	R	R	R	R	R	R	R
105	MP1388	R	R	S	S	R	S	R	R	R	S	R	R
106	GW542	R	R	S	R	R	R	R	R	R	S	R	R
107	GW538	R	R	S	R	R	R	R	R	R	S	R	R
108	WH1310	R	S	R	S	R	S	S	S	R	S	S	S

109	LOK79	R	R	R	R	R	R	R	R	R	R	R	R
110	RAJ4083(C)	R	R	R	R	R	R	R	R	R	R	R	R
111	HD3090(C)	R	R	R	R	R	R	R	R	R	R	R	R
112	HI1633(C)	R	R	S	R	R	S	R	R	R	R	R	R
113	UAS478(d)	R	R	R	R	R	R	R	R	R	S	R	R
114	UAS481(d)	R	R	R	S	R	S	R	S	R	S	S	R
115	HI1665	R	R	R	R	R	R	R	R	R	R	R	R
116	HI8840(d)	R	R	R	R	R	R	R	R	R	R	R	R
117	DBW397	R	R	R	R	R	R	R	R	R	R	R	R
118	DDW61(d)	R	R	R	R	R	R	R	R	R	R	R	R
119	NIAW4028	R	R	R	R	R	R	R	R	R	R	R	R
120	HI1605(C)	R	R	S	R	R	R	R	R	R	S	R	R
121	NIAW3170(C)	R	R	S	R	R	R	R	R	R	S	R	R
122	UAS446(d)(C)	R	R	S	R	R	R	R	R	R	S	R	R
123	NIDW1149(d)(C)	R	R	R	S	R	R	R	S	S	S	R	R
124	DBW380	R	R	R	R	R	R	R	R	R	S	R	R
125	DBW370(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R
126	DBW371(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R
127	DBW372(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R
128	PBW872(I)(C)	R	R	R	R	R	R	R	R	R	R	R	R
129	DBW377	R	R	S	R	R	R	R	R	R	S	R	R
130	CG1044	R	R	S	R	R	R	R	R	R	S	S	R
131	GW543	R	R	S	R	R	R	R	R	S	S	R	R
132	DBW187(C)	R	R	S	R	R	R	R	R	R	R	R	R
133	DBW303(C)	R	R	R	R	R	R	R	R	R	R	R	R
134	GW322(C)	R	S	S	R	R	R	R	R	R	S	S	R

Annexure 6: Disease response of IPPSN entries during 2022-23

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
ARS, Niphad											
1	NIAW 4471	6.2	20MS	12.1	40S	21.4	40S	47.5	80S	46	78
2	NIAW 4493	4.5	15MS	12.6	40S	18.7	40S	52.5	80S	57	89
3	NIAW 4497	3.9	10MS	14.8	40S	11.7	40S	47.5	60S	57	99
4	NIAW 4511	1.3	10S	3.0	15MS	14.0	40S	40.0	60S	57	99
5	NIAW 4513	5.6	15MS	4.5	20MS	17.6	60S	46.5	60S	57	89
6	NIAW 4516	4.8	15MS	5.8	10S	13.2	40S	50.5	80S	57	89
7	NIAW 4522	6.9	20S	12.8	40S	14.3	40S	37.3	80S	57	99
8	NIAW 4528	5.0	40MR	5.0	10S	1.7	5S	38.4	60S	57	78
9	NIAW 4533	3.0	10MS	0.5	5MR	4.7	20S	28.4	60S	46	79
10	NIAW 4542	8.3	20S	13.6	30S	15.0	40S	15.5	40MS	46	78
11	NIAW 4546	4.8	20S	6.8	20S	3.1	20S	67.5	80S	57	89
12	NIAW 4547	11.3	20S	12.4	40S	5.0	30S	62.5	80S	58	89
13	NIAW 4559	4.3	20MS	13.0	40S	10.4	60S*	48.3	80S	57	89
14	NIAW 4578	6.8	20S	5.9	20MS	2.0	20MR	35.8	80S	57	89
15	NIAW 4579	4.0	15MS	2.5	20MS	1.2	20MR	35.0	80S	57	99
16	NIAW 4580	4.9	20S	1.8	20MR	14.0	80S	25.5	60S	56	99
17	NIAW 4581	2.5	10MS	2.3	10MS	3.1	20S	20.1	40S	56	99
18	NIAW 4588	6.3	20MS	9.9	30S	18.3	60S	20.1	80S	57	99
19	NIAW 4589	9.4	40MS	10.5	40S	16.0	60S	55.0	60S	45	79
20	NIAW 4601	5.6	10S	14.3	40S	10.9	40S	35.6	60S	67	99
20A	Infector	72.5	100S	75.0	80S	78.6	100S	80.0	80S	78	99
21	NIAW 4612	4.0	10S	6.3	20MS	10.4	60S*	7.3	20S	57	78
22	NIAW 4621	2.4	10MS	3.3	10S	5.6	20MS	7.6	20S	57	99
23	NIAW 4624	2.1	10MS	2.3	10S	0.9	5MS	22.5	40S	67	99
24	NIAW 4628	3.9	10S	6.2	20MS	13.9	80S	18.8	40S	57	89
25	NIAW 4643	8.1	20S	8.0	20S	9.6	40S	8.4	20S	68	99
26	NIDW 1542	5.8	20S	1.8	10S	0.9	5MR	0.3	5MR	57	99
27	NIDW 1555	33.0	60S	7.7	40S	1.1	5MS	1.1	5S	57	89
28	NIDW 1556	10.5	20S	2.8	10S	2.9	20S	1.5	5S	57	78
29	NIDW 1557	9.0	20S	3.0	20MS	0.7	10MR	2.3	10S	57	78
30	NIDW 1561	9.3	20S	5.0	40S	5.7	40S	3.8	20S	57	79
	JNKVV, Sagar										

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
31	JWS-1344	5.5	20S	6.1	20S	11.5	40S	32.3	60S	57	79
32	JWS-1521	6.6	20S	8.1	40S	4.7	20S	59.0	80S	57	89
33	JWS-1528	7.9	20MS	5.5	20MS	7.7	40S	35.0	60S	57	99
34	JWS-1532	18.6	40S	23.0	40S	6.3	20S	77.5	80S	67	99
35	JWS-1553	26.5	60S	25.8	60S	30.0	60S	42.0	60S	57	99
36	JWS-1555	11.0	20S	12.6	40S	13.3	40S	44.0	60S	46	78
37	JWS-1572	1.9	20MR	4.0	10S	10.9	40S	46.5	60S	46	89
38	JWS-1013	5.6	20S	8.0	20MS	13.3	40S	33.8	60S	46	78
39	JWS-1644	13.5	40S	15.5	40S	24.9	60S	41.9	60S	57	89
40	JWS-1613	2.1	10MS	0.7	5S	0.6	5MS	29.3	60S	58	89
40A	Infector	72.5	100S	75.0	80S	78.6	100S	77.5	80S	78	99
41	JWS-1027	6.2	20S	32.6	80S	28.9	60S	50.0	60S	56	99
VNMKV, Parbhani											
42	PBN 0257	8.5	20S	6.9	20S	5.7	40S	1.7	10MS	56	99
43	PBN 1726	5.5	20MS	10.3	20S	23.7	60S	49.5	60S	46	99
44	PBN 1729	6.4	20S	21.6	40S	29.3	60S	44.0	60S	46	78
45	PBN 1738	6.8	20S	4.8	20S	3.4	30MS	18.2	40S	56	78
46	PBN 1760	9.8	20S	13.5	40S	6.4	40S	72.5	100S	46	89
47	PBN 1764	14.3	20S	16.3	60S	2.9	10S	75.0	100S	56	99
48	PBN 1782	4.0	10MS	3.4	20S	2.7	20MS	24.4	40S	57	99
49	PBN 1839	7.0	20S	6.2	20S	20.0	60S	5.9	20S	46	57
50	PBN 1841	8.0	20S	1.8	10MS	2.6	20MS	5.4	10MS	57	99
51	PBN 2115	1.3	10MS	0.8	5MS	0.6	10MR	10.5	40MS	47	78
ARS, Kota											
52	RKD 416-1	18.5	40S	3.4	10S	2.3	20MS	3.4	10S	47	78
53	RKD 416-2	23.0	60S	6.3	20S	5.9	30S	6.0	10S	58	89
54	RKD 418-1	18.0	40S	2.8	20MS	6.4	40S	6.8	20S	57	89
55	RKD 418-2	33.0	80S	5.3	40S	6.4	40S	5.8	20MS	57	99
56	RKD 438	4.5	10S	6.3	20S	2.4	20MS	16.9	40S	47	99
57	RKD 439	7.3	20S	1.1	5MS	0.3	5MR	31.0	60S	57	99
58	RKD 440	3.3	10S	2.8	10S	1.7	10MS	26.4	40S	57	99
59	RKD 442	9.9	20S	13.1	80S*	6.5	40S	30.1	40S	68	99
60	RKD 492	33.3	80S	5.4	20S	3.4	20S	11.8	40S	67	99
60A	Infector	70.0	100S	70.0	80S	75.7	80S	75.0	80S	78	99
61	RKA 502	9.4	20S	10.5	60S	1.1	5S	19.1	40S	57	79

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
62	RKA 504	12.5	40S	3.5	20S	2.6	10S	15.9	40S	47	78
63	RKA 505	10.4	20S	3.9	10S	9.6	40S	28.3	80S	47	89
Lokbharti, Sanosara											
64	LOK-2022-1	4.5	20MS	6.3	40S	0.3	5MR	34.1	60S	68	99
65	LOK-2022-2	12.5	40S	10.8	20S	6.9	20S	29.0	60S	68	99
66	LOK-2022-3	22.5	60S	26.3	60S	2.7	10S	57.5	80S	67	89
67	LOK-2022-4	2.9	20MR	2.0	10S	5.1	20MS	37.0	60S	67	99
68	LOK-2022-5	32.5	80S	8.3	40S	6.4	40S	65.0	80S	68	78
SDAU, Vijapur											
69	VA 2021-19	7.8	20S	1.0	10MS	5.7	40S	72.5	80S	68	78
70	VA 2021-18	2.1	10MS	0.3	5MR	0.3	5MR	57.5	80S	57	89
71	VA 2021-07	4.6	20MS	1.0	10MS	2.9	20S	58.8	80S	57	89
72	VA 2021-06	4.3	20S	1.3	10MS	0.3	5MR	54.0	80S	57	78
73	VA 2021-02	2.1	10MS	2.0	10MS	2.0	10S	55.0	80S	47	78
74	VA 2021-22	4.3	20MS	3.3	20S	2.3	20MS	67.5	100S	67	89
75	VA 2021-21	3.0	20MS	2.3	10S	0.3	5MR	55.0	80S	68	99
76	VA 2021-20	5.1	20MS	4.3	20MS	11.4	40S	48.8	60S	57	99
77	VA 2021-28	4.8	20MS	6.0	40S	5.7	40S	35.0	40S	68	79
78	VA 2021-15	2.9	20MS	1.8	10S	2.1	10MS	26.0	40S	57	79
79	VA 2021-27	8.8	20S	7.3	20MS	7.5	40S	23.8	40S	57	78
80	VA 2021-09	4.0	20MS	1.0	10MS	3.1	20S	50.0	80S	68	89
80A	Infector	67.5	100S	75.0	80S	75.7	80S	77.5	80S	78	89
81	VA 2021-29	3.8	20MS	2.1	10MS	5.7	40S	24.5	40S	68	89
82	VA 2021-13	3.0	20MS	14.8	40S	8.6	40S	45.1	80S	68	78
83	VA 2021-24	3.6	20MS	3.5	20S	2.9	20S	52.5	80S	68	89
84	VA 2021-12	1.3	10MR	1.3	10S	3.4	20S	58.8	100S	67	79
85	VA 2021-10	2.5	10MS	1.8	10S	1.1	10MS	41.0	80S	68	79
86	VA 2021-05	2.4	20MS	1.6	10MS	0.3	5MR	47.6	80S	57	89
87	VA 2021-03	2.3	10MS	1.0	10MS	1.4	10S	47.3	60S	68	99
88	VA 2021-23	0.9	5MS	0.5	5MS	0.6	10MR	34.5	60S	68	99
89	VA 2021-25	3.6	20MS	1.0	10MS	1.3	10MS	53.3	80S	67	78
90	VA 2021-08	1.3	5MS	0.8	5MS	1.1	10MS	47.0	80S	78	99
91	VA 2021-04	4.0	15MS	4.3	20S	2.9	20S	63.8	100S	68	99
92	VD 2021-2	9.0	40S	4.3	20S	3.0	20MS	19.5	80S	57	99
93	VD 2021-6	5.8	20MS	2.8	10S	5.8	40S	9.6	20S	57	99

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
94	VD 2021-9	2.5	10MS	0.3	5MR	5.8	40S	6.9	40S	57	99
95	VD 2021-10	2.6	10MS	2.5	10MS	5.8	40S	31.4	80S	67	99
96	VD 2021-12	8.8	20S	7.0	20S	1.9	5S	9.6	40S	57	99
97	VD 2021-14	1.4	10MS	0.8	5MS	0.3	5MR	8.5	40MS	57	99
98	VD 2021-20	4.5	10S	4.0	20S	0.9	5MS	9.3	40MS	68	89
99	VD 2021-21	2.9	10S	3.8	10S	6.3	40S	52.0	100S	78	99
100	VD 2021-24	3.2	20MS	2.3	10S	0.8	5S	13.3	80S*	68	89
100A	Infector	70.0	100S	70.0	80S	80.0	100S	75.0	80S	78	99
101	VD 2021-28	6.1	20S	2.5	20S	5.7	40S	5.2	20S	57	78
102	VD 2021-4	8.6	20S	6.0	40S	1.2	10MS	5.8	20MS	57	68
103	VD 2021-8	2.9	10MS	2.3	10S	1.2	10MS	5.7	20MS	58	68
104	DR 20-14	12.0	40S	6.0	20S	1.1	5MS	5.1	20MS	68	89
105	DR 20-37	35.0	60S	2.7	10MS	3.0	15S	31.5	60S	68	79
106	DR 20-25	27.5	60S	8.0	40S	2.6	10S	72.5	100S	67	79
107	DR 20-33	17.0	60S	7.5	20S	1.9	20MR	76.0	100S	78	89
108	DR 20-23	33.6	80S	4.5	20S	1.9	10MS	73.5	100S	68	79
ARI, Pune											
109	MACS 4138	37.3	80S	4.5	20S	1.3	5S	11.1	40S	68	89
110	MACS 4139	42.0	80S	2.8	20S	0.7	5S	4.2	10MS	68	99
111	MACS 4140	7.6	20S	2.0	20MS	0.3	5MR	1.9	10S	67	99
112	MACS 4141	9.0	40S	1.0	10MS	6.1	40S	3.4	10MS	57	99
113	MACS 4142	37.5	80S	2.8	20S	3.4	20S	3.7	10MS	57	79
114	MACS 4143	8.3	20S	1.0	10MS	0.7	5S	8.4	20MS	68	78
115	MACS 4144	9.3	40MS	2.3	10S	1.4	10S	1.6	10MS	67	78
116	MACS 4145	3.1	10MS	0.3	5MR	1.3	10MS	4.9	10MS	68	99
117	MACS 4146	6.6	20S	2.8	20S	4.3	30S	3.8	10MS	57	89
118	MACS 4147	8.8	20S	1.0	10MS	2.9	20S	1.3	5MS	57	99
119	MACS 4148	16.3	40S	2.5	20S	0.3	5MR	1.8	5S	57	99
120	MACS 4149	39.8	80S	5.2	40S	5.8	40S	11.5	40S	67	99
120A	Infector	77.5	100S	72.5	80S	75.7	100S	75.0	80S	78	89
121	MACS 4150	16.5	40S	3.0	20S	1.4	20MR	3.9	10MS	58	99
122	MACS 4151	10.0	20S	2.3	10S	1.2	20MR	1.7	10MS	57	99
123	MACS 6850	3.1	20MS	0.8	5MS	1.7	15MS	21.6	60S	57	78
124	MACS 6851	2.5	10S	0.0	R	1.1	10MS	22.9	60S	67	78
125	MACS 6852	5.5	20MS	1.3	10MS	1.1	5MS	26.8	60S	78	99

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
126	MACS 6853	1.0	10MR	1.3	10MS	1.4	20MR	53.5	80S	78	99
127	MACS 6854	1.5	5MS	9.6	40S	9.0	20S	44.5	80S	68	99
128	MACS 6855	4.3	20MS	4.5	20MS	2.3	10S	77.5	100S	68	99
129	MACS 6856	7.0	20MS	3.1	20MS	1.1	5MS	75.0	100S	67	78
130	MACS 6857	3.3	40MR	2.5	10MS	3.1	20S	76.3	100S	78	89
131	MACS 6858	4.5	40MR	3.0	20MS	2.7	10S	62.5	80S	67	89
132	MACS 6859	15.0	40S	18.4	40S	8.4	20S	8.5	20S	57	89
133	MACS 6860	4.8	20MS	3.0	20MS	8.3	40S	14.1	40S	68	78
134	MACS 6861	19.5	60S	3.9	10S	4.1	10S	9.2	40S	58	99
135	MACS 6862	6.7	20S	5.8	20MS	6.6	40S	27.0	40S	68	99
136	MACS 6863	4.8	20MS	3.6	20S	1.1	10MS	16.8	40S	67	79
137	MACS 6864	10.8	40S	2.1	10MS	0.6	10MR	16.3	40S	57	79
138	MACS 6865	6.5	20S	6.3	20MS	4.9	20S	21.6	40S	58	89
139	MACS 6866	6.1	20S	1.5	10MS	0.4	5MR	24.5	40S	67	99
140	MACS 6867	4.0	20S	3.0	10S	6.3	30MS	12.4	40S	57	79
140A	Infector	70.0	100S	80.0	80S	78.6	100S	75.0	80S	78	99
141	MACS 6868	10.8	40S	3.5	10S	3.3	10S	5.9	20MS	57	79
142	MACS 5064	4.8	20MS	1.0	10MS	3.0	20MS	12.7	40S	58	79
143	MACS 5065	10.5	40S	4.8	20MS	2.3	20MS	4.0	10MS	67	78
AAU, Shillongani											
144	ST 11	21.4	40S	16.0	40S	9.6	40S	6.8	20S	57	89
145	ND 15	24.9	60S	22.8	60S	11.6	40S	11.7	40S	68	99
146	RD 43	34.8	60S	22.5	60S	18.4	40S	11.1	40S	57	99
147	TH 73	14.0	30S	20.7	60S	12.4	40MS	10.5	20S	78	78
148	NE 731	25.2	60S	16.0	60S	21.3	40S	19.4	60S	57	99
PDKV, Akola											
149	AKAW - 4662	28.0	60S	10.3	20S	12.1	40S	55.1	80S	68	99
150	AKDW - 5348	6.8	20MS	9.3	20S	1.9	10MS	9.8	40S	78	89
151	AKAW - 5354	19.3	40S	28.5	80S	18.6	60S	47.0	80S	68	99
152	AKAW - 5441	9.8	40S	3.9	20S	2.6	10S	62.5	80S	56	78
153	AKAW - 5444	17.8	40S	20.3	40S	16.5	40S	41.0	80S	57	79
154	AKAW - 5445	14.1	40S	17.3	40S	10.1	40S	44.5	80S	68	99
155	AKAW - 5448	10.2	40S	8.0	10S	3.1	10S	45.8	80S	68	79
156	AKAW - 5513	19.0	40S	14.6	20S	5.7	20S	52.5	80S	57	89
157	AKAW - 5515	17.8	40S	33.8	60S	18.4	60S	52.5	80S	58	78

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
158	AKAW - 5518	11.0	20S	26.0	80S	10.1	40S	53.8	80S	57	78
159	AKAW - 5519	27.3	60S	26.6	60S	21.4	60S	43.9	80S	57	99
160	AKDW - 5520	9.9	40S	6.0	20S	11.4	40S	4.9	20MS	57	99
160A	Infector	75.0	100S	80.0	80S	78.6	100S	75.0	80S	68	89
161	AKAW - 5521	6.3	20MS	3.9	20S	4.7	20S	44.0	80S	68	78
162	AKAW - 5546	28.5	60S	9.8	40S	9.8	40S	10.5	20S	57	89
163	WSM - 141	3.0	20MS	2.3	10MS	5.7	40S	31.0	60S	46	89
RARI, Durgapura											
164	WR 2155	29.8	60S	42.5	80S	25.7	60S	2.7	20S	68	99
165	WR 2156	29.8	60S	25.0	60S	8.6	20S	4.8	20MS	68	78
166	WR 2157	10.9	40S	1.3	10S	6.7	40S	3.3	5S	57	89
167	WR 2158	2.8	20MS	3.5	10S	6.6	20S	19.1	60S	67	99
168	WR 2159	25.5	60S	25.6	60S	22.9	60S	12.9	30S	68	99
169	WR 2160	31.5	80S	34.4	80S	28.1	60S	14.9	40S	68	89
170	WR 2161	6.1	20MS	16.8	60S	14.0	40S	24.5	60S	68	78
171	WR 2162	6.0	20S	3.8	20S	1.4	10S	9.4	20S	78	99
172	WR 2163	6.1	20MS	2.5	20S	5.8	40S	5.6	10S	57	99
173	WR 2164	3.1	10MS	6.2	20S	7.1	20S	1.5	10MS	58	99
174	WR 2165	1.2	10MS	1.0	10MS	6.3	40S	8.4	20S	57	99
175	WR 2166	5.3	20MS	4.0	20S	5.7	40S	9.5	20S	67	89
176	WR 2167	3.8	10S	22.5	60S	24.0	40S	21.3	60S	58	78
177	WR 2168	0.6	10MR	8.3	20S	6.9	20S	34.5	80S	67	99
178	WR 2169	1.1	5MS	8.4	20S	8.6	40S	26.1	60S	57	99
179	WR 2170	12.9	40S	15.5	60S	17.0	80S	15.5	40S	46	78
180	WR 2171	2.4	10MS	1.8	10S	3.0	20MS	38.3	60S	57	78
180A	Infector	75.0	100S	80.0	100S	80.0	100S	75.0	80S	78	99
181	WR 2172	1.2	5MS	4.6	10MS	5.8	20S	21.8	60S	56	99
182	WR 2173	10.5	20S	20.5	40MS	22.3	60S	36.6	80S	57	99
183	WR 2174	1.1	5MS	1.3	10S	1.7	10S	19.5	60S	68	99
184	WR 2175	3.5	20S	5.0	20S	6.1	40S	11.0	40S	47	79
185	WR 2176	13.3	40S	3.2	10S	7.3	40S	7.6	20S	47	79
186	WR 2177	8.0	20S	9.6	20S	1.1	20MR	20.4	40S	58	79
187	WR 2178	7.0	40S	17.4	60S	7.9	20S	5.3	20S	67	99
188	WR 2179	13.5	40S	26.1	80S	21.3	60S	26.1	60S	78	99
189	WR 2180	14.5	40S	25.0	60S	19.0	40S	28.1	80S	56	78

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
190	WR 2181	2.0	10MS	7.7	20S	10.0	40S	9.4	20MS	57	89
191	WR 2182	8.3	20S	23.5	80S	25.3	60S	5.1	20S	56	99
192	WR 2183	22.0	40S	31.6	60S	30.6	60S	17.3	40S	57	99
193	WR 2184	4.6	20S	3.4	10S	3.7	30MS	10.0	20S	57	78
194	WR 2185	10.3	40S	6.1	40S	3.0	10MS	11.9	40S	57	99
195	WR 2186	6.0	20S	6.0	40S	6.3	40S	13.9	40S	57	99
196	WR 2187	10.4	40S	12.0	20S	5.3	10S	8.2	20S	68	78
197	WR 2188	10.5	40S	7.5	40S	10.1	40S	13.3	40MS	67	79
198	WR 2189	4.0	10MS	1.5	20MR	3.4	20S	14.6	40S	57	68
UAS, Dharwad											
199	UASD-2201	6.1	20S	7.4	40S	1.5	5S	33.3	80S	47	67
200	UASD-2202	3.0	10MS	3.9	10S	3.5	10S	6.9	20MS	56	68
200A	Infector	72.5	100S	77.5	100S	78.6	100S	75.0	80S	78	99
201	UASD-2203	5.6	20S	2.8	10S	1.8	20MR	3.4	10S	56	89
202	UASD-2204	0.4	5MR	1.3	10S	2.9	20S	29.6	60S	57	99
203	UASD-2205	4.3	20MS	6.9	30S	2.1	5S	8.6	40S	57	99
204	UASD-2206	2.0	5MS	0.5	5.MS	0.2	TMS	3.0	10S	57	89
205	UASD-2207	5.5	20MS	1.9	10S	0.9	5MS	1.8	10S	46	89
206	UASD-2208	5.5	20MS	2.8	10S	1.8	20MR	12.0	40S	57	89
207	UASD-2209	2.6	10MS	4.1	20MS	2.1	10S	7.8	20S	57	79
208	UASD-2210	5.0	20MS	2.5	10MS	1.5	10S	6.0	20S	57	99
209	UASD-2211	4.3	20MS	1.5	10MS	1.1	5S	5.5	20S	57	99
210	UASD-2212	6.0	20MS	2.0	10MS	1.0	10MR	2.3	10S	56	99
211	UASD-2213	20.5	40S	3.8	10MS	0.9	5MS	5.6	20S	57	78
212	UASD-2214	21.1	40S	7.6	20S	0.9	5MS	41.5	80S	57	78
213	UASD-2215	11.4	20S	3.7	10S	1.7	10S	32.1	80S	57	78
214	UASD-2216	1.3	5MS	0.0	R	1.3	10MS	27.1	60S	57	89
215	UASD-2217	25.6	60S	2.6	10S	1.4	10MS	0.7	5MS	46	89
216	UASD-2218	11.0	20S	12.4	40S	1.5	5S	4.8	10S	47	57
217	UASD-2219	45.5	80S	5.3	20MS	6.3	40S	25.1	60S	57	89
218	UASD-2220	6.5	20S	8.5	60S	1.7	20MR	8.1	20MS	67	78
219	UASD-2221	5.8	20MS	3.3	20MS	0.0	R	1.4	5S	57	79
220	UASD-2222	4.3	20MS	2.5	20MS	1.1	5MS	2.4	10S	67	99
220A	Infector	75.0	80S	80.0	100S	78.6	100S	75.0	80S	78	99
221	UASD-2223	3.0	10MS	2.5	10MS	0.9	10MR	26.5	80S	57	99

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
222	UASD-2224	1.4	10S	2.8	20MS	0.9	5MR	16.6	40S	46	58
223	UASD-2225	2.8	15MS	3.5	10S	2.7	20MR	17.1	60S	46	58
224	UASD-2226	3.5	10MS	4.0	20MS	2.9	20S	5.5	10S	47	58
225	UASD-2227	3.8	15S	2.6	20MS	2.0	10MS	37.5	60S	47	68
226	UASD-2228	2.6	10MS	1.1	5S	0.9	5MS	2.9	20MS	57	68
227	UASD-2229	21.3	40S	0.5	5MS	1.1	10MS	4.1	20S	68	99
228	UASD-2230	4.9	20S	2.3	10MS	1.1	10MS	34.0	60S	68	99
229	UASD-2231	12.6	40S	1.7	10MS	2.3	20MS	24.3	60S	57	78
230	UASD-2232	2.4	10MS	0.5	5MS	3.4	30MS	4.2	20S	57	99
231	UASD-2233	2.6	10MS	1.3	10MS	1.0	5S	0.3	TS	67	78
232	UASD-2234	12.4	40S	3.8	10S	4.9	20S	18.1	60S	57	78
233	UASD-2235	10.0	20S	2.8	20S	4.7	20S	28.0	60S	58	79
HPKV, Malan											
234	PW 2201	7.6	20S	6.5	20S	10.3	20S	12.6	40S	57	78
235	PW 2202	7.5	20MS	2.9	10S	7.1	30MS	12.9	40S	67	99
236	PW 2203	20.4	40S	3.3	20MS	2.0	10S	15.6	60S	67	89
237	PW 2204	5.8	10S	7.8	20S	8.9	40S	17.3	40S	68	89
238	PW 2205	11.0	20S	7.6	20S	17.7	60S	33.0	80S	68	89
239	PW 2206	7.5	20MS	6.5	20MS	13.1	40S	30.1	60S	68	89
240	PW 2207	7.5	20MS	8.0	40S	9.3	40S	10.3	40S	68	89
240A	Infector	75.0	100S	80.0	100S	75.7	100S	75.0	80S	78	89
241	PW 2208	12.0	40S	19.3	60S	11.9	40S	0.6	5MS	68	99
242	PW 2209	12.3	20S	19.0	40S	21.7	60S	11.6	40S	68	99
243	PW 2210	14.5	40S	12.7	20S	12.3	40S	27.0	60S	57	68
244	PW 2211	18.0	40S	15.9	60S	14.9	40S	2.4	10MS	57	89
245	PW 2212	4.0	10S	7.1	20MS	5.3	20S	28.1	80S	68	89
246	DW 293	6.9	20MS	13.8	40S	21.9	60S	28.0	60S	68	79
247	DW 294	2.7	15MS	4.7	10S	4.3	20S	28.4	80S	67	78
248	DW 298	0.8	5MS	6.1	20MS	11.3	40S	17.3	60S	67	78
ANDUAT, Ayodhya											
249	NW-8078	6.4	20S	6.3	20S	8.6	40S	10.5	20MS	57	78
250	NW-8079	1.5	5MS	15.8	40S	22.3	60S	21.0	40S	47	68
251	NW-8080	5.0	20S	6.6	40S	6.9	40S	18.1	40S	57	78
252	NW-8081	2.6	10MS	2.7	10S	2.2	10S	6.5	20S	57	78
253	NW-8082	12.5	40S	9.0	40S	7.5	40S	3.1	10S	57	79

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
254	NW-8083	5.1	10S	6.6	20MS	8.9	40S	20.5	40S	56	78
255	NW-8084	1.3	10MS	5.0	20MS	5.3	20S	12.4	40S	57	99
256	NW-8085	3.9	20MS	2.5	20S	3.8	20MS	8.6	20S	45	78
257	NW-8086	7.8	20S	7.3	40S	7.6	20S	13.6	40S	57	78
258	NW-8087	7.0	20S	0.9	10MR	8.7	40S	7.9	20MS	57	89
259	NW-8088	3.8	10S	10.1	40MS	5.6	20S	30.0	40S	58	79
260	NW-8089	6.8	20S	1.0	10MS	2.0	10MS	12.6	40MS	56	68
260A	Infector	72.5	100S	80.0	100S	78.6	100S	77.5	80S	78	99
261	NW-8090	5.4	20MS	6.3	20S	0.7	5S	12.9	40S	56	68
262	NW-8091	2.8	10S	1.3	10S	1.1	10MS	28.9	60S	57	79
263	NW-8092	2.3	10S	7.1	40S	5.7	20S	33.3	60S	57	78
264	NW-8093	7.6	20S	3.3	20S	4.5	20MS	17.6	60S	57	78
265	NW-8094	1.1	10MR	0.0	R	1.7	10S	4.2	10MS	57	78
266	NW-8095	6.9	20S	3.1	10S	3.8	20S	4.9	10S	56	68
267	NW-8096	2.2	10MS	1.6	10S	1.1	20MR	17.8	60S	57	78
268	NW-8097	12.8	40S	5.4	10S	10.4	60S*	37.4	60S	57	78
269	NW-8098	5.0	20S	1.9	10S	5.8	20S	15.8	40S	57	67
270	NW-8099	2.6	10S	3.5	10MS	7.0	40S	12.1	40S	57	68
271	NW-8100	2.1	5S	2.2	10MS	7.6	40S	10.0	20S	58	78
272	NW-8101	4.2	20MS	2.3	10MS	3.4	10S	12.1	40S	57	68
273	NW-8102	6.6	20S	3.0	10S	8.5	40S	7.4	40MS	57	78
GBPUAT, Pantnagar											
274	UPW-1	7.3	20MS	5.6	20S	6.3	20S	46.5	60S	36	57
275	UPW-2	5.1	20S	3.6	20S	5.0	20S	36.1	60S	46	57
276	UPW-3	4.0	10S	1.3	10S	7.5	40S	31.6	60S	46	68
277	UPW-4	3.6	10S	1.0	10MS	6.6	20S	9.4	40S	46	58
278	UPW-5	5.6	10S	5.2	30S	4.6	20MS	56.3	80S	47	78
279	UPW-6	3.0	20MR	0.5	10MR	1.9	10MS	57.5	80S	67	99
280	UPW-7	5.3	20MS	1.3	10MS	3.6	20S	3.7	10MS	46	78
280A	Infector	72.5	100S	80.0	100S	81.4	100S	75.0	80S	78	89
281	UPW-8	3.2	15MS	4.5	20MS	8.9	40S	31.6	60S	47	57
282	UPW-9	10.3	40MS	8.3	20S	18.1	60S	35.5	60S	47	78
283	UPW-10	6.6	20S	4.3	10S	4.1	20S	20.6	40S	57	89
284	UPW-11	7.3	20S	8.3	40S	9.5	40S	35.5	60S	47	68
285	UPW-12	10.6	40S	4.8	20S	9.3	40S	5.9	10S	46	47

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
286	UPW-13	3.3	10S	5.8	40S	4.4	20MS	33.0	60S	35	58
287	UPW-14	8.1	20MS	3.6	20S	12.3	60S*	6.1	20S	46	56
288	UPW-15	5.3	20MS	1.5	10S	8.6	40S	28.5	60S	57	57
289	UPW-16	1.8	10S	1.8	10S	4.1	20S	35.0	60S	46	58
290	UPW-17	7.9	20MS	7.8	40S	7.3	40S	42.6	60S	47	58
291	UPW-18	30.6	60S	5.1	20MS	0.3	5MR	24.8	60S	57	78
292	UPW-19	8.9	40S	3.0	20S	2.4	10S	27.1	60S	46	56
293	UPW-20	1.0	5MS	2.4	10S	7.3	40S	9.7	20S	57	89
294	UPW-21	17.0	40S	6.6	20S	5.3	20MS	45.3	60S	57	78
295	UPW-22	16.9	60S	3.4	10S	4.1	20S	34.6	60S	57	78
296	UPW-23	6.9	20MS	3.0	20S	3.4	30MS	18.6	40S	47	58
297	UPW-24	2.7	10MS	7.2	20S	12.1	40S	20.4	40S	56	78
298	UPW-25	10.0	20S	5.5	20S	7.1	40S	11.6	40MS	57	68
299	UPW-26	5.0	10S	3.0	20S	0.1	TMR	30.3	60S	57	67
300	UPW-27	5.8	20S	8.0	60S*	11.4	40S	9.3	20S	56	67
300A	Infector	75.0	100S	80.0	100S	78.6	100S	80.0	80S	79	99
301	UPW-28	5.4	20S	0.5	5MS	2.9	10S	7.4	20S	57	79
302	UPW-29	6.4	20S	0.5	5MS	0.6	5MS	9.4	20S	57	78
303	UPW-30	2.0	20MR	1.3	10MS	1.1	10MS	4.4	20MS	57	78
304	UPW-31	2.3	10MS	15.3	40S	17.6	60S	11.9	20S	57	78
305	UPW-32	5.3	20MS	20.3	40S	20.0	60S	12.0	20S	68	89
306	UPW-33	9.0	20S	5.5	10S	15.8	60S	18.1	40S	67	89
307	UPW-34	4.0	10S	1.0	10MS	7.1	20S	6.4	10S	57	78
308	UPW-35	4.5	20MS	3.1	10S	5.4	20S	18.3	40S	57	68
309	UPW-36	11.4	30S	11.8	30S	14.9	40S	11.3	40MS	57	78
310	UPW-37	3.0	10S	10.1	40S	1.7	5S	8.3	20S	57	78
311	UPW-38	5.0	10S	0.0	R	0.3	5MR	26.6	60S	56	68
312	UPW-39	12.5	40S	5.8	30S	12.3	40S	22.5	60S	67	89
313	UPW-40	1.1	5MS	1.3	10S	1.4	10S	16.8	40S	57	78
314	UPW-41	5.0	10S	2.1	10MS	4.4	30S	23.0	40S	46	57
315	UPW-42	2.1	10MS	2.8	10S	1.1	10MS	1.8	10MS	46	68
316	UPW-43	5.0	20S	4.8	20MS	0.9	5MS	26.6	60S	46	67
317	UPW-44	1.2	20MR	0.3	5MR	0.3	5MR	47.5	80S	46	58
318	UPW-45	2.3	5S	3.4	10S	12.7	60S*	10.9	40MS	46	58
319	UPW-46	18.0	40S	10.4	20S	8.3	40S	38.6	60S	47	58

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
320	UPW-47	9.5	40S	9.0	40S	10.9	40S	35.8	60S	67	89
320A	Infector	70.0	100S	80.0	100S	78.6	100S	77.5	80S	78	99
321	UPW-48	6.5	20MS	6.4	40S	1.0	5S	1.7	10MS	36	57
322	UPW-49	4.4	10MS	2.6	10S	0.6	5MS	3.9	10MS	46	58
323	UPW-50	12.5	40S	2.7	10MS	5.0	30S	9.9	40S	46	67
BAU, Ranchi											
324	JKW 311	11.4	40S	11.8	20S	9.8	60S*	45.8	80S	46	67
325	JKW 312	3.8	20MS	11.1	40S	11.3	40S	14.9	40S	57	78
326	JKW 313	19.1	60S	9.6	20S	6.5	40S	49.4	80S	57	68
327	JKW 314	10.5	40S	9.1	40S	12.4	40S	34.6	60S	57	89
328	JKW 315	5.2	20MS	1.9	10MS	7.4	40S	1.9	5MS	47	89
329	JKW 316	5.9	20MS	4.3	10MS	10.0	40S	23.9	60S	47	68
330	JKW 317	4.8	20MS	1.9	10S	4.4	20S	12.0	40S	47	78
331	JKW 318	2.3	10MS	3.6	20MS	6.4	20S	8.4	20S	46	68
332	JKW 319	6.8	20S	4.8	20S	5.7	40S	14.1	40MS	47	68
333	JKW 320	8.4	40S	7.9	20S	7.7	40S	7.4	20MS	57	68
MPUAT, Udaipur											
334	PWU 7	2.9	10S	6.4	20S	4.6	20S	35.4	60S	57	78
335	PWU 38	14.9	40S	13.9	40S	11.2	40S	14.4	40S	67	99
336	PWU 43	2.0	20MS	7.8	20MS	7.1	40S	30.5	60S	57	89
337	PWU 50	2.8	10MS	1.8	10MS	1.1	10MS	58.8	80S	57	78
338	PWU 52	2.8	10S	0.2	5R	5.8	40S	8.6	40S	67	89
339	PWU 86	1.4	5S	1.4	10S	1.4	10S	46.8	80S	57	78
340	PWU 87	4.3	20S	1.3	10MS	1.2	20MR	12.9	60S	57	78
340A	Infector	72.5	100S	80.0	100S	75.7	100S	77.5	80S	68	99
341	PWU 88	1.6	5MS	3.1	20S	1.1	20MR	6.2	20MS	68	99
342	PWU 112	2.1	5S	0.0	R	2.7	10S	0.1	TS	67	99
343	PWU 114	9.8	40S	2.0	10MS	5.0	20S	2.6	10S	57	99
JNKVV, Powarkheda											
344	PKD-IPPSN-2023-01	2.5	10S	1.8	10MS	6.5	40S	1.9	10MS	57	99
345	PKD-IPPSN-2023-02	1.3	5MS	1.5	10MS	5.8	40S	0.6	5MS	57	99
346	PKD-IPPSN-2023-03	6.4	20MS	3.5	20S	9.3	40S	14.4	40S	57	78
347	PKD-IPPSN-2023-04	4.4	20MS	10.9	20S	11.6	40S	45.8	60S	46	67
348	PKD-IPPSN-2023-05	0.2	5R	1.3	10MS	3.0	10S	20.3	60S	57	99
349	PKD-IPPSN-2023-06	5.5	20S	4.1	10S	3.2	20S	36.1	60S	68	78

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
350	PKD-IPPSN-2023-07	10.0	40S	4.5	10S	5.1	20MS	22.4	40S	67	99
351	PKD-IPPSN-2023-08	3.8	10MS	2.9	10S	2.9	10S	31.1	60S	57	78
352	PKD-IPPSN-2023-09	2.4	10S	2.9	10S	5.6	20MS	32.0	60S	47	68
353	PKD-IPPSN-2023-10	3.2	10S	4.8	10S	5.6	20S	4.7	10MS	57	78
354	PKD-IPPSN-2023-11	1.9	10MS	2.3	10S	2.4	10MS	3.8	10MS	68	99
355	PKD-IPPSN-2023-12	2.8	10S	21.0	80S	9.0	40S	37.3	60S	57	99
356	PKD-IPPSN-2023-13	1.2	10MS	0.8	5MS	11.4	60S	34.1	60S	57	99
357	PKD-IPPSN-2023-14	5.7	20MS	10.3	30S	18.6	60S	44.8	80S	67	99
358	PKD-IPPSN-2023-15	2.0	20MR	3.6	20S	4.9	20S	7.3	40MS	46	89
359	PKD-IPPSN-2023-16	8.1	30S	4.4	10S	13.7	40S	18.7	60S	57	78
360	PKD-IPPSN-2023-17	6.6	20MS	9.0	30S	14.3	60S	26.4	60S	57	99
360A	Infector	70.0	100S	77.5	100S	75.7	100S	75.0	80S	78	99
361	PKD-IPPSN-2023-18	2.4	10MS	2.7	10S	6.4	20S	24.8	60S	56	99
362	PKD-IPPSN-2023-19	11.9	30S	13.6	40S	8.5	20S	6.0	10S	56	99
363	PKD-IPPSN-2023-20	0.5	5MS	1.3	10S	1.5	10S	20.0	60S	57	99
364	PKD-IPPSN-2023-21	6.4	20S	7.8	30S	12.9	40S	4.7	10MS	57	99
365	PKD-IPPSN-2023-22	4.4	30MR	6.3	20S	0.7	10MR	5.0	10MS	57	78
366	PKD-IPPSN-2023-23	3.4	10S	4.0	20S	0.9	5MS	30.8	60S	57	89
367	PKD-IPPSN-2023-24	2.3	10MS	4.5	20S	6.1	40S	26.8	40S	67	99
368	PKD-IPPSN-2023-25	4.5	30MR	2.5	10MS	1.8	10S	10.1	40S	57	78
369	PKD-IPPSN-2023-26	2.7	10MS	1.3	10S	3.2	10S	30.9	60S	67	99
370	PKD-IPPSN-2023-27	3.4	10MS	0.8	10MR	1.5	10S	36.0	60S	57	89
371	PKD-IPPSN-2023-28	3.3	15MS	1.8	10S	3.1	10S	29.1	60S	57	99
372	PKD-IPPSN-2023-29	4.6	15S	4.0	20S	3.0	10S	30.6	60S	56	99
373	PKD-IPPSN-2023-30	2.6	10S	5.5	20S	15.0	60S	28.6	60S	57	99
UBKV, Coochbehar											
374	UBKV-2022-1	7.3	20S	6.4	20S	4.0	10S	16.3	40S	56	99
375	UBKV-2022-2	2.9	10S	9.3	20S	9.0	40S	12.9	40S	46	78
376	UBKV-2022-3	1.8	10MS	2.3	10MS	1.5	10S	10.9	40S	57	89
377	UBKV-2022-4	4.1	10S	2.3	10S	1.5	10S	10.0	40S	57	89
378	UBKV-2022-5	10.8	20S	10.6	40S	4.9	20MS	14.6	40S	68	99
379	UBKV-2022-6	18.9	40S	3.0	20S	0.6	10MR	18.6	60S	57	99
380	UBKV-2022-7	3.5	10S	2.1	10MS	12.0	60S	15.0	40S	57	99
380A	Infector	70.0	100S	77.5	80S	75.7	100S	80.0	80S	78	99
381	UBKV-2022-8	9.6	20S	10.1	40S	11.5	40S	38.4	60S	45	99

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
382	UBKV-2022-9	8.0	20S	16.4	40S	22.9	60S	48.8	80S	46	89
383	UBKV-2022-10	6.4	10S	24.3	80S	24.3	60S	38.3	60S	57	99
BCKV, Kalyani											
384	BCW 31	8.9	40S	4.0	20S	6.4	20S	16.5	40S	68	99
385	BCW 32	4.6	10MS	2.0	10S	11.0	40S	6.1	20MS	57	89
386	BCW 33	2.2	10MS	0.5	5MS	2.4	10S	31.4	60S	57	99
387	BCW 34	8.1	20S	1.0	5MS	2.9	10S	24.9	60S	57	89
388	BCW 35	3.6	10S	0.0	R	4.9	10S	5.1	20S	56	99
389	BCW 36	1.8	10S	6.1	40S	5.0	20MS	35.8	60S	46	99
390	BCW 37	8.4	20MS	8.3	20S	12.7	60S	18.5	40S	57	99
391	BCW 38	6.5	15S	6.9	10S	1.8	5S	25.0	60S	57	67
392	BCW 39	2.5	10S	3.0	10MS	8.3	40MS	27.8	60S	68	99
393	BCW 40	10.1	40S	3.8	10S	2.3	10S	14.9	40S	78	99
CSSRI, Karnal											
394	KRL 2206	5.3	20S	1.8	10S	1.4	10MS	4.5	20S	46	89
395	KRL 2207	36.4	80S	12.3	40S	0.9	10MR	18.2	60S	57	99
396	KRL 2208	21.0	40S	1.5	10MS	0.7	10MR	22.3	40S	57	99
397	KRL 2209	21.5	40S	11.3	60S*	11.9	40S	20.5	40S	56	78
398	KRL 2210	3.0	10MS	2.0	10S	1.1	20MR	32.5	60S	47	68
399	KRL 2211	5.3	20S	8.4	40S	3.3	10S	21.1	40S	47	68
400	KRL 2212	2.8	10S	7.5	20S	6.3	20S	13.1	40S	57	68
400A	Infector	70.0	100S	77.5	80S	78.6	100S	75.0	80S	78	99
401	KRL 2213	2.8	10MS	2.6	10S	8.6	30MS	7.3	20S	67	99
402	KRL 2214	1.3	10S	8.7	40S	18.4	60S	11.1	40S	57	99
403	KRL 2215	11.1	40S	2.5	10MS	17.9	80S	8.8	40S	56	68
BAU, Sabour											
404	BRW3948	5.5	20MS	9.3	20S	16.4	40S	22.3	60S	57	68
405	BRW3949	8.8	20S	11.3	20S	23.9	60S	39.0	60S	57	78
406	BRW3950	0.8	5MS	0.0	R	8.7	40S	39.0	60S	57	68
407	BRW3951	13.8	40S	9.8	20S	22.6	60S	37.8	60S	57	68
408	BRW3952	33.8	60S	24.0	40S	29.0	60S	35.5	60S	56	78
409	BRW3953	2.1	10S	2.8	10S	3.7	10S	18.8	40S	57	78
410	BRW3954	5.6	20S	1.3	10S	0.7	5S	19.8	40S	56	99
411	BRW3955	6.4	20S	4.1	10S	4.1	10S	25.8	60S	46	68
412	BRW3956	6.1	20MS	6.9	20S	11.3	40S	34.5	60S	57	78

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
413	BRW3957	3.1	10S	4.0	10S	4.9	20S	16.8	40S	57	78
414	BRW3958	9.9	40S	5.1	20S	1.4	5MS	27.0	40S	46	68
415	BRW3959	11.4	40S	1.2	5S	1.7	10S	16.0	40S	57	99
416	BRW3960	8.3	20S	0.0	R	5.7	40S	6.3	10S	57	68
417	BRW3961	6.5	20S	6.7	20S	15.6	60S	43.3	60S	57	67
418	BRW3962	4.9	15MS	4.0	20S	7.9	40S	5.2	20S	46	57
419	BRW3963	3.1	10MS	2.6	10S	0.0	R	24.0	60S	46	58
420	BRW3964	3.1	10MS	5.5	10S	1.0	5S	17.8	40S	68	89
420A	Infector	72.5	100S	80.0	80S	75.7	100S	75.0	80S	89	99
421	BRW3965	13.3	40S	2.9	10S	1.9	20MR	45.0	60S	46	57
422	BRW3966	5.6	10S	7.6	20S	12.3	60S	24.0	40S	46	68
423	BRW3967	15.0	40MS	11.0	40S	10.7	40S	11.0	20S	56	58
SKUAST, Kashmir											
424	SKW-377	2.2	10MS	9.0	40S	6.1	20S	11.5	40S	57	99
425	SKW-378	3.7	20S	2.3	10S	0.9	5MS	22.5	60S	57	78
426	SKW-379	3.1	10MS	3.8	20S	3.0	20MS	24.8	40S	57	78
427	SKW-380	4.6	15S	2.3	10S	7.4	20S	29.5	60S	58	78
428	SKW-381	9.3	20S	4.6	10S	26.4	40S	19.3	40S	67	78
429	SKW-382	1.2	10MR	0.7	10MR	1.8	20MR	2.3	10S	57	78
430	SKW-383	7.5	20S	13.9	40S	16.3	40S	6.4	40S	57	78
431	SKW-384	6.1	15MS	1.0	10MS	0.0	R	3.0	10MS	57	58
432	WGS-9018	5.0	10S	6.0	20MS	9.0	40S	23.9	60S	57	78
433	WGS-3036	8.6	40S	11.9	20S	10.3	40S	9.7	40S	68	99
434	WGS-1051	5.0	20S	5.3	10S	2.3	20MS	16.3	40S	67	78
435	WGS-4021	8.0	20S	11.5	20S	12.1	40S	5.6	20MS	57	99
436	WGS-5012	4.3	10S	22.3	60S	15.4	40S	21.1	40S	67	99
JAU, Junagadh											
437	J 21-01	1.4	10MS	7.6	60S	2.9	20S	65.0	80S	57	99
438	J 21-07	1.6	10MS	0.5	5MS	5.7	40S	52.3	80S	67	99
439	J 21-09	2.6	10MS	1.1	5S	2.9	20S	50.0	80S	68	79
440	J 21-15	3.0	10MS	1.6	10MS	3.6	20S	65.0	80S	67	89
440A	Infector	70.0	100S	80.0	80S	75.7	100S	75.0	80S	78	99
441	J 21-16	6.5	20S	6.1	40S	2.9	20S	61.3	80S	67	89
442	J 21-18	2.3	20MR	0.3	5MR	5.7	40S	54.8	80S	67	79
443	J 21-22	6.4	20S	23.0	40S	26.0	80S	50.0	80S	78	99

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
444	J 21-27	6.3	20MS	0.6	5MS	1.7	15MS	50.0	80S	78	99
445	J 21-28	11.0	20S	31.3	80S	24.7	80S	58.1	80S	68	99
446	J 21-29	2.8	10MS	0.8	5MS	4.0	30MS	59.4	80S	78	99
447	J 21-30	2.8	10MS	0.3	10R	5.7	40S	62.5	80S	68	89
448	J 21-33	1.1	10MR	0.5	5MS	2.9	20S	39.9	80S	68	89
449	J 21-34	3.8	20MS	0.3	5MR	0.9	15MR	60.6	80S	78	89
450	J 21-36	12.1	40S	14.9	40S	14.3	40S	54.8	80S	78	99
451	J 21-37	15.6	40S	12.5	20S	12.1	40S	48.8	80S	78	89
452	J 21-38	2.9	10MS	0.5	5MS	0.6	10MR	54.8	80S	78	99
453	JD 21-05	24.0	60S	1.5	10MS	2.7	10S	3.9	10MS	67	99
454	JD 21-07	32.5	80S	2.0	20MS	2.1	15MR	8.7	40MS	68	79
455	JD 21-10	4.4	10MS	3.0	20S	2.9	20S	2.2	10MS	67	99
456	JD 21-16	2.1	10MS	1.6	10MS	1.1	20MR	3.5	10MS	57	78
HAU, Hisar											
457	P 14127	5.0	20S	1.3	10S	3.4	10S	7.4	20S	57	99
458	P 14128	5.4	15MS	2.3	10S	11.7	40S	7.0	20S	46	78
459	P 14155	7.5	20S	4.0	20S	7.7	20S	10.3	40S	57	99
460	P 14156	4.0	10S	7.0	40S	9.7	40S	13.1	40S	57	68
460A	Infector	70.0	100S	77.5	80S	78.6	100S	75.0	80S	78	99
461	P 14158	3.6	10S	11.0	30S	10.9	60S*	12.9	40MS	57	78
462	P 14168	4.5	15MS	4.5	20MS	9.0	40S	10.9	40S	57	78
463	P 14174	7.9	20S	10.0	40S	4.3	20S	11.3	40S	57	78
464	P 14177	10.1	20S	6.3	40S	6.9	40S	11.1	40S	57	99
465	P 14178	7.5	20S	9.5	40S	11.4	40S	16.1	40S	57	99
466	P 14180	3.6	10S	12.6	60S	12.1	40S	29.3	80S	67	99
467	P 14246	29.8	60S	22.8	60S	23.6	40S	23.8	80S	67	99
468	P 20005	12.3	60S	18.2	40S	9.9	40S	24.3	80S	56	99
469	P 20006	9.0	20S	16.5	40S	5.4	30MS	13.1	40S	68	99
470	P 20021	9.4	20S	5.3	40S	9.2	40S	8.0	20MS	57	78
471	P 30004	11.6	40S	12.8	40S	3.4	10MS	28.9	60S	56	99
472	P 30005	3.5	20MS	2.0	10MS	9.9	60S*	25.5	60S	56	68
473	P 30007	11.3	40S	7.5	20S	2.7	10S	10.5	40S	57	68
474	P 30008	12.4	40S	3.1	10S	5.6	20MS	3.4	10MS	46	68
475	P 30009	11.8	40S	1.0	10MS	5.0	20S	16.1	40S	56	78
476	P 30012	4.0	10S	2.8	10MS	1.4	10S	13.1	40S	57	99

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
477	P 30013	2.3	10MS	4.3	15MS	2.0	10S	12.5	40S	56	99
478	P 9001	4.6	20MS	1.0	10MS	4.9	30MS	4.4	20MS	57	99
479	P 9009	5.5	20S	0.5	5MS	2.3	20MR	11.2	40S	57	99
480	P 9043	9.3	40S	0.5	5MS	2.2	10S	2.0	10S	57	99
480A	Infector	72.5	100S	77.5	80S	75.7	100S	77.5	80S	78	99
481	P13855	18.5	80S	2.9	10MS	2.9	20S	27.8	60S	57	99
482	P13935	7.3	20S	11.3	30S	22.0	40S	32.6	60S	57	99
483	P13938	7.8	20S	0.5	5MS	5.1	20MS	17.4	40S	57	99
484	P13982	2.7	10MS	3.1	10S	6.4	20S	11.2	40S	57	78
485	P 14153	9.9	40S	5.8	20S	12.9	40S	3.6	10S	57	99
486	P 14165	6.6	20S	4.3	20S	6.1	20S	21.1	40S	67	99
487	P 14169	7.3	20S	4.8	10S	7.7	40S	11.3	40S	67	99
488	P 14172	12.9	20S	8.4	20MS	7.9	40S	18.7	60S	68	99
489	P 14183	11.6	40S	7.9	20S	9.5	40S	9.9	40S	67	99
490	P 14917	8.6	20S	21.3	60S	7.6	20S	10.0	40S	56	78
491	P 14214	13.0	40S	13.0	40S	10.4	40S	10.5	40S	57	68
492	P 14217	8.0	20S	17.3	60S	9.9	40S	12.2	40S	56	99
493	P 14501	10.8	40S	6.8	20S	1.8	10S	10.8	40S	58	78
494	P 14502	16.0	40S	12.8	40S	4.9	20S	17.1	40S	56	68
495	P 14503	9.8	20S	21.3	60S	8.9	40S	20.9	40S	57	78
496	P 14293	13.4	40S	10.5	60S*	15.7	40S	4.8	10S	57	78
497	P 14294	24.0	60S	13.0	40S	9.0	20S	10.4	40S	57	78
498	P 14295	33.3	80S	19.9	60S	16.7	40S	17.1	40S	57	78
499	P 14296	35.4	80S	25.0	60S	14.9	40S	11.3	40S	67	89
500	P 14297	36.8	80S	22.5	80S	10.4	40S	16.3	40S	57	89
500A	Infector	72.5	100S	77.5	80S	78.6	100S	77.5	80S	78	99
501	P 14298	17.1	40S	7.9	20S	9.1	40S	14.4	40S	57	78
502	P 14299	4.3	10MS	2.5	10MS	6.9	40S	17.4	40S	57	58
503	P 14300	19.6	80S	5.8	20S	5.7	20S	10.8	40S	57	68
504	P 14301	26.6	80S	11.4	20S	10.7	40S	5.1	10S	57	78
505	P 14302	34.0	80S	18.9	40S	8.6	40S	5.2	10S	56	78
506	P 14303	9.0	20S	2.1	10S	3.4	10S	25.9	60S	57	78
Nuziveedu Seeds											
507	NWS2124	12.1	40S	7.8	20S	6.6	20S	2.5	10MS	57	78
508	NWS2205	14.1	40S	1.7	10MS	2.9	20S	45.0	60S	46	67

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
509	NWS2240	9.4	40S	4.7	10S	13.4	40S	12.7	60S	46	78
510	NWS2237	6.1	20S	3.8	10S	12.0	40S	28.3	60S	57	78
RPCAU, Pusa											
511	RAUW113	6.6	20MS	4.5	20S	6.4	20S	30.1	60S	57	78
512	RAUW114	2.6	10MS	13.6	60S	7.6	20S	10.6	20S	58	99
513	RAUW115	11.1	40S	5.0	20MS	14.0	40S	11.4	40S	57	78
514	RAUW116	17.9	40S	8.8	20S	5.8	20S	27.5	60S	57	99
515	RAUW117	5.0	20S	2.5	10S	5.6	30MS	36.4	60S	68	99
516	RAUW118	2.3	10MS	0.2	5R	12.6	60S	11.4	40MS	67	99
517	RAUW119	15.5	40S	20.0	40S	14.3	60S	21.1	40S	57	99
SKUAST, Jammu											
518	JAUW 715	11.8	40S	16.4	40S	23.6	60S	7.0	20S	57	99
519	JAUW 716	6.1	10S	4.8	20MS	15.1	40S	14.1	40S	56	99
520	JAUW 717	6.6	20MS	6.3	30S	11.5	40S	8.1	40S	57	99
520A	Infector	70.0	100S	80.0	80S	78.6	100S	75.0	80S	78	99
521	JAUW 718	0.4	5MR	8.8	20S	8.3	30MS	22.8	60S	57	89
522	JAUW 719	8.0	30S	6.0	20S	5.3	20S	3.7	10S	56	89
523	JAUW 720	3.6	10S	8.5	20S	15.0	40S	3.0	10S	57	79
524	JAUW721	7.8	20S	8.8	20S	18.7	40S	2.2	5MS	56	89
525	JAUW 722	1.8	10MS	5.2	20S	11.5	40S	13.4	40MS	57	79
526	JAUW 723	11.1	40S	5.9	20S	6.5	20S	5.4	10S	67	78
527	JAUW 724	9.4	20S	15.9	20S	19.3	40S	41.0	60S	57	99
Modipuram											
528	SVPWL22-01	6.2	20S	13.3	40S	19.9	60S	9.9	20S	57	99
529	SVPWL22-02	35.5	80S	7.1	20S	5.7	20S	1.6	5MS	68	99
530	SVPWL22-03	3.9	10S	1.3	10MS	1.7	5MS	3.3	10MS	57	99
531	SVPWL22-04	5.7	20MS	2.9	10S	2.6	5S	5.9	40MS	57	67
532	SVPWL22-05	7.5	20S	5.8	20S	4.1	20S	10.7	20S	57	78
533	SVPWL22-06	6.6	20S	3.5	20MS	0.4	5MR	4.7	20MS	68	99
534	SVPWL22-07	3.1	15MS	1.3	10MR	2.4	10MS	11.6	40S	67	99
535	SVPWL22-08	3.9	10S	1.0	10MS	1.7	20MR	19.0	40S	57	99
536	SVPWL22-09	10.0	20S	5.5	20S	9.9	40S	8.9	20S	56	78
537	SVPWL22-10	10.0	30S	9.8	20S	6.8	40S	6.4	20S	58	78
IIWBR Station Trials											
538	RWP1227	2.7	20S	1.8	10S	3.1	10S	4.9	10S	57	78

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
539	RWP1238	3.5	10S	2.4	10S	6.1	30MS	24.6	60S	67	99
540	RWP1280	3.5	10S	2.8	10MS	2.1	10S	15.4	40S	56	99
540A	Infector	75.0	100S	77.5	80S	78.6	100S	77.5	80S	78	99
541	RWP1332	5.4	20S	2.2	10S	7.9	40S	12.6	40S	67	99
542	RWP1350	6.5	20S	1.8	10S	9.2	40S	11.6	40S	68	99
543	RWP1365	1.4	10MS	0.8	10MR	2.3	20MS	23.8	60S	57	99
544	RWP1407	2.8	10S	1.5	10S	4.6	20MS	8.3	40S	67	99
545	RWP1449	5.5	20S	0.5	10MR	1.4	10S	9.1	40MS	67	99
546	LBP-2021-02	6.6	20S	2.6	20MR	0.4	5MR	21.5	60S	57	89
547	LBP-2021-07	2.9	10S	2.0	10MS	1.4	10S	10.0	40S	67	99
548	LBP-2021-08	4.4	15MS	3.2	20S	0.9	5S	6.0	20S	57	78
549	LBP-2021-11	2.8	10MS	2.8	10S	6.9	40S	17.1	40S	58	99
550	LBP-2021-18	2.3	10S	1.0	5MS	5.7	40S	19.6	60S	57	78
551	LBP-2021-20	11.4	20S	2.4	10MS	10.3	40S	4.4	10S	57	99
552	LBP-2021-22	9.4	40S	10.8	40MS	4.7	20S	3.9	10MS	57	99
553	DWAP2101	7.5	20S	11.5	40S	1.0	5S	6.3	20S	67	99
554	DWAP2105	8.4	20S	17.6	60S	7.7	30MS	9.4	40S	67	89
555	DWAP2108	5.8	10S	2.5	10S	11.4	40S	12.6	20S	56	78
556	DWAP2109	6.8	20S	3.8	20S	5.8	40S	7.1	20S	57	78
557	DWAP2113	4.1	20MS	2.3	10MS	0.7	5MS	4.0	10S	68	99
558	DWAP2114	10.4	40S	5.6	20S	8.0	40S	4.9	10MS	67	89
559	DWAP2117	11.6	40S	5.5	20S	6.6	30MS	6.3	10S	67	78
560	PBS-IR-TS-16	7.4	20S	6.1	20S	4.3	10S	4.9	10S	68	89
560A	Infector	77.5	100S	77.5	80S	78.6	100S	77.5	80S	78	89
561	PBS-IR-TS-25	19.1	60S	6.3	30S	9.7	40S	9.7	40S	68	78
562	PBS-IR-TS-26	20.5	60S	6.1	20S	3.2	10MS	5.9	20S	57	78
563	QYT 2104	9.3	20S	4.3	20S	6.6	30MS	6.5	20S	57	78
564	QYT 2105	10.9	40S	4.6	20S	12.8	40S	5.2	10S	57	99
565	QYT 2114	9.5	40S	4.3	15MS	6.7	20S	6.9	20S	57	89
566	QYT 2117	16.0	40S	17.8	30S	7.8	40S	4.5	20S	46	89
567	BSP-TS 2117	5.4	15S	2.3	10S	4.3	20S	21.0	40S	56	78
568	BSP-TS 2118	7.3	20S	3.6	10MS	11.7	40S	17.8	40S	67	78
569	BSP-TS 2123	7.1	40S	6.8	20S	5.9	20S	6.1	20MS	57	78
570	BSP-TS 2138	8.3	40S	6.4	10MS	8.6	40S	2.9	10MS	57	89
571	RWP1065	3.0	10MS	5.0	20S	2.9	10S	8.1	40S	57	78

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
572	RWP1199	2.7	10MS	12.8	40S	6.3	20S	9.2	40S	67	78
573	RWP1203	2.4	10MS	6.0	30S	8.3	20S	3.7	10S	57	78
574	RWP1343	5.9	20S	5.3	20S	14.5	60S	10.4	40S	57	99
575	RWP1479	5.4	20S	6.0	20S	11.6	60S	14.1	40S	56	78
576	LBP-2021-01	1.8	10MS	9.8	20S	12.3	20S	8.8	40S	57	78
577	LBP-2021-04	5.2	20S	5.6	20MS	5.3	20S	22.1	60S	57	78
578	LBP-2021-05	21.0	80S	8.8	20S	15.9	60S	23.8	60S	57	78
579	LBP-2021-06	14.9	40S	8.4	20S	5.4	20S	23.8	60S	67	99
580	LBP-2021-13	8.0	40S	4.8	10S	7.5	40S	27.0	60S	57	89
580A	Infector	75.0	100S	75.0	80S	81.4	100S	70.0	80S	78	99
581	LBP-2021-16	9.1	20S	7.3	40S	6.0	20S	27.1	60S	56	99
582	DWAP2110	5.4	20MS	8.5	20S	21.5	60S	14.3	60S	57	89
583	DWAP2111	8.8	40S	5.5	20S	9.1	40S	26.6	60S	68	99
584	PBS-IR-TS-01	4.0	15 MS	14.1	40S	18.3	40S	21.4	40S	67	99
585	PBS-IR-TS-12	5.4	20S	5.9	20S	12.1	60S	19.9	40S	67	99
586	PBS-IR-TS-19	10.3	40S	6.4	15MS	13.1	60S	33.1	60S	47	89
587	PYTSR24	1.6	10MS	1.1	10MS	5.1	20S	36.6	60S	57	89
588	QYT 2101	5.4	20S	6.3	40S	12.7	60S	6.4	20MS	57	89
589	QYT 2106	5.5	20MS	5.1	20S	14.0	60S	16.6	40S	58	89
590	QYT 2110	3.4	10S	3.5	20S	5.3	40MS	9.5	40MS	56	89
591	QYT 2111	29.5	80S	3.9	20S	1.6	5S	5.4	20MS	57	67
592	QYT 2112	3.4	10S	1.3	10S	0.6	5MS	37.0	80S	67	89
593	BSP-TS-2130	3.3	10S	7.0	30S	17.1	40S	15.4	40S	67	99
594	RWP1034	4.2	15S	3.3	10S	7.4	40S	13.9	40S	57	67
595	RWP1062	6.5	20S	6.3	20S	6.1	20S	10.0	40S	67	99
596	RWP1170	5.2	20S	2.5	10S	0.9	10MR	10.7	40S	57	78
597	RWP1285	3.6	10S	7.2	40S	9.9	40S	7.8	40MS	46	78
598	RWP1344	3.5	15S	3.5	20S	10.1	40MS	18.1	40S	57	78
599	LBP-2021-45	1.3	10S	8.3	40S	17.9	60S	12.6	40S	56	78
600	LBP-2021-49	8.5	40S	10.9	40S	10.7	40S	23.1	60S	56	78
600A	Infector	75.0	100S	75.0	80S	75.7	100S	72.5	80S	78	99
601	LBP-2021-51	3.9	15S	1.9	10S	6.9	40S	15.0	40S	57	78
602	LBP-2021-54	3.3	10MS	4.5	20S	9.3	40S	25.4	40S	57	99
603	LBP-2021-56	2.3	10S	5.6	40S	2.7	10MS	13.9	40S	57	89
604	LBP-2021-58	8.4	40S	4.8	30S	3.8	20MS	28.1	40S	67	99

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
605	DWAP 2131	6.8	20S	1.8	10S	4.3	20MS	16.6	40S	57	78
606	DWAP 2140	9.2	20S	4.5	20S	12.1	40S	5.6	20MS	67	99
607	DWAP 2141	14.8	40S	11.0	40S	15.1	60S	9.5	40S	67	99
608	DWAP 2142	11.5	20S	5.6	20S	3.6	20S	19.9	40S	57	59
609	PBS-IR-LS-02	8.1	20S	2.3	10S	11.5	40S	12.9	40S	46	67
610	PBS-IR-LS-03	7.1	20S	9.5	30S	12.1	40S	16.0	40S	57	89
611	PBS-IR-LS-06	6.6	20S	1.0	10MS	3.4	20S	15.6	40S	56	89
612	PBS-IR-LS-11	0.3	5MR	0.0	R	1.1	10MS	24.3	60S	57	99
613	PBS-IR-LS-12	4.4	20MS	9.8	20S	8.7	40S	11.4	40S	67	99
614	PBS-IR-LS-14	11.8	40S	11.0	30S	13.4	60S	10.4	40S	57	78
615	QYT 2141	10.1	40S	5.0	20S	10.3	60S*	9.2	40S	57	78
616	QYT 2152	9.0	20S	33.5	80S	18.6	40S	21.1	40S	57	99
617	RWP1267	2.3	10S	0.8	5MS	3.6	10MS	13.6	40S	57	78
618	RWP1275	5.3	20S	5.5	15MS	16.7	40S	11.0	40S	47	89
619	RWP1286	10.1	40S	8.5	40S	14.0	40S	34.0	60S	56	79
620	RWP1313	8.5	40S	1.0	10MS	9.0	40S	16.0	40S	57	89
620A	Infector	75.0	100S	72.5	80S	78.6	100S	75.0	80S	78	99
621	RWP1314	5.9	20S	2.6	10S	8.0	40S	14.3	40MS	57	89
622	RWP1319	5.8	20S	4.1	20S	9.0	40S	9.8	40MS	57	89
623	RWP1328	4.1	20S	2.5	10S	3.7	20MS	13.1	40S	67	78
624	RWP1347	7.3	40S	5.8	20S	11.5	40S	9.7	40S	67	79
625	LBP2021-29	9.7	20S	2.6	10S	5.9	20MS	17.4	60S	56	78
626	LBP2021-34	3.6	20S	2.1	10S	2.4	5S	10.1	40S	56	78
627	LBP2021-35	3.2	20MS	1.8	10MS	1.0	5S	11.4	40S	57	78
628	LBP2021-38	3.3	20S	6.1	20S	3.3	10S	26.5	60S	46	78
629	LBP2021-39	7.4	20MS	7.2	40S	4.3	10MS	9.0	40S	46	78
630	LBP2021-41	7.9	20S	6.8	30S	8.6	30MS	32.1	60S	57	78
631	DWAP 2153	15.5	40S	15.0	40S	16.9	40S	30.1	60S	57	99
632	DWAP 2158	13.3	40S	5.6	20S	1.1	20MR	7.9	40MS	57	99
633	PBS-RI TS- 02	4.6	15S	2.8	10S	4.1	20S	9.7	40MS	57	99
634	PBS-RI-TS-15	10.8	40S	4.1	20S	10.2	40S	14.1	40S	46	78
635	PBS-RI-TS-16	8.3	20S	3.9	20S	10.9	40S	7.7	40S	46	89
636	QYT2130	7.0	20S	9.6	40S	12.0	40S	3.6	10MS	47	78
637	QYT2139	5.1	20S	1.8	10S	1.4	10MS	18.4	60S	47	89
638	BSP2101	11.0	40S	6.5	20S	5.2	20S	4.1	10MS	57	78

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
639	BSP2111	5.8	20S	3.6	20S	2.0	10S	12.9	40S	57	99
640	RWP1955	10.5	40S	4.3	10S	5.0	20S	6.4	20MS	56	78
640A	Infector	75.0	100S	77.5	80S	78.6	100S	77.5	80S	78	99
641	RWP1961	4.8	20S	6.8	40S	7.1	20S	9.1	40MS	46	78
642	RWP1998	2.6	10S	3.8	20S	11.5	40S	4.2	10S	56	99
643	RWP2023	3.3	10MS	8.3	20S	8.1	20S	4.8	20S	57	99
644	LBP2201	3.3	10MS	10.3	40S	10.3	40S	1.1	5MS	56	99
645	LBP2202	5.1	20MS	6.8	20S	1.6	5MS	0.1	TS	56	99
646	LBP2203	10.7	40S	11.8	20S	15.9	40S	2.3	5S	57	89
647	LBP2204	11.4	40S	3.6	10S	2.9	20MS	6.1	20S	46	78
648	WAP 2201	4.6	20S	3.0	10S	1.6	5S	14.3	20S	46	99
649	WAP 2202	2.8	10MS	2.3	10S	7.2	40S	3.8	10MS	57	89
650	WAP 2203	9.9	40S	3.5	10S	10.7	40S	6.3	40MS	46	78
651	WAP 2204	12.8	40S	3.5	10S	8.2	40MS	5.9	20S	56	99
652	PBS01	11.0	40S	3.3	10S	9.6	20S	13.6	40S	57	89
653	PBS02	18.3	60S	23.8	60S	9.8	40S	12.9	40S	67	89
654	PBS03	10.8	40S	25.4	60S	23.6	60S	18.6	40S	57	89
655	PBS04	4.8	20S	5.1	20S	8.6	40S	15.0	40S	57	89
656	QYT2201	3.1	10MS	2.3	10S	8.3	40S	17.3	40S	57	78
657	QYT2202	1.8	10MS	2.5	10S	6.3	40S	17.6	40S	57	99
658	QYT2203	4.8	15S	10.4	20S	12.7	40S	23.0	40S	56	99
659	BSP 2201	6.5	20S	3.8	10S	9.0	40S	9.5	40S	57	99
660	BSP 2202	6.9	20S	3.7	10S	0.6	5MR	20.3	40S	57	78
660A	Infector	75.0	100S	77.5	80S	75.7	100S	72.5	80S	78	99
661	BSP 2203	6.9	20S	3.0	10S	13.8	40S	10.3	40S	57	89
Mahodaya Seeds											
662	Mahodaya - 11	11.9	40S	31.5	80S	21.4	40S	48.5	60S	68	99
CSAUAT, Kanpur											
663	KA 2201	4.3	10S	1.1	10MS	5.7	40S	15.8	40S	57	89
664	KA 2202	4.4	10S	5.3	20S	4.4	20MS	39.8	60S	57	78
665	KA 2203	3.1	10S	2.3	10S	6.1	20S	27.9	60S	57	89
666	KA 2204	5.3	15MS	4.4	20S	3.1	15MS	28.6	60S	68	78
667	KA 2205	2.9	15MS	5.8	20S	11.4	40S	29.6	60S	57	89
668	KA 2206	2.0	10MS	4.0	10S	11.6	60S*	22.5	40S	57	78
669	KA 2207	1.7	10MS	1.4	10S	9.4	60S*	31.9	60S	56	68

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
670	KA 2208	1.4	5MS	7.0	20S	10.0	40S	30.1	60S	57	99
671	KA 2209	6.9	20S	8.6	40S	14.1	40S	4.1	10MS	67	89
672	KA 2210	5.9	20S	2.3	10S	11.2	60S*	33.1	60S	57	99
673	KA 2211	5.5	20S	2.1	10S	0.6	5MS	25.3	60S	57	99
674	KA 2212	26.9	40S	11.3	40S	4.0	20S	57.5	80S	68	99
675	KA 2213	0.7	10MR	0.0	R	2.3	20MS	20.8	60S	57	68
676	KA 2214	8.0	20S	5.6	40S	4.6	20S	18.4	60S	56	99
677	KA 2215	8.8	20S	3.3	10S	7.7	20S	43.0	60S	57	99
678	KA 2216	14.9	40S	16.5	40S	7.4	40MS	33.0	60S	57	99
679	KA 2217	22.3	40S	16.8	40S	16.9	60S	56.3	80S	57	99
680	KA 2218	5.8	20MS	4.3	20S	1.5	10S	19.1	60S	67	99
680A	Infector	75.0	100S	75.0	80S	75.7	100S	75.0	80S	68	99
681	KA 2219	10.0	20S	13.5	60S	5.7	20S	11.9	40S	57	99
682	KA 2220	4.7	10S	8.9	20S	11.4	40S	19.6	60S	57	78
683	KA 2221	1.3	5S	10.4	30S	4.1	20MS	30.0	60S	67	89
684	KA 2222	0.7	10MR	5.3	20MS	9.7	40MS	27.5	60S	67	99
685	KA 2223	1.5	5MS	2.8	10S	3.7	20S	24.9	60S	67	99
686	KA 2224	13.4	40S	11.1	40S	11.9	60S	11.0	40S	57	99
687	KA 2225	11.4	20S	7.9	20S	6.3	20MS	45.5	60S	57	99
688	KA 2226	9.8	20S	6.8	30S	6.5	40S	10.5	40S	57	99
689	KA 2227	8.4	20S	8.5	30S	10.0	40S	29.8	60S	67	99
690	KA 2228	13.6	40S	13.3	40S	13.6	40S	8.2	20MS	57	99
691	KA 2229	9.8	20S	2.1	10S	2.6	10S	18.5	40S	57	99
692	KA 2230	6.6	20S	4.3	10S	7.1	40S	20.0	40S	57	99
693	KA 2231	10.6	40S	8.6	20S	6.3	20S	17.3	40S	67	99
694	KA 2232	8.0	20S	2.4	10S	4.3	20S	10.8	40S	57	99
695	KA 2233	4.3	20S	2.5	10S	1.2	20MR	21.1	40S	57	99
696	KA 2234	6.7	20S	8.8	30S	5.1	20MS	23.4	60	57	99
697	KA 2235	8.3	20MS	7.1	20MS	7.7	40S	9.1	40S	57	99
JNKVV, Jabalpur											
698	MP 3583	7.4	20MS	10.3	30MS	8.6	20S	47.5	60S	57	99
699	MP 3584	0.2	TMS	1.8	10S	1.1	10MS	51.3	60S	57	99
700	MP 3585	2.3	10MS	18.0	40S	5.9	20S	5.5	20MS	67	99
700A	Infector	72.5	100S	75.0	80S	77.1	100S	77.5	80S	78	99
701	MP 3586	8.2	20S	7.4	20S	3.7	10MS	43.9	80S	57	99

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
702	MP 3587	16.4	60S	22.9	60S	19.6	60S	35.8	60S	56	99
703	MP 3588	3.8	10S	16.1	40S	9.3	40S	27.9	60S	57	99
704	MP 3589	2.5	10S	7.3	30S	0.4	5MR	37.9	60S	57	99
705	MP 3590	0.9	5MS	1.0	10MS	1.3	5S	44.5	60S	68	99
706	MP 3591	1.8	5S	7.2	30S	4.3	20S	4.8	10MS	57	99
707	MP 3592	3.4	10S	10.5	20S	5.3	20S	3.8	10S	57	78
708	MP 3593	1.9	5S	9.1	20S	8.6	40S	30.1	60S	57	99
709	MP 3594	2.8	10MS	6.9	20S	1.6	15MR	41.3	60S	57	89
710	MP 3595	6.3	20S	11.5	30S	8.0	40S	37.3	60S	57	89
711	MP 3596	1.6	5S	6.1	20S	9.3	40S	5.9	20S	57	78
712	MP 3597	2.0	10S	11.3	30S	11.0	40S	27.3	60S	56	99
713	MP 3598	4.6	20MS	8.8	20S	15.9	40S	25.5	60S	56	99
714	MP 3599	7.1	40S	13.8	30S	10.7	40S	44.8	80S	67	99
715	MP 3600	8.9	20S	13.5	40S	7.5	20S	46.4	80S	57	78
716	MP 3601	3.3	10S	17.4	40S	17.1	60S	36.8	60S	57	99
717	MP 3602	9.1	40S	20.3	60S	18.9	60S	36.4	60S	57	99
IARI, New Delhi											
718	IARI-22-1	9.5	40S	7.3	20S	15.6	40S	8.6	20S	57	99
719	IARI-22-2	3.3	10S	5.9	10S	14.3	40S	32.1	60S	67	99
720	IARI-22-3	7.5	20S	8.6	20S	10.7	40S	8.8	30S	67	99
720A	Infector	72.5	100S	72.5	80S	81.4	100S	75.0	80S	78	99
721	IARI-22-4	6.8	20MS	2.4	10S	2.3	10S	3.0	10S	56	99
722	IARI-22-5	12.0	20S	3.6	20S	0.6	10MR	2.3	10MS	56	99
723	IARI-22-6	13.3	60S	5.6	40MR	10.3	40S	3.4	10S	56	89
724	IARI-22-7	11.5	40S	5.6	20S	3.6	20MS	4.2	10S	57	99
725	IARI-22-8	13.5	60S	6.6	20MS	2.7	15MS	2.5	10S	67	89
726	IARI-22-9	17.6	60S	16.3	40S	23.2	60S	7.4	20S	57	78
727	IARI-22-10	30.8	80S	11.5	40S	15.4	80S*	1.2	5MS	57	68
728	IARI-22-11	23.5	80S	10.0	40S	8.6	20S	8.4	20S	56	99
729	IARI-22-12	26.4	80S	6.9	20S	1.5	5MS	8.9	20S	57	99
730	IARI-22-13	5.6	20S	2.8	20S	4.6	20S	11.9	40MS	67	99
731	IARI-22-14	2.1	10S	11.6	40S	19.6	40S	3.1	10MS	56	79
732	IARI-22-15	3.7	15S	3.8	20S	7.8	40S	1.9	15S	57	68
733	IARI-22-16	11.6	40S	7.9	20S	10.6	40S	5.2	15S	46	78
734	IARI-22-17	5.9	10S	14.5	40S	13.7	40S	46.0	80S	57	79

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
735	IARI-22-18	5.5	20MS	4.3	20S	14.6	40S	28.1	60S	67	99
736	IARI-22-19	6.1	20S	5.0	20S	4.1	10S	4.9	20MS	57	67
737	IARI-22-20	7.9	40MR	5.5	40MS	10.7	30S	3.5	10S	67	79
738	IARI-22-21	0.3	5MR	0.1	R	0.3	5MR	39.0	80S	56	67
739	IARI-22-22	1.9	10S	7.7	20S	15.9	60S	39.9	80S	56	79
740	IARI-22-23	4.9	30MS	2.7	20MS	5.7	20S	1.4	10S	57	99
740A	Infector	72.5	100S	80.0	80S	78.6	100S	75.0	80S	78	99
741	IARI-22-24	7.1	20MS	1.9	10S	1.6	5S	3.5	10MS	67	99
742	IARI-22-25	10.0	20S	1.8	10S	1.5	10MS	6.2	20S	56	68
743	IARI-22-26	26.0	60S	14.5	40S	8.4	30S	1.1	5MS	57	76
744	IARI-22-27	6.0	20S	4.6	20S	4.3	20S	4.1	20MS	56	89
745	IARI-22-28	14.9	40S	6.5	20MS	5.1	20S	1.1	5S	57	89
746	IARI-22-29	3.0	10S	10.8	20S	14.3	40S	20.6	60S	57	99
747	IARI-22-30	23.5	60S	4.3	20S	3.3	20MS	9.1	20MS	56	89
748	IARI-22-31	3.0	20MR	0.8	5MS	2.4	15MS	10.4	40S	56	89
749	IARI-22-32	31.8	60S	18.0	60S	27.1	60S	16.9	40S	57	68
750	IARI-22-33	4.0	10S	2.6	10S	1.0	5S	2.7	10S	56	89
751	IARI-22-34	5.8	20S	6.8	30S	5.9	20S	42.4	60S	57	99
752	IARI-22-35	2.6	10S	0.1	TMR	3.3	20MS	57.0	80S	58	79
753	IARI-22-36	2.4	10MS	0.3	5MR	4.3	30S	60.5	80S	67	89
754	IARI-22-37	1.3	5MS	1.8	10MS	1.7	15MS	57.0	80S	78	99
755	IARI-22-38	2.3	20MR	0.7	5MS	2.4	10MS	59.5	80S	67	89
756	IARI-22-39	0.5	5MR	0.3	5MR	1.1	10MS	42.1	80S	57	79
757	IARI-22-40	0.6	5MR	0.9	10MR	0.6	5MR	42.3	80S	57	79
758	IARI-22-41	0.5	10MR	0.0	R	2.3	20MS	52.5	80S	57	79
759	IARI-22-42	0.5	5MS	1.1	5MS	17.9	60S	37.3	60S	68	89
760	IARI-22-43	3.7	10MS	3.8	30S	7.4	30MS	2.6	10MS	57	79
760A	Infector	72.5	100S	77.5	80S	78.6	100S	75.0	80S	78	99
761	IARI-22-44	4.5	20S	3.5	10MS	7.7	20S	10.3	40S	67	89
762	IARI-22-45	4.3	20S	2.3	10S	9.3	40S	25.6	60S	67	79
763	IARI-22-46	3.8	10S	1.0	10MS	3.7	30MS	19.6	60S	57	79
764	IARI-22-47	25.5	60S	5.1	20MS	4.4	20MS	2.5	20S	56	79
765	IARI-22-48	15.8	40S	6.7	20MS	6.1	20S	1.1	5MS	57	89
766	IARI-22-49	3.6	10S	1.8	5MS	4.3	20S	37.0	60S	57	89
767	IARI-22-50	4.9	20S	5.5	20S	2.6	20MS	10.4	40S	57	89

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
768	IARI-22-51	14.3	60S	4.7	20MS	5.0	20S	1.7	10MS	67	79
769	IARI-22-52	25.4	60S	6.3	20S	4.3	20S	0.5	5MS	56	89
770	IARI-22-53	13.9	80S	5.2	20S	5.3	15MS	1.6	5S	57	79
771	IARI-22-54	12.8	60S	5.6	30S	2.1	10S	1.6	10MS	57	89
772	IARI-22-55	7.8	20S	3.0	20S	2.6	10S	5.6	20MS	68	89
773	IARI-22-56	5.0	15MS	3.3	20S	0.6	5MS	7.2	20S	57	78
774	IARI-22-57	21.3	40S	8.3	30S	0.1	TMR	10.8	40S	56	68
775	IARI-22-58	0.3	5MR	4.5	10S	5.0	20MS	23.0	60S	56	79
776	IARI-22-59	5.3	20S	2.0	10MS	5.4	20S	9.3	40S	57	89
777	IARI-22-60	21.5	80S	3.9	20MS	1.9	10MS	19.0	60S	67	89
778	IARI-22-61	21.3	80S	1.5	10S	3.3	20MS	28.6	60S	57	89
779	IARI-22-62	3.0	10S	1.3	10S	3.7	20MS	3.6	10MS	56	89
780	IARI-22-63	7.5	40S	1.7	10S	0.8	5S	32.3	60S	56	89
780A	Infector	72.5	100S	72.5	80S	81.4	100S	77.5	80S	78	99
781	IARI-22-64	6.3	40S	1.3	20MR	2.3	20MS	2.2	10MS	78	99
782	IARI-22-65	4.2	20S	6.8	20S	5.9	20S	26.8	60S	68	89
783	IARI-22-66	1.6	10MS	2.8	10MS	6.7	20S	18.1	40S	68	79
784	IARI-22-67	9.0	20S	2.1	20MS	14.1	60S	11.1	40S	67	99
785	IARI-22-68	1.0	5MR	0.6	10MR	2.3	20MS	55.8	80S	68	99
786	IARI-22-69	2.0	20MR	0.7	5MR	1.1	10MS	57.5	80S	78	99
787	IARI-22-70	2.1	10MS	0.1	TR	2.1	10S	58.5	80S	78	89
788	IARI-22-71	1.6	10MR	0.3	5MR	3.0	20MS	49.5	80S	67	99
789	IARI-22-72	1.3	10MR	0.1	TR	6.0	40S	47.5	80S	67	99
790	IARI-22-73	2.0	10MR	0.1	TR	4.6	20S	53.5	80S	68	99
791	IARI-22-74	2.4	10MS	1.3	10S	7.1	40S	12.8	40S	57	89
792	IARI-22-75	2.3	10MS	1.8	10S	1.4	20MR	10.2	40S	67	78
793	IARI-22-76	2.5	5MS	4.3	20S	13.7	40S	37.6	80S	67	79
794	IARI-22-77	2.1	15MR	1.3	10S	6.9	40S	33.3	60S	78	99
795	IARI-22-78	0.6	5MS	1.8	10MS	0.3	5MR	15.4	40S	67	99
796	IARI-22-79	8.5	20S	9.6	30S	17.5	40S	11.9	40S	67	99
797	IARI-22-80	0.7	5MR	1.3	10S	2.3	10MS	6.1	20MS	67	99
798	IARI-22-81	5.8	10S	1.5	10MS	1.9	5S	19.8	40S	57	79
799	IARI-22-82	3.8	10S	0.5	5MS	2.9	20S	23.0	40S	68	79
800	IARI-22-83	10.3	20S	2.1	10MS	1.4	20MR	25.3	40S	67	99
800A	Infector	67.5	100S	70.0	80S	75.7	100S	75.0	80S	78	99

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
801	IARI-22-84	4.7	20S	1.3	10S	2.9	20S	3.7	10MS	68	99
802	IARI-22-85	13.1	40S	2.7	10S	0.9	5MS	4.4	10MS	67	99
803	IARI-22-86	8.1	20S	1.0	10MR	0.9	5MS	6.6	20MS	68	79
804	IARI-22-87	6.3	20S	0.8	10MR	1.2	5MS	2.3	10MS	57	89
805	IARI-22-88	3.4	10S	0.3	5MR	1.4	10MS	4.6	10MS	67	89
806	IARI-22-89	11.8	40S	0.4	5MR	6.3	40S	9.6	20MS	68	89
807	IARI-22-90	30.9	60S	15.5	40S	17.7	60S	24.0	40S	67	99
808	IARI-22-91	1.3	10MR	0.2	5R	9.7	40S	38.8	60S	68	89
809	IARI-22-92	0.5	5MR	1.3	10S	1.4	10S	27.3	60S	78	89
810	IARI-22-93	5.1	30S	13.9	40S	12.0	40S	16.4	40S	68	89
811	IARI-22-94	0.5	10MR	0.0	R	7.9	40S	51.3	80S	67	89
812	IARI-22-95	5.8	20S	6.4	20MS	9.6	40S	14.4	40S	57	99
813	IARI-22-96	9.4	20S	1.4	10MS	8.8	40S	7.6	20S	57	79
814	IARI-22-97	17.8	60S	10.8	40S	14.7	60S	40.5	60S	57	89
815	IARI-22-98	8.3	30S	4.8	20MS	12.3	40S	40.5	60S	57	78
816	IARI-22-99	3.5	10S	10.5	20S	5.9	20S	35.0	60S	56	99
817	IARI-22-100	2.8	15S	6.5	20S	13.4	40S	27.3	40S	67	99
818	IARI-22-101	2.0	20MR	0.8	5MR	3.4	20S	20.3	60S	67	99
819	IARI-22-102	4.4	20S	7.6	40S	10.3	40S	13.3	40S	67	99
820	IARI-22-103	3.6	40MR	2.5	10S	5.8	20S	11.1	40MS	67	99
820A	Infector	72.5	100S	72.5	80S	72.9	80S	75.0	80S	78	99
821	IARI-22-104	3.9	20MS	1.9	10S	4.9	30S	5.4	10S	57	89
822	IARI-22-105	0.3	5MR	1.9	10S	9.0	40S	11.3	40S	46	67
823	IARI-22-106	0.4	5MR	1.3	10MS	1.1	20MR	58.5	80S	57	89
824	IARI-22-107	0.0	R	0.0	R	2.3	20MS	55.0	80S	46	67
825	IARI-22-108	6.6	20S	2.6	10MS	7.0	40S	63.0	80S	57	99
826	IARI-22-109	4.8	20S	3.8	10MS	3.5	20S	22.5	40S	68	99
827	IARI-22-110	12.8	40S	3.2	10MS	16.2	60S	5.9	20S	67	89
828	IARI-22-111	4.3	20S	1.9	10MS	13.4	60S	3.6	10S	57	99
829	IARI-22-112	3.9	20S	2.1	10MS	9.3	40S	8.4	20S	57	99
830	IARI-22-113	12.8	40S	2.3	10MS	3.3	20S	5.7	20S	67	89
831	IARI-22-114	6.8	15S	4.5	20MS	7.6	40S	14.3	40S	56	79
832	IARI-22-115	14.1	60S	18.0	40S	12.3	60S*	11.9	40S	67	89
833	IARI-22-116	6.0	20S	18.5	40S	19.6	60S	16.8	40S	56	99
834	IARI-22-117	3.9	15MS	4.3	20MS	10.7	60S*	31.4	60S	57	89

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
835	IARI-22-118	14.7	60S	4.9	20S	4.1	10S	4.7	10S	57	89
836	IARI-22-119	3.4	10S	6.8	40S	3.1	10MS	22.0	40S	56	99
837	IARI-22-120	9.5	40S	8.0	20S	4.3	20S	13.7	40S	57	99
838	IARI-22-121	22.6	40S	3.4	20MS	6.7	40S	1.2	5M	57	79
839	IARI-22-122	17.0	60S	9.0	30S	8.7	40S	2.6	10MS	68	99
840	IARI-22-123	17.0	60S	13.8	40S	12.4	40S	6.4	20MS	67	99
840A	Infector	70.0	100S	72.5	80S	77.1	80S	75.0	80S	78	99
841	IARI-22-124	8.8	40S	4.5	10S	8.7	20S	2.4	5S	57	99
842	IARI-22-125	9.0	40S	4.9	10S	9.6	40S	5.4	20MS	57	99
843	IARI-22-126	3.9	20S	4.9	10S	15.7	40S	16.6	40S	47	79
844	IARI-22-127	3.9	10S	2.5	10MS	3.6	20S	8.9	20S	46	58
845	IARI-22-128	3.6	20MS	4.5	20MS	5.0	20S	3.1	20MS	46	68
846	IARI-22-129	1.0	5MR	0.4	5MR	0.7	5S	48.0	60S	67	79
847	IARI-22-130	0.6	10R	0.3	5MR	1.4	10S	48.3	80S	68	79
848	IARI-22-131	1.3	10MR	0.1	R	4.7	20S	43.8	80S	68	89
849	IARI-22-132	2.3	20MR	0.1	TR	14.3	60S	67.5	80S	67	89
850	IARI-22-133	1.5	20MR	0.1	R	14.3	80S	2.6	20MS	57	89
851	IARI-22-134	6.6	20MS	3.1	10S	9.1	20S	7.5	20S	56	89
852	IARI-22-135	30.5	80S	30.0	40S	30.0	60S	16.1	40S	57	89
853	IARI-22-136	3.8	10S	18.0	40S	9.7	20S	2.8	10MS	57	89
854	IARI-22-137	2.3	10MS	1.0	10MS	3.7	20S	50.5	80S	67	89
855	IARI-22-138	1.3	5MS	2.3	10S	4.3	20S	4.8	20S	67	89
856	IARI-22-139	9.8	20S	6.5	20S	4.0	20S	3.3	10S	56	79
857	IARI-22-140	29.4	60S	10.3	20S	3.6	20S	9.4	40S	67	89
858	IARI-22-141	13.0	40S	1.0	20MR	1.7	10MS	15.9	40S	56	79
859	IARI-22-142	10.0	20S	9.3	40S	6.4	20S	7.1	20S	56	89
860	IARI-22-143	2.8	10MS	2.3	10MS	4.9	20S	15.5	40S	57	79
860A	Infector	70.0	100S	77.5	80S	81.4	100S	72.5	80S	79	99
861	IARI-22-144	8.0	20S	10.8	20S	8.4	40S	3.4	10S	56	89
862	IARI-22-145	2.2	10S	1.3	10MS	2.0	10S	9.4	20MS	57	99
863	IARI-22-146	16.3	40S	19.8	30S	24.4	80S	11.5	40S	57	89
864	IARI-22-147	12.3	40S	9.5	20S	14.1	60S	8.1	40S	56	99
865	IARI-22-148	5.1	30MS	4.0	20S	7.3	40S	8.2	20S	56	89
866	IARI-22-149	4.4	20S	0.5	5MS	1.5	10S	4.4	10S	57	89
867	IARI-22-150	9.3	20S	7.5	20S	9.3	40S	11.3	40MS	46	79

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
868	IARI-22-151	4.3	20S	6.8	20MS	7.7	20S	4.4	15S	56	89
869	IARI-22-152	3.8	10S	1.8	10MS	1.6	10S	18.5	60S	57	89
870	IARI-22-153	3.1	10MS	3.5	10MS	7.6	40S	17.9	40S	67	99
871	IARI-22-154	9.0	40S	10.9	40S	18.6	40S	1.8	10S	68	89
872	IARI-22-155	6.3	20S	3.9	10S	14.4	40S	7.6	20S	68	99
873	IARI-22-156	1.0	10MR	0.1	TR	5.0	30S	0.6	5S	67	89
874	IARI-22-157	1.5	20MR	0.6	5MS	1.1	10MS	17.4	60S	57	68
875	IARI-22-158	26.8	80S	18.3	60S	11.3	60S*	9.9	60S	68	89
876	IARI-22-159	19.8	40S	10.0	20S	12.6	40S	7.5	20S	57	89
877	IARI-22-160	7.9	20S	3.7	20S	9.3	40S	0.6	5MS	46	99
878	IARI-22-161	3.1	10S	2.0	10S	3.1	20S	14.8	40S	56	89
879	IARI-22-162	6.4	20S	9.6	20S	7.6	40S	31.0	60S	67	79
880	IARI-22-163	13.4	40S	15.8	80S	8.4	40S	4.5	20S	67	89
880A	Infector	70.0	100S	72.5	80S	78.6	100S	75.0	80S	78	99
881	IARI-22-164	14.0	60S	5.9	30S	2.3	10S	1.2	10MS	57	79
882	IARI-22-165	11.3	40S	9.0	40S	3.0	20MR	4.4	15S	57	89
883	IARI-22-166	4.3	20S	1.5	10MS	4.9	20MS	30.5	60S	67	89
884	IARI-22-167	2.4	10S	1.2	5S	3.4	30MS	25.6	60S	57	79
885	IARI-22-168	2.5	5S	5.1	20S	8.3	40S	20.1	40S	57	68
886	IARI-22-169	3.4	10S	6.0	20MS	8.0	40S	38.5	80S	57	68
887	IARI-22-170	4.3	20MS	4.1	10S	6.4	40S	7.9	20S	56	89
PAU, Ludhiana											
888	WBL1342	8.8	20MS	4.3	20S	2.9	20S	3.6	10MS	46	68
889	WBL1393	6.4	15S	4.2	20MS	0.7	5S	1.1	5MS	56	99
890	WBL1406	6.9	10MS	4.4	20MS	1.4	10S	0.1	TS	57	79
891	WBL1410	5.0	20S	0.6	5MS	1.4	10MS	0.6	5S	46	67
892	WBL1436	23.5	40S	5.5	20S	5.7	30S	2.1	20MS	46	68
893	WBL1441	19.5	40S	11.1	20MS	7.1	20S	6.3	20S	46	79
894	WBL1442	16.8	40S	7.3	20MS	4.7	20S	3.0	20S	57	79
895	WBL1445	30.8	60S	9.5	20S	10.3	40S	2.1	10S	56	89
896	WBL1460	22.5	40S	10.9	20S	16.9	80S	0.5	5MS	57	89
897	WBL1464	8.9	20S	22.8	40S	10.6	40S	1.0	5MS	56	89
898	WBL1465	21.3	40S	12.3	40S	23.6	80S	1.0	5MS	57	79
899	WBL1466	6.9	20MS	16.6	40S	23.1	60S	1.0	5MS	56	99
900	WBL1467	5.4	20MS	21.9	40S	27.0	60S	6.0	40S	67	89

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
900A	Infector	70.0	100S	75.0	80S	78.6	100S	75.0	80S	78	99
901	WBL1468	10.4	40S	24.6	60S	17.7	60S	2.6	10S	57	89
902	WBL1470	8.8	40S	26.4	40S	28.6	80S	2.5	10S	57	79
903	WBL1471	7.4	20MS	24.0	60S	31.4	80S	1.4	10S	46	89
904	WBL1472	8.6	20S	27.0	40S	24.6	60S	2.4	10S	46	79
905	WBL1482	6.4	20MS	8.5	20S	1.9	5S	3.3	20S	46	68
906	WBL1483	7.5	20MS	6.3	20S	4.3	20S	0.1	5R	57	79
907	WBL1484	8.0	20S	3.0	20MS	7.1	40S	3.9	20S	57	89
908	WBL1485	15.9	40S	8.5	40S	2.9	20MR	0.7	5S	57	89
909	WBL1487	11.0	20S	2.0	10S	1.5	10MS	0.3	5MR	57	89
910	WBL1488	14.3	40S	13.3	20S	14.7	60S	2.5	10S	56	68
911	WBL1489	11.0	20S	11.5	20S	16.9	80S	1.1	10MS	57	99
912	WBL1490	12.4	20S	16.1	20S	12.0	40S	3.1	20S	56	78
913	WBL1494	11.5	20S	2.0	10MS	0.6	5MS	0.6	5MS	56	89
914	WBL1496	10.9	20MS	3.0	20MS	1.0	5S	1.6	10S	46	79
915	WBL1499	27.5	60S	20.0	60S	20.3	60S	8.0	20S	56	89
916	WBL1511	9.8	20S	18.8	40S	11.7	40S	2.1	10MS	56	68
917	WBL1512	10.0	20S	7.3	40S	4.1	20S	1.1	10MS	56	68
918	WBL1513	8.6	20S	6.8	20S	2.9	20S	2.3	10S	46	79
919	WBL1514	13.0	40S	16.2	60S	15.3	40S	2.0	10MS	56	79
920	WBL1515	9.3	20S	19.0	40S	12.6	40S	1.4	10MS	56	68
920A	Infector	75.0	100S	77.5	80S	80.0	100S	75.0	80S	78	99
921	WBL1516	14.0	40MS	7.5	20MS	4.0	20S	0.8	5MS	57	78
922	WBL1517	13.6	40S	3.7	20MS	3.1	20S	4.0	20MS	46	67
923	WBL1518	28.9	60S	18.9	80S	21.4	60S	6.1	20S	56	89
924	WBL1519	24.5	40S	7.2	20S	7.1	40S	6.6	20S	57	78
925	WBL1520	7.5	20MS	2.3	10MS	0.6	5MR	2.2	10MS	57	79
926	WBL1521	7.0	20S	3.0	10S	0.6	10MR	0.0	0	57	99
927	WBL1522	8.1	20S	4.1	20S	2.8	10S	1.2	5S	67	79
928	WBL1523	11.3	40S	8.8	20S	4.0	10S	0.1	TS	46	57
929	WBL1524	4.5	40MR	0.5	10MR	1.3	5S	0.0	0	57	67
930	WBL 1686	25.0	40S	1.2	5S	1.7	10MS	2.6	10S	46	89
931	WBL 1728	29.5	60S	3.8	20MS	2.0	10S	1.6	10MS	57	89
932	WBL 1746	2.8	10S	0.3	5MR	1.6	5S	1.2	5S	57	89
933	WBL 1871	5.6	10S	3.9	20M	0.3	5MR	5.0	20MS	57	79

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
934	WBL 1932	10.9	40MS	9.0	20S	6.6	20S	1.7	10MS	57	79
935	WBL 1934	6.9	10S	5.2	20S	5.1	20S	1.0	5MS	46	79
936	WBL 1935	4.3	10S	10.8	40S	6.3	20S	0.0	0	46	68
937	WBL 1939	9.5	20S	4.0	10MS	10.9	60S	2.9	20MS	56	79
938	WBL 1942	10.3	20S	1.5	10S	8.0	40S	2.1	10S	46	68
939	WBL 1981	13.8	40S	1.3	10S	0.3	5MR	0.1	TS	46	78
940	WBL 1992	9.9	40MS	21.3	40S	15.6	40S	1.1	10MS	46	89
940A	Infector	72.5	100S	75.0	80S	75.7	80S	77.5	80S	78	99
941	WBL 1994	10.1	20S	8.1	20S	10.0	40S	3.1	10MS	57	89
942	WBL 2001	6.6	20S	10.9	40S	2.9	10S	0.8	5S	56	79
943	WBL 2034	2.8	10S	0.5	5MS	1.1	10MS	0.0	0	46	79
944	WBL 2039	3.3	20MS	5.0	20MS	2.3	15MS	0.0	0	56	89
945	WBL 2040	7.5	20S	38.0	80S	37.7	60S	0.4	5MR	57	99
946	WBL 2074	6.1	20MS	6.6	20S	17.7	60S	5.9	10S	57	99
947	WBL 2095	6.6	20S	5.3	20S	2.7	10MS	4.8	10MS	56	89
948	WBL 2109	17.3	60S	25.0	80S	54.3	80S	3.2	20S	67	99
949	WBL 2111	5.1	20MS	4.8	20S	1.9	10MS	1.0	5MS	56	89
950	WBL 2112	6.3	20MS	3.8	20MS	7.1	40S	0.5	5MS	56	89
951	WBL 2113	4.5	10S	4.3	20S	0.9	5MS	3.3	10S	47	79
952	WBL 2114	7.4	20MS	6.0	20S	2.5	10MS	2.1	15S	47	79
953	WBL 2115	3.8	10MS	5.8	20MS	5.6	20S	1.2	10MS	47	89
954	WBL 2116	22.6	40S	7.2	20S	1.8	10MS	6.0	20S	57	68
955	WBL 2117	12.3	30S	2.0	20MS	0.0	R	3.2	10S	46	67
956	WBL 2451	7.3	20S	27.6	60S	15.4	40S	0.6	5MS	67	89
957	WBL 2452	0.8	10MR	3.8	20S	2.9	20S	1.3	10S	57	68
958	WBL 2453	0.8	5MR	1.3	10MS	3.1	10S	0.1	TS	57	79
959	WBL 2454	2.1	20MR	4.5	15MS	2.7	10S	3.1	10MS	57	68
960	WBL 2455	4.9	15MS	1.9	10S	1.0	5S	2.2	5S	57	99
960A	Infector	72.5	100S	75.0	80S	77.1	100S	70.0	80S	78	99
961	WBL 2456	3.7	40MR	2.0	20MS	6.6	20S	1.1	5MS	57	79
962	WBL 2457	4.3	20MS	10.1	20S	15.9	60S	2.1	10MS	57	79
963	WBL 2458	9.3	30MS	5.8	20MS	3.6	20S	9.9	40S	68	78
964	WBL 2459	4.4	20S	4.4	20MS	4.0	20S	4.8	20MS	57	79
965	WBL 2460	16.4	60S	12.3	20S	28.6	40S	7.6	20MS	57	79
966	WBL 2461	11.5	40MS	15.0	20S	17.0	40S	9.2	40S	57	89

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
967	WBL 2462	6.9	40MS	1.9	10S	1.6	10S	6.9	20S	57	79
968	WBL 2463	16.0	40S	7.3	20MS	11.3	40S	10.1	40S	57	79
969	WBL 2464	12.0	30S	6.8	20S	8.9	40S	8.7	20S	57	89
970	WBL 2465	11.0	30S	3.5	20S	2.6	10S	3.7	10S	56	89
971	WBL 2466	1.4	20MR	5.2	30S	5.9	20S	2.4	10MS	46	79
972	WBL 2467	6.1	20MS	12.5	40S	19.6	40S	3.0	10S	47	79
973	WBL 2468	3.5	10MS	3.3	10S	6.4	40S	3.6	20S	57	89
974	WBL 2469	0.7	5MS	0.0	R	8.6	60S*	2.9	10S	58	89
975	WBL 2470	15.6	60S	8.5	40S	7.9	40S	4.3	10MS	57	89
976	WBL 2471	4.0	10S	2.2	10MS	1.6	10MS	4.0	10MS	57	89
977	WBL 2472	7.8	30MS	3.4	20S	2.3	10S	8.1	20S	57	89
978	WBL 2473	10.0	40S	3.6	20S	5.8	40S	6.0	10S	56	89
979	WBL 2474	8.6	40S	1.3	10MS	5.7	40S	0.8	5S	56	99
980	WBL 2475	27.0	80S	22.3	60S	27.1	40S	14.1	40S	57	89
980A	Infector	72.5	100S	75.0	80S	78.6	100S	77.5	80S	78	99
981	WBL 2476	4.9	10S	7.5	30S	6.4	20S	8.3	20S	57	89
982	WBL 2477	6.0	20MS	19.8	40S	22.3	60S	10.4	40MS	57	89
983	WBL 2478	6.3	20S	6.8	20MS	3.8	20MS	6.1	20MS	57	89
984	WBL 2479	24.8	60S	3.1	10S	0.3	5MR	0.6	5MS	57	78
985	BWL 7349	10.8	40S	2.3	10MS	0.3	5MR	15.6	60S	57	78
986	BWL 7742	5.6	20MS	4.0	20MS	2.6	10MS	6.0	20MS	57	78
987	BWL 8194	18.3	60S	3.3	20MS	2.9	20MS	3.8	10S	57	79
988	BWL 8667	19.9	60S	7.0	20MS	0.3	5MR	22.8	60S	57	79
989	BWL 9941	3.9	20S	2.5	10S	0.8	5S	3.5	10MS	57	89
990	BWL 9992	9.9	20S	3.3	20MS	3.3	10S	6.6	20MS	57	89
991	BWL 9994	16.0	40S	4.1	20S	6.0	40S	4.4	10MS	57	89
992	BWL 10001	11.3	40S	4.3	30S	6.5	40S	3.3	10MS	56	99
993	DW590	16.0	60S	4.3	20MS	1.9	10S	1.1	5MS	57	79
994	DW591	30.0	60S	4.3	20MS	5.7	40S	2.2	10MS	57	68
995	DW592	14.8	60S	3.5	20MS	6.9	40S	1.8	5S	67	79
996	DW593	16.5	60S	2.7	10S	18.4	80S	0.2	TS	57	78
997	WBL1454	7.4	20S	32.0	80S	20.7	60S	1.7	5MS	57	79
998	WBL1455	18.5	40S	7.5	40S	17.3	80S	10.2	40S	57	68
999	WBL1473	8.2	20S	26.5	60S	23.6	60S	1.1	10MS	56	79
1000	WBL1480	8.0	20MS	3.0	20MS	5.7	40S	0.1	TS	56	68

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
1000A	Infector	72.5	100S	75.0	80S	75.7	100S	75.0	80S	78	99
1001	WBL1481	16.4	60S	4.5	40MS	1.6	5S	9.7	40S	56	79
1002	WBL1492	9.5	20S	1.0	10MS	0.6	10MR	1.2	10MS	56	89
1003	WG2604	19.5	40S	5.2	10S	1.3	5S	20.6	40S	56	89
1004	WG2607	14.0	40S	3.3	10MS	0.3	5MR	5.2	20MS	46	58
1005	WG2612	7.0	20MS	5.2	20MS	2.3	10S	2.4	10S	57	89
1006	WG2619	9.1	20S	4.3	20MS	1.1	10MS	5.1	20MS	56	78
1007	WG2633	4.3	10S	4.1	20MS	7.3	40S	14.6	40S	57	89
1008	WG2636	13.0	40S	8.3	20S	7.6	40S	15.7	40S	57	79
1009	WG2637	9.5	20S	4.5	20S	2.9	5S	16.0	40S	57	89
1010	WG2648	5.0	10S	2.8	10S	6.7	40S	3.8	10S	57	79
1011	WG2650	8.8	20S	4.6	20S	0.6	5MS	6.4	20MS	56	89
1012	WG2671	9.6	20S	8.6	40S	4.1	20S	2.3	5S	46	68
1013	WG2702	17.6	40S	6.7	20S	1.3	10MS	1.8	5S	56	79
1014	WG2707	3.9	10S	3.1	20S	1.1	10MR	5.0	10S	56	78
1015	WG2727	6.0	20S	4.1	10S	0.3	5MR	1.1	5MS	57	79
1016	WG2728	9.6	20S	6.0	20MS	0.6	5MR	0.4	5MR	57	68
1017	WG2731	8.5	20S	5.6	20S	5.6	20S	2.6	10MS	57	79
1018	WG2764	7.9	40MS	3.3	10S	5.4	20S	14.1	40S	47	79
1019	WG2793	13.3	20S	8.3	40S	13.5	40S	11.9	40S	46	67
1020	WG3052	14.1	40S	2.4	15MS	5.7	40S	2.7	20MS	56	79
1020A	Infector	75.0	100S	80.0	80S	78.6	100S	75.0	80S	78	99
1021	WG3053	33.8	80S	19.0	40S	4.3	20S	1.6	10MS	57	79
1022	WG3054	12.9	40S	3.5	20S	1.9	10MS	6.9	40S	57	79
1023	WG3055	8.5	20S	5.3	20MS	1.1	10MS	1.1	5MS	57	68
1024	WG3056	8.3	20S	7.5	20S	3.1	20MS	1.6	10MS	68	79
1025	WG3057	11.8	40S	5.4	20MS	9.9	20S	0.6	5MS	56	89
1026	WG3058	6.2	20S	5.0	20S	15.7	40S	10.2	40MS	56	79
1027	WG3059	15.6	40S	7.9	20S	17.0	60S	7.5	20MS	56	89
IIWBR, Projects											
1028	RWP1397	4.0	20S	1.3	10MS	4.1	20S	0.1	TS	56	79
1029	RWP1939	6.1	20S	3.6	20S	0.9	5S	14.1	40S	56	79
1030	RWP1944	1.6	10MS	2.8	20S	9.3	40S	10.9	40S	57	79
1031	RWP2020	6.5	20S	2.6	10S	5.5	20S	2.5	10S	67	79
1032	RWP2024	7.8	40S	3.3	20S	3.0	10MS	4.9	10S	57	89

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	HS	ACI	HS	ACI	HS	ACI	HS	AVG.	HS
1033	RWP2030	6.0	20S	4.4	20S	0.3	5MR	9.6	40MS	56	79
1034	RWP2036	10.8	20S	8.8	20S	12.9	40S	10.5	40MS	67	79
1035	RWP1521	12.9	20S	12.8	20S	22.1	60S	4.8	20MS	57	79
1036	WAP2205	13.5	40S	11.0	20S	7.3	20S	8.2	20MS	57	89
1037	WAP2206	0.7	10MR	0.3	10R	2.9	20S	4.9	20MS	57	89
1038	WAP2207	2.5	10S	1.5	10S	0.3	5MR	0.6	5S	57	89
1039	WAP2208	5.6	20S	8.3	20S	5.7	20S	2.5	10S	56	79
1040	WAP2209	4.4	10S	5.6	20S	20.8	40S	9.1	40MS	46	89
1040A	Infector	75.0	100S	75.0	80S	78.6	100S	75.0	80S	78	99
1041	WAP2210	5.1	10S	5.9	20S	7.9	20S	10.9	40MS	67	79
1042	WAP2211	9.1	20S	1.8	10S	0.6	10MR	6.6	20MS	57	79
1043	WAP2212	7.8	20S	0.0	R	5.7	15S	7.5	20S	56	79
1044	BRNS1	11.3	40S	2.5	20MS	2.4	10S	11.4	20S	46	68
1045	BRNS2	7.3	20MS	20.6	40S	26.4	60S	14.1	40S	57	78
1046	BRNS3	12.3	20MS	13.0	20S	7.1	40S	19.8	40S	56	78
1047	BRNS4	7.5	20S	13.8	20S	19.3	60S	12.6	40MS	57	78
1048	BRNS5	7.3	20S	1.8	10S	2.3	10S	8.9	20S	56	78
1049	BRNS6	7.5	20S	2.6	20S	8.0	40S	4.2	20MS	57	78
1050	BRNS7	13.1	40S	22.5	40S	28.9	60S	12.3	40MS	57	99
1051	BRNS8	10.9	20S	9.5	20S	11.9	40S	11.9	40MS	57	78
1052	BRNS9	11.0	20S	7.0	30S	9.5	20S	4.6	20MS	67	89
1053	BRNS10	7.3	20S	10.5	30S	18.4	40S	7.5	20MS	57	78
1054	BRNS11	9.4	20S	8.2	40S	10.3	40S	9.9	40MS	57	78
1055	BRNS12	10.8	40S	13.9	30S	15.3	40S	7.5	20S	46	78
1056	BRNS13	8.0	20S	13.9	40S	8.3	40S	32.1	60S	57	99
1057	BRNS14	14.8	60S	18.8	40S	22.7	80S	12.4	40MS	57	78
1058	BRNS15	7.9	20MS	15.3	40S	16.4	60S	11.3	40MS	57	89
1059	BRNS16	7.1	10S	21.1	40S	9.1	20S	7.4	20MS	57	78
1060	BRNS17	11.8	40S	23.0	60S	15.1	40S	14.5	40MS	57	89
1060A	Infector	72.5	100S	77.5	80S	80.0	100S	77.5	80S	78	99
1061	BRNS18	9.8	20S	20.8	40S	20.0	40S	5.3	20MS	67	89
1062	BRNS19	9.8	20S	18.9	40S	15.0	40S	10.2	40MS	57	99
1063	BRNS20	7.8	20S	12.5	40S	9.2	40S	30.8	80S	46	68
1064	BRNS21	6.3	20S	11.0	40S	17.0	60S	11.5	40MS	46	78
1065	BRNS22	15.6	40S	9.1	20S	11.7	60S*	10.0	40MS	67	89

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
1066	BRNS23	14.5	60S	19.8	60S	17.6	80S	8.5	40MS	67	89
1067	BRNS24	8.6	20S	13.6	40S	11.7	20S	17.1	60S	57	89
1068	BRNS25	11.3	40S	18.8	40S	16.0	40S	11.8	40MS	57	89
1069	BRNS26	8.9	20S	11.8	20S	17.9	60S	7.6	40MS	57	89
1070	BRNS27	6.9	20S	10.3	20S	24.9	60S	14.6	40S	57	79
1071	BRNS28	8.5	20S	11.1	20S	11.0	40S	30.8	60S	56	89
1072	BRNS29	13.1	60S	20.0	60S	15.4	40S	9.3	40MS	57	89
1073	BRNS30	5.4	10S	15.0	40MS	9.3	40S	8.6	40MS	56	89
1074	BRNS31	7.3	20S	16.8	40S	11.4	40S	11.4	40MS	56	89
1075	BRNS32	17.0	60S	11.5	20S	20.0	80S	9.8	40MS	57	89
1076	BRNS33	11.3	40S	12.3	30S	16.4	40S	6.1	20MS	67	89
1077	BRNS34	18.8	60S	11.9	20S	19.4	80S	12.0	40MS	67	89
1078	BRNS35	7.5	20S	15.4	40S	15.9	60S	6.1	20MS	67	89
1079	BRNS36	10.0	20S	11.8	40S	13.0	40S	5.9	20MS	67	89
1080	BRNS37	12.9	40S	20.5	40S	16.4	60S	11.3	40MS	57	89
1080A	Infector	70.0	100S	75.0	80S	75.7	100S	72.5	80S	78	99
1081	BRNS38	16.9	40S	12.1	20S	19.0	60S	9.9	40S	67	99
1082	BRNS39	11.6	20S	6.9	20S	4.6	20S	15.3	60S	57	78
1083	BRNS40	6.0	20MS	5.3	20S	2.9	20S	17.5	40S	57	78
1084	BRNS41	6.5	20S	3.3	20S	0.7	5S	26.8	60S	57	79
1085	BRNS42	12.3	40S	2.8	10S	1.0	5S	13.5	40MS	57	99
1086	BRNS43	9.4	60S*	3.6	20S	2.0	5S	17.0	40S	67	78
1087	BRNS44	7.8	20S	9.5	20S	13.9	40S	21.8	60S	57	68
1088	BRNS45	9.1	60S*	9.9	60S	4.1	20S	10.8	60S	56	78
1089	BRNS46	12.8	60S	7.4	30S	12.4	60S	3.9	10S	56	78
1090	BRNS47	6.9	20S	3.3	20S	4.3	20S	3.1	10MS	46	78
1091	BRNS48	7.8	20S	3.0	20S	1.6	5S	2.6	10S	46	67
1092	NE IPPSN22-1	5.3	20S	2.8	15MS	0.3	5MR	8.7	40MS	57	78
1093	NE IPPSN22-2	17.8	40S	12.3	30S	4.3	20S	0.6	5MS	67	78
1094	NE IPPSN22-3	10.9	20S	11.5	20S	7.8	40S	3.4	10MS	57	79
1095	NE IPPSN22-4	6.9	20S	4.1	10S	0.1	TMR	6.4	40S	56	89
1096	NE IPPSN22-5	2.0	10MS	2.4	10S	1.9	10MS	0.1	TS	46	79
1097	NE IPPSN22-6	12.2	30S	9.5	20S	5.6	20S	0.6	5MS	46	68
1098	NE IPPSN22-7	12.5	40S	13.0	30S	6.4	20S	1.2	5S	57	78
1099	NE IPPSN22-8	4.7	20S	3.8	15MS	1.3	5S	1.6	5S	57	89

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
1100	NE IPPSN22-9	16.3	40S	22.3	60S	14.1	40S	0.6	5S	46	89
1100A	Infector	72.5	100S	77.5	80S	78.6	100S	75.0	80S	78	99
1101	NE IPPSN22-10	10.1	40S	18.0	40S	17.3	40S	1.7	10MS	57	99
1102	NE IPPSN22-11	20.0	60S	9.5	20S	10.4	40S	11.3	60S	58	68
1103	NE IPPSN22-12	9.2	20S	6.9	20S	4.6	20S	7.5	20S	56	89
1104	NE IPPSN22-13	11.0	40S	10.5	40S	20.7	80S	7.0	20MS	67	78
1105	NE IPPSN22-14	8.8	40S	7.8	20S	1.8	10S	12.3	40MS	57	89
1106	PBS IPPSN22 -01	3.4	10MS	3.9	10S	0.3	5MR	19.1	40S	67	99
1107	PBS IPPSN22 -02	14.8	40S	11.3	20S	29.3	60S	19.5	40S	56	99
1108	PBS IPPSN22 -03	9.1	40S	4.4	20MS	7.9	20S	7.9	40MS	68	68
1109	PBS IPPSN22 -04	0.8	10MR	11.8	40MS	17.3	40S	14.4	30S	68	89
1110	PBS IPPSN22 -05	4.1	20MS	2.3	10MS	3.1	10S	4.7	20S	56	89
1111	PBS IPPSN22 -06	20.1	40S	11.4	20S	14.1	40S	26.0	40S	57	89
1112	QLT 01	5.5	20S	5.1	10S	9.9	40S	13.3	60S	56	89
1113	QLT 02	5.3	20MS	5.4	20MS	3.0	10S	3.8	20MS	67	89
1114	QLT 03	7.4	20S	5.9	20S	6.3	40S	6.0	40MS	57	89
1115	QLT 04	8.3	40S	5.0	10S	8.9	40S	8.8	40S	67	89
1116	QLT 05	5.1	20S	6.3	20MS	13.3	60S	32.5	60S	56	78
1117	QLT 06	1.8	10MS	10.0	20S	20.3	60S	26.3	40S	46	78
1118	QLT 07	12.9	40S	3.7	10S	0.0	R	26.8	40S	47	78
1119	QLT 08	7.3	20MS	3.7	20MS	8.3	40S	39.0	60S	57	78
1120	QLT 09	5.9	20S	6.0	20S	2.1	10MS	14.0	40S	57	89
1120A	Infector	72.5	100S	77.5	80S	75.7	100S	72.5	80S	78	99
1121	QLT 10	2.4	10MS	9.3	40S	4.3	30S	35.8	60S	67	99
BioSeeds											
1122	BW19R9057	6.4	10S	14.8	40S	20.7	40S	48.5	80S	67	99
1123	BW20R	2.7	10S	7.4	20S	9.1	40S	4.4	10S	67	89
CSSRI, Karnal (SATSN)											
1124	KRL 2101	2.8	10S	1.6	10MS	5.7	40S	6.4	20S	46	67
1125	KRL 2105	0.5	5MR	1.5	10MS	1.5	10S	10.8	30S	56	78
1126	KRL 2106	5.9	20MS	0.3	5MR	0.3	5MR	3.9	10S	57	89
1127	KRL 2112	20.5	60S	9.8	20S	1.0	5MS	5.0	15S	57	99
1128	KRL 2114	14.5	40S	3.4	20MS	6.1	20S	5.9	20MS	46	67
1129	KRL 2201	16.8	60S	15.0	60S	9.5	40S	16.4	60S	57	99
1130	KRL 2202	7.1	20S	6.1	20MS	6.1	40S	15.8	60S	57	99

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
1131	KRL 2203	15.5	40S	14.8	40S	10.7	60S*	12.6	40S	67	78
1132	KRL 2204	1.0	10MR	4.0	20S	12.1	40S	24.0	40S	57	89
1133	KRL 2205	10.5	20S	5.8	20MS	9.4	40S	11.4	40S	57	89
1134	WBL 2305	20.8	40S	2.3	10S	1.4	10S	3.3	20MS	46	89
1135	WBL 2306	9.8	40S	20.5	40S	37.1	80S	3.1	20MS	46	68
1136	WBL 2307	9.3	20S	30.0	60S	40.0	80S	1.9	15S	57	78
1137	WBL 2308	9.1	20S	4.0	20S	1.4	10S	1.3	5MS	57	78
1138	WBL 2309	12.5	40S	3.5	20MS	1.5	5S	4.5	20S	57	89
1139	KRL 210	29.9	60S	19.5	60S	37.1	80S	7.4	20S	78	99
1140	Kh.65	24.4	60S	33.5	80S	34.3	60S	53.6	80S	67	99
1140A	Infector	75.0	100S	75.0	80S	78.6	100S	75.0	80S	78	99
1141	DBW 187	7.3	20S	2.8	10S	8.0	20S	7.3	20MS	56	99
VPKAS,Almora											
1142	VW2201	5.9	20MS	6.8	20S	11.6	40S	2.3	5S	67	89
1143	VW2203	2.1	10MS	11.0	40MS	16.9	40S	14.1	40S	67	78
1144	VW2204	4.1	10S	5.8	20MS	10.7	20S	7.1	20S	57	89
1145	VW2205	0.9	10MR	0.3	5MR	4.3	20S	15.0	40S	56	78
1146	VW2208	16.8	60S	13.1	40S	17.9	40S	3.4	20MS	67	89
1147	VW2210	8.1	20S	11.0	40S	27.1	60S	3.8	20S	56	89
1148	VW2213	10.4	40S	1.0	5MS	4.3	10S	3.9	20MS	56	78
1149	VW2214	7.3	30S	5.0	20MS	9.4	20MS	7.6	20S	56	89
1150	VW2215	33.0	80S	35.0	60S	37.7	80S	2.1	10S	67	89
1151	VW2217	27.5	60S	23.4	80S	28.4	80S	7.1	20S	67	89
1152	VW2218	2.5	10S	4.1	20S	4.2	20S	7.0	20S	57	68
1153	VW2219	19.3	60S	15.0	60S	20.1	60S	3.1	20MS	57	89
1154	VW2220	10.5	60S	8.8	20MS	10.6	40S	10.2	40S	57	89
1155	VW2221	5.0	20S	3.0	15MS	5.0	10S	1.4	10MS	67	89
1156	VW2223	4.0	10S	11.9	40S	10.0	40S	6.1	20S	67	89
1157	VW2228	19.0	40S	4.6	10S	12.5	40S	8.9	40S	67	89
1158	VW2230	18.3	80S	16.1	60S	16.1	40S	3.2	20S	57	89
1159	VW2232	6.9	40S	1.3	10MS	10.1	60S*	4.5	20MS	57	89
1160	VW2236	12.1	60S	3.5	10S	10.7	40S	0.6	5S	46	78
1160A	Infector	72.5	100S	77.5	80S	80.0	100S	72.5	80S	78	99
1161	VW2237	3.5	10S	3.5	20MS	9.6	40S	5.6	30S	57	89
1162	VW2238	4.7	20S	4.3	20MS	15.0	40S	7.4	20MS	57	89

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
1163	VW2239	2.3	10MS	4.2	20MS	4.4	20S	5.6	15S	67	89
1164	VW2240	2.1	10MS	3.0	20MS	5.0	20S	20.3	60S	47	68
1165	VW2241	4.5	20S	4.2	20MS	5.1	20S	3.1	20S	57	67
1166	VW2242	7.3	40S	4.0	20MS	12.1	40S	2.4	10S	67	78
BHU, Varanasi											
1167	HUWL2201	21.3	60S	0.0	R	0.6	10MR	41.0	60S	46	67
1168	HUWL2202	12.3	40S	0.0	R	0.3	5MR	26.3	60S	57	68
1169	HUWL2203	16.0	60S	0.0	R	9.3	40S	19.7	60S	57	79
1170	HUWL2204	4.3	20S	0.0	R	6.0	40S	42.3	80S	68	99
1171	HUWL2205	7.1	40MS	25.5	60S	26.9	60S	2.3	10S	68	99
1172	HUWL2206	19.3	40S	22.9	40S	42.9	60S	1.6	5S	57	99
1173	HUWL2207	7.3	20MS	2.0	10MS	0.9	10MR	14.5	40S	57	78
1174	HUWL2208	5.3	20S	0.8	5MS	0.3	5MR	19.6	40S	57	89
1175	HUWL2209	9.1	20S	30.6	60S	26.4	60S	39.1	80S	57	89
1176	HUWL2210	8.8	20S	5.9	20MS	9.4	40S	25.3	60S	47	78
1177	HUWL2211	8.4	20S	4.4	20S	10.5	40S	21.0	40S	57	78
1178	HUWL2212	10.3	40S	3.3	10S	12.1	40S	4.2	15S	57	89
1179	HUWL2213	15.5	60S	25.0	60S	12.9	40S	4.9	20MS	57	78
1180	HUWL2214	11.4	40S	6.5	20S	15.6	60S	8.0	20MS	68	89
1180A	Infector	75.0	100S	80.0	80S	78.6	100S	75.0	80S	68	99
1181	HUWL2215	31.5	80S	22.3	40S	23.4	60S	44.3	80S	67	89
1182	HUWL2216	11.8	40S	15.0	40S	15.7	60S	40.3	80S	68	78
1183	HUWL2217	12.0	40S	22.9	60S	25.1	60S	35.8	60S	57	68
1184	HUWL2218	20.0	60S	11.3	40S	11.4	20S	21.6	60S	57	68
1185	HUWL2219	18.3	40S	19.0	60S	25.0	40S	25.6	60S	56	78
1186	HUWL2220	12.6	40S	9.8	20S	10.0	40S	16.0	40S	56	78
IGKV, Bilaspur											
1187	CG 2201	16.9	40S	13.0	40S	17.0	40S	34.9	80S	57	68
1188	CG 2202	5.7	20S	4.3	20MS	5.0	20S	42.3	60S	56	78
1189	CG 2203	16.9	40S	12.1	40S	21.4	80S	55.0	80S	68	89
1190	CG 2204	18.5	40S	7.5	20S	16.3	60S	25.0	60S	67	78
1191	CG 2205	22.5	60S	28.1	60S	21.3	60S	51.0	80S	78	99
1192	CG 2206	25.0	60S	14.1	60S	6.3	40S	10.0	20S	57	78
1193	CG 2207	13.5	40S	6.3	20S	14.0	40S	52.5	80S	68	78
1194	CG 2208	26.0	80S	7.5	20S	14.7	40S	58.8	80S	68	89

S. No.	Entry	Stem rust		Leaf rust (S)		Leaf rust (N)		Stripe rust		Foliar blight	
		ACI	**HS**	**ACI**	**HS**	**ACI**	**HS**	**ACI**	**HS**	**AVG.**	**HS**
1195	CG 2209	7.5	20S	3.6	20S	3.1	20S	12.5	40S	67	99
1196	CG 2210	24.5	60S	4.0	20S	4.3	20S	19.3	40S	57	89
1197	CG 2211	15.5	40S	6.8	20S	29.4	80S	48.5	80S	67	99
1198	CG 2212	11.0	40S	1.4	5S	1.1	10MS	62.5	80S	67	99
1199	CG 2213	4.3	20S	1.7	10MS	2.9	20S	46.5	80S	67	99
1200	CG 2214	12.5	40S	6.3	20S	17.4	40S	41.3	60S	78	99
1200A	Infector	75.0	100S	77.5	80S	75.7	100S	77.5	80S	78	89
1201	CG 2215	30.0	60S	17.8	40S	24.7	60S	39.0	60S	78	89
SHUATS, Prayagraj											
1202	SHUATS –W71 (MR-3222)	37.3	60S	14.7	40S	11.1	40S	42.3	60S	78	99
1203	SHUATS -W82	42.8	80S	17.3	40S	9.4	40S	57.5	80S	57	89
1204	SHUATS -W88 (MR-3012/1/3/7)	18.5	60S	12.0	40MS	6.3	30S	25.0	60S	56	99
1205	AAI-W30 (MR-3087)	15.0	40S	5.8	20S	6.3	40S	58.5	80S	56	99
1206	SHUATS-W76 (MR-3117/21/4)	30.5	60S	11.5	40S	1.1	5S	42.4	60S	56	99
1207	SHUATS-W87 (G3-MUTANT-2)	24.8	60S	5.9	20S	6.0	40S	61.0	80S	67	99
1208	AAI-W12	23.8	60S	22.6	40S	29.9	80S	48.8	80S	57	78
1209	AAI-W47 (MR-3040/10/3/1)	55.0	80S	24.3	60S	32.6	80S	42.3	80S	68	89
1210	SHUATS-W24 (MR-1010)	13.8	40S	9.0	20S	30.7	80S	42.3	60S	68	99
1211	SHUATS-W74 (MR-3036/8/1)	41.9	60S	23.1	60S	22.9	40S	34.5	60S	67	99
1212	SHUATS-W76 (MR-3117/21/4)	33.5	60S	14.0	60S	15.1	40S	45.0	60S	56	99
1213	SHUATS-W68 (MR-3004)	45.0	60S	13.8	40S	6.0	20S	36.9	80S	57	99
1214	AAI-W66 (MR-1129)	30.8	80S	9.0	20S	5.1	20S	42.5	60S	57	89
1214A	Infector	75.0	100S	75.0	80S	78.6	100S	75.0	80S	78	99

Abbreviations: ACI = Average Coefficient of Infection, HS = Highest Score, *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 2022-23

S. No.	Entries	Avg	HS
1	HD3472	97.69	100.00
2	HD3444	96.60	100.00
3	HD3445	95.43	100.00
4	HD3446	56.19	60.00
5	HD3447	30.00	60.00
6	DBW408	5.00	10.00
7	DBW409	43.00	50.00
8	DBW410	25.00	50.00
9	DBW411	9.51	19.02
10	DBW412	35.00	50.00
11	PBW908	60.00	100.00
12	PBW909	25.00	40.00
13	PBW910	7.78	10.00
14	PBW911	89.58	100.00
15	PBW912	54.45	68.91
16	UP3121	33.48	66.96
17	UP3122	9.17	10.00
18	UP3123	12.22	14.44
19	RAJ4576	5.00	10.00
20	RAJ4577	5.00	10.00
21	RAJ4578	5.00	10.00
22	WH1315	30.00	60.00
23	WH1316	8.95	10.00
24	NW8072	47.01	74.01
25	K2201	12.43	14.86
26	HUW854	5.00	10.00
27	BRW3944	5.00	10.00
28	KRL2106	5.00	10.00
29	JAUW711	14.38	18.75
30	NWS2442	5.00	10.00
31	BCW28	5.00	10.00
32	UBW18	10.00	20.00
33	SVPWL21-15	16.52	23.04
34	HD3448	30.00	40.00
35	HD3449	5.00	10.00
36	HP1978	100.00	100.00
37	HP1979	35.00	70.00
38	HD3467	5.00	10.00
39	DBW413	17.69	25.38
40	DBW414	30.00	60.00
41	DBW415	25.00	50.00
42	DBW416	5.00	10.00
43	DBW417	5.00	10.00
44	PBW913	10.00	20.00
45	PBW914	7.78	10.00
46	PBW915	16.89	23.77
47	PBW916	93.40	97.85
48	PBW917	86.71	90.00
49	UP3124	15.56	21.11
50	UP3125	12.30	14.59
51	UP3132	98.00	100.00
52	NW8073	90.96	100.00
53	NW8075	100.00	100.00
54	WH1317	90.00	100.00
55	WH1318	99.47	100.00
56	K2203	92.45	94.90
57	K2204	95.00	100.00
58	BRW3946	88.59	90.00
59	BRW3942	96.63	100.00
60	RAJ4579	95.00	100.00
61	JKW305	61.64	70.00
62	HUW855		
63	NWS2216	84.84	90.00
64	BCW29	91.58	93.16
65	UBW19	85.00	100.00
66	SVPWL21-07	93.70	97.40
67	HD3450	60.26	70.00
68	HD3451	69.85	80.00
69	HI1683	50.18	80.00
70	HI1684	20.00	40.00
71	MACS6826	32.55	40.00
72	MACS6837	5.00	10.00
73	MACS6842	93.72	100.00
74	MACS6844	99.22	100.00
75	GW548	90.00	100.00
76	GW549	30.00	60.00
77	GW550	100.00	100.00
78	DBW418	89.58	100.00
79	DBW419	41.79	60.00
80	UAS3025	100.00	100.00
81	UAS3026	100.00	100.00
82	MP3570	99.46	100.00
83	MP3573	30.00	60.00
84	NIAW4364	82.81	100.00
85	NIAW4440	30.00	60.00
86	MP1392	95.00	100.00
87	MP1393	97.93	100.00
88	GW554	5.00	10.00
89	GW555	10.00	20.00
90	PWU16	5.00	10.00
91	PWU20	31.18	40.00
92	PBW918		
93	RAJ4582	79.82	89.64
94	CG1045	56.72	70.00
95	AKAW5347	90.00	100.00
96	PBN16-1766	82.86	85.71
97	LOK80	100.00	100.00
98	NWS2170	95.85	100.00

S. No.	Entries	Avg	HS
99	BW18R6016	87.50	100.00
100	HD3452	100.00	100.00
101	HD3453	95.00	100.00
102	HD3454	100.00	100.00
103	HD3455	89.22	98.45
104	HP1980	100.00	100.00
105	DBW420	100.00	100.00
106	DBW421	94.68	100.00
107	DBW422	100.00	100.00
108	DBW423	100.00	100.00
109	DBW424	32.94	60.00
110	PBW919	28.95	50.00
111	PBW920	65.14	70.27
112	PBW921	39.12	70.00
113	PBW922	49.33	60.00
114	PBW923	85.00	90.00
115	WH1322	16.69	23.39
116	WH1323	41.15	50.00
117	WH1324	8.95	10.00
118	K2206	31.67	50.00
119	K2207	85.00	90.00
120	K2208	13.97	17.95
121	RAJ4580	100.00	100.00
122	RAJ4581	27.94	50.00
123	NW8055	85.00	70.00
124	NW8071	70.00	70.00
125	UP3126	8.13	10.00
126	UP3127	59.59	80.00
127	JKW303	75.00	80.00
128	BRW3941	38.57	70.00
129	BCW30	99.22	100.00
130	UBW20	100.00	100.00
131	SVPWL21-14	100.00	100.00
132	HD3456	58.57	100.00
133	HI1685	80.00	100.00
134	HI1686	100.00	100.00
135	HI1687	7.35	10.00
136	DBW425	5.00	10.00
137	DBW426	16.64	23.28
138	UAS3027	88.98	100.00
139	UAS3028	10.00	20.00
140	MP3568	5.00	10.00
141	MP3575	14.43	18.86
142	NIAW4300	70.00	100.00
143	NIAW4432	47.50	50.00
144	MACS6829	30.62	41.24
145	MACS6830	12.89	20.00
146	GW551	87.42	100.00
147	GW558	28.75	50.00
148	WSM138	85.08	90.16
149	CG1046	100.00	100.00
150	WH1325	100.00	100.00

S. No.	Entries	Avg	HS
151	GW556	90.00	100.00
152	LOK81	100.00	100.00
153	PBW924	100.00	100.00
154	MP1394	99.49	100.00
155	HI8848(d)	94.85	100.00
156	HI8849(d)	8.92	17.84
157	HI8850(d)	89.42	94.82
158	NIDW1499(d)	100.00	100.00
159	NIDW1534(d)	100.00	100.00
160	NIDW1520(d)	0.00	0.00
161	DDW62(d)	57.59	60.00
162	DDW63(d)	44.21	80.00
163	UAS482(d)	5.00	10.00
164	UAS483(d)	100.00	100.00
165	PDW364(d)	5.00	10.00
166	PDW365(d)	94.95	100.00
167	MPO1395(d)	95.00	100.00
168	MPO1396(d)	7.63	10.00
169	MACS4125(d)	50.00	100.00
170	MACS4135(d)	9.17	10.00
171	GW1365(d)	56.46	70.00
172	GW1366(d)	9.41	10.00
173	WHD968(d)	55.23	75.68
174	PWU24(d)	70.00	100.00
175	GW1367(d)	50.00	90.00
176	AKDW5516(d)	100.00	100.00
177	HD3457	65.00	100.00
178	HD3458	47.67	50.00
179	HD3459	100.00	100.00
180	HD3460	100.00	100.00
181	HD3468	10.98	17.67
182	DBW427	60.00	100.00
183	DBW428	10.00	10.00
184	DBW429	9.41	10.00
185	DBW430	65.21	73.81
186	PBW925	100.00	100.00
187	PBW926	100.00	100.00
188	PBW927	65.00	80.00
189	PBW928	70.00	80.00
190	UP3129	76.83	100.00
191	UP3133	100.00	100.00
192	WH1326	65.00	80.00
193	WH1327	91.84	100.00
194	K2210	9.76	10.00
195	NW8053	47.79	70.00
196	JKW304	100.00	100.00
197	BRW3935	100.00	100.00
198	JAUW705	96.91	100.00
199	HI1688	94.76	100.00
200	HI1689	77.33	100.00
201	HI1693	96.67	100.00
202	HI8851(d)	100.00	100.00

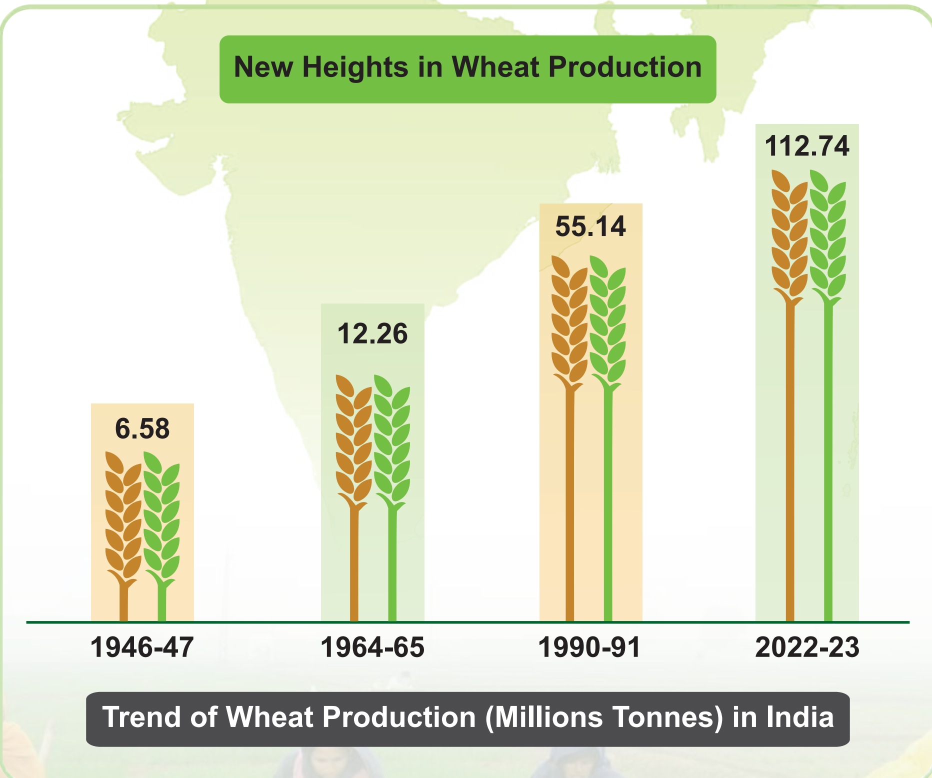
S. No.	Entries	Avg	HS
203	HI8852(d)	90.41	100.00
204	DBW431	67.63	80.00
205	DBW432	5.00	10.00
206	DDW64(d)	7.00	10.00
207	UAS3029	100.00	100.00
208	UAS484(d)	5.00	10.00
209	NIAW4267	85.00	100.00
210	NIAW4387	84.39	88.78
211	GW552	12.65	16.97
212	GW1368(d)	20.79	31.58
213	AKAW5514	11.32	12.63
214	CG1047	95.00	100.00
215	MP3577	0.00	0.00
216	MPO1398(d)	96.88	100.00
217	MACS4131(d)	9.41	10.00
218	PBN16-1826	100.00	100.00
219	HD3461	35.34	64.49
220	HD3462	100.00	100.00
221	HD3463	95.83	100.00
222	HD3464	39.45	58.91
223	HI1690	14.41	18.81
224	HI1691	5.00	10.00
225	PBW903	73.36	80.00
226	PBW904	65.75	80.00
227	PBW905	0.00	0.00
228	PBW906	0.00	0.00
229	PBW907	53.33	100.00
230	PBW929	90.00	100.00
231	DBW433	5.00	10.00
232	DBW434	97.42	100.00
233	DBW435	5.00	10.00
234	DBW436	95.81	100.00
235	DBW437	87.76	100.00
236	DBW438	7.05	10.00
237	DBW439	0.00	0.00
238	DBW440	79.11	90.00
239	WH1320	99.06	100.00
240	WH1321	0.00	0.00
241	UP3130	8.24	10.00
242	RAJ4583	0.00	0.00
243	BRW3922	7.63	10.00
244	CG1049		
245	RAUW107	9.50	10.00
246	JWS1333	5.00	10.00
247	GW553	95.00	100.00
248	GW557	8.42	10.00
249	MP3572	5.00	10.00
250	MP1399	92.35	100.00
251	HD3470	87.51	90.00
252	HD3471	75.00	90.00
253	DBW441	0.00	0.00
254	DBW442	0.00	0.00

S. No.	Entries	Avg	HS
255	DBW443	5.00	10.00
256	DBW444	98.72	100.00
257	HD3469	94.23	98.45
258	UP3083	93.68	100.00
259	RWP1397	92.56	100.00
260	RWP1939	5.00	10.00
261	RWP1944	5.00	10.00
262	RWP2020	9.17	10.00
263	RWP2024	0.00	0.00
264	RWP2030	0.00	0.00
265	RWP2036	5.00	10.00
266	RWP1521	17.50	25.00
267	RWP1280	16.68	25.86
268	RWP1332	0.00	0.00
269	RWP1350	7.63	10.00
270	RWP1365	5.00	10.00
271	RWP1407	38.06	70.00
272	RWP1449	5.00	10.00
273	WAP2213	4.17	8.33
274	WAP2214	0.00	0.00
275	WAP2215	65.00	70.00
276	WAP2216	8.75	10.00
277	WAP2217	5.00	10.00
278	WAP2218	2.89	5.79
279	WAP2219	5.00	10.00
280	WAP2220	8.53	10.00
281	WAP2221	62.30	70.00
282	WAP2222	0.00	0.00
283	WAP2223	0.00	0.00
284	WAP2224	0.00	0.00
285	WAP2225	92.27	100.00
286	WAP2226	80.00	100.00
287	NE-WB22-1	8.95	10.00
288	NE-WB22-2	90.00	90.00
289	NE-WB22-3	9.41	10.00
290	NE-WB22-4	6.94	10.00
291	NE-WB22-5	34.17	60.00
292	NE-WB22-6	70.00	90.00
293	NE-WB22-7	14.17	20.00
294	NE-WB22-8	48.38	80.00
295	NE-WB22-9	46.84	80.00
296	NE-WB22-10	34.17	60.00
297	NE-WB22-11	8.06	10.00
298	NE-WB22-12	7.63	10.00
299	NE-WB22-13	38.57	70.00
300	NE-WB22-14	7.78	10.00
301	FLW1	94.82	100.00
302	FLW2	92.45	100.00
303	FLW3	99.21	100.00
304	FLW4*	100.00	100.00
305	FLW5	97.42	100.00
306	FLW6*	80.00	80.00

S. No.	Entries	Avg	HS
307	FLW7		
308	FLW8	97.44	100.00
309	FLW9	97.44	100.00
310	FLW10	94.87	94.87
311	FLW11	100.00	100.00
312	FLW12	96.67	100.00
313	FLW13	94.79	100.00
314	FLW15	100.00	100.00
315	FLW16	90.00	100.00
316	FLW17	95.00	100.00
317	FLW18	100.00	100.00
318	CNM-1	7.63	10.00
319	CNM-2	7.75	10.00
320	CNM-3	82.41	94.82
321	CNM-4	38.85	70.00
322	CNM-5	28.42	50.00
323	CNM-6	17.95	20.00
324	CNM-7	33.29	36.57
325	CNM-8	89.85	90.00
326	CNM-9	38.18	60.00
327	BRNS 88-1	9.41	10.00
328	BRNS 88-2	18.86	20.00

S. No.	Entries	Avg	HS
329	BRNS 88-3	7.89	10.00
330	BRNS 88-4	75.00	80.00
331	BRNS 88-5	70.00	80.00
332	BRNS 88-6	90.00	100.00
333	BRNS 88-7	95.00	100.00
334	BRNS 88-8	85.00	100.00
335	BRNS 88-9	90.00	100.00
336	BRNS 88-10	85.00	100.00
337	BRNS 88-11	0.00	0.00
338	BRNS 88-12	74.64	79.27
339	BRNS 88-13	13.06	20.00
340	BRNS 88-14	90.00	100.00
341	BRNS 88-15	13.13	20.00
342	BRNS 88-16	0.00	0.00
343	BRNS 88-17	0.00	0.00
344	BRNS 88-18	0.00	0.00
345	BRNS 88-19	0.00	0.00
346	BRNS 88-20	7.06	10.00
347	BRNS 88-21	5.00	10.00
348	BRNS 88-22	0.00	0.00
349	BRNS 88-23	0.00	0.00
350	BRNS 88-24	2.25	4.50

Total 350 entries sent in 2020 were screened against blast at Jashore, Bangladesh at two different dates of sowing during 2022-23. * indicates the entries whose disease recoding made only on single date of sowing.



62वीं अखिल भारतीय गेहूँ एवं जौ अनुसंधान कार्यकर्ता गोष्ठी

महाराणा प्रताप कृषि एवं प्रौद्योगिकी विश्वविद्यालय, उदयपुर, राजस्थान

(अगस्त 28-30, 2023)

62nd All India Wheat and Barley Research Worker's Meet-2023

Maharana Pratap University of Agriculture and Technology (MPUAT), Udaipur, Rajasthan

(August 28-30, 2023)