# प्रगति प्रतिवेदन
# PROGRESS REPORT
# 2023-24

## फसल संरक्षण
## 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 (हरियाणा)

**ICAR-Indian Institute of Wheat & Barley Research, Karnal (Haryana)**

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# AlCRP ON WHEAT AND BARLEY

## PROGRESS REPORT
**2023-24**

# CROP PROTECTION


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(Pradeep Sharma)

Date: 01 September 2024

Principal Investigator
(Crop Protection Programme)

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# PROGRAMME OF WORK, 2023-24 (WHEAT)

The programme for the crop year 2023-24 was chalked out in the 63rd All India Wheat and Barley Research Workers Meet held at MPAUT Udaipur during 28-30 August 2023. The various activities to be executed to be respective centers are given below:

## PROGRAMME 1: Host resistance -IPPSN and PPSN
## Adult Plant Resistance for rusts & other diseases

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

**Objectives**

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

**(a) Rusts:**

**Stripe rust:** Durgapura, Ludhiana, Gurdaspur, Pantnagar, Bajaura, Karnal, Hisar, Delhi, Dhaulakuan, Almora, Malan, Jammu, and Khudwani.

**Leaf rust (North):** Durgapura, Ludhiana, Pantnagar, Karnal, Kanpur, Delhi, and Jammu

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

**Stem rust:** Junagadh, Mahabaleshwar, Pune, Indore, Niphad, Powarkheda, Vijapur, Dharwad and Wellington.

**(b) Leaf blights:** Ludhiana, Pantnagar, Ayodhya, Varanasi, 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:** Durgapura, Ludhiana, Gurdaspur, Pantnagar, Bajaura, Karnal, Hisar, Delhi, Dhaulakuan, Almora, Malan, Jammu, and Khudwani.

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

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

**Stem rust:** Junagadh, Mahabaleshwar, Pune, Indore, Niphad, Powarkheda, Vijapur, Dharwad and Wellington.

**Note**: The samples of leaves of AVT entries and varieties (checks) in PPSN showed resistance in the past but now showing rust severity of 40S or more at any centre, should be sent to the Incharge, IIWBR Regional Station Flowerdale, Shimla for pathotype analysis, with information to P.I. (Crop Protection).

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

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

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

4. **AUDPC based identification of slow rusters in AVT material:**
   **Stripe rust:** Ludhiana,Karnal, Durgapura
   **Leaf rust:** Ayodhya, Mahabaleshwar
   **Stem rust:** Mahabaleshwar, Indore

**PROGRAMME 2: Seedling rust resistance and rust gene postulation**

1. **Race specific adult plant resistance**
   AVT entries will be screened for adult plant resistance to specific predominant races
   a) **Stripe, leaf and stem rusts (under controlled conditions):** Flowerdale, Shimla
   b) **Stripe rust –** Ludhiana and New Delhi
   c) **Leaf rust –**Ludhiana and New Delhi
   d) **Black rust (under controlled conditions):** Pune, Indore and Mahabaleshwar

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

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

2. **Seedling Resistance Tests (SRT) and postulation of rust resistance genes**
   **(a) Stripe, leaf and stem rusts** (All races): IIWBR, Regional Station, Flowerdale, Shimla for AVT's (*T. aestivum*) entries. Flowerdale centre to generate data on rust resistance genes of all the AVT entries.
   **(b) Leaf and stem rust**: Mahabaleshwar for SRT on AVT entries of CZ, PZ and NIVT (durum entries).

**PROGRAMME 3: Leaf Blight**

**Leaf Blight Screening Nursery (LBSN):**
This nursery will consist of AVT 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, New Delhi 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 and Durgapura
2. **Head scab:**Dhulakuan, Gurdaspur, Karnal, Delhi, Coochbehar, Kalyani 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**
    - A
      ll 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. Rust samples collected during the survey 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 coordinated by Flowerdale, Shimla):** The nursery will be planted at 38 locations including Kudwani (Srinagar), Varanasi KVK, Rampur and Yamunanagar (Haryana). Samples from this nursery should be sent regularly to IIWBR, RS, Flowerdale, Shimla for virulence analysis and information. Information on rust appearance to be provided at monthly intervals, starting from end of December to the P.I. (Crop Protection).

**Off-season Disease Monitoring Nursery (To be coordinated by IIWBR Reg. Station, flowerdale)**: This nursery will be planted in Dalang Maidan, Kukumseri, Sangla, Sarahan (HP) and Leh (J&K). High altitude varieties and one hulless barley variety will also be included in this nursery (Inclusion of PBW 757 in place of WL 711).

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

2. **Post- harvest crop health monitoring**

**Monitoring of Karnal bunt and black point in harvested grains**

Post harvest monitoring will be undertaken by all the cooperating centres by analysing samples from grain *mandies* of their respective states

**PROGRAMME 9: Integrated disease management**

1. **Elite 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:** Durgapura, Ludhiana, Gurdaspur, Pantnagar, Bajaura, Karnal, Hisar, Delhi, Dhaulakuan, Almora, Malan, Jammu, and Khudwani.

**Leaf rust (North):** Ayodhya, Durgapura, Ludhiana, Pantnagar, Karnal, Kanpur, Delhi, and Jammu

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

**Leaf Blight:** Ayodhya, Varanasi, RPCAU Pusa, 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, Shimla, Jammu, Pantnagar and Wellington

**Flag smut:** Ludhiana, Hisar and Durgapura

**Head scab:**Dhaulakuan, Gurdaspur, Karnal, Kalyani, Wellington, Dharwad 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 Karnal bunt of wheat (New Experiment):**

**Centres:** Malan, Jammu, Ludhiana, Karnal, Hisar and Pantnagar. The chemicals will be tested are:

| S. No. | Treatments | Doses |
|---|---|---|
| 1 | Azoxystrobin 11% + Tebuconazole 18.3% w/w SC | @ 0.1% |
| 2 | Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC | @ 0.1% |
| 3 | Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC | @ 0.1% |
| 4 | Picoxystrobin 7.05% + Propiconazole 11.7% SC, | @ 0.1% |
| 5 | Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, | @ 0.1% |
| 6 | Tebuconazole 50% + Trifloxystrobin 25% WG, | @ 0.06% |
| 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 Loose smut of wheat (New Experiment):**

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

The chemicals will be tested are:

| S. No. | Treatments | Doses |
|---|---|---|
| 1 | Imidacloprid 18.5% + Hexaconazole 1.5% FS | 0.2% |
| 2 | Carboxin 37.5%+ Thiram 37.5%WS | 3 gm/Kg seed |
| 3 | Difenoconazole 3% WS | 2.5 g $kg^{-1}$ seed) |
| 4 | Carbendazim 50%WP | 2gm/kg seed |
| 5 | Control | - |

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

**(c) Management of head scab through bioformulations (New Experiment)**

**Centres (Head scab):** Gurdaspur, Ludhiana, Karnal and Wellington

| S. No. | Treatments | Dose per 100g seed |
|---|---|---|
| 1 | KUSH-PlantEx | 2 ml |
| 2 | KUSH-PlantEx | 1 ml |
| 3 | KUSH-PlantEx | 0.5 ml |
| 4 | KUSH-SalBoost | 2 ml |
| 5 | KUSH-SalBoost | 1 ml |
| 6 | KUSH-SalBoost | 0.5 ml |
| 7 | KUSH-PhosphoBoost | 2 ml |
| 8 | KUSH-PhosphoBoost | 1 ml |
| 9 | KUSH-PhosphoBoost | 0.5 ml |
| 10 | Control | - |

The chemical will be evaluated under artificial inoculated condition using variety HD 2967 and spray will be done at heading stage. Design – RBD, Plot size – 6 rows of 3 meters, replications - 3.

**Parameters to be recorded-**Seed germination, Disease incidence, Plant height after 30 days, Number of tillers, Root biomass, Root volume and Yield

**Root biomass Determination method:** Uproot the plants carefully in such a way that maximum number of roots remain intact. Remove soil particles by shaking and then clean under running tapwater. After cleaning, separate the roots from stem by cutting at the crown region. Soak excess water from the roots using paper towel or tissue paper. Weigh the roots using an electronic balance. Take observation at 28 and 60 days after sowing.

**Root volume Determination method:** After the root fresh biomass is recorded, put the roots (from each plant) into a beaker (250 ml or 500 ml) half of which is filled with water. Record the volume of the water displaced by the roots. The volume of the water displaced will be considered as root volume.

**(d) Management of Leaf blight through bioformulations (New Experiment)**

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

| S. No. | Treatments | Dose per 100g seed |
|---|---|---|
| 1 | KUSH-PlantEx | 2 ml |
| 2 | KUSH-PlantEx | 1 ml |
| 3 | KUSH-PlantEx | 0.5 ml |
| 4 | KUSH-SalBoost | 2 ml |
| 5 | KUSH-SalBoost | 1 ml |
| 6 | KUSH-SalBoost | 0.5 ml |
| 7 | KUSH-PhosphoBoost | 2 ml |
| 8 | KUSH-PhosphoBoost | 1 ml |
| 9 | KUSH-PhosphoBoost | 0.5 ml |
| 10 | 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.

**Parameters to be recorded-**Seed germination, Disease incidence, Plant height after 30 days, Number of tillers, Root biomass, Yield

**Assessment of yield losses caused by stripe rust in wheat (New Experiment)**
**Centres:** Karnal, Ludhiana, Hisar, Pantnagar, Jammu, Durgapura, Gurdaspur

**PROGRAMME 10. ENTOMOLOGY**

**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.

**(i)** **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: Kanpur and Ludhiana)
**(iii)** Wheat Aphids (Centres: Niphad, Ludhiana, Karnal, Khudwani, RPCAU Pusa, and Kharibari) **(iv)**Root aphid (Centres: Karnal and Ludhiana)

**(ii)** **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: Kanpur and Ludhiana)
**(iii)** Foliar aphids (Centres: Niphad, Ludhiana, Karnal, Khudwani, RAU Pusa, and Kharibari) **(iv)**Root aphid (Centres: Karnal and Ludhiana)

**3. 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)** **Assessment of grain yield losses caused by aphid complex in wheat (New Trial)**
**(Centres:** Karnal, Ludhiana,Kanpur, Kharibari&Niphad, RPCAU, Pusa)

The susceptible wheat variety for aphids will be sown plots in 6 rows of 6 m length in a replicated trial under irrigated conditions in the month of November. The trial will consist of two treatments viz.

sprayed and un-sprayed and spraying will be done with CIB recommended insecticide, Thiamethoxam 25% WG 12.5 a. i. g/ha against aphids. Data will be collected at flag leaf stage, ear head and milking stage. During each sampling date, five wheat plants from each plot will be selected randomly and the number of aphids per tiller of each plant will be counted. At harvest, the yield of both sprayed and unsprayed plots will be compared to assess yield losses. To determine the grain weight of sprayed and unsprayed plots, 1000 grains of every plot will be counted and their weights will be compared. Data on weather parameters will also be recorded to determine the change in yield losses with abiotic factors. The data obtained from this experiment will be used to revisit the economic threshold level of aphids for wheat crop.

**(e) Management of aphids in wheat through border crops (New Trial)**

(Centres: Karnal and, Kanpur Ludhiana, Kharibari)

The main hypothesis of the experiment is that more diverse cropping systems harboured lower incidence of aphids and help in reduction aphid infestation as compared to mono-cropping systems. In this experiment, the susceptible wheat variety for aphids will be sown plots size of 50 m2 under irrigated conditions in the month of November. Border crop of mustard and radish will be also sown at the same time. Five plants from each plot from main crop as well as border crop will be selected randomly, and observations will be recorded on the number of aphids per tiller of each plant. At harvest time, yield will be recorded from main and border crop.

| Treatment | Treatment details |
|---|---|
| 1 | Wheat+ 1 row of border crop of mustard |
| 2 | Wheat+ 2 rows of border crop of mustard |
| 3 | Wheat+ 1 row of border crop of radish |
| 4 | Wheat+ 2 rows of border crop of radish |
| 5 | Control |

**(f) Management of aphids through foliar application of new chemical molecules**

**(Centres:** Karnal, Ludhiana, Niphad, Kanpur,P RAU Pusa, RPCAU, Pusa**)**

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 | - |

**(g) Management of lepidoterous pests (pink stem borer, army worm & cutworms) of wheat:**

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

Following chemicals will be evaluated against lepidopterous insect-pests in wheat. Observations will be recorded on percentage of damage tillers before and after 3, 7 and 15 days of treatment. Yield in each treatment will also be recorded during harvest time.

| Treatment ID. | Treatments | Dosages/ha |
|---|---|---|
| T1 | Foliar spray of Coragen 18.5 SC (chlorantraniliprole) | 125 ml |
| T2 | Soil application of fipronil 0.6 GR | 7.0 Kg |
| T3 | Soil application of chlorpyriphos 20EC | 2.5 litre |
| T4 | Takumi 20 WG (flubendiamide 20%) | 40 g |
| T5 | Takumi 20 WG (flubendiamide 20%) | 50 g |

| | | |
|---|---|---|
| T6 | Takumi 20 WG (flubendiamide 20%) | 60 g |
| T7 | Untreated Check | - |

**(h) Management of termites through seed treatment of chemical molecules combinations**

(**Centres:**Durgapura, Kanpur, Ludhiana)

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

Observation will be recorded on plant population/m row, percent damaged shoots/m row after 3,4 and 5 weeks of treatment, per cent damaged tillers/m row at ear head stage, no. of damaged effective tillers/ha and grain yield (q/ha).

| Sr. No. | Treatment | Dosage |
|---|---|---|
| T1 | Seed treatment with Neonix (Imidacloprid 18.5%+ Hexaconazole 1.5% FS) | 2 ml/kg of seed |
| T2 | Cruiser 70 WS (thiamethoxam) | 1 ml/kg of seed |
| T3 | Cruiser 70 WS (thiamethoxam) | 1.5 ml/kg of seed |
| T4 | Soil application of fipronil 0.3 GR | 17.5 Kg |
| T5 | Soil application of fipronil 0.6 GR | 20 Kg |
| T6 | Soil application of chlorpyriphos 20EC | 2.5 l |
| T7 | Soil application of chlorpyriphos 20EC | 3.0 l |
| T8 | Untreated control | - |

**3. Stored Grain Pest Management**

**(a) Storability and damage potential of major storage insect pests of barley; *Sitophilus oryzae* or *Rhizopertha dominica* in wheat**

(**Centres**: Karnal, Niphad, Kanpur and Durgapura)

Each treatment will consist of 0.5 kg seed sample of wheat in a cloth bag. Freshly emerged 20 adults of *Sitophilus oryzae* or *Rhizopertha dominica* will be released into each bag then bags will be closed and kept undisturbed. Experiment will be laid out in RBD design with three replications. The 1st census count will be taken 30 days after inoculation of insects and continued at 60, 90, 120, 150 and 180 days. At each census the dead insects will be removed. During each census, data on weight of seed grains, adult survival population, percent grain damage, percent repellence and percent seed germination will be taken.

**PROGRAMME 11. NEMATOLOGY**

**Monitoring of Nematodes:** *Heterodera avenae*, *Anguina tritici*, *Meloidogyne graminicola* and other plant parasitic nematode: All centres of Nematology

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

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

**2. Management of cereal cyst nematode, *Heterodera avenae* in wheat through bio-agentsand organic manure (New Trial)**

Centres: Hisar and Durgapura.

**Treatments:**

*T1-Purpureocillium lilacinum @ 2.5 Kg /ha.*
*T2-Purpureocillium lilacinum @ 3.5 Kg /ha.*
*T3-Pseudomonas fluorescens @ 2.5 Kg /ha.*
*T4-Pseudomonas fluorescens @ 3.5 Kg /ha.*
*T5-Trichoderma harzianum @ 2.5 Kg /ha.*
*T6-Trichoderma harzianum @ 3.5 Kg /ha.*
*T7-T1+500 kg Vermicompost / ha*
*T8-T4+500 kg Vermicompost / ha*
*T9-T6+500 kg Vermicompost / ha*
*T10-Untreated check*

# List of Cooperators

## PLANT PATHOLOGY PROGRAMME

**NHZ**

**ICAR-IIWBR, Regional Station, Flowerdale, Shimla.**

*O.P. Gangwar, Pramod Prasad, Subodh Kumar*

**VPKAS, Almora**
*K.K. Mishra*

**HPKVV, RWRC, Malan**
*Suman Kumar, A.D. Bhindra*

**SKUAST-K, Khudwani, Srinagar**
*Fayaz Ahmad Mohiddin*

**CSKHPKV, HAR&EC, Dhaulakuan**
*Shiwani Dhiman*

**CSKHPKV, HAR&EC, Bajoura**
*Rakesh Devlash*

**NWPZ**

**ICAR-IIWBR, Karnal**
*Pradeep Sharma, Prem Lal Kashyap, Ravindra Kumar*

**ICAR-IARI, New Delhi**
*M.S. Saharan, V.K. Singh, MS Gujar*

**GBPUA &T, Pantnagar**
*Deepshikha*

**CCSHAU, Hisar**
*R.S. Beniwal*

**PAU, Ludhiana**
*Jaspal Kaur, Ritu Bala*

**NEPZ**

**RPCAU, Pusa, Bihar**
*Dinesh Rai*

**CSAUA&T, Kanpur**
*Jitendra Kumar, JK Yadav, Charul Kanchan*

**BHU, Varanasi**
*S.S. Vaish*

**BCKV, Kalyani (W.B.)**
*Mr. Raghunath Mandal*

**NDUA&T, Ayodhya**
*S.P. Singh, VP Chaudhary*

**UBKV, Pundibari, Coochbehar**
*Satyajit Hembram*

**BAU, Sabour**
*C. S. Azad*

**RARS, Assam Agricultural University, Shillongani**
*Ranjana Chakrabarty*

**CZ**

**ICAR- IARI, Regional Station, Indore**
*T.L. Prakasha*

**JAU, Junagadh**
*I.B. Kapadia*

**SDAU, Vijapur**
*Ms. Elangbam Premabatidevi, Ronak Thakkar*

**JNKVV. Research Station, Powarkheda**
*K.K. Mishra*

**PAU, R S, GURDASPUR**
*Jaspal Kaur*

**PZ**

**ARI, Pune**
*Sudhir Navathe*

**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*

**ARS, Niphad**
*Bhalchandra Mhaske*

**Kharibari, WB**
*Wasim Reza*

**SKUAST-K. Khudwani**
*Shabir Hussain Wani*

**RPCAU, PusaBihar**
*M.S. Sai Reddy*

**NEMATOLOGY PROGRAMME**

**SKNAU, RARI, Durgapura**
*S.P. Bishnoi*

**CCSHAU, Hisar**
*Priyanka Duggal*

**Summary of trials and nurseries allotted and conducted at different cooperating centres during 2023-24 in Crop Protection Programme (Plant Pathology, Entomology & Nematology)**

| S.N | Centre | Cooperators | Nurseries & Trials | Allotted | Conducted | Data Not Considered | Data Not Received |
|---|---|---|---|---|---|---|---|
| **NHZ** | | | | | | | |
| 1. | Almora | K.K. Mishra | PPSN,LSSN,PMSN,Hill Bunt, EMDSN, chemical management of loose smut | 6 | 6 | PPSN(YR) | LSSN |
| 2. | Dhaulakuan | Shiwali Dhiman | IPPSN, PPSN, PMSN,HBSN,EMDSN | 5 | 5 | | FHB |
| 3. | Malan | SumanKumar | IPPSN, PPSN,KBSN,LSSN,PMSN, Hill Bunt, EMDSN, chemical control of KB& loose smut, | 9 | 9 | IPPSN(YR), PPSN (YR) | KBSN, LSSN |
| 4. | Bajaura | Rakesh Devlash | IPPSN,PPSN, Hill Bunt, EMDSN | 4 | 4 | | |
| 5. | Shimla | O.P. Gangwar, Parmod Prasad | PMSN, APR, SRT, PMSN | 4 | 4 | | |
| 6. | Kudwani (J & K) | Fayaz Ahemad Mohiddin | IPPSN,PPSN,EMDSN | 3 | 3 | IPPSN(YR), PPSN(YR) EMDSN(YR) | |
| **NWPZ** | | | | | | | |
| 1. | Chattha ( Jammu ) | M. K. Pandey | IPPSN, PPSN, KBSN,PMSN, EMDSN chemical control of KB & assessment of yield losses caused by stripe rust | 7 | 7 | EMDSN(YR) | |
| 2. | Ludhiana | Jaspal Kaur, Ritu Bala, | IPPSN, PPSN,AVT FOR AUDPC,APR, LBSN,KBSN,LSSN, FSSN, chemical control of KB & loose smut and FHB through bioformulations, assessment of yield losses caused by stripe rust | 11 | 11 | EMDSN(YR) | |
| 3. | Gurdaspur | Jaspal Kaur | IPPSN, PPSN, , HBSN, EMDSN, chemical controlof FHB through bioformulations., assessment of yield losses caused by stripe rust | 6 | 6 | EMDSN(YR) | |
| 4. | Pantnagar | Deepshikha, | IPPSN,PPSN, LBSN,KBSN,PMSN, EMDSN, chemical control of KB, assessment of yield losses caused by stripe rust | 8 | 8 | | |
| 5. | Duragupra | P.S. Sekhawat, | IPPSN, PPSN, AVT FOR AUDPC, LSSN, FSSN, EMDSN, chemical control of loose smut, assessment of yield losses caused by stripe rust | 8 | 8 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6. | Karnal | Pradeep Sharma, P.L. Kashyap, Ravindra Kumar | IPPSN, PPSN, AVT FOR AUDPC, LBSN,KBSN, , HBSN, EMDSN chemical control KB, loose smut & FHB and LB through bioformulation, assessmentof yield losses caused by stripe rust. | 12 | 12 | IPPSN(LR) | |
| 7. | New Delhi | M. S. Saharan, V.K. Singh, | IPPSN, PPSN,APR,LBSN,KBSN, EMDSN , HBSN | 7 | 7 | | |
| 8. | Hisar | R.S. Beniwal, | IPPSN, PPSN, LBSN, KBSN,LSSN, FSSN, EMDSN chemical management of KB, loose smut, assessment of yield losses caused by stripe rust | 10 | 10 | | |
| **NEPZ** | | | | | | | |
| 1. | Ayodhya | S.P. Singh, V.P. Chaudhary | IPPSN, PPSN, AVT FOR AUDPC ,LBSN, EMDSN, chemical managementof LB through bioformulations | 6 | 6 | | |
| 2. | Varanasi | S.S. Vaish | IPPSN, LBSN, EMDSN | 3 | 3 | | |
| 3. | Coochbehar | Satyajit Hembram | IPPSN, LBSN, , HBSN, EMDSN,chemical managementof LB through bioformulations | 5 | 5 | | |
| 4. | Ranchi | H.C. Lal | LBSN | 1 | 1 | | |
| 5. | Shillongani | R. Chakravarty | LBSN, | 2 | 2 | | LBSN |
| 6. | Kalyani | Raghunath Mandal, | IPPSN, LBSN, , HBSN, EMDSN, ., chemical managementof LB through bioformulations | 5 | 5 | | |
| 7. | RPCAU, Pusa | S.K. Singh, Dinesh Rai | LBSN, EMDSN | 2 | 2 | | LBSN |
| 8. | Kanpur | Jintendra Kumar, mk Yadav, C Kanchan | IPPSN,PPSN,EMDSN | 3 | 3 | | |
| 9. | Sabour | C.S. Azad | IPPSN, LBSN, EMDSN, chemical control of LB through bioformulations | 4 | 4 | | |
| **CZ** | | | | | | | |
| 1. | Indore | T.L. Prakasha | IPPSN, PPSN, AVT FOR AUDPC, APR, EMDSN | 5 | 5 | | |
| 2. | Powarkheda | K.K. Mishra | IPPSN, PPSN, EMDSN | 3 | 3 | EMDSN(LR) | |
| 3. | Vijapur | Ronak Thakkr | IPPSN, PPSN, EMDSN | 3 | 3 | EMDSN(YR,LR) | |
| 4. | Junagarh | I.B. Kapadia | IPPSN,PPSN, EMDSN | 3 | 3 | PPSN(LR) | |

| PZ & SHZ | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | Dharwad | Gurudatt.M. Hegde | IPPSN,PPSN,LBSN,FRSN, EMDSN,chemical managementof leaf blight through bioformulations | 6 | 6 | LBSN, PPSN (LR) EMDSN(LB) | |
| 2. | Wellington | P. Nallathambi, | IPPSN,PPSN, PMSN,HBSN, EMDSN, chemical managementof head scab through Bioformulations | 6 | 6 | IPPSN(SR), PPSN(LR ) PPSN (SR) FHB EMDSN(rusts, PM,FHB) | |
| 3. | Mahabaleshw ar | V.M.Sali,M. A.Sushir | IPPSN, PPSN, AVT FOR AUDPC,APR, SRT, EMDSN | 6 | 6 | | |
| 4. | Niphad | B.M. Ilhe, B. C. Game. | IPPSN, PPSN, EMDSN | 3 | 3 | | |
| 5. | Pune | Sudhir Navathe | IPPSN,PPSN,LBSN, APR, EMDSN, Control of leaf blight through bioformulations | 5 | 5 | EMDSN(lR) | |

**ENTOMOLOGY PROGRAMME**

| S. No. | Centre | Cooperators | Name ofNursery | Total Trials/Nurseries | | Data Not Considered | Other Trials |
|---|---|---|---|---|---|---|---|
| NHZ | | | | Allotted | Conducted | | |
| 1 | Khudwani | Sabir H Wani | ESN, MPSN | 2 | 2 | ESN (APH) | |
| NWPZ | | | | | | | |
| 1 | Ludhiana | Beant Singh | ESN, MPSN | 2 | 2 | | 9 |
| 2 | Duragupra | A.S. Baloda, B.N.Sharma | ESN, MPSN | 2 | 2 | ESN (BR Mite) ESN (APH) | |
| 3 | Karnal | Poonam Jasrotia | ESN, MPSN | 2 | 2 | | 9 |
| NEPZ | | | | | | | |
| 1 | Shillongani | K.K. Samra | ESN, MPSN | 2 | 2 | | |
| 2 | Kanpur | J.K. Singh | ESN, MPSN | 2 | 2 | ESN(BR Mite) | 3 |
| 3 | Kharibari | Wasim Reza | ESN, MPSN | 2 | 2 | | 4 |
| CZ | | | | | | | |
| 1 | Vijapur | Ronak Thakkar | - | | | | |
| PZ | | | | | | | |
| 1 | Dharwad | Gurudatt. M.Hegde | ESN,MPSN | 2 | 2 | | |
| 2 | Niphad | BhalchandraMaske | ESN, MPSN | 2 | 2 | ESN (APH) | 4 |

**NEMATOLOGY PROGRAMME**

| S. No. | Centre | Cooperators | Name ofnursery | Total trials/nurseries | | Data not considered | Other trials |
|---|---|---|---|---|---|---|---|
| NWPZ | | | | Allotted | Conducted | | |
| 1 | Hisar | SP Bishnoi | AVT, EMDSN | 2 | 2 | | |
| 2 | Duragupra | Priyanka Duggal | AVT, EMDSN | 2 | 2 | | |
| | | | | | | | |

# SUMMARY

The Crop Protection Programme mandate is to minimize losses caused by biotic stresses (diseases, insects, and nematodes) to harness the maximum yield and quality potential of wheat varieties. Additionally, it keeps vigilant watch on new pathotypes of rusts, the occurrence of any exotic diseases, and the status of Karnal bunt and other diseases and insect pests. The programme also collaborates with wheat breeders to evaluate resistance to biotic stresses, such as rusts and leaf blight, in pre-coordinated yield trial entries (IPPSN) and against major diseases, pests, and nematodes in coordinated yield trial entries along with check varieties. This aims to assist breeders in promoting their entries in yield trials, ensuring climate resilience, and proposing varieties for identification and release across all wheat-growing zones of India. To circumvent these losses, the Crop Protection Programme continuously maintains strict surveillance, identifies new resistance sources, strategically deploys resistant varieties, and develops management strategies. The major aim of AICRPW&B is to develop high-yielding, disease-resistant wheat varieties. Coordination and knowledge sharing among different agencies like DAC & FW, ICAR, SAUs, State Agriculture Departments, KVKs, and farmers is facilitated through regular strategy planning meetings, trainings, field days, discussions, distribution of literature, and the use of IT tools. The achievements during 2023-24 are summarized below:

## PATHOLOGY

### Survey and surveillance for diseases

During 2023-24, 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. 29 (Issues 1 to 5) which was issued during the crop season and also uploaded on ICAR-IIWBR website (www.iiwbr.icar.gov.in). Stripe (yellow) rust of wheat was first reported on 24$^{th}$ January, 2024 from RS Pura (Jammu) on an unknown variety and at Badyal Qazian on HD2967. Subsequently, the stripe rust was observed in 4 fields of villages Niku Nangal and Dhokli in district Ropar (Punjab) on February 8, 2024. After that the incidence of the stripe rust was also observed in villages Chandpur Bela, Dher Raipur, Mehakpur in Ropar. stripe rust symptoms (up to 40MS) were observed on some local cultivars in village Rawaikhal and adjoining wheat growing areas of District Bageshwar (Uttarakhand) on 06.03.2024. Low incidence of stripe and leaf rust was reported during March 28-29, 2024 from farmers' fields of Hansi, Shekhupur, Narnaund and other villages in Hisar (Haryana). Leaf (brown) rust was first observed from the farmers' field in the Pune and Satara districts (Maharashtra) during 2$^{nd}$ and 4$^{th}$ week of January 2024. The occurrence of leaf rust in farmer's fields of Dewas, Indore, Sehore and Dhar districts of Madhya Pradesh was observed in February. The infection of leaf rust was noticed in some fields of Banaskantha district of Gujarat on off type wheat plants on 16$^{th}$ Feb., 2024. In Bihar leaf rust was noticed in farmer's field of Sabour, Barari, Jagdishpur, Goradih, and Nathnagar.The stem (black) rust occurrence was first reported from different villages in Dharwad district (Karnataka) during the second fortnight of January, 2024. Consequently, the stem rust incidence was also reported from Belagavi, Bagalkote, Dharwad and Gadag districts. First incidence of stem rust from Maharashtra during the season was reported from Umbarkhed village (Niphad) on 31st January 2024. Leaf rust and stem rust was also observed on-off types andvarieties from private companies during 2nd and 3rd week of February 2024 from the farmers' fields in Pune, Satara and Sangli districts. 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 2023-24. 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.

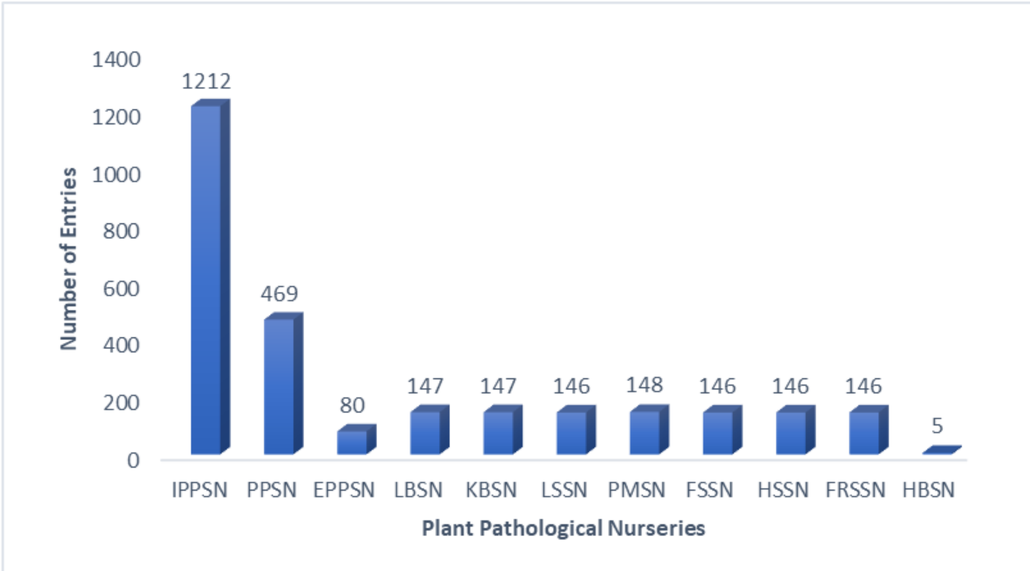


**Fig: 1. Number of entries in different plant pathological screening nurseries during 2023-24**

**Rust resistance materials in AVT (2023-24) with ACI upto 10.0 are given below:**

**Stem, Leaf and Stripe rusts**

DBW476, DBW173(C), PBW927, WH1402(I)(C), HP1978, VL2059, MACS4125(d), MACS4135(d), HI8849(d), HI8850(d), DBW428, HI8851(d), HI8852(d), HI8627(d), DDW62(d), NIDW1149(d)

**Stem and Stripe rust**

HD3494, DBW476, PBW725, NW8071, DBW173(C), PBW927, HD3468, WH1402(I)(C), HP1978, VL2059, MACS4125(d), MACS4135(d), HI8849(d), HI8850(d), DBW428, HI8851(d), HI8852(d), HI8627(d), DDW62(d), DBW443*, NIDW1149(d)

**Leaf rust and Stripe rust**

DBW476, DBW477, HD3471, HD3455, DBW173, RAJ4581, HD3428, PBW771(C), PBW927, HD3369, DBW296, WH1402 (I)(C), HP1978, HD3447, PBW915, HD3388 (I)(C), PBW833 (C), VL2059, MACS4125 (d), MACS4135 (d), HI8849 (d), HI8850 (d), MPO1395, HI8737 (d), DBW428, UAS484 (d), HI8851 (d), HI8852 (d), MACS4131 (d), MPO1398 (d), HI8627 (d), DDW62 (d), MPO1395(d), MACS3949(d), DBW426, UAS446(d), NIDW1149 (d), UAS478(d)(I)

**Leaf and stem rust**

DBW476, HD3059(C), DBW173(C), PBW927, WH1402(I)(C), HP1978, KRL2106, HI1563(C), VL2059, MACS4125(d), MACS4135(d), HI1669, HI1683, HI1684, HI8848(d), HI8849(d), HI8850(d), GW554, GW555, MACS6768, HI1650, GW547(I), HI8713(d), HI1674, HI1687, WSM138, MAC6830, GW556, DBW428, HI8851(d), HI8852(d), CG1036, HI1655*, HI8823(d), HI8627(d), DDW62(d), AKAW5100**, MACS6222, MP1378(I), MACS6829, NIAW4120, NIAW4432, LOK79, HD3090(C), HI1633(C), NIDW1149(d), HI1665(I)

**Identification of multiple disease resistant entries**

**Resistant to all three rusts + HS+FS**

DBW 386

**Resistant to all three rusts**

NIAW 4120

**Resistant to stripe rust and leaf rust**

DBW394

**Resistant to stripe rust + leaf rust + KB + FS**
PBW 893 and DDW 61(d)
**Resistant to stripe rust + leaf rust + PM + FS**
HI 1665 and PBW 889
**Resistant to stripe rust + leaf rust + FS**
HI1669 and NIAW 4028 and HI 8840(d)
**Resistant to leaf rust and stem rust**
DBW443, HI1672
**Resistant to leaf rust + stem rust + KB +FS**
PWU15
**Resistant to leaf rust + stem rust + PM+FS**
LOK 79
**Resistant to leaf rust + stem rust + FS**
DBW 444, NIAW 4183, HI 1673, HI 1675 and PBW 897
**Resistant to stem rust + stripe rust+ HS**
NIAW4153
**Resistant to stem rust + stripe rust + FS**
VL 2041 and GW547

**Utilization of resistant sources**

The NGSN comprising 27 entries with confirmed sources of high level of disease resistance were shared with19 breeding centers across different agro climatic zones of country for their utilizationin breeding for resistance to biotic stresses. The 24 entries were utilized in the range of 4.17- 37.50% by different breeding centers. The most utilized entries at many centers were PBW902, PBW870 and HD3440. Durgapura center, utilized maximum 9 entries in their breeding programme followed by Ludhiana and ICAR-CSSRI, Karnal.

**Pathotype distribution of *Puccinia* species on wheat and barley**

During 2023-24, a total of 858 samples of three rusts of wheat and stripe rust of barley were pathotyped from India and Nepal.

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

During this crop year, 173 stripe rust samples of wheat were analyzed from six Indian states (Himachal Pradesh, Punjab, Haryana, Uttarakhand, Uttar Pradesh and Rajasthan) and Nepal. A totalof nine pathotypes {238S119, 110S119, 46S119, T (47S103), P (46S103), 78S84, 110S84, 79S68, and 6S0} of wheat stripe rust pathogen were identified. Stripe rust pathogen population wasavirulent to *Yr5*, *Yr10*, *Yr15*, *Yr16*, *Yr32*, and *YrSP*. Most of the stripe rust samples of wheat were analyzed from Punjab (67) followed by Uttar Pradesh (21) and Uttarakhand (20). During the cropping season frequency of pathotype 238S119 was maximum (36.4%) followed by 110S119 and46S119. The frequency of 46S119 (virulent on *Yr2*, *Yr3*, *Yr4*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr18*, *Yr19*, *Yr21*, *Yr22*, *Yr23*, *Yr25*, and *YrA*) increased to 26.0%. Other pathotypes were identified in low frequency (<4%). Pathotype 57 (0S0) of *Puccinia striiformis* f. sp. *hordei* (*Psh*) was identified in a barley yellow rust sample that was collected from Dangar, Bilaspur (H.P.).

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

A total of 208 black rust samples received from Gujarat, Himachal Pradesh, Madhya, Pradesh, Maharashtra, Karnataka, Uttar Pradesh, Uttarakhand and Tamil Nadu; and Nepal were pathotyped on wheat differentials. Eight pathotypes 11, 15-1, 21, 21-1, 21A-2, 40A, 40-2 and 40-3 of *Puccinia graminis* f. sp. *tritici* (*Pgt*) were identified. The *Pgt* population was avirulent to *Sr26*, *Sr27*, ***Sr31***, *Sr32*, *Sr35*, *Sr39*, *Sr40*, *Sr43*, *SrTt3* and *SrTmp*. Maximum number of samples was pathotyped fromKarnataka (61) followed by Tamil Nadu (51) and Gujarat (28). 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*and *SrMcN*, was recorded in 47.5% of the samples. Pathotypes 40A and 40-2 were identified in 21% and 14% of the samples, respectively. Pathotypes 15-1 and 21 were identified in two samples while pathotype 21-1 was found only in one sample collected from Uttarakhand.

**Leaf rust of wheat (*P. triticina*)**

A total of 477 samples of wheat leaf rust were pathotyped from 10 states of India and neighboring country Nepal. Among the 26 pathotypes of *Puccinia triticina* that were identified in these samples, pathotype 77-9 (121R60-1) was the most widely distributed and occurred in 44.8% of the samples followed by 52-4 (121R60-1,7) in 22.3% samples. Pathotype 77-5 (121R63-1), that remained the most predominant for more than 20 years was observed in 9.5% samples only. The remaining 15 pathotypes were identified in 75 samples only. In Nepal, fourteen pathotypes were identified in 76 samples. Pathotype 77-9 was the most predominant and recorded in 47.4 % samples received from Nepal.

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

For identifying rust resistance sources, ~5500 wheat and barley lines were evaluated at seedling stage under controlled conditions during 2023-24. Of these, 335 lines including 146 of AVT and 189 of NBDSN/EBDSN were subjected to multiple pathotypes screening under controlled light and temperature conditions. Seedling (all-stage) rust resistance remains effective throughout the life of wheat plants. Advanced wheat lines (146) were evaluated at seedling stage against 60 pathotypes of three *Puccinia* spp. on wheat. Fifteen most virulent and predominant pathotypes of stripe, 22 of stem and 23 of leaf rust pathogens were used for evaluation.

**Rust Resistant wheat lines (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 121 AVT lines. The frequency of *Sr2*, postulated based on morphological marker micro flecking, was maximum as it was postulated in 48 AVT entries followed by *Sr11, Sr7b*, and *Sr13* which were characterized in 37, 35 and 34 entries, respectively. The *Sr31* linked with *Lr26* and *Yr9* genes, and conferring resistance to all the known *Pgt* pathotypes in Indian subcontinent, was postulated in ten AVT entries, while *Sr24* linked to *Lr24* was characterized in twenty-one entries. Other *Sr* genes i.e. *9b, 9e*, and *8a* were characterized in 14, 6, and 3 lines while *Sr30* and *Sr5* in ten lines and *Sr8b* and *Sr28* were postulated in one line each.

***Lr*-genes**

Eight *Lr* genes (*Lr1*, *Lr3*, *Lr10*, *Lr13*, *Lr23*, *Lr24*, *Lr26*, and *Lr28*) were characterized in 115 entries. *Lr13* was the most commonly postulated leaf rust resistance gene that was characterized, alone or in combination, in maximum number of lines (63) followed by *Lr10* (31 lines), and *Lr1* and *Lr23* (21 lines). *Lr24* that is linked with *Sr24* was postulated in 21 entries. *Lr26*, tightly linked with *Yr9* and *Sr31*, was characterized in 10 lines. *Lr28* was postulated only in PBW915.

***Yr*-genes**

Among the 146 lines of AVT, *Yr* genes were characterized in 80 lines. *Yr* genes were postulated in lines where differential interactions were observed and some cases tight linkage of *Yr*genes to other *Lr* and *Sr* genes also implicated the presence of a resistance gene. Three *Yr* genes viz. *Yr2*, *Yr9*, and *YrA* contributed to yellow rust resistance in Indian wheat material. Among the postulated *Yr* genes, the frequency of *Yr2* was maximum and it was characterized in 73 lines. *Yr9* was postulated in 10 entries AKAW5100, DBW173(C), HD3090(C), HI1633(C), HI1634, HI1650, MACS6768,MP1378 (I), PBW771(C), VL907(C).

**Management of diseases through chemicals**

During the first year of field evaluations at different locations, it was observed that seed treatment with Carboxin 37.5% + Thiram 37.5% WS at 3 g/kg seed, followed by Difenoconazole 3% WS at 2g/kg seed, was effective in managing loose smut in wheat. For Karnal bunt, Tebuconazole 50% + Trifloxystrobin 25% WG at 0.06% and Propiconazole at 0.1% proved to be effective. No phytotoxicity was recorded with any of the tested concentrations of fungicides on wheat plants.

**Advisory for stripe rust management**

During the current season 2023-24, 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 programmes.

**Preparedness to wheat blast**

Survey was conducted during the cropping season 2023-24 in 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 348 entries were screened against blast at Jessore at two different dates of sowing during 2022-23. Five entries [DBW447, DBW448, DBW449, PBW942, PBW943] were found free from infection and while 12 entries namely; UP3141, DBW455, DBW454, NIAW4621, HP1981, DBW446, K2301, JKW317, HUW859, RAUW107, HUW861, QYT2310 are categorized resistant on the basis of highest score upto 10% infection.

**Wheat Disease Monitoring Nursery (WDMN)**

Wheat disease monitoring nursery (earlier trap plot nursery) is an effective tool to monitor the occurrence of wheat diseases especially rusts across different wheat growing areas of India. The 56$^{th}$ wheat disease monitoring nursery having 20 entries was planted at 38 locations, covering all the major wheat growing areas on the country, especially those situated near the bordering areas to the neighboring countries.

**SAARC wheat Disease Monitoring Nursery**

For monitoring of wheat diseases in SAARC countries to combat wheat diseases jointly SAARC- Wheat Disease Monitoring Nursery (SAARC-WDMN) was planted at 27 locations across the six SAARC countries.

**Post harvest surveys for Karnal bunt**

A total of 8100 grain samples collected from various mandies in different zones and were analyzed at different cooperating centers. The overall 6.56% samples were found infected. The samples from Hisar showed maximum infection (47.05%).

**Training for Human Resource development**

To bring more uniformity in disease creation and data recording, training was organized on "Streamlining data recording and reporting under AICRP on wheat and Barley" from March 11-15, 2024 at ICAR-IIWBR, Karnal jointly with Crop Improvement section. 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 pests of wheat and barley, survey of Punjab state were undertaken during 2023-24 crop seasons. 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 coccinellids, 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. Out of the total surveyed area, approx. 95% cropped area was free pink stem borer incidence; 1-5% pink stem borer incidence was recorded in about 3-4% area and 8-10% incidence in less than 1% area. About 1% area was found to be affected with general yellowing of the crop due to water stagnation in the fields. No serious infestation of armyworm was recorded during 2023-24 crop year.

- Survey was carried out in the villages of Nashik and adjoining district Ahemednagar, Beed, Parbhani, Hingoli and Buldhana of different crop stages on farmer's field during the January and February 2024. There were 36 samples were observed, medium incidence of aphids was recorded during the survey. The Coccinellids larvae, beetles and *Crysoparla carnea* predator adults were also observed. The incidence of Shoot fly, stem borer and jassids was recorded in low intensity also termite attack was also observed in some samples but was very low.

- In Kanpur, surveys were conducted in villages viz., Sani, Daleep Nagar and Kalimitti during 2023-24. Incidence of shootfly was recorded to be between 1 to 1.66% at these locations. The incidence of termite was observed 12-12.66 per cent on wheat varieties viz., PBW343 and HUW 234 of wheat. High infestation (30-55 aphid/tiller) of foliar aphid was on barley variety namely, 'Barley Local' at surveyed locations. The higher incidence of pink stem of 1.66% borer was observed in irrigated crop one per cent in variety HD-2967 at Daleep Nagar.

- Moderate to severe infestations of foliar wheat aphids were reported in nearby location of Karnal viz., Indri, Kunjpua, Kathial, Racina, Jind. Early in the crop growth period, minor damage from termites and root aphids was also observed in Karnal and nearby locations. In some fields, pink stem borer and cutworm infestation was reported both at the beginning of the season in December and later in March. The overall incidence of aphids, termites, pink stem borers, and army worms was moderate, ranging between 2-5%. Termite and root aphid infestations were recorded at about 2-3% during November and December. Aphid infestations began appearing in January, startingwith 5-6 aphids per tiller, but by February, the numbers had risen significantly, averaging 30-35 aphids per tiller in the fields. Natural enemies, coccinellid beetle grubs and adults and spiders were also observed in aphid-infested 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 7.35 % of shoot fly entry was reported in entry CG1029. However, the highest shoot fly infestation index of 19.59 % was recorded in entry DBW222. At Ludhiana centre, the lowest infestation index of 4.42 % was reported on GW547 and the highest infestation index of 8.44% on Sonalika. At Dharwad location, the lowest shootfly index (8.75 %) was recorded on entry MPO1395 while highest infestation (40.83%) was observed on Raj4581. At Kanpur location, the lowest infestation 2.85 % was observed on DBW 386 and the highest infestation of 20.00% were recorded on entry PBW957.
**Brown wheat mite:** At Ludhiana, entry MP1386 recorded the minimum mite population of 9.00/10 $cm^2$ area while the maximum mite population of 15.67 /10 $cm^2$ was recorded in entry HD3468. 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, Kharibari and Pusa, four entries viz., PBW891, HD3118(C), NIAW4364 and DBW443 scored an average score of equal or below 3.5 and were in moderately resistance category (grade 3). Location-wise, atLudhiana centre one entry entry, HD3293 (C) were found to be moderately resistance category(grade 3). Two entries at Karnal viz., DBW443 & DBW426 and two entries at Pusa viz., HI1674 and HI1655 gave resistance response (grade 2). At Kharibari, entries were found to be either insusceptible (grade 4) or highly susceptible (grade 5) category. None of the entry showed the moderately resistance (grade 3) or resistance (grade 2) reaction at Kharibari. The infestation ofaphids at Durgapura, Niphad, Khudwani was recorded to very low and therefore data was rejected.
**Root aphid:** Among the tested entries, all entries were found to be either in susceptible (grade 4) orhighly susceptible (grade 5) category against root aphid. 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, Dharwad &Kanpur) and it was to be lowest (12.82 %) in entry HD3428 and the highest (19.24 %) for VL2041(I)(C). The lowest population of 8.00 brown wheat mites/10 $cm^2$ was recorded in entry NIAW4114 while HI1669 had the highest population of 16.00 mites/10 $cm^2$ at Ludhiana. Based on an average score of four locations (Ludhiana, Karnal, Pusa and Kharibari), only one entry entryviz., DBW395 showed moderate resistance response (grade 3) to foliar aphid. The rest of entries were found to be either susceptible (grade 4) or highly susceptible (grade 5) to foliar aphid (Table A2-10.1b). At Ludhiana, only one entry, DBW386 showed moderately resistance response (grade 3) to root aphid. All other entries were found to be either susceptible (grade 4) or highly susceptible (grade 5) to root aphid.

**Integrated pest management studies**

- The termite damage recorded at seedling stage in different dates of sowing indicated that early sown wheat crop (first fortnight of Nov 2023) 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 appeared in second week of February (6 SMW) in I, and II sowing dates whereas aphids were first recorded in third week of February (7 SMW) in III and IV 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) in early sown crop, 10th SMW in timely and late sown crop and 11th SMW in very late sown crop during 2023-24.
- 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.
- Assessment of grain yield losses caused by aphid complex in wheat comprised of six treatments i.e. spraying the crop at maximum tillering stage, flag leaf stage, earhead emergence stage, milky grain stage, grain maturity stage and unsprayed plots. The crop was sprayed with CIB recommended insecticide i.e. thiamethoxam 25% WG @ 12.5 a. i. g/ha for the control of aphids in wheat. It was found that significantly lower aphid population recorded in the treatment where insecticides were applied at earhead emergence stage. Significant decrease in aphid population and increase in grain yield was recorded 7 days after insecticide application at milky grain stage .Yield of plots treated with insecticides up to milky grain stage were at par with each other. Insecticide application should be done between earhead emergence and milky grain stage to avoid grain yield losses in wheat.
- Trial for management of aphids in wheat through border crops were conducted at Ludhiana and Karnal centers. The trial consists of five treatments i.e. wheat + one row of border crop of mustard, wheat + two rowsof border crop of mustard, wheat + one row of border crop of radish, wheat + two rows of border crop of radish and wheat without any border crop. The observation on the number of aphids/earhead and coccinellids/$m^2$ were recorded at the weekly interval at a peak period of their activity. Observations of aphid incidence were recorded from five randomly selected tiller/plot whereas coccinellid were recorded from five randomly selected spots of one square meter area in each plot. The number of aphids and coccinellid were also recorded from border crop at peak period of their activity. At harvest, the yield from each plot was recorded to assess the yield losses. It was observed that significantly lower aphids/earhead in wheat were observed in plots where mustard is grown as border crop as compared to wheat without any border crop.

- 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 effectivetillers/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.

## NEMATOLOGY

### Resistance against *Heterodera avenae*

One hundred forty six entries of AVT were screened for resistance against *H. avenae* (CCN) under sick plot conditions or pot condition at Hisar and Durgapura centers. None of the entries at both locations were reported to be resistant or moderately resistant.

### Survey for nematode incidence

Crop health monitoring survey of wheat and barley was done in the month of March, 2024 in Hisar, Karnal and Rewari districts of Haryana. Roots of wheat and barley plants were checked on the spot for the detection of white female of cyst nematode and further a total of 21 soil and root samples from Karnal district, around 09 samples from the experimental plots of DDUCEOF, CCSHAU, Hisar and 15 samples from Rewari district were collected for lab analysis to identify the other important plant parasitic nematodes (PPNs) associated with both the crops. Out of 45 samples, cereal cyst nematode (CCN, *Heterodera avenae*) was reported from 10 samples of Rewari district only. No of cysts ranged from 2-58 per 200 cc soil. Plant parasitic nematodes present in 200 cc soil samples were *Tylenchorhynchus* sp., *Pratylenchus* sp., *Helicotylenchus* sp., *Hoplolaimus* sp., *Criconematids* sp., *Dorylaimids* sp. Wheat seed gall nematode (*Anguina tritici*) and rice root-knot nematode (*Meloidogyne graminicola*) was not recorded from the samples.

### Organic management of Cereal cyst nematode, *Heterodera avenae* in Wheat

The organic management of *Heterodera avenae* in wheat was evaluated using different type of Bio pesticide at Hisar and Durgapura centers. The experiment consisted of application of three biopesticides viz. *Purpureocillium lilacinum, Pseudomonas fluorescens and Trichoderma harzianum* at different rates and also in combination with vermicompost. The treatment involving *Trichoderma harzianum* @ 3.5 Kg /ha. in combination with 500 kg vermicompost was found to be the most effective control for cereal cyst Nematode, *Heterodera avenae* in wheat at both Hisar and Durgapura locations.

## PROGRAMME 1. HOST RESISTANCE: IPPSN AND PPSN

**Constitution of different plant pathological nurseries during 2023-24**

Wheat germplasm and advance breeding materials were evaluated against disease and insect pests resistance at various hot spot locations under artificially inoculated conditions. Themajor plant pathological nurseries were: Initial Plant Pathological Nursery (IPPSN), PlantPathological 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, and Foot rot Screening Nursery. The numbers of entries tested under different plant pathological nurseries are given in Figure 1.

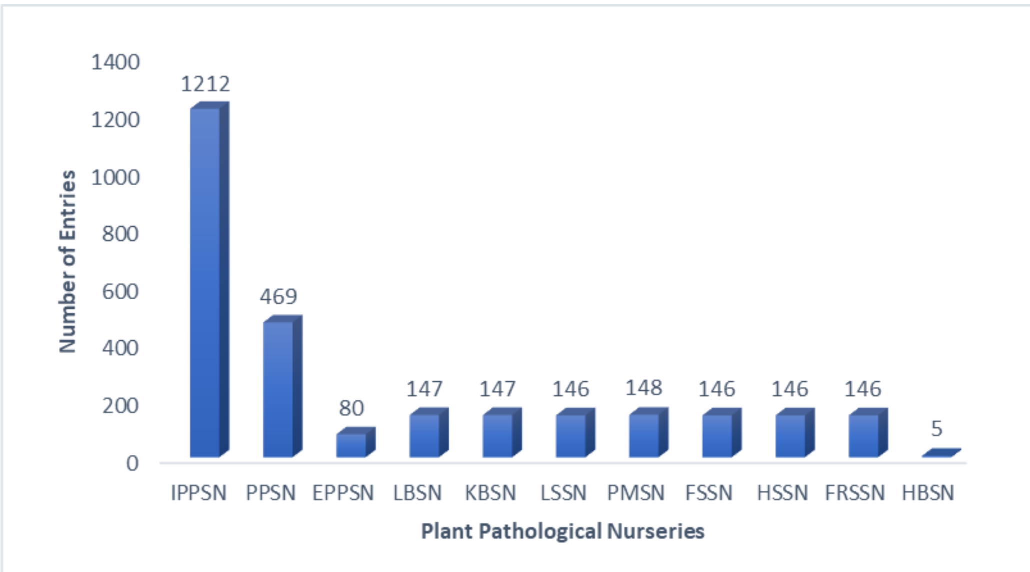


**Fig: 1. Constitution of different plant pathological nurseries during 2023-24**

**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: 1212

No. of breeding centers: 47

**Test Locations**

**(a) Rusts**

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

**Leaf rust:** Durgapura, Ludhiana, Pantnagar, Karnal, Kanpur, Delhi, and Jammu (7)

**South**

**Stem rust:** Junagadh, Mahabaleshwar, Pune, Indore, Niphad, Powarkheda, Vijapur, Dharwad And Wellington (9)

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

**(a) Leaf Blight:** Ludhiana, Pantnagar, Ayodhya, Varanasi, Sabour, Kalyani, Coochbehar, Pune and Dharwad (9)

Stripe rust data of Malan and Khudwani were not considered due to wrong recording and erratic/poor disease development; leaf rust data of Karnal was not considered due to erratic data; stem rust of Wellington was not considered due to erratic and low disease development and Leaf blight of Dharwad was 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. graminis tritici* | 11, 40A, 117-6 | 11, 40A |
| Stripe/Yellow | *P. striiformis* | 238S119,46S119, 110S119 | 238S119, 46S119 |
| Leaf/Brown | *P. triticina* | 77-9, 77-5, 104-2 | 77-9, 77-5 |

The entries found resistant (ACI<10) and qualify for promotion (ACI<20) to three rusts are given in Table 1.1. A total of 1212 entries were screened for rusts at multilocation under artificially inoculated conditions. Out of these, 276, 1066, 869, and 550 entries were found resistant against stem rust, leaf rust (S), leaf rust (N), and stripe rust, respectively (Fig. 1.2). The center-wise percent 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.

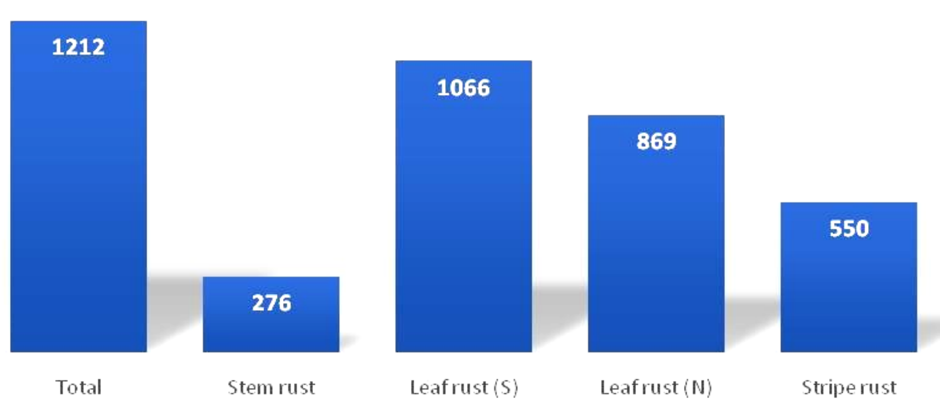


**Fig: 1.2. Number of IPPSN entries found resistant to different rusts**

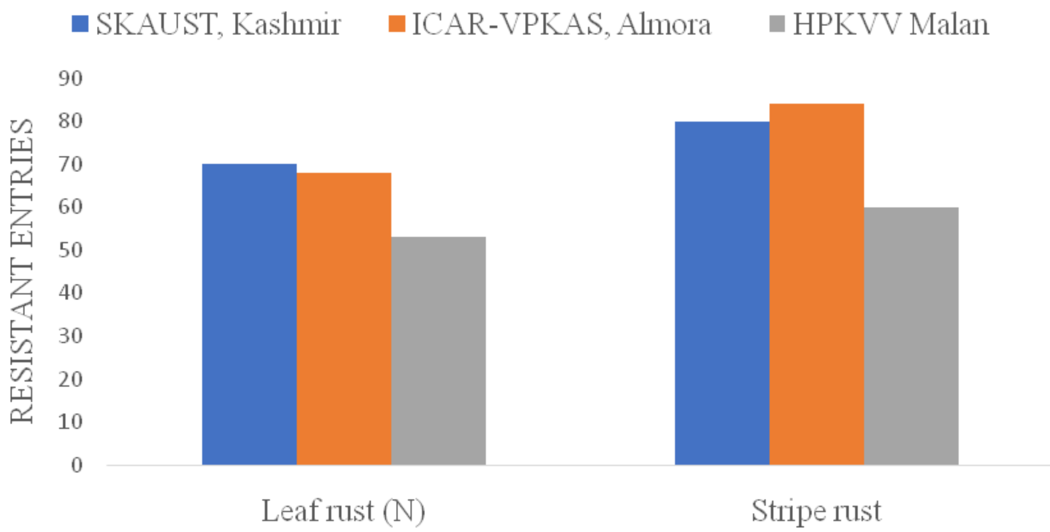


**Fig: 1.3. Percent of rust-resistant entries in IPPSN slots belonging to cooperating centersof NHZ (Leaf rust (N) and Stripe rust)**

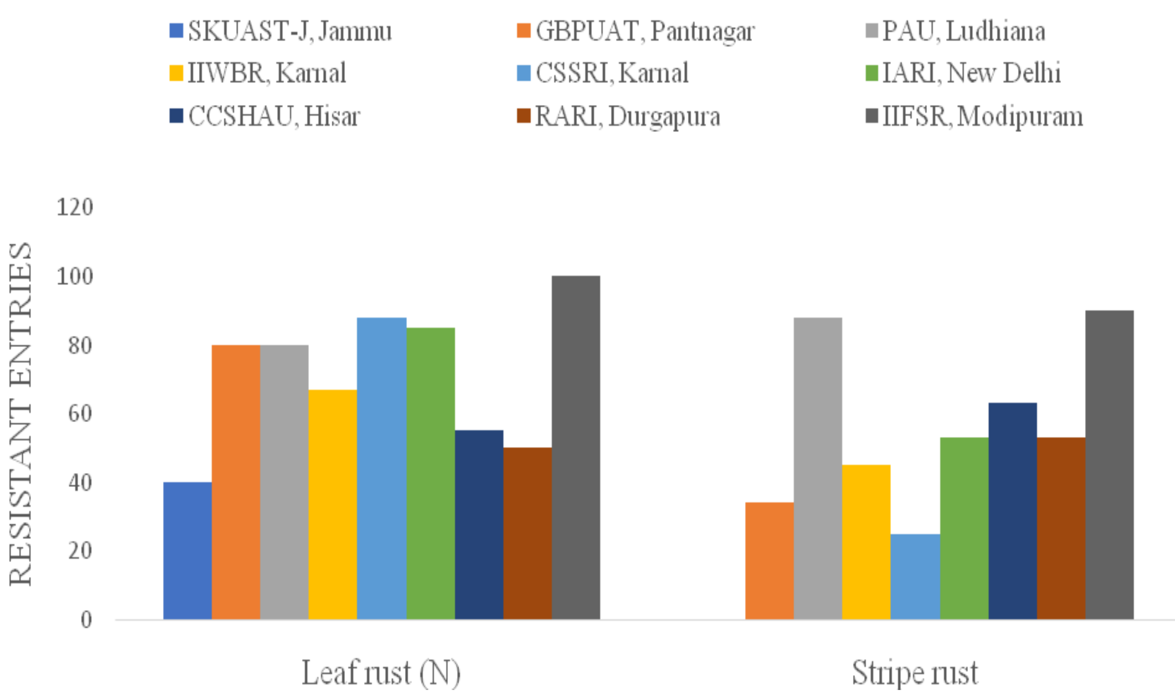


**Fig: 1.4. Percent of rust-resistant entries in IPPSN slots belonging to cooperating centres of NWPZ (Leaf rust (N) and Stripe rust)**

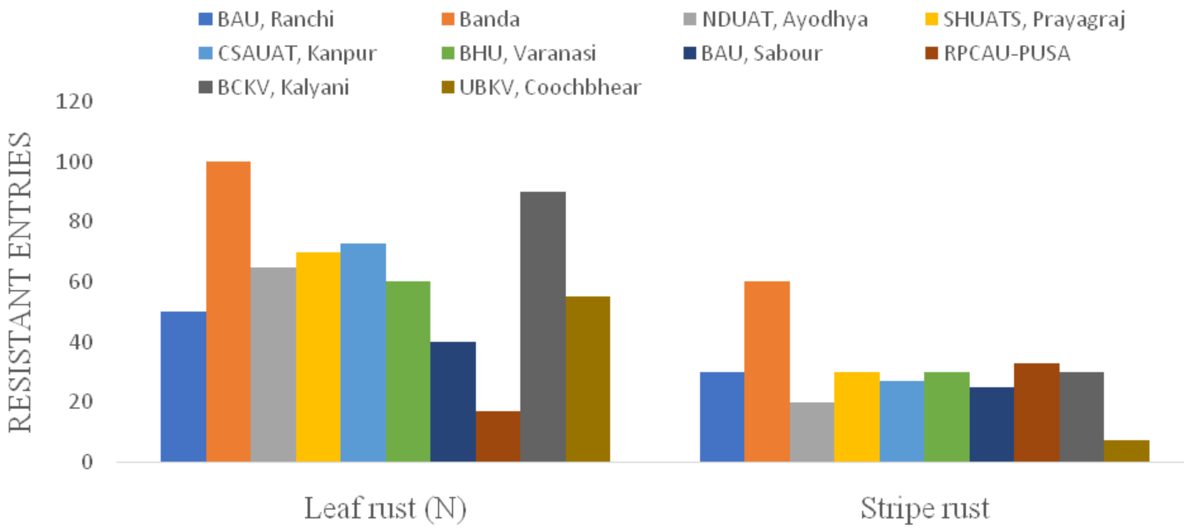


**Fig: 1.5. Percent of rust-resistant entries in IPPSN slots belonging to cooperating centres of NEPZ (Leaf rust (N) and Stripe rust)**

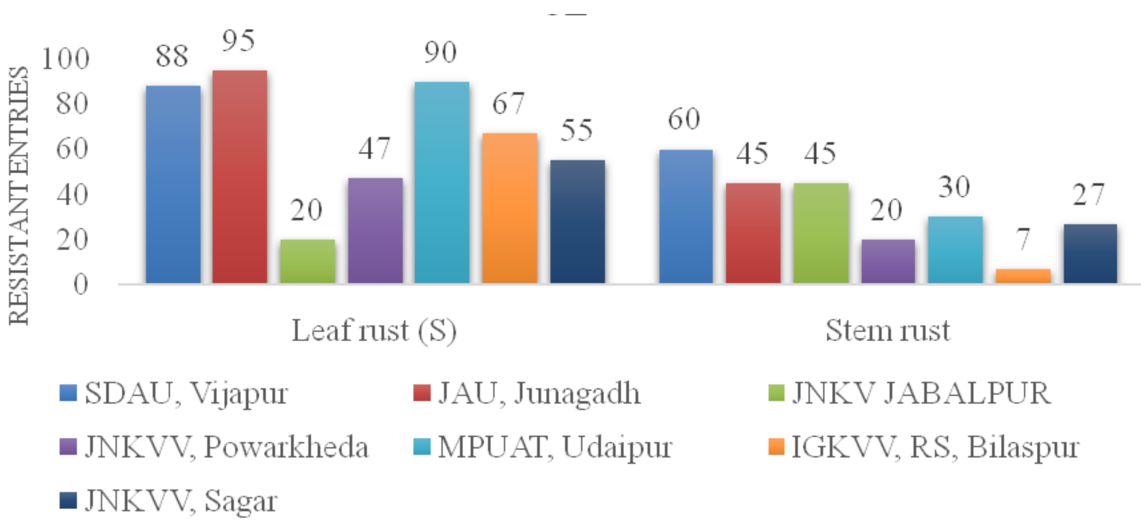


**Fig: 1.6. Percent of rust-resistant entries in IPPSN slots belonging to cooperating centres of CZ (Leaf rust (S) and Stem rust)**

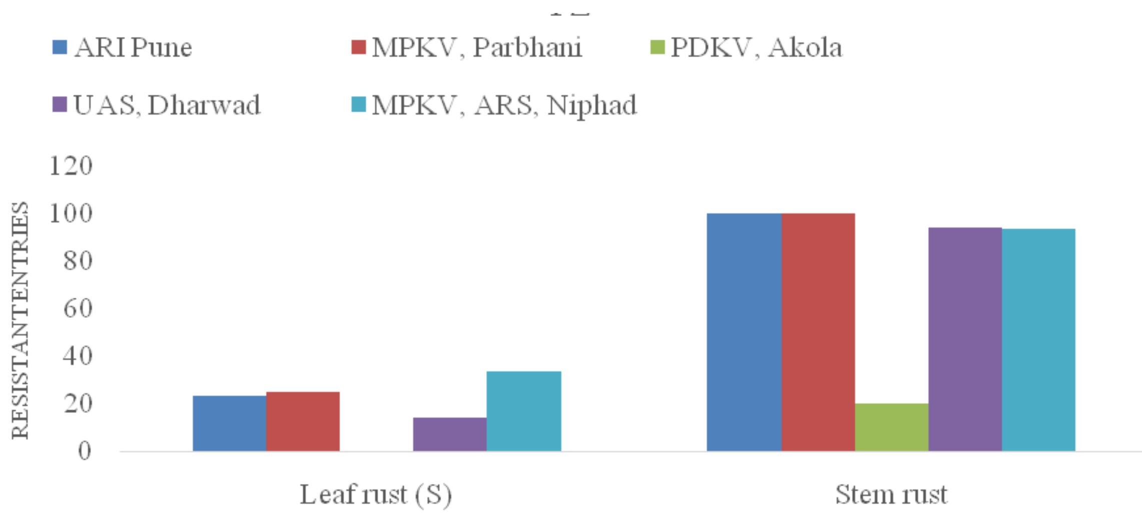


**Fig: 1.7. Percent of rust-resistant entries in IPPSN slots belonging to cooperating centres of PZ (Leaf rust (S) and Stem rust)**

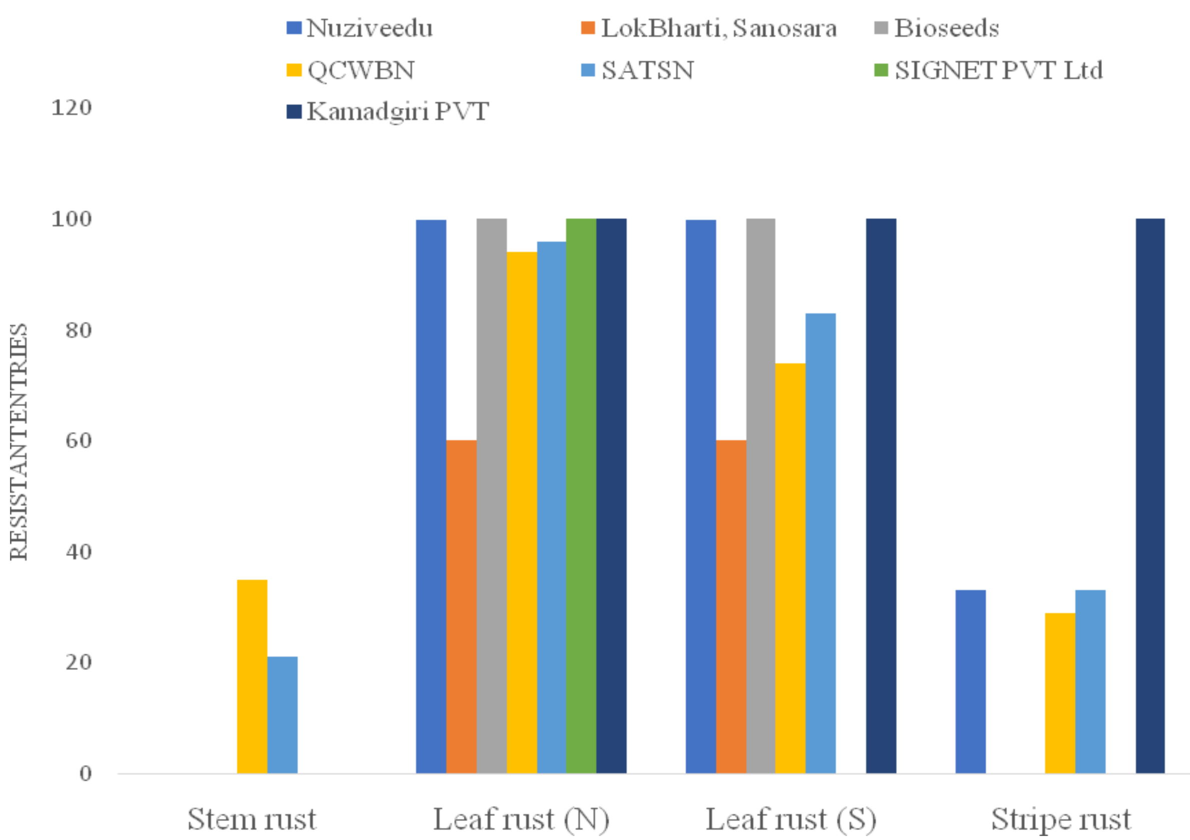


**Fig: 1.8. Percent of rust resistant entries in IPPSN slots belonging to QCWBN, SATSN and different private seed companies (Stem, Leaf and stripe rust)**

**Table 1.1: Number to resistant entries (ACI<10) and entries qualify for promotion (ACI <20)in IPPSN slots of different centres during 2023-24.**

| | | Resistant entries (ACI<10) | | | | Promotional entries (ACI<20) | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Centers** | **Total Entries** | **Stem rust** | **Leaf rust** | | **Stripe rust** | **Stem rust** | **Leaf rust** | | **Stripe rust** |
| | | | **South** | **North** | | | **South** | **North** | |
| **NHZ** | | | | | | | | | |
| SKAUST, Kashmir | 10 | 2 | 10 | 7 | 8 | 7 | 0 | 3 | 2 |
| ICAR-VPKAS, Almora | 25 | 8 | 21 | 17 | 21 | 6 | 3 | 3 | 2 |
| HPKVV Malan | 15 | 3 | 12 | 8 | 9 | 6 | 2 | 3 | 4 |
| **NWPZ** | | | | | | | | | |
| SKUAST-J, Jammu | 10 | 3 | 9 | 4 | 0 | 4 | 1 | 3 | 5 |
| GBPUAT, Pantnagar | 50 | 6 | 47 | 40 | 17 | 28 | 3 | 9 | 20 |
| PAU, Ludhiana | 140 | 20 | 132 | 112 | 123 | 61 | 7 | 24 | 16 |
| ICAR-IIWBR, Karnal | 192 | 47 | 170 | 129 | 86 | 87 | 21 | 51 | 81 |
| CSSRI, Karnal | 8 | 2 | 7 | 7 | 2 | 3 | 1 | 1 | 4 |
| ICAR-IARI, New Delhi | 172 | 47 | 157 | 147 | 90 | 57 | 15 | 20 | 40 |
| CCSHAU, Hisar | 65 | 8 | 47 | 36 | 41 | 23 | 18 | 13 | 18 |
| RARI, Durgapura | 36 | 7 | 27 | 18 | 19 | 15 | 9 | 4 | 16 |
| ICAR-IIFSR, Modipuram | 10 | 0 | 9 | 10 | 9 | 5 | 1 | 0 | 1 |
| **NEPZ** | | | | | | | | | |
| BAU, Ranchi | 10 | 0 | 8 | 5 | 3 | 6 | 2 | 2 | 2 |
| Banda | 5 | 0 | 5 | 5 | 3 | 2 | 0 | 0 | 2 |
| NDUAT, Ayodhya | 20 | 1 | 18 | 13 | 4 | 12 | 2 | 6 | 9 |
| SHUATS, Prayagraj | 10 | 1 | 6 | 7 | 3 | 2 | 3 | 1 | 0 |
| CSAUAT, Kanpur | 30 | 12 | 30 | 22 | 8 | 13 | 0 | 7 | 8 |
| BHU, Varanasi | 20 | 4 | 17 | 12 | 6 | 9 | 3 | 6 | 9 |
| BAU, Sabour | 20 | 5 | 13 | 8 | 5 | 9 | 7 | 5 | 5 |
| RPCAU-PUSA | 6 | 0 | 5 | 1 | 2 | 1 | 1 | 4 | 1 |
| BCKV, Kalyani | 10 | 3 | 10 | 9 | 3 | 5 | 0 | 1 | 1 |
| UBKV, Coochbhear | 15 | 1 | 12 | 8 | 1 | 7 | 3 | 4 | 4 |
| **CZ** | | | | | | | | | |
| SDAU, Vijapur | 40 | 24 | 33 | 35 | 11 | 12 | 5 | 1 | 2 |
| JAU, Junagadh | 20 | 9 | 20 | 19 | 4 | 11 | 0 | 0 | 0 |
| JNKV JABALPUR | 20 | 9 | 15 | 4 | 1 | 8 | 5 | 9 | 3 |
| JNKVV, Powarkheda | 30 | 6 | 24 | 14 | 13 | 14 | 5 | 13 | 8 |
| MPUAT, Udaipur | 10 | 3 | 10 | 9 | 4 | 7 | 0 | 0 | 0 |
| IGKVV, RS, Bilaspur | 15 | 1 | 14 | 10 | 2 | 9 | 1 | 2 | 3 |
| JNKVV, Sagar | 11 | 3 | 9 | 6 | 0 | 5 | 2 | 4 | 1 |
| **PZ** | | | | | | | | | |
| ARI Pune | 35 | 8 | 35 | 33 | 15 | 19 | 0 | 2 | 5 |
| MPKV, Parbhani | 8 | 2 | 8 | 5 | 1 | 2 | 0 | 3 | 4 |
| PDKV, Akola | 10 | 0 | 2 | 3 | 0 | 4 | 6 | 3 | 0 |
| UAS, Dharwad | 35 | 5 | 33 | 32 | 10 | 9 | 2 | 2 | 3 |
| MPKV, ARS, Niphad | 30 | 10 | 28 | 21 | 7 | 11 | 2 | 9 | 11 |
| **Others and Private companies** | | | | | | | | | |
| QCWBN | 31 | 11 | 29 | 23 | 9 | 12 | 2 | 6 | 7 |
| SATSN | 24 | 5 | 23 | 20 | 8 | 13 | 1 | 4 | 13 |
| LokBharti, Sanosara | 5 | 0 | 3 | 3 | 0 | 3 | 1 | 0 | 0 |
| Nuziveedu Seeds | 3 | 0 | 3 | 3 | 1 | 1 | 0 | 0 | 0 |
| Bioseeds | 3 | 0 | 3 | 3 | 0 | 2 | 0 | 0 | 2 |
| SIGNET PVT Ltd | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| Sahib Seed | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Kamadgiri PVT | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| **Total** | **1212** | **276** | **1066** | **869** | **550** | **512** | **135** | **228** | **314** |

## 1.2 Plant Pathological Screening Nursery (PPSN)

### Objectives

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 469 entries that comprise AVT, NIVT and special trials including checks during 2023-24. 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, Kharchia65, VL804, K8027, HD2932*, NI5439, Cow(W) -1, GW322, HD2864, NIAW1415, MACS2496, MACS2946, HMP4010* 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, Khudwani and Jammu (13)

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

**South:**

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

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

**Leaf Blight:** Ludhiana, Karnal, Hisar, New Delhi, Pantnagar, Ayodhya, Varanasi, RPCAU Pusa,Sabour, Kalyani, Coochbehar, Pune, Shillongani and Dharwad (14)

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

**Stripe rust:** Almora, Malan, Khudwani

**Leaf rust (S):** Dharwad, Wellington, Junagrah

**Stem rust:** Wellington

### Evaluation under artificial epiphytotic

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 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 checks 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 (2023-24) with ACI upto 10.0 are givenStem, Leaf and Stripe rusts

DBW476, DBW173(C), PBW927, WH1402(I)(C), HP1978, VL2059, MACS4125(d), MACS4135(d), HI8849(d), HI8850(d), DBW428, HI8851(d), HI8852(d), HI8627(d), DDW62(d),NIDW1149(d)

**Stem and Stripe rust**

HD3494, DBW476, PBW725, NW8071, DBW173(C), PBW927, HD3468, WH1402(I)(C), HP1978, VL2059, MACS4125(d), MACS4135(d), HI8849(d), HI8850(d), DBW428, HI8851(d), HI8852(d), HI8627(d), DDW62(d), DBW443*, NIDW1149(d)

**Leaf rust and Stripe rust**

DBW476, DBW477, HD3471, HD3455, DBW173, RAJ4581, HD3428, PBW771(C), PBW927, HD3369, DBW296, WH1402 (I)(C), HP1978, HD3447, PBW915, HD3388 (I)(C), PBW833 (C), VL2059, MACS4125 (d), MACS4135 (d), HI8849 (d), HI8850 (d), MPO1395, HI8737 (d),DBW428, UAS484 (d), HI8851 (d), HI8852 (d), MACS4131 (d), MPO1398 (d), HI8627 (d), DDW62 (d), MPO1395(d), MACS3949(d), DBW426, UAS446(d), NIDW1149 (d), UAS478(d)(I)

**Leaf and stem rust**

DBW476, HD3059(C), DBW173(C), PBW927, WH1402(I)(C), HP1978, KRL2106, HI1563(C), VL2059, MACS4125(d), MACS4135(d), HI1669, HI1683, HI1684, HI8848(d), HI8849(d), HI8850(d), GW554, GW555, MACS6768, HI1650, GW547(I), HI8713(d), HI1674, HI1687, WSM138, MAC6830, GW556, DBW428, HI8851(d), HI8852(d), CG1036, HI1655*, HI8823(d), HI8627(d), DDW62(d), AKAW5100*, MACS6222, MP1378(I), MACS6829, NIAW4120, NIAW4432, LOK79, HD3090(C), HI1633(C), NIDW1149(d), HI1665(I).

**Table: 1.2. Adult plant response of AVT entries against three rusts under epihytotic conditions at hot spot locations in fieldduring 2023-24**

| AVT No. | Entry | Stem rust (S) | | Leaf Rust (S) | | Leaf Rust (N) | | Stripe Rust (N) | | Postulation genes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ACI | HS | ACI | HS | ACI | HS | ACI | HS | *Sr* | *Lr* | *Yr* |
| 1 | HD3086(C) | 47.5 | 80S | 26 | 60S | 39.8 | 100S | 7.3 | 60S* | *Sr7b+2+* | *Lr23+10+3+* | *Yr2+* |
| 2 | HI1668* | 13.3 | 20S | 7.7 | 20S | 21 | 60S | 6.7 | 20S | *#Sr30+2+* | *#Lr13+* | *#Yr2+* |
| 3 | HD3494 | 7.8 | 20S | 7.7 | 20S | 30.1 | 60S | 1.4 | 10S | *Sr13+11+* | *Lr13+* | *R* |
| 4 | DBW417 | 41 | 60S | 5.4 | 20MS | 8.9 | 30S | 10.7 | 40S | *Sr9b+13+* | *Lr13+* | - |
| 5 | DBW88 (C) | 7.4 | 20S | 1.4 | 10MR | 13.1 | 50S | 27.6 | 60S | *Sr11+2+* | *Lr13+10+3+* | - |
| 6 | PBW957 | 15.3 | 40S | 6.4 | 20MS | 17.9 | 60S | 1.7 | 10S | *Sr9b+13+11+* | *Lr13+10+* | *R* |
| 7 | DBW222(C)* | 18.1 | 40S | 1.9 | 10MR | 5.4 | 20S | 14.4 | 40S | *#* | *#Lr13+* | *#Yr2+* |
| 8 | DBW477 | 14.6 | 40S | 6 | 20MS | 9 | 30S | 3.8 | 20S | - | *Lr13+10+* | *R* |
| 9 | HD3471 | 12.5 | 20S | 3.4 | 10S | 9.1 | 30S | 6.9 | 40S | *Sr13+7b+* | *Lr13+10+* | *Yr2+* |
| 10 | PBW916 | 20.3 | 40S | 1.9 | 10S | 10.6 | 20S | 0.4 | 5MS | *R* | *Lr13+10+* | *R* |
| 11 | DBW386* | 14.2 | 40S | 8 | 20S | 15.9 | 30S | 4.8 | 10S | *#Sr9b+13+11+* | *#Lr13+10+1+* | *#Yr2+* |
| 12 | PBW826(C) | 17.8 | 60S | 4.8 | 20MR | 11.7 | 40S | 8.1 | 20S | *Sr30+8a+2+* | *Lr23+1+* | *Yr2+* |
| 13 | DBW476 | 7.1 | 40MS | 3.7 | 10MS | 9.4 | 30S | 2.2 | 10S | *Sr13+7b+* | *Lr13+10+* | *R* |
| 14 | HD2967 | 24.3 | 40S | 5.8 | 20S | 19.3 | 60S | 46.7 | 60S | *Sr8a+11+2+* | *Lr23+* | *Yr2+* |
| 15 | PBW725 | 7.5 | 20MS | 3 | 10S | 12.9 | 40S | 0.4 | 5MR | *Sr11+7b+* | *Lr13+10+* | *R* |
| 16 | HD3386(I)(C) | 14 | 40S | 6 | 20S | 17.2 | 40S | 5.5 | 20S | *Sr30+5+2+* | *Lr13+10+* | *Yr2+* |
| 17 | PBW958 | 23.8 | 60S | 5.5 | 20S | 23.2 | 90S | 1.9 | 10MS | *Sr13+7b+* | *Lr13+10+* | *R* |
| 18 | HD3455 | 17.5 | 40S | 8 | 20S | 2.6 | 10MS | 3 | 20MS | *Sr13+7b+* | - | *R* |
| 19 | HD3059(C) | 6.8 | 20MS | 2.5 | 5S | 4.9 | 20S | 28.4 | 60S | *Sr11+2+* | *Lr13+3+* | *Yr2+* |
| 20 | JKW261(C) | 36.3 | 60S | 3.7 | 10S | 5.1 | 20S | 19.1 | 40S | *Sr11+* | *Lr23+13+* | - |
| 20A | Infector | 80 | 80S | 80 | 100S | 80 | 100S | 80 | 90S | | | |
| 21 | NW8071 | 5.9 | 20S | 4.1 | 10S | 10.6 | 30S | 7.3 | 20S | - | *Lr13+1+* | *R* |
| 22 | DBW173(C) | 2.9 | 20S | 2.2 | 5S | 6.2 | 30S | 5.3 | 20MS | *Sr31+5+2+* | *Lr26+10+3+* | *Yr9+* |
| 23 | WH1324 | 13 | 20S | 4.3 | 10MS | 12 | 40S | 3.2 | 10MS | *Sr13+11+* | *Lr13+1+* | - |
| 24 | DBW422 | 26.3 | 40S | 10.7 | 20S | 22.1 | 50S | 12 | 40S | *Sr9b+13+11+* | *Lr13+1+* | *Yr2+* |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | RAJ4581 | 18.3 | 40S | 2 | 5MS | 7.2 | 20S | 6.4 | 20S | *Sr13+11+* | *Lr13+* | *Yr2+* |
| 26 | HD3428 | 15.6 | 40S | 4.7 | 20S | 1.4 | 5S | 7.6 | 40S | - | *Lr13+1+* | *Yr2+* |
| 27 | HD3495 | 17.5 | 40S | 10 | 20S | 18.7 | 40S | 1 | 10MR | *Sr9e+13+* | *Lr13+10+* | - |
| 28 | PBW771(C) | 18.5 | 60S | 3.9 | 20MR | 2.9 | 20S | 5.7 | 20MS | *Sr31+2+* | *Lr26+23+1+* | *Yr9+* |
| 29 | PBW921 | 19 | 40S | 6.8 | 20S | 15.6 | 40S | 2.1 | 10MS | *Sr9e+11+* | *Lr13+10+* | *R* |
| 30 | PBW644(C) | 11.4 | 30S | 11.7 | 20S | 14.6 | 60S | 27.7 | 80S | *Sr11+2+* | *Lr13+1+* | *Yr2+* |
| 31 | HI1653(C) | 12 | 20S | 6.7 | 20S | 21.3 | 60S | 7.8 | 20S | *Sr7b+* | *Lr13+10+3+* | *Yr2+* |
| 32 | PBW927 | 8 | 20S | 5 | 20S | 6.4 | 20S | 1.3 | 10MS | *Sr13+7b+* | *Lr13+10+* | *R* |
| 33 | HD3369 | 25.2 | 60S | 5.1 | 20S | 1.9 | 10MS | 1.4 | 10MS | *Sr13+* | *Lr13+* | - |
| 34 | HD3468 | 9 | 20S | 7.7 | 20S | 20.9 | 50S | 7 | 20S | *Sr11+7b+* | *Lr13+10+* | *Yr2+* |
| 35 | NIAW3170(C) | 28.5 | 80S | 12.5 | 40S | 3.1 | 10S | 27.6 | 60MS | *Sr8a+2+* | *Lr13+10+1+* | *Yr2+* |
| 36 | WH1326 | 14.4 | 40S | 8 | 20S | 23.3 | 60S | 10.3 | 40MS | - | *Lr13+* | *Yr2+* |
| 37 | DBW296 | 18 | 60S | 5 | 20S | 8.9 | 40S | 1.4 | 10MS | *Sr13+7b+* | *Lr23+13+10+* | *Yr2+* |
| 38 | JKW304 | 16.8 | 40S | 11 | 20S | 32.4 | 60S | 6.2 | 40S | *Sr13+7b+* | *Lr13+* | *R* |
| 39 | WH1402(I)(C) | 9 | 20S | 1.7 | 10MR | 3.8 | 20S | 1.3 | 10MS | *R* | *Lr13+1+* | *R* |
| 40 | PBW908 | 38.5 | 60S | 10.7 | 40S | 4.4 | 20S | 5.1 | 40S | *Sr13+11+7b+* | *R* | *R* |
| 40A | Infector | 77.5 | 80S | 80 | 80S | 80 | 100S | 81.1 | 90S | | | |
| 41 | HP1978 | 3.3 | 10MS | 4 | 20MS | 1.9 | 10S | 2.9 | 10S | *R* | *R* | *YrA+* |
| 42 | HD3447 | 14.8 | 40S | 7.8 | 20S | 4.4 | 15S | 6.9 | 20S | *R* | *Lr13+* | *Yr2+* |
| 43 | PBW915 | 24 | 60S | 7 | 20MS | 0.2 | TS | 0 | 0 | *Sr13+11+* | *Lr28+* | *R* |
| 44 | HD3388(I) (C) | 17 | 20S | 3.8 | 10MS | 2.4 | 20S | 2.4 | 10MS | *Sr13+7b+* | *Lr13+3+* | *Yr2+* |
| 45 | UP3124 | 19.5 | 40S | 8.4 | 20MS | 24.2 | 80S | 9.4 | 40S | *Sr30+5+* | *Lr23+10+* | - |
| 46 | KRL2106 | 8.8 | 10S | 3.7 | 10MS | 6.4 | 20S | 12.2 | 40MS | *Sr9b+13+7b+* | *Lr13+* | *YrA+* |
| 47 | HD3249 (C) | 16.3 | 40S | 8 | 20MS | 17.2 | 40S | 11 | 40MS | *Sr11+2+* | *Lr13+* | *Yr2+* |
| 48 | PBW913 | 11.8 | 20S | 7.7 | 10S | 15 | 40S | 1.4 | 10MS | *Sr13+11+* | *Lr13+10+* | *R* |
| 49 | HD3467 | 14.6 | 40S | 4 | 10MS | 17.4 | 40S | 4.7 | 20S | *Sr11+7b+* | *Lr23+1+* | - |
| 50 | BCW29 | 12.3 | 30S | 7 | 20MS | 19.3 | 60S | 5.1 | 20S | *Sr13+7b+* | *Lr13+* | *R* |
| 51 | UP3123 | 25.8 | 60S | 7.3 | 20S | 6.4 | 20S | 12.4 | 40S | *Sr9b+13+* | *Lr13+1+* | *YrA+* |
| 52 | HI1563 (C) | 3.6 | 20MS | 1 | 10MR | 5 | 20S | 65.6 | 100S | *Sr24+R* | *R+Lr24+* | *Yr2+* |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 53 | DBW107(C)* | 35 | 80S | 15.3 | 40S | 18.7 | 40S | 10.2 | 20S | *#* | *#Lr23+* | *#Yr2+* |
| 54 | PBW833(C) | 28.3 | 60S | 4.4 | 20S | 1.2 | 5S | 8.1 | 40MS | *Sr7b+2+* | *R* | - |
| 55 | WH1323 | 11.5 | 20S | 1.9 | 5S | 17.8 | 40S | 10.2 | 40S | *Sr30+5+* | - | - |
| 56 | HD3118(C) | 31.5 | 80S | 16 | 20S | 29.4 | 60S | 9.8 | 40S | *Sr9b+11+* | - | *Yr2+* |
| 57 | HI1621(C) | 35 | 80S | 15 | 30S | 28 | 60S | 7.6 | 20S | *Sr28+* | *Lr13+* | *Yr2+* |
| 58 | HD3171 (C) | 20.1 | 40S | 14.7 | 20S | 34.7 | 60S | 28.7 | 80S | *Sr11+7b+2+* | *Lr23+13+10+* | - |
| 59 | HD3460 | 18.3 | 60MS | 4.7 | 20MS | 7.4 | 40S | 22.7 | 60S | *Sr13+* | *Lr23+* | *Yr2+* |
| 60 | HD3293 (C) | 13.8 | 40S | 13 | 20S | 31.1 | 60S | 6 | 40MS | *Sr13+2+* | *Lr13+10+* | *Yr2+* |
| 60A | Infector | 80 | 80S | 80 | 80S | 82.2 | 100S | 81.1 | 90S | | | |
| 61 | HI1612 (C) | 56.5 | 80S | 20.5 | 80S | 5.2 | 20MS | 10 | 40S | *Sr7b+2+* | *Lr23+* | *Yr2+* |
| 62 | K1317(C)* | 27 | 60S | 16.3 | 40S | 12.6 | 40S | 13.6 | 40S | *#R* | *#Lr13+* | *#-* |
| 63 | VL2041 (C) | 7.8 | 20S | 5.7 | 10S | 14.2 | 40S | 24.6 | 60S | *Sr30+5+11+* | *Lr13+* | - |
| 64 | HPW349 (C) | 31.8 | 80S | 13.3 | 40S | 9.2 | 30S | 12.6 | 40S | *Sr7b+2+* | *Lr13+10+* | *Yr2+* |
| 65 | VL2059 | 9.3 | 60S* | 3 | 20MS | 0.6 | 10MR | 2.7 | 20MS | *Sr24+R* | *R+Lr24+* | *R* |
| 66 | HS562 (C) | 42 | 80S | 9.8 | 20S | 18 | 40S | 2 | 10S | *Sr8a+9b+11+* | *Lr23+10+3+* | *YrA+* |
| 67 | VL907 (C) | 4.6 | 20S | 5.2 | 20S | 19.5 | 40S | 10.7 | 40MS | *Sr31+2+* | *Lr26+10+* | *Yr9+* |
| 68 | MACS6837 | 17 | 40S | 6.3 | 20MS | 9.4 | 30S | 38.3 | 60S | *R* | *Lr23+1+* | *Yr2+* |
| 69 | MACS4125(d) | 10 | 30MS | 2.4 | 10MS | 1.1 | 10MS | 3.4 | 20MS | *Sr11+* | *R* | - |
| 70 | MACS4135(d) | 9.5 | 40MS | 2.5 | 10S | 1.1 | 10MS | 1.6 | 20MR | *Sr11+* | *R* | - |
| 71 | HI1669 | 9.3 | 40S | 3.7 | 10S | 1 | 10MS | 63.3 | 100S | *Sr24+R* | *R+Lr24+* | - |
| 72 | HI1683 | 4.8 | 20MS | 3.7 | 10S | 2 | 10S | 48.7 | 80S | *Sr24+R* | *R+Lr24+* | - |
| 73 | HI1684 | 8.5 | 40MS | 2.3 | 10S | 1.1 | 10S | 68.9 | 100S | *Sr24+R* | *R+Lr24+* | - |
| 74 | HI8848(d) | 5.1 | 20MS | 5.3 | 20MS | 2 | 10S | 13 | 40MS | *Sr7b+2+* | - | - |
| 75 | HI8849(d) | 6.4 | 20MS | 6.3 | 20MS | 0.4 | 10MR | 6.1 | 20MS | *Sr7b+* | - | - |
| 76 | HI8850(d) | 3.6 | 10MS | 2.3 | 10MR | 0.1 | TMS | 4.2 | 10S | *Sr7b+* | - | - |
| 77 | GW554 | 6.5 | 30MS | 3.4 | 10MS | 2 | 10MS | 68.9 | 80S | *Sr24+R* | *R+Lr24+* | *Yr2+* |
| 78 | GW555 | 6.8 | 40MS | 4.7 | 20MS | 2.1 | 10S | 64.4 | 80S | *Sr24+R* | *R+Lr24+* | *Yr2+* |
| 79 | MP3570 | 17.3 | 40S | 15.3 | 60S | 33.3 | 60S | 50 | 80S | *Sr9b+13+2+* | *Lr13+10+* | *Yr2+* |
| 80 | MPO1395 | 19.8 | 60S | 6 | 20S | 5.2 | 20S | 7 | 20S | *Sr9e+2+* | - | *Yr2+* |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 80A | Infector | 80 | 80S | 76.7 | 80S | 80 | 100S | 82.2 | 90S | | | |
| 81 | GW322 | 18.8 | 40S | 7 | 20MS | 28.3 | 80S | 46.2 | 80S | *Sr11+2+* | *Lr13+1+* | - |
| 82 | MACS6768 | 9.3 | 30S | 4.3 | 10S | 2.9 | 10MS | 80 | 100S | *Sr31+2+* | *R+Lr26+* | *Yr9+* |
| 83 | HI1650 | 8.3 | 30MS | 1.4 | 10MR | 2.6 | 10MS | 30.4 | 60S | *Sr31+* | *R+Lr26+* | *Yr9+* |
| 84 | GW547(I) | 2.8 | 20MR | 2.4 | 10S | 2.1 | 15MS | 24.9 | 60S | *Sr24+2+R* | *R+Lr24+* | *Yr2+* |
| 85 | HI8737(d) | 13.5 | 40MS | 2.6 | 10S | 1.7 | 15MS | 4.9 | 10MS | *Sr9e+2+* | - | - |
| 86 | HI8713(d) | 7.3 | 40MS | 3.4 | 10MS | 1.6 | 15MS | 15.2 | 60S | *Sr9e+2+* | - | - |
| 87 | HI1674 | 4.3 | 20MS | 2.7 | 10MS | 0.9 | 10MS | 52.2 | 80S | *Sr24+R* | *#R+Lr24+* | *Yr2+* |
| 88 | HI1687 | 6.7 | 30MS | 2.4 | 10S | 0.5 | 5MS | 55 | 80S | *Sr24+R* | *R+Lr24+* | - |
| 89 | WSM138 | 3.7 | 20S | 2.7 | 20MR | 1 | 10MS | 32.4 | 60S | *Sr24+R* | *R+Lr24+* | *Yr2+* |
| 90 | MACS6830 | 5.1 | 30MR | 1.7 | 10MS | 0.9 | 10MS | 71.1 | 100S | *Sr24+R* | *R+Lr24+* | *Yr2+* |
| 91 | DBW425 | 18.4 | 40S | 9 | 20MS | 25.6 | 80S | 11.2 | 40S | *Sr5+9b+13+* | *Lr3+* | *YrA+* |
| 92 | GW556 | 8.9 | 40MS | 4 | 20S | 2.2 | 20S | 73.3 | 100S | *Sr24+R* | *R+Lr24+* | - |
| 93 | HD2932* | 28 | 80S | 26.7 | 60S | 39.6 | 60S | 55 | 80S | *Sr11+* | - | - |
| 94 | HMP4010* | 27.8 | 60S | 20 | 40S | 32.2 | 80S | 52.8 | 80S | - | *#Lr13+1+* | *Yr2+* |
| 95 | HI1634 | 12.6 | 40S | 2.4 | 10S | 4.2 | 20S | 46.2 | 80S | *Sr31+* | *R+Lr26+* | *Yr9+* |
| 96 | CG1029 | 11.6 | 40S | 2.4 | 10S | 4.2 | 20S | 67.8 | 90S | *Sr24+2+R* | *R+Lr24+* | *Yr2+* |
| 97 | DBW441[M*] | 27.8 | 60S | 17.3 | 40S | 17.7 | 40S | 44.4 | 80S | *Sr8b+7b+2+* | *Lr13+* | *Yr2+* |
| 98 | DBW428 | 5.1 | 20MS | 2 | 10MS | 2.2 | 20MS | 6.4 | 20S | *Sr9b+13+11+* | *Lr13+* | - |
| 99 | DBW432 | 17.5 | 40S | 4.5 | 15MS | 11.2 | 40S | 2.1 | 10MS | *Sr9b+13+11+* | *Lr13+1+* | *YrA+* |
| 100 | UAS3029 | 31.5 | 80S | 11 | 20S | 8.9 | 30S | 13.1 | 40MS | *Sr9b+13+11+* | *Lr23+10+* | *YrA+* |
| 100A | Infector | 77.5 | 80S | 83.3 | 100S | 85.6 | 100S | 81.1 | 90S | | | |
| 101 | UAS484(d) | 14.3 | 40S | 6.7 | 20S | 2.3 | 20S | 6.7 | 20S | *Sr7b+2+* | *R* | - |
| 102 | NIAW4267 | 16.1 | 60MS | 4 | 10S | 1.8 | 10S | 66.7 | 90S | *Sr24+R* | *R+Lr24+* | - |
| 103 | HI8851(d) | 7.3 | 30MS | 3.2 | 10S | 1.7 | 5S | 3.1 | 20S | *Sr13+7b+* | *Lr23+* | *Yr2+* |
| 104 | HI8852(d) | 6.6 | 30MS | 2.4 | 10S | 0.6 | 5S | 4.9 | 20S | *Sr13+7b+2+* | *Lr23+* | *Yr2+* |
| 105 | MACS4131(d) | 13.3 | 40MS | 4.7 | 10S | 0 | 0 | 0.8 | 5S | *Sr7b+* | *R* | *Yr2+* |
| 106 | MPO1398(d) | 18.4 | 60MS | 5.4 | 20S | 0.6 | 5S | 3.6 | 20S | *Sr7b+2+* | *R* | - |
| 107 | DBW110 | 19.5 | 40MS | 4.1 | 10S | 12.7 | 40S | 40.9 | 80S | *R* | *Lr23+10+1+* | *Yr2+* |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 108 | CG1036 | 9.5 | 40MS | 4 | 20S | 3.9 | 20S | 77.8 | 100S | *Sr7b+2+* | *#R* | - |
| 109 | HI1655* | 1.9 | 10MS | 1.9 | 10S | 0.6 | 5S | 33.6 | 60S | *Sr2+R* | *#* | - |
| 110 | HI8627(d) | 5.6 | 20S | 4.4 | 20S | 0.6 | 5S | 6.7 | 20S | *Sr13+11+7b+* | - | - |
| 111 | HI8823(d) | 6.2 | 20S | 2.7 | 10MS | 1.6 | 10S | 12.3 | 40S | *Sr11+2+* | - | - |
| 112 | DBW359(I) | 15.8 | 40S | 13.7 | 40S | 16.4 | 40S | 6.7 | 20S | *Sr9b+7b+2+* | *#Lr3+* | *Yr2+* |
| 113 | CG1040(I) | 31.5 | 60S | 13 | 20S | 25.6 | 80S | 46.7 | 80S | *R* | *Lr13+* | *Yr2+* |
| 114 | MACS6842 | 19.5 | 40S | 8.7 | 20S | 17.3 | 40S | 37.3 | 60S | - | *Lr13+1+* | *Yr2+* |
| 115 | MACS6844 | 8.1 | 20S | 6.7 | 20S | 18.1 | 40S | 73.3 | 100S | *R* | *Lr13+* | - |
| 116 | NIAW4364 | 27.3 | 60S | 14.8 | 40S | 26.7 | 60S | 39.4 | 60S | - | *Lr13+* | *Yr2+* |
| 117 | PBW891 | 5.8 | 20S | 6.7 | 10S | 20.2 | 60S | 39.6 | 70S | *R* | *Lr13+10+* | *Yr2+* |
| 118 | DBW443* | 5.6 | 20MS | 10.7 | 20S | 24.9 | 60S | 7.2 | 20S | *R* | *#Lr13+1+* | *Yr2+* |
| 119 | DDW62(d) | 8.6 | 20S | 2.4 | 10S | 7.2 | 60S* | 1.8 | 20MR | *Sr9e+2+* | - | - |
| 120 | AKAW5100** | 3.9 | 20MS | 4 | 10S | 7.1 | 40S | 35.1 | 60S | *Sr31+2+* | *#Lr26+* | *Yr9+* |
| 120A | Infector | 80 | 80S | 80 | 80S | 77.8 | 100S | 81.1 | 90S | | | |
| 121 | WH1306 | 14.3 | 40MS | 5.7 | 20MS | 20.3 | 60S | 6.7 | 20MS | *Sr30+5+2+* | - | - |
| 122 | NWS2222 | 9.4 | 20S | 3 | 20MR | 24.7 | 60S | 21 | 40S | *Sr30+5+* | *Lr13+* | - |
| 123 | UAS3026 | 28 | 60S | 11.7 | 20S | 21.3 | 50S | 34.2 | 60S | *Sr13+11+7b+* | *Lr23+10+* | - |
| 124 | CG1045 | 17 | 40S | 11.7 | 20S | 15.9 | 50S | 11.2 | 60S | *Sr30+2+* | *Lr13+1+* | *Yr2+* |
| 125 | MPO1395(d) | 16.6 | 60MS | 4 | 10S | 1.5 | 10MS | 2.7 | 20S | *Sr9e+2+* | - | *Yr2+* |
| 126 | MACS6222 | 9.5 | 40MS | 4 | 10MS | 0.1 | TS | 14.6 | 80S | *Sr24+2+R* | *R+Lr24+* | *Yr2+* |
| 127 | MP1378(I) | 6.3 | 30MS | 2.4 | 10S | 1.1 | 10S | 53.3 | 80S | *Sr31+* | *Lr26+* | *Yr9+* |
| 128 | MACS3949(d) | 20.1 | 60S | 2.7 | 10S | 1.5 | 10MS | 1 | 5MS | *Sr7b+2+* | *R* | *Yr2+* |
| 129 | DBW426 | 11.8 | 30S | 1.4 | 10MR | 0.6 | 5S | 8.2 | 20S | *R* | *R* | *YrA+* |
| 130 | MACS6829 | 9.3 | 40S | 2.4 | 10S | 1.1 | 10S | 50 | 60S | *Sr24+R* | *R+Lr24+* | - |
| 131 | NIAW4114* | 11.8 | 30S | 2 | 10S | 3.4 | 20S | 78.9 | 100S | *Sr24+R* | *#R+Lr24+* | *Yr2+* |
| 132 | NIAW4120 | 5.8 | 30MS | 4 | 20MS | 2.8 | 20S | 76.7 | 90S | *Sr24+R* | *R+Lr24+* | *Yr2+* |
| 133 | NIAW4432 | 6.3 | 20MS | 2.7 | 10S | 1.7 | 10S | 33.3 | 80S | *Sr24+R* | *R+Lr24+* | *Yr2+* |
| 134 | UAS3027 | 15.8 | 40S | 2.4 | 10S | 4.6 | 20S | 38.2 | 60S | *Sr30+5+2+* | *Lr13+1+* | *Yr2+* |
| 135 | LOK79 | 6.3 | 30S | 2.7 | 10S | 1.1 | 10S | 62.2 | 100S | *Sr24+R* | *R+Lr24+* | - |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 136 | RAJ4083 (C) | 11.8 | 30S | 8.7 | 20MS | 20.1 | 60S | 32.8 | 60S | *Sr11+2+* | *Lr13+* | *Yr2+* |
| 137 | HD3090 (C) | 6.6 | 30MS | 5 | 20MS | 2.1 | 10S | 47.3 | 80S | *Sr31+* | *R+Lr26+* | *Yr9+* |
| 138 | HI1633 (C) | 7.3 | 30S | 2 | 10MS | 1.2 | 10S | 45.8 | 80S | *Sr31+2+* | *R+Lr26+* | *Yr9+* |
| 139 | CG1047 | 15.5 | 40S | 6.5 | 20MS | 19.4 | 40S | 41.3 | 80S | - | *Lr13+* | - |
| 140 | GW1368(d) | 16.5 | 40S | 7.1 | 20S | 4.1 | 20S | 35.1 | 80S | - | - | - |
| 140A | Infector | 77.5 | 80S | 83.3 | 100S | 84.4 | 100S | 78.9 | 90S | | | |
| 141 | HI1605 | 22.1 | 60S | 24 | 60S | 38.7 | 60S | 30.9 | 60S | *Sr5+11+* | *Lr13+* | *Yr2+* |
| 142 | NIAW3170 | 22 | 40S | 10.7 | 20S | 0.2 | TS | 22.2 | 40S | *Sr8a+2+* | *Lr13+10+1+* | - |
| 143 | UAS446(d) | 13.1 | 60MS | 3 | 10S | 1 | 5S | 1.6 | 5MS | *Sr11+2+* | *R* | - |
| 144 | NIDW1149(d) | 8.3 | 20S | 2.3 | 10S | 0.2 | TS | 1.1 | 10S | *Sr11+2+* | *Lr23+* | - |
| 145 | HI1665(I) | 1.9 | 10MS | 0.2 | 5R | 2.8 | 15S | 57.8 | 80S | *Sr2+R* | *R* | *Yr2+* |
| 146 | UAS478(d)(I) | 23.5 | 60S | 3 | 10S | 0.6 | 10MR | 5.9 | 20S | *Sr7b+2+* | *Lr23+* | - |

**Abbreviations:** ACI = Average Coefficient of Infection. HS = Highest Score, Avg. = Mean, Leaf rust (S) = Leaf rust (South), Leaf rust (N) = leaf rust (North), * Indicates rust score (more than 40S) at one location only, *Sr* = Stem rust resistance genes, *Lr* = leaf rust resistance genes, *Yr* = yellow rust resistance genes; # Different seed lot to that of previous cropping season, - Gene not postulated, R resistant to all pathotypes

**Table: 1.3. Performance of AVTs entries against different diseases under multi-location testing during 2023-24.**

| S. No. | Entry | LB | | PM | | KB | | LS (%) | | FS (%) | | FR (%) | FHB (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HS | AV | HS | AV | HS | ACI | HS | AV | HS | AV | HS | HS |
| 1 | HD3086(C) | 79 | 68 | 6 | 4 | 39.5 | 12.8 | 60.5 | 33.9 | 7.14 | 5.79 | 12.50 | 3 |
| 2 | HI1668 | 99 | 58 | 6 | 3 | 18.4 | 8.0 | 83.3 | 42.6 | 6.40 | 3.20 | 22.22 | 4 |
| 3 | HD3494 | 59 | 36 | 6 | 4 | 19.0 | 7.3 | - | - | 9.20 | 3.73 | 25.00 | 3 |
| 4 | DBW417 | 68 | 36 | 6 | 4 | 13.1 | 4.8 | - | - | 5.70 | 2.93 | 31.25 | 3 |
| 5 | DBW88 (C) | 79 | 58 | 7 | 5 | 62.0 | 13.9 | - | - | 5.40 | 1.80 | 27.78 | 3 |
| 6 | PBW957 | 89 | 57 | 9 | 5 | 48.7 | 11.9 | - | - | 7.30 | 3.40 | 6.25 | 3 |
| 7 | DBW222(C) | 89 | 57 | 9 | 5 | 9.5 | 5.2 | 70.8 | 42.4 | 9.10 | 3.03 | 38.89 | 3 |
| 8 | DBW477 | 89 | 58 | 9 | 5 | 11.2 | 4.9 | - | - | 8.40 | 3.19 | 35.00 | 4 |
| 9 | HD3471 | 79 | 68 | 7 | 4 | 47.7 | 13.6 | 46.4 | 11.6 | 6.30 | 2.10 | 35.00 | 3 |
| 10 | PBW916 | 89 | 36 | 6 | 4 | 23.6 | 10.0 | - | - | 10.20 | 6.45 | 33.33 | 3 |
| 11 | DBW386* | 78 | 47 | 9 | 5 | 18.0 | 6.4 | 65 | 31.6 | 8.60 | 4.35 | 30.00 | 4 |
| 12 | PBW826(C) | 89 | 58 | 5 | 4 | 36.8 | 8.6 | - | - | 6.40 | 2.36 | 12.50 | 3 |
| 13 | DBW476 | 68 | 58 | 7 | 5 | 39.0 | 9.8 | - | - | 8.10 | 2.70 | 25.00 | 3 |
| 14 | HD2967 | 78 | 58 | 9 | 4 | 37.0 | 12.1 | 56.6 | 20.5 | 5.50 | 2.15 | 16.67 | 4 |
| 15 | PBW725 | 79 | 57 | 7 | 5 | 35.9 | 9.5 | - | - | 5.60 | 1.87 | 27.78 | 3 |
| 16 | HD3386(I)(C) | 78 | 47 | 7 | 4 | 36.6 | 9.8 | - | - | 8.20 | 4.35 | 16.67 | 4 |
| 17 | PBW958 | 78 | 58 | 7 | 6 | 50.6 | 11.5 | - | - | 9.70 | 3.63 | 35.00 | 3 |
| 18 | HD3455 | 89 | 57 | 6 | 3 | 22.0 | 4.9 | - | - | 8.40 | 2.80 | 25.00 | 4 |
| 19 | HD3059(C) | 79 | 57 | 7 | 4 | 41.7 | 14.5 | 66.6 | 32.6 | 5.40 | 2.67 | 11.11 | 4 |
| 20 | JKW261(C) | 78 | 46 | 6 | 3 | 28.2 | 8.3 | 81.1 | 45.4 | 6.20 | 4.20 | 25.00 | 3 |
| 20A | Infector | 99 | 89 | 9 | 7 | 36.2 | 21.9 | 86.6 | 49.5 | 28.33 | 15.66 | | 5 |
| 21 | NW8071 | 79 | 47 | 7 | 3 | 28.5 | 8.2 | - | - | 11.20 | 3.73 | 16.67 | 3 |
| 22 | DBW173(C) | 78 | 47 | 7 | 3 | 6.6 | 3.1 | 64 | 29.8 | 12.40 | 5.64 | 27.78 | 4 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 | WH1324 | 76 | 57 | 5 | 3 | 40.0 | 13.4 | - | - | 9.90 | 3.30 | 16.67 | 3 |
| 24 | DBW422 | 89 | 57 | 7 | 4 | 34.9 | 12.1 | - | - | 7.60 | 3.51 | 15.00 | 4 |
| 25 | RAJ4581 | 99 | 67 | 7 | 4 | 82.1 | 24.3 | - | - | 6.70 | 2.23 | 35.00 | 3 |
| 26 | HD3428 | 89 | 57 | 7 | 4 | 27.3 | 10.7 | 43.3 | 14.6 | 5.80 | 2.46 | 16.67 | 3 |
| 27 | HD3495 | 78 | 47 | 9 | 6 | 31.1 | 9.3 | - | - | 8.50 | 3.27 | 31.25 | 3 |
| 28 | PBW771(C) | 89 | 57 | 9 | 6 | 84.6 | 19.3 | 45.2 | 25.3 | 5.40 | 1.80 | 30.00 | 4 |
| 29 | PBW921 | 79 | 58 | 6 | 4 | 15.5 | 8.8 | - | - | 4.10 | 1.37 | 25.00 | 3 |
| 30 | PBW644(C) | 99 | 47 | 6 | 4 | 12.3 | 5.7 | 73.3 | 25.6 | 11.10 | 3.98 | 16.67 | 3 |
| 31 | HI1653(C) | 89 | 68 | 8 | 5 | 22.4 | 9.7 | 45 | 24.2 | 12.80 | 5.57 | 25.00 | 3 |
| 32 | PBW927 | 89 | 57 | 9 | 4 | 62.7 | 17.4 | - | - | 8.30 | 4.97 | 27.78 | 4 |
| 33 | HD3369 | 89 | 68 | 7 | 3 | 20.9 | 6.7 | 35 | 22.3 | 8.50 | 3.40 | 16.67 | 3 |
| 34 | HD3468 | 89 | 58 | 8 | 5 | 71.1 | 18.3 | - | - | 11.40 | 5.84 | 20.00 | 3 |
| 35 | NIAW3170(C) | 89 | 58 | 6 | 3 | 22.6 | 6.4 | 83.3 | 41.9 | 11.60 | 5.91 | 38.89 | 3 |
| 36 | WH1326 | 79 | 57 | 6 | 3 | 40.8 | 12.9 | - | - | 9.70 | 3.23 | 22.22 | 3 |
| 37 | DBW296 | 78 | 47 | 9 | 4 | 66.7 | 14.5 | 46.6 | 26.1 | 14.30 | 6.18 | 11.11 | 3 |
| 38 | JKW304 | 79 | 58 | 9 | 5 | 53.0 | 11.5 | - | - | 17.46 | 9.97 | 33.33 | 4 |
| 39 | WH1402(I)(C) | 78 | 47 | 7 | 4 | 20.9 | 6.4 | - | - | 11.20 | 4.23 | 30.00 | 3 |
| 40 | PBW908 | 89 | 58 | 9 | 4 | 27.9 | 8.0 | - | - | 10.61 | 7.50 | 30.00 | 5 |
| 40A | Infector | 89 | 89 | 9 | 8 | 41.1 | 23.4 | 86 | 45.6 | 24.20 | 15.02 | | 5 |
| 41 | HP1978 | 99 | 57 | 7 | 3 | 39.5 | 8.7 | - | - | 8.60 | 6.40 | 22.22 | 2 |
| 42 | HD3447 | 79 | 68 | 8 | 3 | 7.4 | 2.9 | - | - | 6.40 | 2.13 | 16.67 | 2 |
| 43 | PBW915 | 79 | 58 | 9 | 6 | 50.3 | 15.5 | - | - | 5.20 | 1.73 | 25.00 | 3 |
| 44 | HD3388(I) (C) | 79 | 57 | 7 | 4 | 52.0 | 16.2 | - | - | 3.40 | 2.22 | 30.00 | 5 |
| 45 | UP3124 | 89 | 57 | 6 | 4 | 30.0 | 10.0 | - | - | 5.70 | 1.90 | 11.11 | 3 |
| 46 | KRL2106 | 78 | 36 | 6 | 4 | 28.1 | 7.6 | - | - | 8.89 | 5.83 | 16.67 | 3 |
| 47 | HD3249 (C) | 99 | 68 | 4 | 3 | 22.9 | 6.3 | - | - | 6.80 | 2.27 | 27.78 | 4 |
| 48 | PBW913 | 57 | 57 | 8 | 4 | 49.1 | 14.0 | - | - | 9.10 | 3.03 | 35.00 | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 49 | HD3467 | 89 | 57 | 9 | 5 | 38.4 | 11.0 | - | - | 10.20 | 4.93 | 22.22 | 3 |
| 50 | BCW29 | 79 | 47 | 9 | 6 | 47.9 | 9.6 | - | - | 12.10 | 4.44 | 27.78 | 3 |
| 51 | UP3123 | 78 | 57 | 6 | 3 | 30.6 | 10.0 | - | - | 13.30 | 4.43 | 22.22 | 3 |
| 52 | HI1563 (C) | 99 | 79 | 8 | 5 | 19.5 | 11.0 | - | - | 3.40 | 1.87 | 44.44 | 4 |
| 53 | DBW107(C) | 89 | 58 | 8 | 6 | 32.6 | 9.3 | - | - | 5.80 | 3.33 | 45.00 | 5 |
| 54 | PBW833(C) | 68 | 47 | 7 | 5 | 98.8 | 23.5 | - | - | 3.50 | 2.15 | 6.25 | 3 |
| 55 | WH1323 | 89 | 67 | 7 | 5 | 13.3 | 6.2 | - | - | 5.70 | 1.90 | 12.50 | 3 |
| 56 | HD3118(C) | 89 | 68 | 6 | 4 | 10.6 | 4.6 | - | - | 8.20 | 2.73 | 30.00 | 5 |
| 57 | HI1621(C) | 99 | 78 | 6 | 4 | 28.2 | 7.1 | - | - | 11.70 | 3.90 | 38.89 | 3 |
| 58 | HD3171 (C) | 89 | 68 | 7 | 4 | 13.7 | 5.2 | - | - | 12.50 | 4.17 | 35.00 | 3 |
| 59 | HD3460 | 89 | 57 | 9 | 4 | 53.3 | 13.7 | - | - | 10.60 | 6.33 | 30.00 | 3 |
| 60 | HD3293 (C) | 87 | 57 | 7 | 4 | 79.1 | 16.0 | - | - | 11.40 | 4.05 | 12.50 | 3 |
| 60A | Infector | 89 | 89 | 9 | 8 | 45.6 | 23.5 | 84 | 45.3 | 25.00 | 15.60 | | 5 |
| 61 | HI1612 (C) | 78 | 36 | 6 | 3 | 29.2 | 9.3 | 45 | 20.4 | 12.20 | 6.79 | 16.67 | 4 |
| 62 | K1317(C) | 89 | 68 | 8 | 5 | 46.4 | 14.0 | 69.8 | 37.3 | 4.35 | 3.80 | 22.22 | 3 |
| 63 | VL2041 (C) | 67 | 46 | 5 | 4 | 14.1 | 5.8 | 52.5 | 24.9 | 5.40 | 1.80 | 38.89 | 3 |
| 64 | HPW349 (C) | 89 | 57 | 6 | 4 | 89.6 | 17.4 | 63.3 | 34.6 | 6.80 | 2.58 | 33.33 | 3 |
| 65 | VL2059 | 99 | 68 | 8 | 6 | 34.7 | 9.3 | - | - | 8.10 | 3.85 | 22.22 | 3 |
| 66 | HS562 (C) | 99 | 57 | 8 | 5 | 40.8 | 9.7 | 48.1 | 23.1 | 8.10 | 2.70 | 33.33 | 3 |
| 67 | VL907 (C) | 79 | 47 | 7 | 4 | 35.8 | 9.8 | 65 | 26 | 8.10 | 3.65 | 27.78 | 3 |
| 68 | MACS6837 | 89 | 68 | 7 | 3 | 13.4 | 4.6 | - | - | 5.20 | 1.73 | 25.00 | 3 |
| 69 | MACS4125(d) | 78 | 68 | 5 | 3 | 9.3 | 3.8 | - | - | 6.70 | 2.23 | 30.00 | 4 |
| 70 | MACS4135(d) | 99 | 58 | 6 | 4 | 6.8 | 1.6 | - | - | 6.50 | 2.17 | 38.89 | 3 |
| 71 | HI1669* | 99 | 69 | 8 | 5 | 30.2 | 9.7 | 87.3 | 41.8 | 6.50 | 3.79 | 35.00 | 5 |
| 72 | HI1683 | 99 | 69 | 9 | 4 | 43.9 | 9.4 | - | - | 6.50 | 2.17 | 30.00 | 3 |
| 73 | HI1684 | 99 | 79 | 9 | 5 | 27.5 | 11.3 | - | - | 6.50 | 3.95 | 27.78 | 4 |
| 74 | HI8848(d) | 89 | 69 | 9 | 6 | 11.5 | 4.1 | - | - | 8.30 | 4.15 | 38.89 | 5 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 75 | HI8849(d) | 89 | 68 | 9 | 6 | 48.6 | 12.0 | - | - | 6.10 | 2.03 | 27.78 | 4 |
| 76 | HI8850(d) | 89 | 58 | 9 | 5 | 36.7 | 7.6 | - | - | 5.30 | 1.77 | 16.67 | 3 |
| 77 | GW554 | 89 | 79 | 9 | 6 | 31.7 | 6.4 | - | - | 5.30 | 2.92 | 11.11 | 5 |
| 78 | GW555 | 99 | 79 | 9 | 5 | 43.5 | 14.3 | - | - | 3.20 | 1.07 | 6.25 | 5 |
| 79 | MP3570 | 99 | 79 | 9 | 4 | 15.7 | 7.0 | - | - | 2.50 | 0.83 | 5.56 | 5 |
| 80 | MPO1395(d) | 89 | 68 | 9 | 5 | 10.3 | 3.0 | - | - | 5.40 | 1.80 | 7.14 | 4 |
| 80A | Infector | 99 | 89 | 9 | 8 | 54.2 | 24.5 | 84 | 46.1 | 22.22 | 16.17 | | 5 |
| 81 | GW322 | 89 | 68 | 9 | 6 | 11.6 | 3.8 | 42.8 | 26.2 | 8.53 | 6.63 | 18.75 | 4 |
| 82 | MACS6768 | 99 | 79 | 9 | 6 | 72.5 | 15.7 | 65 | 28.8 | 7.10 | 3.36 | 27.78 | 4 |
| 83 | HI1650 | 89 | 78 | 9 | 5 | 30.4 | 9.4 | 86.6 | 39.7 | 5.40 | 3.39 | 35.00 | 4 |
| 84 | GW547(I) | 99 | 79 | 6 | 4 | 58.8 | 12.9 | - | - | 6.40 | 3.21 | 35.00 | 4 |
| 85 | HI8737(d) | 89 | 69 | 9 | 6 | 11.2 | 5.3 | - | - | 8.20 | 2.73 | 38.89 | 4 |
| 86 | HI8713(d) | 89 | 68 | 8 | 5 | 12.6 | 5.8 | - | - | 8.10 | 3.06 | 22.22 | 3 |
| 87 | HI1674* | 99 | 79 | 9 | 5 | 25.8 | 7.2 | 66.6 | 29.2 | 9.40 | 4.03 | 16.67 | 4 |
| 88 | HI1687 | 99 | 79 | 9 | 4 | 20.9 | 7.6 | - | - | 11.40 | 7.01 | 15.00 | 3 |
| 89 | WSM138 | 89 | 79 | 9 | 4 | 76.1 | 15.7 | - | - | 10.70 | 4.64 | 30.00 | 3 |
| 90 | MACS6830 | 89 | 79 | 9 | 5 | 41.3 | 15.5 | - | - | 8.60 | 3.37 | 27.78 | 3 |
| 91 | DBW425 | 89 | 69 | 5 | 4 | 12.9 | 7.5 | - | - | 9.30 | 4.38 | 16.67 | 3 |
| 92 | GW556 | 89 | 69 | 8 | 5 | 44.1 | 10.4 | - | - | 10.70 | 3.57 | 12.50 | 4 |
| 93 | HD2932 | 89 | 69 | 9 | 4 | 11.8 | 3.6 | 65 | 30.4 | 8.50 | 2.83 | 25.00 | 4 |
| 94 | MP4010 | 99 | 68 | 9 | 6 | 38.6 | 9.7 | 63.3 | 36.1 | 12.60 | 4.92 | 35.00 | 5 |
| 95 | HI1634 | 99 | 79 | 9 | 5 | 39.1 | 12.2 | 83.3 | 46.6 | 10.50 | 6.42 | 35.00 | 5 |
| 96 | CG1029 | 99 | 69 | 8 | 5 | 14.1 | 5.8 | 86.6 | 34.4 | 16.36 | 10.53 | 25.00 | 5 |
| 97 | DBW441M* | 89 | 68 | 9 | 5 | 13.7 | 3.6 | - | - | 14.20 | 5.26 | 33.33 | 3 |
| 98 | DBW428 | 89 | 57 | 6 | 4 | 24.4 | 5.4 | - | - | 13.30 | 5.66 | 16.67 | 3 |
| 99 | DBW432 | 89 | 58 | 9 | 3 | 23.2 | 6.3 | - | - | 12.50 | 5.52 | 38.89 | 3 |
| 100 | UAS3029 | 89 | 57 | 6 | 3 | 10.5 | 4.4 | - | - | 11.70 | 5.71 | 30.00 | 4 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100A | Infector | 89 | 89 | 9 | 7 | 39.9 | 22.0 | 85 | 46.6 | 15.20 | 10.33 | | 5 |
| 101 | UAS484(d) | 78 | 47 | 4 | 2 | 12.5 | 3.3 | - | - | 11.10 | 3.70 | 25.00 | 3 |
| 102 | NIAW4267 | 89 | 69 | 8 | 4 | 24.4 | 7.0 | - | - | 10.81 | 6.82 | 6.25 | 3 |
| 103 | HI8851(d) | 78 | 46 | 9 | 5 | 24.5 | 6.6 | - | - | 6.20 | 2.07 | 12.50 | 3 |
| 104 | HI8852(d) | 89 | 57 | 6 | 4 | 8.2 | 3.9 | - | - | 6.00 | 2.00 | 33.33 | 3 |
| 105 | MACS4131(d) | 89 | 57 | 9 | 4 | 7.8 | 4.5 | - | - | 2.94 | 0.98 | 16.67 | 3 |
| 106 | MPO1398(d) | 89 | 47 | 5 | 3 | 11.9 | 5.8 | - | - | 2.74 | 0.91 | 37.50 | 3 |
| 107 | DBW110 | 89 | 57 | 5 | 3 | 10.5 | 4.3 | 42.7 | 35.4 | 8.40 | 2.80 | 40.00 | 3 |
| 108 | CG1036 | 99 | 79 | 8 | 4 | 32.7 | 6.9 | 56.6 | 24.6 | 10.60 | 3.53 | 35.00 | 3 |
| 109 | HI1655 | 99 | 69 | 7 | 4 | 18.9 | 3.9 | 35.2 | 20.7 | 14.93 | 8.75 | 33.33 | 3 |
| 110 | HI8627(d) | 89 | 69 | 7 | 4 | 89.6 | 19.5 | - | - | 6.30 | 2.10 | 30.00 | 4 |
| 111 | HI8823(d) | 99 | 68 | 9 | 5 | 16.1 | 6.0 | - | - | 3.40 | 1.13 | 38.89 | 3 |
| 112 | DBW359(I) | 89 | 69 | 4 | 2 | 40.5 | 9.4 | 53.8 | 27 | 6.10 | 2.28 | 40.00 | 3 |
| 113 | CG1040(I) | 89 | 68 | 4 | 3 | 29.2 | 9.2 | 80 | 42.5 | 3.70 | 1.23 | 22.22 | 4 |
| 114 | MACS6842 | 99 | 68 | 4 | 2 | 18.8 | 4.0 | - | - | 0.00 | 0.00 | 12.50 | 3 |
| 115 | MACS6844 | 99 | 69 | 6 | 4 | 52.6 | 10.1 | - | - | 5.50 | 2.44 | 16.67 | 4 |
| 116 | NIAW4364 | 89 | 57 | 6 | 3 | 14.7 | 4.1 | - | - | 0.00 | 0.00 | 22.22 | 3 |
| 117 | PBW891* | 78 | 47 | 6 | 3 | 50.9 | 11.2 | 76 | 29 | 4.71 | 1.57 | 25.00 | 3 |
| 118 | DBW443* | 89 | 47 | 6 | 4 | 50.0 | 12.4 | 88 | 39.5 | 5.30 | 1.77 | 38.89 | 3 |
| 119 | DDW62(d) | 78 | 47 | 6 | 3 | 21.8 | 5.5 | - | - | 5.40 | 1.80 | 27.78 | 4 |
| 120 | AKAW5100* | 89 | 58 | 7 | 5 | 13.0 | 4.0 | 66.6 | 38.7 | 4.58 | 1.53 | 35.00 | 3 |
| 120A | Infector | 89 | 89 | 9 | 7 | 47.9 | 23.9 | 86.6 | 46.3 | 16.60 | 10.51 | | 5 |
| 121 | WH1306* | 68 | 47 | 4 | 2 | 29.1 | 8.0 | 82.8 | 65.9 | 5.60 | 2.25 | 25.00 | 3 |
| 122 | NWS2222* | 89 | 58 | 9 | 4 | 19.9 | 8.3 | 85 | 39.7 | 5.60 | 3.14 | 18.75 | 3 |
| 123 | UAS3026 | 99 | 58 | 7 | 4 | 28.6 | 10.3 | - | - | 5.40 | 1.80 | 22.22 | 3 |
| 124 | CG1045 | 99 | 57 | 7 | 5 | 33.0 | 14.4 | - | - | 8.60 | 2.87 | 15.00 | 3 |
| 125 | MPO1395(d) | 89 | 58 | 9 | 3 | 37.6 | 11.3 | - | - | 6.30 | 2.10 | 38.89 | 4 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 126 | MACS6222 | 99 | 68 | 9 | 5 | 41.3 | 10.3 | 67.9 | 42.6 | 8.40 | 5.54 | 31.25 | 3 |
| 127 | MP1378(I) | 89 | 57 | 9 | 6 | 47.4 | 11.5 | 45 | 19.6 | 9.30 | 3.10 | 18.75 | 3 |
| 128 | MACS3949(d) | 89 | 47 | 9 | 6 | 8.3 | 2.4 | 65 | 27.2 | 11.40 | 3.80 | 16.67 | 4 |
| 129 | DBW426 | 89 | 57 | 8 | 4 | 13.7 | 6.1 | - | - | 8.60 | 2.87 | 30.00 | 3 |
| 130 | MACS6829 | 99 | 58 | 8 | 5 | 31.9 | 10.4 | - | - | 12.10 | 7.01 | 16.67 | 5 |
| 131 | NIAW4114* | 99 | 68 | 9 | 6 | 60.7 | 16.5 | 66.6 | 36.3 | 10.10 | 3.37 | 16.67 | 5 |
| 132 | NIAW4120* | 99 | 68 | 9 | 5 | 88.2 | 19.8 | 65 | 32.8 | 9.20 | 3.78 | 30.00 | 5 |
| 133 | NIAW4432 | 99 | 68 | 9 | 4 | 11.5 | 5.2 | - | - | 6.10 | 2.03 | 25.00 | 4 |
| 134 | UAS3027 | 99 | 68 | 9 | 5 | 12.5 | 4.0 | - | - | 2.63 | 1.59 | 22.22 | 4 |
| 135 | LOK79* | 99 | 58 | 9 | 5 | 65.5 | 17.4 | 65 | 22.8 | 8.30 | 2.77 | 30.00 | 5 |
| 136 | RAJ4083 (C) | 89 | 68 | 9 | 5 | 28.3 | 7.5 | 85 | 32.3 | 5.40 | 1.80 | 35.00 | 4 |
| 137 | HD3090 (C) | 99 | 58 | 9 | 6 | 91.3 | 21.1 | 30 | 13.7 | 3.67 | 1.72 | 25.00 | 3 |
| 138 | HI1633 (C) | 99 | 69 | 9 | 6 | 44.0 | 12.1 | 75 | 41.2 | 1.75 | 0.58 | 12.50 | 4 |
| 139 | CG1047 | 79 | 68 | 9 | 5 | 21.6 | 6.6 | - | - | 3.13 | 1.44 | 38.89 | 5 |
| 140 | GW1368(d) | 99 | 69 | 9 | 6 | 25.9 | 5.8 | - | - | 0.00 | 0.00 | 38.89 | 4 |
| 140A | Infector | 99 | 89 | 9 | 8 | 54.0 | 27.1 | - | - | 16.67 | 11.88 | | 5 |
| 141 | HI1605 | 99 | 68 | 9 | 5 | 9.3 | 4.0 | 85 | 39.5 | 0.00 | 0.00 | 33.33 | 3 |
| 142 | NIAW3170 | 89 | 68 | 8 | 4 | 17.3 | 5.5 | - | - | 0.00 | 0.00 | 38.89 | 3 |
| 143 | UAS446(d) | 89 | 57 | 8 | 4 | 10.4 | 2.9 | 65 | 41 | 1.20 | 0.40 | 27.78 | 3 |
| 144 | NIDW1149(d) | 89 | 67 | 8 | 3 | 9.7 | 4.1 | 81.1 | 31.9 | 0.00 | 0.00 | 25.00 | 5 |
| 145 | HI1665(I) | 89 | 68 | 9 | 5 | 72.0 | 18.3 | 99.3 | 42.1 | 6.20 | 3.10 | 18.75 | 5 |
| 146 | UAS478(d)(I) | 79 | 58 | 9 | 4 | 26.0 | 6.5 | 35.9 | 19.7 | 9.10 | 3.03 | 25.00 | 3 |

Note: Hill bunt data not reported by the centers; “-” not recorded

## Table: 1.4. Status of disease resistance in AVT (Final Year Entries) and check varieties during 2021-2022, 2022-23, and 2023-24

| 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 | HS | AV | HS | AV | HS | AV | HS | AV | HS | HS | HS | AV |
| **NWPZ** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | DBW 386* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 2.7 | 10S | 1.6 | 10MS | 6.7 | 20S | 12.9 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 2.8 | 20MS | 4.1 | 20MS | 4.9 | 20S | 12.3 | 60S | 79 | 46 | 55.8 | 14.1 | 9 | 4 | 5.3 | 1.8 | 5 | 33.33 | - | - |
| | | 2023-24 | 14.2 | 40S | 8.0 | 20S | 15.9 | 30S | 4.8 | 10S | 78 | 47 | 18 | 6.4 | 9 | 5 | 8.6 | 4.35 | 4 | 30 | 65 | 31.6 |
| | | MEAN | 6.6 | 40S | 4.6 | 20S | 9.2 | 30S | 10.0 | 60S | 79 | 47 | 55.8 | 10.3 | 9 | 5 | 8.6 | 3.07 | 5 | 33.3 | 65 | 32 |
| 2 | HD 3471* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 11.3 | 20S | 1.4 | 5MS | 9.5 | 40S | 11.8 | 60S | 99 | 57 | 32.4 | 13.3 | 7 | 4 | 7.3 | 2.4 | 3 | 18.75 | | |
| | | 2023-24 | 12.5 | 20S | 3.4 | 10S | 9.1 | 30S | 6.9 | 40S | 79 | 68 | 47.7 | 13.6 | 7 | 4 | 6.3 | 2.1 | 3 | 35 | 46.4 | 11.6 |
| | | MEAN | 11.9 | 20S | 2.4 | 10S | 9.3 | 40S | 9.4 | 60S | 99 | 68 | 47.7 | 13.5 | 7 | 4 | 7.3 | 2.3 | 3 | 35 | 46 | 12 |
| 3 | HI1668* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 11.4 | 20S | 11.3 | 40S | 7.6 | 40S | 15.9 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 13.7 | 60S | 4.0 | 10S | 8.0 | 20S | 19.8 | 80S | 79 | 57 | 65.6 | 15.5 | 9 | 5 | 6.6 | 2.8 | 4 | 22.22 | | |
| | | 2023-24 | 13.3 | 20S | 7.7 | 20S | 21.0 | 60S | 6.7 | 20S | 99 | 58 | 18.4 | 8 | 6 | 3 | 6.4 | 3.2 | 4 | 22.22 | 83.3 | 42.6 |
| | | MEAN | 12.8 | 60S | 7.7 | 40S | 12.2 | 60S | 14.1 | 80S | 99 | 58 | 65.6 | 11.8 | 9 | 4 | 6.6 | 3 | 4 | 22.2 | 83 | 43 |
| 4 | HD 3428* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 3.6 | 20MR | 3.2 | 20MS | 0.7 | 5S | 15.3 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 5.3 | 20MS | 1.2 | 5MS | 1.1 | 5S | 13.8 | 60S | 78 | 46 | 18.3 | 8.2 | 7 | 3 | 6.3 | 3.2 | 5 | 33.33 | | |
| | | 2023-24 | 15.6 | 40S | 4.7 | 20S | 1.4 | 5S | 7.6 | 40S | 89 | 57 | 27.3 | 10.7 | 7 | 4 | 5.8 | 2.46 | 3 | 16.67 | 43.3 | 14.6 |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MEAN | 8.2 | 40S | 3.0 | 20S | 1.1 | 5S | 12.2 | 60S | 89 | 57 | 27.3 | 9.5 | 7 | 4 | 6.3 | 2.83 | 5 | 33.33 | 43 | 15 |
| 5 | HD2967(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 7.7 | 40S | 16.8 | 80S* | 5.8 | 20S | 42.8 | 80S | 67 | 35 | 13.0 | 4.5 | 5 | 3 | 12.5 | 6.6 | 4 | 33.3 | 71.1 | 28.3 |
| | | 2022-23 | 5.4 | 10S | 8.0 | 20S | 7.1 | 20S | 40.2 | 80S | 89 | 56 | 14.4 | 4.0 | 7 | 3 | 11.0 | 8.4 | 3 | 25.0 | 60.0 | 17.6 |
| | | 2023-24 | 24.3 | 40S | 5.8 | 20S | 19.3 | 60S | 46.7 | 60S | 78 | 58 | 37 | 12.1 | 9 | 4 | 5.5 | 2.15 | 4 | 16.67 | 56.6 | 20.5 |
| | | MEAN | 12.5 | 40S | 10.2 | 80S* | 10.7 | 60S | 43.2 | 80S | 89 | 46 | 37.0 | 6.9 | 9 | 3 | 12.5 | 5.7 | 4 | 33.3 | 71.1 | 22.1 |
| 6 | DBW 88 ( C ) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2023-24 | 7.4 | 20S | 1.4 | 10MR | 13.1 | 50S | 27.6 | 60S | 79 | 58 | 62 | 13.9 | 7 | 5 | 5.4 | 1.8 | 3 | 27.78 | - | - |
| | | MEAN | 7.4 | 20S | 1.4 | 10MR | 13.1 | 50S | 27.6 | 60S | 79 | 58 | 62 | 13.9 | 7 | 5 | 5.4 | 1.8 | 3 | 27.78 | - | - |
| 7 | HD 3086(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 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 | 89 | 57 | 40.5 | 10.0 | 6 | 3 | 8.1 | 7.1 | 5 | 31.3 | | |
| | | 2023-24 | 47.5 | 80S | 26.0 | 60S | 39.8 | 100S | 7.3 | 60S* | 79 | 68 | 39.5 | 12.8 | 6 | 4 | 7.14 | 5.79 | 3 | 12.5 | 60.5 | 33.9 |
| | | MEAN | 35.1 | 80S | 17.0 | 60S | 33.0 | 100S | 15.0 | 80S | 89 | 67 | 40.5 | 11.4 | 6 | 4 | 8.1 | 6.4 | 5 | 31.3 | 61.0 | 34.0 |
| 8 | DBW 187(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 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 | 99 | 57 | 40.8 | 11.4 | 7 | 5 | 8.1 | 5.2 | 7 | 20.0 | - | - |
| | | 2023-24 | 13.5 | 30S | 1.3 | 10MR | 11.8 | 60S | 7.8 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | MEAN | 9.3 | 30S | 3.4 | 20MS | 5.3 | 60S | 13.6 | 60S | 99 | 57 | 40.8 | 11.4 | 7 | 5 | 8.1 | 5.2 | 7 | 20.0 | - | - |
| 9 | DBW222(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 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 | 78 | 46 | 33.3 | 10.4 | 7 | 4 | 6.3 | 2.1 | 7 | 21.4 | - | - |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2023-24 | 18.1 | 40S | 1.9 | 10MR | 5.4 | 20S | 14.4 | 40S | 89 | 57 | 9.5 | 5.2 | 9 | 5 | 9.1 | 3.03 | 3 | 38.89 | 70.8 | 42.4 |
| | | MEAN | 14.7 | 40S | 3.9 | 20S | 4.0 | 20S | 19.8 | 60S | 89 | 47 | 33.3 | 7.8 | 9 | 5 | 9.1 | 2.6 | 7 | 38.9 | 71.0 | 42.0 |
| 10 | PBW826(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 6.3 | 20MS | 6.9 | 30S | 11.7 | 60S | 11.5 | 40S | 78 | 46 | 54.2 | 14.2 | 5 | 3 | 7.3 | 4.4 | 5 | 16.7 | 15.0 | 8.7 |
| | | 2022-23 | 3.6 | 10MS | 6.0 | 20MS | 9.9 | 40S | 14.3 | 60S | 68 | 46 | 50.4 | 15.0 | 7 | 4 | 6.6 | 3.5 | 5 | 30.0 | 65.0 | 21.8 |
| | | 2023-24 | 17.8 | 60S | 4.8 | 20MR | 11.7 | 40S | 8.1 | 20S | 89 | 58 | 36.8 | 8.6 | 5 | 4 | 6.4 | 2.36 | 3 | 12.5 | | |
| | | MEAN | 9.2 | 60S | 5.9 | 30S | 11.1 | 60S | 11.3 | 60S | 89 | 47 | 54.2 | 12.6 | 7 | 4 | 7.3 | 3.4 | 5 | 30.0 | 65.0 | 15.3 |
| 11 | PBW 725 ( C ) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2023-24 | 7.5 | 20MS | 3.0 | 10S | 12.9 | 40S | 0.4 | 5MR | 79 | 57 | 35.9 | 9.5 | 7 | 5 | 5.6 | 1.87 | 3 | 27.78 | | |
| | | MEAN | 7.5 | 20MS | 3.0 | 10S | 12.9 | 40S | 0.4 | 5MR | 79 | 57 | 35.9 | 9.5 | 7 | 5 | 5.6 | 1.87 | 3 | 27.78 | | |
| 12 | HD 3386(I) ( C ) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 7.0 | 20S | 2.0 | 15MR | 9.7 | 40S | 13.4 | 40S | 68 | 36 | 42.1 | 13.1 | 9 | 5 | 11.5 | 7.9 | 5 | 27.8 | | |
| | | 2022-23 | 4.0 | 20S | 2.6 | 20MR | 11.0 | 40S | 13.7 | 60S | 68 | 46 | 48.3 | 17.0 | 9 | 6 | 8.1 | 3.8 | 4 | 18.8 | 70.0 | 19.4 |
| | | 2023-24 | 14.0 | 40S | 6.0 | 20S | 17.2 | 40S | 5.5 | 20S | 78 | 47 | 36.6 | 9.8 | 7 | 4 | 8.2 | 4.35 | 4 | 16.67 | | |
| | | MEAN | 8.3 | 40S | 3.5 | 20S | 12.6 | 40S | 10.9 | 60S | 78 | 46 | 48.3 | 13.3 | 9 | 5 | 11.5 | 5.4 | 5 | 27.8 | 70.0 | 19.4 |
| 13 | HD 3059 ( C ) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 6.3 | 20MS | 6.0 | 30S | 3.4 | 10S | 28.2 | 60S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 4.1 | 20MS | 1.1 | 10MR | 7.4 | 20S | 27.7 | 60S | 89 | 57 | 11.6 | 3.4 | 8 | 3 | 0.0 | 0.0 | 4 | 25.0 | - | - |
| | | 2023-24 | 6.8 | 20MS | 2.5 | 5S | 4.9 | 20S | 28.4 | 60S | 79 | 57 | 41.7 | 14.5 | 7 | 4 | 5.4 | 2.67 | 4 | 11.11 | 66.6 | 32.6 |
| | | MEAN | 5.7 | 20MS | 3.2 | 30S | 5.2 | 20S | 28.1 | 60S | 89 | 57 | 41.7 | 9.0 | 8 | 4 | 5.4 | 1.3 | 4 | 25 | 67 | 33 |
| 14 | DBW 173 ( C ) | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2021-22 | 0.7 | 5MS | 6.1 | 30S | 2.6 | 5S | 15.3 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 0.9 | 10MR | 0.7 | 5MS | 1.9 | 10MS | 7.3 | 40MS | 99 | 56 | 39.3 | 10.2 | 9 | 3 | 12.5 | 4.2 | 4 | 25.0 | - | - |
| | | 2023-24 | 2.9 | 20S | 2.2 | 5S | 6.2 | 30S | 5.3 | 20MS | 78 | 47 | 6.6 | 3.1 | 7 | 3 | 12.4 | 5.64 | 4 | 27.78 | 64 | 29.8 |
| | | MEAN | 1.5 | 20S | 3.0 | 30S | 3.6 | 30S | 9.3 | 40S | 99 | 57 | 39.3 | 6.7 | 9 | 3 | 12.5 | 4.9 | 4 | 27.8 | 64.0 | 30.0 |
| 15 | PBW 771 ( C ) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 4.9 | 20MS | 3.3 | 20MS | 7.7 | 40S | 12.0 | 40S | 89 | 46 | 11.1 | 4.9 | 9 | 4 | 31.6 | 13.7 | 5.0 | 22.2 | 19.5 | 15.4 |
| | | 2022-23 | 8.0 | 20MS | 6.0 | 20MS | 3.3 | 10S | 8.8 | 40S | 89 | 57 | 56.1 | 13.2 | 7 | 3 | 34.0 | 21.0 | 4 | 11.1 | 40.0 | 18.9 |
| | | 2023-24 | 18.5 | 60S | 3.9 | 20MR | 2.9 | 20S | 5.7 | 20MS | 89 | 57 | 84.6 | 19.3 | 9 | 6 | 5.4 | 1.8 | 4 | 30 | 45.2 | 25.3 |
| | | MEAN | 10.5 | 60S | 4.4 | 20MS | 4.6 | 40S | 8.8 | 40S | 89 | 57 | 84.6 | 12.5 | 9 | 4 | 34 | 12.2 | 5 | 30.0 | 45.0 | 19.9 |
| 16 | JKW 261 ( C ) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 31.4 | 40S | 7.2 | 20MS | 3.6 | 20S | 18.8 | 60S | 79 | 46 | 30.0 | 9.9 | 7 | 2 | 8.6 | 5.2 | 5 | 33.3 | 37.6 | 28.4 |
| | | 2022-23 | 21.3 | 60S | 4.3 | 20S | 3.1 | 15MS | 20.0 | 60S | 79 | 56 | 16.2 | 5.7 | 9 | 4 | 11.1 | 8.3 | 4 | 33.3 | 75.0 | 36.2 |
| | | 2023-24 | 36.3 | 60S | 3.7 | 10S | 5.1 | 20S | 19.1 | 40S | 78 | 46 | 28.2 | 8.3 | 6 | 3 | 6.2 | 4.2 | 3 | 25 | 81.1 | 45.4 |
| | | MEAN | 29.7 | 60S | 5.1 | 20S | 3.9 | 20S | 19.3 | 60S | 79 | 46 | 30 | 8.0 | 9 | 3 | 11.1 | 5.9 | 5 | 33.3 | 81 | 36.7 |
| **NEPZ** | | | | | | | | | | | | | | | | | | | | | | |
| 17 | DBW 386* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 2.7 | 10S | 1.6 | 10MS | 6.7 | 20S | 12.9 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 2.8 | 20MS | 4.1 | 20MS | 4.9 | 20S | 12.3 | 60S | 79 | 46 | 55.8 | 14.1 | 9 | 4 | 5.3 | 1.8 | 5 | 33.33 | - | - |
| | | 2023-24 | 14.2 | 40S | 8.0 | 20S | 15.9 | 30S | 4.8 | 10S | 78 | 47 | 18 | 6.4 | 9 | 5 | 8.6 | 4.35 | 4 | 30 | 65 | 31.6 |
| | | MEAN | 6.6 | 40S | 4.6 | 20S | 9.2 | 30S | 10.0 | 60S | 79 | 47 | 55.8 | 10.3 | 9 | 5 | 8.6 | 3.1 | 5 | 33.3 | 65 | 32 |
| 18 | HD3249(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 13.7 | 60S | 4.0 | 10S | 3.5 | 10S | 4.1 | 15MS | 79 | 46 | 10.0 | 3.4 | 7 | 3 | 2.5 | 1.3 | 5 | 33.3 | 36.2 | 24.2 |
| | | 2022-23 | 13.5 | 40S | 2.9 | 10MS | 1.6 | 5S | 11.7 | 60S | 89 | 57 | 95.0 | 22.4 | 7 | 4 | 7.5 | 4.5 | 3 | 14.3 | 65.0 | 18.1 |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2023-24 | 16.3 | 40S | 8.0 | 20MS | 17.2 | 40S | 11.0 | 40MS | 99 | 68 | 22.9 | 6.3 | 4 | 3 | 6.8 | 2.27 | 4 | 27.78 | | |
| | | MEAN | 14.5 | 60S | 5.0 | 20MS | 7.4 | 40S | 8.9 | 60S | 99 | 57 | 95 | 10.7 | 7 | 3 | 7.5 | 2.7 | 5 | 33.3 | 65.0 | 21.2 |
| 19 | DBW 187 (C) | | | | | | | | | | | | | | | | | | | | | |
| | | 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 | 99 | 57 | 40.8 | 11.4 | 7 | 5 | 8.1 | 5.2 | 7 | 20.0 | - | - |
| | | 2023-24 | 13.5 | 30S | 1.3 | 10MR | 11.8 | 60S | 7.8 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | MEAN | 9.3 | 30S | 3.4 | 20MS | 5.3 | 60S | 13.6 | 60S | 99 | 57 | 40.8 | 11.4 | 7 | 5 | 8.1 | 5.2 | 7 | 20.0 | - | - |
| 20 | DBW222(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 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 | 78 | 56 | 33.3 | 10.4 | 7 | 4 | 6.3 | 2.1 | 7 | 21.4 | - | - |
| | | 2023-24 | 18.1 | 40S | 1.9 | 10MR | 5.4 | 20S | 14.4 | 40S | 89 | 57 | 9.5 | 5.2 | 9 | 5 | 9.1 | 3.03 | 3 | 38.89 | 70.8 | 42.4 |
| | | MEAN | 14.7 | 40S | 3.9 | 20S | 4.0 | 20S | 19.8 | 60S | 89 | 57 | 33.3 | 7.8 | 9 | 5 | 9.1 | 2.6 | 7 | 38.89 | 70.8 | 42.4 |
| 21 | PBW826(I)(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 6.3 | 20MS | 6.9 | 30S | 11.7 | 60S | 11.5 | 40S | 78 | 46 | 54.2 | 14.2 | 5 | 3 | 7.3 | 4.4 | 5 | 16.7 | 15.0 | 8.7 |
| | | 2022-23 | 3.6 | 10MS | 6.0 | 20MS | 9.9 | 40S | 14.3 | 60S | 68 | 46 | 50.4 | 15.0 | 7 | 4 | 6.6 | 3.5 | 5 | 30.0 | 65.0 | 21.8 |
| | | 2023-24 | 17.8 | 60S | 4.8 | 20MR | 11.7 | 40S | 8.1 | 20S | 89 | 58 | 36.8 | 8.6 | 5 | 4 | 6.4 | 2.36 | 3 | 12.5 | - | - |
| | | MEAN | 9.2 | 60S | 5.9 | 30S | 11.1 | 60S | 11.3 | 60S | 89 | 47 | 54.2 | 12.6 | 7 | 4 | 7.3 | 3.4 | 5 | 30 | 65 | 15.3 |
| 22 | HD 3388 ( C ) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 14.4 | 30S | 4.9 | 20MS | 5.9 | 20S | 14.9 | 40S | 78 | 46 | 16.3 | 6.8 | 6 | 3 | 6.6 | 5.2 | 3 | 25.0 | 28.6 | 21.2 |
| | | 2022-23 | 8.3 | 20MS | 4.0 | 20MS | 4.9 | 20S | 8.6 | 40S | 89 | 57 | 12.5 | 3.3 | 7 | 4 | 10.4 | 7.9 | 5 | 27.8 | 80.0 | 28.4 |
| | | 2023-24 | 17.0 | 20S | 3.8 | 10MS | 2.4 | 20S | 2.4 | 10MS | 79 | 57 | 52 | 16.2 | 7 | 4 | 3.4 | 2.22 | 5 | 30 | - | - |
| | | MEAN | 13.2 | 30S | 4.2 | 20MS | 4.4 | 20S | 8.6 | 40S | 89 | 57 | 52.0 | 8.8 | 7 | 4 | 10.4 | 5.1 | 5 | 30.0 | 80.0 | 24.8 |
| **CZ** | | | | | | | | | | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 | HI 1669* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 2.3 | 20MR | 3.3 | 20MS | 3.1 | 10S | 61.5 | 80S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 3.8 | 10MS | 2.1 | 5MS | 0.3 | 5MR | 57.2 | 100S | 89 | 57 | 47.9 | 12.4 | 7 | 4 | 35.7 | 21.1 | 5 | 31.25 | - | - |
| | | 2023-24 | 9.3 | 40S | 3.7 | 10S | 1.0 | 10MS | 63.3 | 100S | 99 | 69 | 30.2 | 9.7 | 8 | 5 | 6.5 | 3.79 | 5 | 35 | 87.3 | 41.8 |
| | | MEAN | 5.1 | 40S | 3.0 | 20MS | 1.5 | 10S | 60.7 | 100S | 99 | 68 | 47.9 | 11.1 | 8 | 5 | 36.0 | 12.4 | 5 | 35 | 87 | 42 |
| 24 | HI 1674* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 0.5 | 5MR | 2.4 | 15MS | 3.0 | 15S | 55.0 | 80S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 5.8 | 20MS | 1.0 | 10MR | 1.6 | 10S | 55.5 | 100S | 99 | 57 | 32.6 | 9.8 | 7 | 4 | 7.6 | 2.5 | 8 | 27.78 | - | - |
| | | 2023-24 | 4.3 | 20MS | 2.7 | 10MS | 0.9 | 10MS | 52.2 | 80S | 99 | 79 | 25.8 | 7.2 | 9 | 5 | 9.4 | 4.03 | 4 | 16.67 | 66.6 | 29.2 |
| | | MEAN | 3.5 | 20MS | 2.0 | 15MS | 1.8 | 15S | 54.2 | 100S | 99 | 68 | 32.6 | 8.5 | 9 | 5 | 9.4 | 3.3 | 8 | 27.8 | 67 | 29 |
| 25 | DBW 441M* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 10.7 | 40S | 10.6 | 20S | 12.5 | 40S | 45.2 | 80S | 99 | 57 | 12.9 | 4.9 | 8 | 4 | 8.6 | 2.9 | 5 | 35.0 | - | - |
| | | 2023-24 | 27.8 | 60S | 17.3 | 40S | 17.7 | 40S | 44.4 | 80S | 89 | 68 | 13.7 | 3.6 | 9 | 5 | 14.2 | 5.26 | 3 | 33.33 | - | - |
| | | MEAN | 19.3 | 60S | 14.0 | 40S | 15.1 | 40S | 44.8 | 80S | 99 | 68 | 13.7 | 4.3 | 9 | 5 | 14.0 | 4.1 | 5 | 35.0 | - | - |
| 26 | GW 322 (C) | | | | | | | | | | | | | | | | | | | | | |
| | | 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 | 99 | 46 | 64.4 | 15.5 | 6 | 3 | 10.8 | 4.3 | 8 | 38.9 | _ | _ |
| | | 2023-24 | 18.8 | 40S | 7.0 | 20MS | 28.3 | 80S | 46.2 | 80S | 89 | 68 | 11.6 | 3.8 | 9 | 6 | 8.53 | 6.63 | 4 | 18.75 | 42.8 | 26.2 |
| | | MEAN | 11.9 | 40S | 10.8 | 40S | 19.1 | 80S | 48.6 | 100S | 99 | 57 | 64.4 | 9.7 | 9 | 5 | 10.8 | 5.5 | 8 | 38.9 | 42.8 | 26.2 |
| 27 | MACS6768(I)(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 3.0 | 20MR | 12.1 | 60S* | 6.0 | 20S | 73.0 | 100S | 89 | 57 | 36.0 | 12.8 | 7 | 4 | 7.3 | 3.7 | 4 | 27.8 | 36.6 | 14.8 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2022-23 | 11.3 | 20S | 4.3 | 20MS | 3.0 | 20S | 66.7 | 80S | 99 | 56 | 67.3 | 13.7 | 5 | 2 | 10.1 | 3.7 | 5 | 7.1 | 80.0 | 41.5 |
| | | 2023-24 | 9.3 | 30S | 4.3 | 10S | 2.9 | 10MS | 80.0 | 100S | 99 | 79 | 72.5 | 15.7 | 9 | 6 | 7.1 | 3.36 | 4 | 27.78 | 65 | 28.8 |
| | | MEAN | 7.9 | 30S | 6.9 | 60S* | 4.0 | 20S | 73.2 | 100S | 99 | 67 | 72.5 | 14.1 | 9 | 4 | 10.1 | 3.6 | 5 | 27.8 | 80.0 | 28.4 |
| 28 | HI1650(I)(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 0.4 | 5MR | 4.0 | 20S | 5.3 | 40MS | 55.7 | 80S | 79 | 57 | 13.0 | 4.9 | 5 | 3 | 12.2 | 5.4 | 5 | 27.8 | 27.7 | 22.7 |
| | | 2022-23 | 3.1 | 10MS | 0.6 | 5MS | 1.3 | 5S | 39.8 | 100S | 89 | 56 | 37.9 | 12.5 | 7 | 4 | 9.3 | 4.2 | 5 | 31.3 | 85.0 | 40.0 |
| | | 2023-24 | 8.3 | 30MS | 1.4 | 10MR | 2.6 | 10MS | 30.4 | 60S | 89 | 78 | 30.4 | 9.4 | 9 | 5 | 5.4 | 3.39 | 4 | 35 | 86.6 | 39.7 |
| | | MEAN | 3.9 | 30MS | 2.0 | 20S | 3.1 | 40MS | 42.0 | 100S | 89 | 67 | 37.9 | 8.9 | 9 | 4 | 12.2 | 4.3 | 5 | 35.0 | 87 | 34.1 |
| 29 | GW547* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 1.9 | 10MR | 1.3 | 15MR | 3.2 | 10S | 42.8 | 90S | 89 | 57 | 15.9 | 4.5 | 7 | 4 | 9.6 | 4.3 | 4 | 15.0 | - | - |
| | | 2022-23 | 2.1 | 20MR | 0.3 | 5MR | 1.4 | 10S | 33.3 | 100S | 79 | 46 | 48.5 | 12.5 | 7 | 4 | 8.5 | 4.6 | 9 | 0.0 | 75.0 | 22.4 |
| | | 2023-24 | 2.8 | 20MR | 2.4 | 10S | 2.1 | 15MS | 24.9 | 60S | 99 | 79 | 58.8 | 12.9 | 6 | 4 | 6.4 | 3.21 | 4 | 35 | - | - |
| | | MEAN | 2.3 | 20MR | 1.3 | 10S | 2.2 | 15MS | 33.7 | 100S | 99 | 57 | 58.8 | 9.96 | 7 | 4 | 9.6 | 4 | 9 | 35 | 75 | 22.4 |
| 30 | HI 8737 ( d ) ( C ) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 5.5 | 20MS | 4.1 | 20S | 1.8 | 10MS | 8.7 | 30S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 5.0 | 20S | 0.6 | 5MR | 0.2 | 5R | 7.5 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2023-24 | 13.5 | 40MS | 2.6 | 10S | 1.7 | 15MS | 4.9 | 10MS | 89 | 69 | 11.2 | 5.3 | 9 | 6 | 8.2 | 2.73 | 4 | 38.89 | - | - |
| | | MEAN | 8.0 | 40MS | 2.4 | 20S | 1.2 | 15MS | 7.0 | 40S | 89 | 69 | 11.2 | 5.3 | 9 | 6 | 8.2 | 2.73 | 4 | 38.89 | - | - |
| | | | | | | | | | | | | | | | | | | | | | | |
| 31 | HI 8713 ( d ) (C) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 1.7 | 20MR | 3.3 | 20MS | 3.1 | 10MS | 16.4 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 11.3 | 40S | 0.6 | 5MR | 0.9 | 5MS | 16.4 | 60S | - | - | - | - | - | - | - | - | - | - | - | - |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2023-24 | 7.3 | 40MS | 3.4 | 10MS | 1.6 | 15MS | 15.2 | 60S | 89 | 68 | 12.6 | 5.8 | 8 | 5 | 8.1 | 3.06 | 3 | 22.22 | - | - |
| | | MEAN | 6.8 | 40S | 2.4 | 20MS | 1.9 | 15MS | 16.0 | 60S | 89 | 68 | 12.6 | 5.8 | 8 | 5 | 8.1 | 3.06 | 3 | 22.22 | - | - |
| 32 | HD 2932 ( C ) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 3.2 | 20MR | 22.4 | 60S | 19.3 | 60S | 63.2 | 90S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 17.5 | 60S | 23.4 | 60S | 14.0 | 40S | 56.7 | 100S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2023-24 | 28.0 | 80S | 26.7 | 60S | 39.6 | 60S | 55.0 | 80S | 89 | 69 | 11.8 | 3.6 | 9 | 4 | 8.5 | 2.83 | 4 | 25 | 65 | 30.4 |
| | | MEAN | 16.2 | 80S | 24.2 | 60S | 24.3 | 60S | 58.3 | 100S | 89 | 69 | 11.8 | 3.6 | 9 | 4 | 8.5 | 2.83 | 4 | 25 | 65 | 30.4 |
| 33 | MP 4010 ( C ) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 15.8 | 40S | 30.9 | 60S | 42.3 | 60S | 54.7 | 80S | 89 | 56 | 22.8 | 6.8 | 7 | 4 | 8.3 | 2.8 | 6 | 35 | - | - |
| | | 2023-24 | 27.8 | 60S | 20.0 | 40S | 32.2 | 80S | 52.8 | 80S | 99 | 68 | 38.6 | 9.7 | 9 | 6 | 12.6 | 4.92 | 5 | 35 | 63.3 | 36.1 |
| | | MEAN | 21.8 | 60S | 25.5 | 60S | 37.3 | 80S | 53.8 | 80S | 99 | 67 | 38.6 | 8.3 | 9 | 5 | 13 | 3.9 | 6 | 35 | 63 | 36 |
| 34 | HI 1634 ( C ) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 1.1 | 10MR | 0.3 | TS | 1.5 | 10S | 51.8 | 90S | 89 | 57 | 24.4 | 10.4 | 7 | 5 | 8.3 | 4.9 | 4 | 33.3 | 32 | 20.2 |
| | | 2022-23 | 3.9 | 10MS | 3.7 | 10S | 8.8 | 60S* | 67.5 | 80S | 89 | 57 | 32 | 12.2 | 7 | 4 | 13 | 7.7 | 7 | 33.33 | 76.1 | 42.1 |
| | | 2023-24 | 12.6 | 40S | 2.4 | 10S | 4.2 | 20S | 46.2 | 80S | 99 | 79 | 39.1 | 12.2 | 9 | 5 | 10.5 | 6.42 | 5 | 35 | 83.3 | 46.6 |
| | | MEAN | 5.9 | 40S | 2.1 | 10S | 4.8 | 60S* | 55.2 | 90S | 99 | 68 | 39.1 | 11.6 | 9 | 5 | 13 | 6.3 | 7 | 35 | 83 | 36.3 |
| 35 | CG 1029 ( C ) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 2.4 | 20MR | 3.2 | 20MS | 0.7 | 5S | 66.7 | 100S | 99 | 67 | 34.8 | 13.1 | 9 | 5 | 12.5 | 7.5 | 4 | 6.3 | 28 | 16.8 |
| | | 2022-23 | 3.3 | 10S | 2.9 | 10S | 2.5 | 10S | 46.7 | 90S | 89 | 57 | 48.9 | 13.2 | 6 | 4 | 12.3 | 4.1 | 5 | 33.33 | 70 | 40.2 |
| | | 2023-24 | 11.6 | 40S | 2.4 | 10S | 4.2 | 20S | 67.8 | 90S | 99 | 69 | 14.1 | 5.8 | 8 | 5 | 16.36 | 10.53 | 5 | 25 | 86.6 | 34.4 |
| | | MEAN | 5.8 | 40S | 2.8 | 20MS | 2.5 | 20S | 60.4 | 100S | 99 | 68 | 48.9 | 10.7 | 9 | 5 | 16 | 7.4 | 5 | 33.3 | 87.0 | 30.5 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | DBW 110 (C) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 7.6 | 20MS | 4.8 | 15MS | 1.5 | 10S | 37.8 | 80S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 17.0 | 40S | 7.7 | 20MS | 6.6 | 20S | 43.3 | 80S | 89 | 46 | 77.3 | 16.1 | 8 | 4 | 8.6 | 2.9 | 5 | 25.0 | 85.0 | 25.5 |
| | | 2023-24 | 19.5 | 40MS | 4.1 | 10S | 12.7 | 40S | 40.9 | 80S | 89 | 57 | 10.5 | 4.3 | 5 | 3 | 8.4 | 2.8 | 3 | 40 | 42.7 | 35.4 |
| | | MEAN | 14.7 | 40S | 5.5 | 20MS | 6.9 | 40S | 40.7 | 80S | 89 | 57 | 77.3 | 10.2 | 8 | 4 | 8.6 | 2.9 | 5 | 40.0 | 85.0 | 30.5 |
| 37 | CG1036(I)(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 1.2 | 5MS | 8.1 | 40S | 4.3 | 30S | 66.7 | 100S | 99 | 56 | 10.5 | 4.4 | 7 | 4 | 5.0 | 3.1 | 5 | 27.8 | 46.6 | 20.6 |
| | | 2022-23 | 5.8 | 20MS | 3.1 | 10MS | 8.6 | 60S* | 68.3 | 100S | 89 | 56 | 58.3 | 13.5 | 8 | 4 | 8.5 | 2.8 | 4 | 35.0 | 55.0 | 31.5 |
| | | 2023-24 | 9.5 | 40MS | 4.0 | 20S | 3.9 | 20S | 77.8 | 100S | 99 | 79 | 32.7 | 6.9 | 8 | 4 | 10.6 | 3.53 | 3 | 35 | 56.6 | 24.6 |
| | | MEAN | 5.5 | 40MS | 5.1 | 40S | 5.6 | 60S* | 70.9 | 100S | 99 | 67 | 58.3 | 8.3 | 8 | 4 | 11 | 3.1 | 5 | 35.0 | 57 | 25.6 |
| 38 | HI1655(I)(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 0.9 | 10MR | 0.4 | 5MR | 2.6 | 10S | 39.5 | 90S | 79 | 57 | 41.2 | 10.6 | 6 | 3 | 6.7 | 4.5 | 5 | 30.0 | 46.6 | 25.2 |
| | | 2022-23 | 1.5 | 10MS | 1.2 | 5MS | 0.3 | 5MR | 38.3 | 100S | 89 | 57 | 45.7 | 11.9 | 8 | 4 | 63.2 | 29.2 | 3 | 27.8 | 80.0 | 39.3 |
| | | 2023-24 | 1.9 | 10MS | 1.9 | 10S | 0.6 | 5S | 33.6 | 60S | 99 | 69 | 18.9 | 3.9 | 7 | 4 | 14.93 | 8.75 | 3 | 33.33 | 35.2 | 20.7 |
| | | MEAN | 1.4 | 10MS | 1.2 | 10S | 1.2 | 10S | 37.1 | 100S | 99 | 58 | 45.7 | 8.8 | 8 | 4 | 63.2 | 14.2 | 5 | 33.3 | 80 | 28.4 |
| 39 | HI8627(d)(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 2.9 | 20MS | 2.5 | 15MS | 1.9 | 10MS | 11.7 | 80S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 9.1 | 40S | 1.4 | 5MS | 0.7 | 5S | 8.5 | 40MS | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2023-24 | 5.6 | 20S | 4.4 | 20S | 0.6 | 5S | 6.7 | 20S | 89 | 69 | 89.6 | 19.5 | 7 | 4 | 6.3 | 2.1 | 4 | 30 | | |
| | | MEAN | 5.9 | 40S | 2.8 | 20S | 1.1 | 10MS | 9.0 | 80S | 89 | 69 | 89.6 | 19.5 | 7 | 4 | 6.3 | 2.1 | 4 | 30 | | |
| 40 | HI8823(d)(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 1.0 | 10MR | 0.9 | 10MR | 1.0 | 5S | 17.0 | 40S | 89 | 57 | 8.3 | 4.3 | 7 | 4 | 3.5 | 1.8 | 4 | 22.2 | 76.2 | 22.4 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2022-23 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2023-24 | 6.2 | 20S | 2.7 | 10MS | 1.6 | 10S | 12.3 | 40S | 99 | 68 | 16.1 | 6 | 9 | 5 | 3.4 | 1.13 | 3 | 38.89 | | |
| | | MEAN | 3.6 | 20S | 1.8 | 10MS | 1.3 | 10S | 14.7 | 40S | 99 | 68 | 16.1 | 5.2 | 9 | 5 | 3.5 | 1.5 | 4 | 38.9 | | |
| 41 | DBW359* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 5.0 | 10S | 8.1 | 20MS | 10.1 | 40S | 7.7 | 20S | 68 | 46 | 52.9 | 14.7 | 5 | 2 | 9.6 | 5.7 | 5 | 30.0 | | |
| | | 2022-23 | 7.3 | 20S | 5.5 | 20MS | 14.5 | 40S | 8.6 | 20MS | 89 | 57 | 45.4 | 11.1 | 6 | 4 | 11.1 | 3.7 | 5 | 27.8 | 83.3 | 31.6 |
| | | 2023-24 | 15.8 | 40S | 13.7 | 40S | 16.4 | 40S | 6.7 | 20S | 89 | 69 | 40.5 | 9.4 | 4 | 2 | 6.1 | 2.28 | 3 | 40 | 53.8 | 27 |
| | | MEAN | 9.4 | 40S | 9.1 | 40S | 13.7 | 40S | 7.7 | 20S | 89 | 57 | 52.9 | 11.7 | 6 | 3 | 11.1 | 3.9 | 5 | 40.0 | 83.3 | 29.3 |
| 42 | CG1040* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 17.1 | 40MS | 15.6 | 40S | 15.4 | 60S | 54.2 | 80S | 89 | 46 | 9.7 | 4.2 | 6 | 3 | 4.3 | 2.5 | 4 | 31.3 | | |
| | | 2022-23 | 18.3 | 40S | 14.9 | 30S | 18.3 | 40S | 50.2 | 80S | 99 | 57 | 46.7 | 15.4 | 7 | 4 | 6.6 | 2.2 | 5 | 0.0 | 65.0 | 23.5 |
| | | 2023-24 | 31.5 | 60S | 13.0 | 20S | 25.6 | 80S | 46.7 | 80S | 89 | 68 | 29.2 | 9.2 | 4 | 3 | 3.7 | 1.23 | 4 | 22.22 | 80 | 42.5 |
| | | MEAN | 22.3 | 60S | 14.5 | 40S | 19.8 | 80S | 50.4 | 80S | 99 | 57 | 46.7 | 9.6 | 7 | 3 | 6.6 | 2.0 | 5 | 31.3 | 80 | 33.0 |
| **PZ** | | | | | | | | | | | | | | | | | | | | | | |
| 43 | PBW 891* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 9.2 | 20S | 2.5 | 10MS | 11.5 | 40S | 22.1 | 60S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 6.6 | 20MS | 8.0 | 20S | 4.4 | 20S | 30.3 | 90S | 99 | 67 | 31.2 | 9.0 | 7 | 4 | 8.1 | 2.7 | 3 | 38.9 | | |
| | | 2023-24 | 5.8 | 20S | 6.7 | 10S | 20.2 | 60S | 39.6 | 70S | 78 | 47 | 50.9 | 11.2 | 6 | 3 | 4.71 | 1.57 | 3 | 25 | 76 | 29 |
| | | MEAN | 7.2 | 20S | 5.7 | 20S | 12.0 | 60S | 30.7 | 90S | 99 | 57 | 50.9 | 10.1 | 7 | 4 | 8.1 | 2.1 | 3 | 38.9 | 76.0 | 29.0 |
| 44 | DBW 443* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2022-23 | 4.5 | 20MS | 5.2 | 20MS | 9.2 | 40S | 15.5 | 40S | 89 | 68 | 15.7 | 5.2 | 8 | 4 | 9.6 | 3.8 | 5 | 35.0 | | |
| | | 2023-24 | 5.6 | 20MS | 10.7 | 20S | 24.9 | 60S | 7.2 | 20S | 89 | 47 | 50 | 12.4 | 6 | 4 | 5.3 | 1.77 | 3 | 38.89 | 88 | 39.5 |
| | | MEAN | 5.1 | 20MS | 8.0 | 20S | 17.1 | 60S | 11.4 | 40S | 89 | 58 | 50.0 | 8.8 | 8 | 4 | 9.6 | 2.8 | 5 | 38.9 | 88.0 | 40.0 |
| 45 | AKAW 5100* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 7.0 | 40S | 8.8 | 20S | 5.3 | 20S | 57.3 | 80S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 2.5 | 10MS | 4.3 | 20S | 1.3 | 10S | 41.2 | 90S | 99 | 67 | 23.5 | 8.4 | 9 | 4 | 8.6 | 3.2 | 4 | 33.3 | | |
| | | 2023-24 | 3.9 | 20MS | 4.0 | 10S | 7.1 | 40S | 35.1 | 60S | 89 | 58 | 13 | 4 | 7 | 5 | 4.58 | 1.53 | 3 | 35 | 66.6 | 38.7 |
| | | MEAN | 4.5 | 40S | 5.7 | 20S | 4.6 | 40S | 44.5 | 90S | 99 | 68 | 23.5 | 6.2 | 9 | 5 | 8.6 | 2.4 | 4 | 35.0 | 67.0 | 39.0 |
| 46 | WH 1306* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 4.1 | 10S | 12.4 | 30S | 13.3 | 40S | 12.0 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 11.9 | 40S | 8.4 | 20S | 11.1 | 20S | 8.3 | 20S | 99 | 57 | 57.0 | 14.3 | 8 | 4 | 8.7 | 2.9 | 4 | 40.0 | - | - |
| | | 2023-24 | 14.3 | 40MS | 5.7 | 20MS | 20.3 | 60S | 6.7 | 20MS | 68 | 47 | 29.1 | 8 | 4 | 2 | 5.6 | 2.25 | 3 | 25 | 82.8 | 65.9 |
| | | MEAN | 10.1 | 40S | 8.8 | 30S | 14.9 | 60S | 9.0 | 40S | 99 | 57 | 57.0 | 11.2 | 8 | 3 | 8.7 | 2.6 | 4 | 40.0 | 83.0 | 66.0 |
| 47 | NWS 2222* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 5.0 | 20MS | 8.0 | 20S | 7.1 | 40S | 41.6 | 80S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 7.3 | 20MS | 5.7 | 20MS | 19.7 | 60S | 30.0 | 60S | 99 | 67 | 61.7 | 15.5 | 8 | 3 | 11.1 | 4.2 | 4 | 27.8 | - | - |
| | | 2023-24 | 9.4 | 20S | 3.0 | 20MR | 24.7 | 60S | 21.0 | 40S | 89 | 58 | 19.9 | 8.3 | 9 | 4 | 5.6 | 3.14 | 3 | 18.75 | 85 | 39.7 |
| | | MEAN | 7.2 | 20S | 5.6 | 20S | 17.2 | 60S | 30.9 | 80S | 99 | 67 | 61.7 | 11.9 | 9 | 4 | 11.1 | 3.7 | 4 | 27.8 | 85.0 | 40.0 |
| 48 | HI 1674* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 0.5 | 5MR | 2.4 | 15MS | 3.0 | 15S | 55.0 | 80S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 5.8 | 20MS | 1.0 | 10MR | 1.6 | 10S | 55.5 | 100S | 99 | 57 | 32.6 | 9.8 | 7 | 4 | 7.6 | 2.5 | 8 | 27.78 | - | - |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2023-24 | 4.3 | 20MS | 2.7 | 10MS | 0.9 | 10MS | 52.2 | 80S | 99 | 79 | 25.8 | 7.2 | 9 | 5 | 9.4 | 4.03 | 4 | 16.67 | 66.6 | 29.2 |
| | | MEAN | 3.5 | 20MS | 2.0 | 15MS | 1.8 | 15S | 54.2 | 100S | 99 | 68 | 32.6 | 8.5 | 9 | 5 | 9.4 | 3.3 | 8 | 27.8 | 67.0 | 29.0 |
| 49 | NIAW 4114* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 3.7 | 40MR | 6.4 | 20MS | 3.1 | 10S | 61.5 | 90S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 6.8 | 20MS | 1.7 | 10MR | 0.6 | 5MS | 70.0 | 100S | 79 | 46 | 55.8 | 11.6 | 8 | 4 | 42.3 | 20.7 | 6 | 21.4 | - | - |
| | | 2023-24 | 11.8 | 30S | 2.0 | 10S | 3.4 | 20S | 78.9 | 100S | 99 | 68 | 60.7 | 16.5 | 9 | 6 | 10.1 | 3.37 | 5 | 16.67 | 66.6 | 36.3 |
| | | MEAN | 7.4 | 30S | 3.4 | 20MS | 2.4 | 20S | 70.1 | 100S | 99 | 57 | 60.7 | 14.1 | 9 | 5 | 42.3 | 12.0 | 6 | 21.4 | 67.0 | 36.0 |
| 50 | NIAW 4120* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 0.7 | 5MR | 2.5 | 10MS | 2.7 | 15S | 69.2 | 90S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 2.6 | 10MS | 2.0 | 10MS | 1.0 | 10MS | 68.3 | 100S | 99 | 57 | 61.6 | 16.4 | 9 | 6 | 28.8 | 14.7 | 7 | 35.0 | - | - |
| | | 2023-24 | 5.8 | 30MS | 4.0 | 20MS | 2.8 | 20S | 76.7 | 90S | 99 | 68 | 88.2 | 19.8 | 9 | 5 | 9.2 | 3.78 | 5 | 30 | 65 | 32.8 |
| | | MEAN | 3.0 | 30MS | 2.8 | 20MS | 2.2 | 20S | 71.4 | 100S | 99 | 68 | 88.2 | 18.1 | 9 | 6 | 28.8 | 9.2 | 7 | 35.0 | 65.0 | 33.0 |
| 51 | LOK79* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 0.3 | 5MR | 0.8 | 10MR | 0.6 | 5MS | 46.5 | 80S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 2.8 | 10MS | 1.7 | 20MR | 8.0 | 60S* | 61.7 | 100S | 89 | 46 | 35.0 | 8.4 | 8 | 5 | 35.2 | 17.4 | 9 | 35.0 | | |
| | | 2023-24 | 6.3 | 30S | 2.7 | 10S | 1.1 | 10S | 62.2 | 100S | 99 | 58 | 65.5 | 17.4 | 9 | 5 | 8.3 | 2.77 | 5 | 30 | 65 | 22.8 |
| | | MEAN | 3.1 | 30S | 1.7 | 10S | 3.2 | 60S* | 56.8 | 100S | 99 | 57 | 65.0 | 12.9 | 9 | 5 | 35.2 | 10.1 | 9 | 35.0 | 65.0 | 23.0 |
| | | | | | | | | | | | | | | | | | | | | | | |
| 52 | MACS6222(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 4.6 | 20MS | 5.6 | 20S | 5.0 | 20S | 37.2 | 80S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 6.8 | 20MS | 8.0 | 20S | 1.9 | 10S | 33.3 | 100S | 89 | 67 | 37.5 | 9.1 | 8 | 5 | 12.8 | 7.9 | 4 | 30.0 | _ | _ |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2023-24 | 11.5 | 40MS | 4.7 | 20MS | 0.0 | TR | 23.2 | 60S | 99 | 68 | 41.3 | 10.3 | 9 | 5 | 8.4 | 5.54 | 3 | 31.25 | 67.9 | 42.6 |
| | | MEAN | 7.6 | 40MS | 6.1 | 20S | 2.3 | 20S | 31.2 | 100S | 99 | 68 | 41.3 | 9.7 | 9 | 5 | 12.8 | 6.7 | 4 | 31.3 | 68.0 | 43.0 |
| 53 | GW 322 (C) | | | | | | | | | | | | | | | | | | | | | |
| | | 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 | 99 | 46 | 64.4 | 15.5 | 6 | 3 | 10.8 | 4.3 | 8 | 38.9 | _ | _ |
| | | 2023-24 | 18.8 | 40S | 7.0 | 20MS | 28.3 | 80S | 46.2 | 80S | 89 | 68 | 11.6 | 3.8 | 9 | 6 | 8.53 | 6.63 | 4 | 18.75 | 42.8 | 26.2 |
| | | MEAN | 11.9 | 40S | 10.8 | 40S | 19.1 | 80S | 48.6 | 100S | 99 | 57 | 64.4 | 9.7 | 9 | 5 | 10.8 | 5.5 | 8 | 38.9 | 43.0 | 26.0 |
| 54 | MP1378* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 1.5 | 20MR | 8.0 | 30S | 2.5 | 15S | 55.0 | 80S | 68 | 46 | 13.6 | 4.6 | 9 | 5 | 5.0 | 3.2 | 5 | 30.0 | - | - |
| | | 2022-23 | 5.0 | 20MS | 3.6 | 10MS | 1.6 | 10S | 56.3 | 100S | 89 | 67 | 33.1 | 8.2 | 7 | 3 | 13.0 | 8.7 | 5 | 21.4 | 43.7 | 17.2 |
| | | 2023-24 | 6.3 | 30MS | 2.4 | 10S | 1.1 | 10S | 53.3 | 80S | 89 | 57 | 47.4 | 11.5 | 9 | 6 | 9.3 | 3.1 | 3 | 18.75 | 45 | 19.6 |
| | | MEAN | 4.3 | 30MS | 4.7 | 30S | 1.7 | 15S | 54.9 | 100S | 89 | 57 | 47.4 | 8.1 | 9 | 5 | 13.0 | 5.0 | 5 | 30.0 | 45.0 | 18.4 |
| 55 | MACS 3949 (C) | | | | | | | | | | | | | | | | | | | | | |
| | | 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 | 99 | 56 | 36.7 | 8.8 | 8 | 5 | 0.0 | 0.0 | 5 | 31.3 | _ | _ |
| | | 2023-24 | 20.1 | 60S | 2.7 | 10S | 1.5 | 10MS | 1.0 | 5MS | 89 | 47 | 8.3 | 2.4 | 9 | 6 | 11.4 | 3.8 | 4 | 16.67 | 65 | 27.2 |
| | | MEAN | 14.9 | 60S | 3.4 | 20S | 1.7 | 20MS | 5.4 | 40S | 99 | 57 | 36.7 | 5.6 | 9 | 6 | 11.0 | 1.9 | 5 | 31.3 | 65.0 | 27.0 |
| 56 | HI 8737(d) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 5.5 | 20MS | 4.1 | 20S | 1.8 | 10MS | 8.7 | 30S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 5.0 | 20S | 0.6 | 5MR | 0.2 | 5R | 7.5 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2023-24 | 13.5 | 40MS | 2.6 | 10S | 1.7 | 15MS | 4.9 | 10MS | 89 | 69 | 11.2 | 5.3 | 9 | 6 | 8.2 | 2.73 | 4 | 38.89 | - | - |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MEAN | 8.0 | 40MS | 2.4 | 20S | 1.2 | 15MS | 7.0 | 40S | 89 | 69 | 11.2 | 5.3 | 9 | 6 | 8.2 | 2.73 | 4 | 38.89 | - | - |
| 57 | RAJ 4083 | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 3.3 | 15MS | 11.6 | 30S | 13.9 | 40S | 45.0 | 90S | 89 | 46 | 37.5 | 11.1 | 9 | 6 | 9 | 5.7 | 5 | 25 | 43 | 25 |
| | | 2022-23 | 5.3 | 20MS | 5.7 | 20MS | 7.8 | 20S | 37.7 | 60S | 99 | 57 | 43 | 12.4 | 8 | 5 | 10.4 | 8 | 4 | 35 | 90 | 31.5 |
| | | 2023-24 | 11.8 | 30S | 8.7 | 20MS | 20.1 | 60S | 32.8 | 60S | 89 | 68 | 28.3 | 7.5 | 9 | 5 | 5.4 | 1.8 | 4 | 35 | 85 | 32.3 |
| | | MEAN | 6.8 | 30S | 8.7 | 30S | 13.9 | 60S | 38.5 | 90S | 99 | 57 | 43 | 10.3 | 9 | 5 | 10.4 | 5.2 | 5 | 35 | 90 | 29.6 |
| 58 | HD 2932 | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 3.2 | 20MR | 22.4 | 60S | 19.3 | 60S | 63.2 | 90S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 17.5 | 60S | 23.4 | 60S | 14.0 | 40S | 56.7 | 100S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2023-24 | 28.0 | 80S | 26.7 | 60S | 39.6 | 60S | 55.0 | 80S | 89 | 69 | 11.8 | 3.6 | 9 | 4 | 8.5 | 2.83 | 4 | 25 | 65 | 30.4 |
| | | MEAN | 16.2 | 80S | 24.2 | 60S | 24.3 | 60S | 58.3 | 100S | 89 | 69 | 11.8 | 3.6 | 9 | 4 | 8.5 | 2.83 | 4 | 25 | 65 | 30.4 |
| 59 | HD 3090 | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 4.0 | 15MS | 1.7 | 20MR | 7.2 | 30S | 60.5 | 90S | 99 | 67 | 45.7 | 15.3 | 9 | 5 | 8.3 | 5.7 | 4 | 27.8 | 30 | 15.3 |
| | | 2022-23 | 4.9 | 20MS | 1.9 | 10MS | 0.4 | 5MR | 49.3 | 80S | 99 | 67 | 48.8 | 15.8 | 8 | 6 | 5.6 | 2.7 | 3 | 10 | 65 | 29.1 |
| | | 2023-24 | 6.6 | 30MS | 5.0 | 20MS | 2.1 | 10S | 47.3 | 80S | 99 | 58 | 91.3 | 21.1 | 9 | 6 | 3.67 | 1.72 | 3 | 25 | 30 | 13.7 |
| | | MEAN | 5.2 | 30MS | 2.9 | 20MS | 3.2 | 30S | 52.4 | 90S | 99 | 67 | 91.3 | 17.4 | 9 | 6 | 8.3 | 3.4 | 4 | 27.8 | 65 | 19.4 |
| 60 | HI 1633 | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 1.6 | 10MR | 3.3 | 20MS | 2.0 | 10S | 58.5 | 90S | 89 | 56 | 40.2 | 11.2 | 9 | 5 | 8.6 | 5.6 | 4 | 27.8 | 25 | 8.9 |
| | | 2022-23 | 3.5 | 10S | 1.2 | 10MS | 3.5 | 20S | 43.8 | 80S | 89 | 57 | 60.3 | 13.7 | 8 | 6 | 7.5 | 3.7 | 5 | 25 | 80 | 37.1 |
| | | 2023-24 | 7.3 | 30S | 2.0 | 10MS | 1.2 | 10S | 45.8 | 80S | 99 | 69 | 44 | 12.1 | 9 | 6 | 1.75 | 0.58 | 4 | 12.5 | 75 | 41.2 |
| | | MEAN | 4.1 | 30S | 2.2 | 20MS | 2.2 | 20S | 49.4 | 90S | 99 | 57 | 60.3 | 12.3 | 9 | 6 | 8.6 | 3.3 | 5 | 27.8 | 75 | 29.1 |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SPL-HYPT-CZ** | | | | | | | | | | | | | | | | | | | | | | |
| 61 | GW 543* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 9.4 | 20S | 0.9 | 10MR | 6.5 | 20S | 47.0 | 80S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 8.8 | 20S | 7.7 | 20MS | 3.1 | 10MS | 37.2 | 100S | 99 | 57 | 7.3 | 5.9 | 7 | 4 | 9.5 | 3.6 | 8 | 0 | - | - |
| | | 2023-24 | 12.8 | 40S | 4.4 | 20MS | 10.6 | 40S | 44.0 | 60S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | MEAN | 10.3 | 40S | 4.3 | 20MS | 6.7 | 40S | 42.7 | 100S | 99 | 57 | 7.3 | 5.9 | 7 | 4 | 9.5 | 3.6 | 8 | 0 | | |
| 62 | CG 1044* | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 10.9 | 40MS | 18.4 | 40S | 13.1 | 40S | 48.7 | 80S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2022-23 | 11.5 | 40S | 9.6 | 20S | 18.9 | 80S | 55.0 | 100S | 89 | 57 | 12.9 | 6.4 | 7 | 5 | 32.5 | 17.4 | 4 | 30 | | |
| | | 2023-24 | 19.0 | 60S | 13.0 | 40S | 26.2 | 90S | 67.8 | 80S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | MEAN | 13.8 | 60S | 13.7 | 40S | 19.4 | 90S | 57.2 | 100S | 89 | 57 | 12.9 | 6.4 | 7 | 5 | 32.5 | 17.4 | 4 | 30 | - | - |
| 63 | DBW 187 (C) | | | | | | | | | | | | | | | | | | | | | |
| | | 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 | 99 | 57 | 40.8 | 11.4 | 7 | 5 | 8.1 | 5.2 | 7 | 20.0 | - | - |
| | | 2023-24 | 13.5 | 30S | 1.3 | 10MR | 11.8 | 60S | 7.8 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | MEAN | 9.3 | 30S | 3.4 | 20MS | 5.3 | 60S | 13.6 | 60S | 99 | 57 | 40.8 | 11.4 | 7 | 5 | 8.1 | 5.2 | 7 | 20.0 | - | - |
| 64 | DBW 303(C) | | | | | | | | | | | | | | | | | | | | | |
| | | 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 | 79 | 46 | 45.1 | 13.6 | 5 | 3 | 11.1 | 4.2 | 4 | 38.9 | | |
| | | 2023-24 | 16.3 | 40S | 2.5 | 10S | 10.6 | 40S | 18.0 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | MEAN | 9.8 | 40S | 4.1 | 40S | 4.8 | 40S | 15.7 | 60S | 79 | 46 | 45.1 | 13.6 | 5 | 3 | 11.1 | 4.2 | 4 | 38.9 | - | - |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 65 | DBW 327( I) ( C ) | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 7.4 | 20S | 5.6 | 20S | 16.6 | 40S | 19.9 | 60S | 89 | 46 | 39.6 | 11.2 | 7 | 5 | 7.3 | 3.7 | 4 | 27.8 | 23.4 | 16.5 |
| | | 2022-23 | 4.9 | 20MS | 4.0 | 20S | 3.9 | 10S | 14.6 | 60S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | 2023-24 | 15.9 | 40MS | 6.4 | 20MS | 15.2 | 40S | 18.4 | 60 S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | MEAN | 9.4 | 40MS | 5.3 | 20S | 11.9 | 40S | 17.6 | 60S | 89 | 47 | 39.6 | 11.2 | 7 | 5 | 7.3 | 3.7 | 4 | 27.8 | 23.4 | 16.5 |
| 66 | DBW377 | | | | | | | | | | | | | | | | | | | | | |
| | | 2021-22 | 3.8 | 20MS | 6.8 | 20MS | 2.2 | 10S | 12.5 | 40S | 89 | 47 | 23.6 | 9.6 | 7 | 5 | 8.3 | 5.2 | 4 | 31.3 | | |
| | | 2022-23 | 9.3 | 20S | 4.6 | 20S | 1.5 | 5MS | 18.0 | 80S | 99 | 46 | 58.3 | 13.4 | 6 | 4 | 6.6 | 2.2 | 5 | 27.8 | 60.0 | 18.2 |
| | | 2023-24 | 10.8 | 20S | 7.0 | 20S | 10.2 | 50S | 10.7 | 40S | - | - | - | - | - | - | - | - | - | - | - | - |
| | | MEAN | 8.0 | 20S | 6.1 | 20S | 4.6 | 50S | 13.7 | 80S | 99 | 47 | 58.3 | 11.5 | 7 | 4 | 8.3 | 3.7 | 5 | 31.3 | 60.0 | 18.2 |
| 67 | GW 322 (C) | | | | | | | | | | | | | | | | | | | | | |
| | | 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 | 99 | 46 | 64.4 | 15.5 | 6 | 3 | 10.8 | 4.3 | 8 | 38.9 | | |
| | | 2023-24 | 18.8 | 40S | 7.0 | 20MS | 28.3 | 80S | 46.2 | 80S | 89 | 68 | 11.6 | 3.8 | 9.0 | 6 | 8.5 | 6.6 | 4 | 18.8 | 42.8 | 26.2 |
| | | MEAN | 11.9 | 40S | 10.8 | 40S | 19.1 | 80S | 48.6 | 100S | 99 | 57 | 64.4 | 9.0 | 9.7 | 5 | 10.8 | 5.5 | 8 | 38.9 | 42.8 | 26.2 |

**Table: 1.5. Adult plant response of NIVT entries against rusts under disease epiphytotic conditions at hot spot locations in field during 2023-24.**

| NIVT No. | Entry name | Stem rust (S) | | Leaf rust (S) | | Leaf rust (N) | | Stripe rust (N) | |
|---|---|---|---|---|---|---|---|---|---|
| | | ACI | HS | ACI | HS | ACI | HS | ACI | HS |
| 1 | HD3477 | 33.5 | 80S | 6.4 | 20MS | 10.6 | 40S | 6 | 20S |
| 2 | DBW449 | 19.8 | 40S | 8.4 | 30S | 14.4 | 60S | 9.2 | 40S |
| 3 | PBW938 | 22.9 | 60S | 2 | 10S | 2.3 | 20MS | 8.2 | 40S |
| 4 | PBW940 | 14.6 | 60S | 3 | 10S | 11.8 | 40S | 11.6 | 40S |
| 5 | UP3141 | 29.5 | 80S | 7 | 20S | 5.4 | 20MS | 8.2 | 40S |
| 6 | UP3142 | 30 | 60S | 4.7 | 20S | 1.5 | 15MS | 2.7 | 10S |
| 7 | RAJ4584 | 8.6 | 60S* | 2.4 | 10S | 3.1 | 15MS | 4.9 | 20MS |
| 8 | RAJ4585, | 14.4 | 40S | 2 | 10MS | 1.3 | 10MS | 4.6 | 10S |
| 9 | HD3086(C) | 45.3 | 100S | 14.3 | 20S | 33.6 | 60S | 6 | 40S |
| 10 | UBW 22 | 42 | 80S | 8 | 20S | 1.8 | 20MS | 22.2 | 40S |
| 11 | KRL2202 | 29.9 | 80S | 5.7 | 10S | 6.7 | 20S | 19.2 | 40S |
| 12 | RAJ4586 | 8.8 | 20S | 8 | 20MS | 22 | 60S | 7.2 | 20S |
| 13 | PBW936 | 6.6 | 20S | 1.4 | 10MR | 3.9 | 20S | 3.4 | 20S |
| 14 | DBW447 | 14.9 | 60S | 10 | 20S | 27.2 | 50S | 7.2 | 40S |
| 15 | HUW858 | 22.3 | 80S | 2.1 | 10S | 0.6 | 5S | 11.8 | 40S |
| 16 | DBW450 | 13 | 20S | 5.3 | 20S | 10.7 | 40S | 6.9 | 40MS |
| 17 | HD3475 | 27.5 | 80S | 8.8 | 20S | 7.6 | 30S | 9.4 | 40S |
| 18 | NW8094 | 4.3 | 20S | 1.4 | 10MR | 2.3 | 20MS | 4.9 | 20S |
| 19 | NWS2124 | 31.9 | 80S | 9 | 20S | 8.6 | 40S | 1.4 | 10S |
| 20 | DBW222(C)* | 19.3 | 40S | 1 | 10MR | 7.8 | 30S | 13.3 | 20S |
| 20A | Infector | 80 | 80S | 83.3 | 100S | 78.9 | 100S | 77.8 | 90S |
| 21 | PBW939 | 16.7 | 60S | 3 | 10S | 18.2 | 80S | 7 | 20S |
| 22 | DBW448 | 18.6 | 40S | 3.7 | 10S | 16 | 70S | 9.9 | 40S |
| 23 | PBW937 | 16.9 | 60S | 4 | 20MS | 14.4 | 50S | 0.1 | TS |
| 24 | WH1329 | 11.1 | 40S | 4.3 | 10S | 13.3 | 40S | 13.3 | 40S |

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| 25 | HP1981 | 16.4 | 60S | 2 | 10S | 12.2 | 50S | 6.6 | 40S |
| 26 | HD3474 | 41 | 80S | 15.7 | 40S | 8.3 | 40S | 11.7 | 40S |
| 27 | K2301 | 6.5 | 30S | 0.7 | 10R | 0.6 | 5S | 19.3 | 40S |
| 28 | BCW35 | 12.8 | 60S | 3 | 10MS | 6.2 | 30S | 27.6 | 40S |
| 29 | DBW187(C) | 13.5 | 30S | 1.3 | 10MR | 11.8 | 60S | 7.8 | 40S |
| 30 | UP3140 | 3.8 | 10S | 1.6 | 10MR | 10.3 | 30S | 6.8 | 20S |
| 31 | DBW446 | 12.9 | 20S | 5.7 | 10S | 14.9 | 40S | 8.9 | 40S |
| 32 | HD3476 | 20.8 | 60S | 8 | 20S | 18.1 | 60S | 7.3 | 20S |
| 33 | WH1328 | 29.3 | 80S | 4.4 | 20MS | 14 | 50S | 2.7 | 10S |
| 34 | Supreme-1122 | 0.5 | 5MR | 0.9 | 10MR | 0.6 | 5S | 44 | 80S |
| 35 | JAUW723 | 19 | 40S | 9.7 | 20S | 19.8 | 50S | 9.3 | 40S |
| 36 | SVPWL22-04 | 20.3 | 60S | 3.3 | 10S | 10.1 | 60S | 6 | 20S |
| 37 | HD3480 | 42.8 | 80S | 9.3 | 20S | 8.5 | 50S | 7.6 | 20S |
| 38 | DBW455 | 15.5 | 30S | 3.8 | 10S | 16 | 70S | 3.2 | 20MS |
| 39 | PBW944 | 22.5 | 40S | 1.4 | 5MS | 9.4 | 50S | 3.2 | 20MS |
| 40 | UP3143 | 4.9 | 20S | 2 | 5MS | 7.4 | 30S | 9.4 | 40S |
| 40A | Infector | 80 | 80S | 80 | 80S | 80 | 100S | 77.8 | 90S |
| 41 | NW8089 | 18.3 | 80S | 0.9 | 10MR | 2.2 | 10S | 13.6 | 40S |
| 42 | NW8095 | 17.4 | 60S | 5 | 10S | 12.9 | 60S | 10.8 | 40S |
| 43 | WH1330 | 29 | 60S | 3 | 10S | 10.7 | 40S | 9.5 | 40S |
| 44 | WH1331 | 17.8 | 40S | 5.3 | 10S | 20.1 | 70S | 6.5 | 20S |
| 45 | KRL2101 | 9.3 | 30S | 2.7 | 10MS | 2.1 | 15S | 10 | 20S |
| 46 | HUW859 | 36.3 | 60S | 11.1 | 20S | 27.9 | 70S | 6.9 | 40S |
| 47 | K2303 | 11.8 | 20S | 3.3 | 10S | 14.1 | 40S | 7.4 | 40S |
| 48 | PBW942 | 22.3 | 60S | 10 | 20S | 24.3 | 70S | 0 | 0 |
| 49 | DBW453 | 13.5 | 20S | 2.7 | 10MS | 9.6 | 30S | 8.4 | 40S |
| 50 | JKW317 | 12.3 | 20S | 6 | 20MS | 13.9 | 60S | 4.6 | 20MS |
| 51 | HP1982 | 23 | 60S | 8 | 20S | 11.6 | 50S | 8.3 | 40MS |
| 52 | BRW3967 | 17.5 | 60S | 7.3 | 10S | 8.2 | 30S | 13.2 | 40S |

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| 53 | BCW32 | 10.6 | 40S | 4 | 10S | 13.4 | 50S | 9.6 | 20S |
| 54 | PBW945 | 17.3 | 40S | 5.7 | 20MS | 1.9 | 10MS | 12.3 | 40S |
| 55 | DBW454 | 17.4 | 40S | 2.3 | 5S | 6.2 | 40S | 3.2 | 20MS |
| 56 | PBW943 | 10.3 | 40S | 5.1 | 20MS | 11.4 | 40S | 3.8 | 20S |
| 57 | BRW3964 | 8.8 | 30S | 3.1 | 10MS | 15.4 | 60S | 22.3 | 40S |
| 58 | DBW451 | 11.6 | 30S | 2.3 | 10MS | 8.4 | 30S | 7.1 | 40S |
| 59 | HD3478 | 7.5 | 20S | 2.3 | 10MS | 2.9 | 20S | 14.3 | 40S |
| 60 | RAJ4587 | 21 | 60S | 10 | 40S | 2.8 | 15S | 11 | 20S |
| 60A | Infector | 80 | 80S | 80 | 80S | 78.9 | 100S | 76.7 | 90S |
| 61 | RAUW107 | 18.3 | 60S | 3.3 | 10MS | 6.8 | 30S | 3.7 | 20S |
| 62 | UP3144 | 9 | 40S | 1 | 10MR | 2.5 | 20S | 5.9 | 40S |
| 63 | DBW452 | 42 | 80S | 5.4 | 20MS | 4.4 | 20MS | 12.3 | 40S |
| 64 | HD3479 | 44 | 80S | 13.2 | 20S | 3.4 | 20S | 10.4 | 40S |
| 65 | K2304 | 26.8 | 80S | 10.3 | 20S | 11.3 | 40S | 19.5 | 40S |
| 66 | SVPWL22-10 | 38 | 80S | 14 | 20S | 6.9 | 30S | 5.7 | 20S |
| 67 | NWS2124 | 22.5 | 60S | 11 | 20S | 9.1 | 30S | 10.3 | 40S |
| 68 | BW20R105 | 25.5 | 60S | 7.3 | 20S | 10.1 | 40S | 6.8 | 20S |
| 69 | PBW941 | 20 | 40S | 4.3 | 10MS | 11.1 | 40S | 10.6 | 40S |
| 70 | WH1332 | 52.5 | 80S | 19.3 | 40S | 21.1 | 40S | 6.6 | 40S |
| 71 | PWU52 | 12.8 | 60S | 5.7 | 20MS | 11.2 | 40S | 40.4 | 80S |
| 72 | AKAW4764 | 25 | 80S | 11.3 | 20S | 10.6 | 30S | 63.3 | 90S |
| 73 | HD3481 | 9.5 | 40S | 3 | 10S | 8.4 | 30S | 13.6 | 40S |
| 74 | PBW946 | 16.6 | 40S | 0.7 | 10MR | 0.7 | 5S | 4.4 | 20S |
| 75 | NWS2237 | 29.8 | 80S | 9 | 20MS | 10.7 | 40S | 11.2 | 40S |
| 76 | RAJ4590 | 21 | 80S | 7.1 | 20S | 9.3 | 30S | 11.9 | 20S |
| 77 | PWU13 | 10.3 | 40S | 12 | 20S | 7 | 20S | 43.6 | 80S |
| 78 | GW560 | 15.5 | 60S | 3 | 10S | 1.7 | 15S | 52.2 | 90S |
| 79 | HI1695 | 9.4 | 40S | 4.7 | 20MS | 1.7 | 10S | 60 | 90S |
| 80 | MACS6862 | 23 | 60S | 2 | 10S | 3 | 15S | 12.2 | 40S |

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|---|---|---|---|---|---|---|---|---|---|
| 80A | Infector | 80 | 80S | 80 | 80S | 80 | 100S | 78.9 | 90S |
| 81 | MACS6864 | 31.5 | 80S | 6.4 | 20S | 6 | 20S | 15.3 | 40S |
| 82 | UAS3030 | 15 | 60S | 4 | 10S | 4.6 | 20S | 55.6 | 80S |
| 83 | DBW457 | 14 | 30S | 8.1 | 40S | 19.3 | 60S | 12.2 | 40S |
| 84 | MP3583 | 28 | 80S | 13.7 | 20S | 28.8 | 60S | 50.7 | 80S |
| 85 | GW566 | 5.3 | 20S | 2.4 | 10S | 6.7 | 20S | 46.7 | 80S |
| 86 | NIAW4516 | 26 | 80S | 7 | 20MS | 6.5 | 40S | 51.8 | 80S |
| 87 | NIAW4581 | 8 | 40MS | 3 | 20MR | 1.7 | 10S | 16.4 | 60S |
| 88 | MP1400 | 9.5 | 20S | 4.5 | 10S | 8.7 | 40S | 6.2 | 20S |
| 89 | MP1401 | 12.8 | 60S | 3.3 | 10MS | 10.3 | 40S | 8.5 | 20S |
| 90 | DBW456 | 20.5 | 40S | 8.7 | 20S | 22.4 | 50S | 23.8 | 60S |
| 91 | GW322(C) | 18.3 | 40S | 9.3 | 40MS | 23.1 | 60S | 36 | 60S |
| 92 | HI1694 | 7.2 | 40MS | 1.7 | 10MR | 5 | 20S | 55.6 | 90S |
| 93 | LOK82 | 7.3 | 40MS | 4 | 20S | 2.3 | 10S | 23 | 40S |
| 94 | MP3584 | 5.2 | 20S | 3.6 | 10S | 3.3 | 20S | 61.1 | 80S |
| 95 | GW561 | 7.6 | 40S | 4.4 | 10S | 5 | 20S | 45.1 | 70S |
| 96 | GW565 | 3.1 | 10S | 2 | 10S | 0 | 0 | 23.1 | 60S |
| 97 | MACS6222(C) | 11.5 | 40MS | 4.7 | 20MS | 0 | TR | 23.2 | 60S |
| 98 | UAS3031 | 30 | 80S | 8 | 20S | 1.1 | 10S | 29.1 | 40S |
| 99 | HI1650(C) | 7.4 | 30MS | 1.9 | 10S | 1.1 | 10S | 28.2 | 60S |
| 100 | MACS6858 | 6.9 | 20MS | 3.3 | 10S | 0.6 | 5S | 29 | 80S |
| 100A | Infector | 77.5 | 80S | 83.3 | 100S | 81.1 | 100S | 73.3 | 90S |
| 101 | CG1050 | 4.5 | 40MR | 2.7 | 10S | 3.9 | 20S | 54 | 80S |
| 102 | HW3928-1 | 3.8 | 10S | 2.1 | 10S | 3.2 | 20S | 45.3 | 80S |
| 103 | GW559 | 10.3 | 40MS | 2.7 | 20MR | 0.6 | 5S | 51.8 | 80S |
| 104 | JWS1528 | 17.5 | 40S | 6.3 | 20MS | 2.2 | 20S | 26 | 60S |
| 105 | HD3484 | 5.4 | 20MS | 2 | 10S | 2.3 | 20S | 7 | 40S |
| 106 | DBW462 | 7 | 20S | 7.4 | 20S | 10.4 | 30S | 6.2 | 20S |
| 107 | PBW950 | 51.5 | 80S | 8.3 | 20S | 2.4 | 10S | 0.3 | 5MR |

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|---|---|---|---|---|---|---|---|---|---|
| 108 | WH1335 | 9 | 40MS | 2.2 | 10S | 4.5 | 20S | 8.8 | 40S |
| 109 | WH1337 | 32 | 60S | 3.7 | 10S | 7.2 | 30S | 16.9 | 60S |
| 110 | K2306 | 24.3 | 60S | 7 | 20S | 17.1 | 50S | 48.9 | 80S |
| 111 | K2307 | 1.4 | 5S | 1.5 | 5MS | 4.4 | 20S | 9.4 | 40S |
| 112 | RAJ4588 | 34.6 | 80S | 11.3 | 20S | 10.5 | 40S | 13.3 | 40S |
| 113 | RAJ4589 | 10.5 | 40MS | 4.5 | 20MS | 5.1 | 20S | 13.4 | 40S |
| 114 | PBW948 | 2.1 | 5MS | 1 | 10MR | 1.7 | 15S | 4.4 | 20MS |
| 115 | DBW460 | 11.5 | 40S | 2 | 5MS | 3.3 | 15S | 12.2 | 40S |
| 116 | JKW319 | 19.8 | 60S | 5.4 | 20S | 6.2 | 20S | 20.9 | 60S |
| 117 | PBW947 | 40 | 80S | 11 | 20S | 14.5 | 40S | 0 | 0 |
| 118 | HP1983 | 27.5 | 60S | 19.3 | 40S | 20.9 | 60S | 12.2 | 30S |
| 119 | UP3145 | 5.3 | 20MS | 3.4 | 10S | 0 | 0 | 3.3 | 10S |
| 120 | PBW951 | 11.6 | 20S | 3.2 | 10S | 9 | 40S | 4.4 | 20S |
| 120A | Infector | 80 | 80S | 83.3 | 100S | 81.1 | 100S | 76.3 | 90S |
| 121 | DBW461 | 8.4 | 20S | 4 | 10S | 14.9 | 90S | 16.9 | 40S |
| 122 | PBW949 | 17.3 | 40S | 4 | 20MS | 8.4 | 40S | 3.3 | 20S |
| 123 | NW8084 | 8.6 | 40S | 11.3 | 20S | 21 | 60S | 19.9 | 40S |
| 124 | DBW458 | 24.3 | 60S | 3.7 | 20MR | 10.1 | 40S | 17.6 | 40S |
| 125 | HD3482 | 3 | 10S | 3.7 | 10MS | 13.7 | 40S | 11.9 | 40MS |
| 126 | UP3146 | 25 | 80S | 5.1 | 20MS | 1.6 | 10S | 12.6 | 60S |
| 127 | WH1336 | 16.3 | 40S | 2.7 | 5MS | 12.8 | 50S | 13.4 | 40S |
| 128 | DBW459 | 19.5 | 40S | 2.1 | 10S | 2 | 15MS | 19.4 | 40S |
| 129 | HD3483 | 13.5 | 20S | 6 | 20S | 8.2 | 40S | 14.6 | 40S |
| 130 | NW8081 | 9.8 | 40MS | 3.4 | 10MS | 9.2 | 30S | 11.7 | 40S |
| 131 | BRW3954 | 15.3 | 40S | 2 | 10MS | 0.6 | 5S | 21 | 60S |
| 132 | HUW860 | 21.1 | 40S | 7.3 | 20MS | 12.4 | 50S | 22.8 | 60S |
| 133 | BCW31 | 11.9 | 30S | 2 | 5MS | 8.7 | 40S | 12.7 | 60MS |
| 134 | UBW21 | 22.5 | 60S | 3.7 | 10S | 10 | 30S | 11 | 40S |
| 135 | SVPWL22-02 | 28.5 | 80S | 6 | 20MS | 0.6 | 5S | 2.8 | 20S |

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| 136 | RAUW111 | 3.3 | 20MS | 3.7 | 20S | 1.2 | 10S | 23.2 | 60S |
| 137 | PBW771(C) | 19.5 | 60MS | 3.4 | 10S | 0.6 | 5S | 10 | 20S |
| 138 | DBW173(C) | 2 | 10MS | 1.3 | 10MR | 1 | 5S | 7.3 | 20S |
| 139 | HI1563(C) | 1 | 5MS | 2.1 | 10S | 1.2 | 10S | 53.1 | 80S |
| 140 | HI1621(C) | 31.5 | 80S | 9.8 | 20MS | 10.6 | 30S | 7.4 | 40S |
| 140A | Infector | 80 | 80S | 80 | 80S | 78.9 | 100S | 78.9 | 90S |
| 141 | HI1699 | 11.8 | 60S | 1.4 | 5MS | 1.9 | 10MS | 54 | 80S |
| 142 | MP3598 | 13.3 | 40S | 3.7 | 10MS | 7.9 | 40S | 36.2 | 80S |
| 143 | MACS6868 | 21.4 | 60S | 3.4 | 10S | 6.7 | 30S | 13.2 | 50S |
| 144 | GW562 | 2.6 | 10MR | 2.4 | 10S | 2.4 | 10S | 35 | 80S |
| 145 | CG1061 | 6.9 | 20S | 4.3 | 10S | 19.1 | 60S | 36.1 | 60S |
| 146 | WH1338 | 11.3 | 40S | 1 | 10R | 7.4 | 40S | 17.2 | 40S |
| 147 | GW567 | 8.1 | 40MS | 1 | 10MR | 3.8 | 20S | 55.3 | 90S |
| 148 | LOK83 | 17.5 | 40S | 11 | 40S | 23.4 | 50S | 32 | 60S |
| 149 | PBW952 | 12.1 | 40S | 5.7 | 10S | 12.2 | 30S | 4.4 | 20S |
| 150 | NIAW4621 | 5.8 | 20S | 2.4 | 10S | 9.3 | 20S | 5.2 | 20S |
| 151 | UAS3032 | 29.3 | 80S | 6.4 | 20S | 6.7 | 20S | 6.3 | 40MS |
| 152 | MP3599 | 19.8 | 80S | 10.3 | 20S | 26.7 | 70S | 46.4 | 80S |
| 153 | HI1697 | 10.7 | 60S | 3.7 | 20S | 8.2 | 20S | 52.2 | 90S |
| 154 | HD2932*(C) | 28 | 80S | 21.3 | 40S | 35.6 | 60S | 52.2 | 90S |
| 155 | MACS6854 | 13 | 60S | 3.4 | 10S | 10.1 | 60S | 64.4 | 90S |
| 156 | UAS3033 | 19.5 | 40S | 3.7 | 10S | 13.7 | 30S | 11.7 | 40S |
| 157 | NIAW4624 | 4.6 | 10S | 2 | 10S | 7.7 | 30S | 12.7 | 40S |
| 158 | HD2864(C) | 7.9 | 40S | 2 | 10S | 6.1 | 30S | 51.1 | 80S |
| 159 | DBW463 | 13.9 | 60S | 6 | 20MS | 11.1 | 40S | 10.2 | 40S |
| 160 | HI1696 | 6.7 | 40S | 1.7 | 10MS | 1.2 | 10S | 47.6 | 80S |
| 160A | Infector | 80 | 80S | 80 | 80S | 83.3 | 100S | 78.9 | 90S |
| 161 | HI1633(C) | 6.2 | 30MS | 1.5 | 10MS | 9.6 | 40S | 39.8 | 60S |
| 162 | WSM141 | 1.6 | 10MS | 1.4 | 10MR | 4.5 | 20S | 30.7 | 60S |

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| 163 | DBW464 | 7.5 | 20S | 3.3 | 5MS | 15 | 40S | 11.8 | 40MS |
| 164 | HI1698 | 5.5 | 30S | 1.7 | 5MS | 2.8 | 20S | 38 | 80S |
| 165 | MP1402 | 17.4 | 60S | 8.3 | 20S | 6.4 | 20S | 40 | 80S |
| 166 | MACS5065(Dic) | 0.8 | 5MS | 0.4 | 10R | 0.7 | 5S | 20.5 | 60S |
| 167 | DDW66 | 5.5 | 20S | 4.7 | 20MR | 1.7 | 10S | 1.7 | 10S |
| 168 | HI8713(C) | 6 | 20S | 3 | 10S | 1.8 | 5S | 10.1 | 30S |
| 169 | HI8858 | 4.2 | 20MR | 3.3 | 20MR | 1.1 | 10S | 14.1 | 40S |
| 170 | HI8855 | 9.6 | 20S | 4 | 15MR | 1.8 | 10S | 5.6 | 20S |
| 171 | HW5306(Dic) | 3.1 | 10MS | 5.4 | 20MS | 2.3 | 10S | 27.1 | 60S |
| 172 | HI8854 | 7.6 | 20S | 5 | 10S | 1.2 | 10S | 14.4 | 40S |
| 173 | WHD969 | 7.3 | 40MR | 7.7 | 20MS | 2.9 | 10S | 6.9 | 20S |
| 174 | DDW67 | 6.8 | 20S | 6.3 | 20S | 2.7 | 20S | 2.8 | 10S |
| 175 | PDW366 | 7.5 | 20MS | 5.7 | 20S | 1.1 | 10S | 2.7 | 10S |
| 176 | UAS485 | 15.8 | 40S | 5.7 | 20MS | 1.1 | 5MS | 3.9 | 20S |
| 177 | PDW368 | 18.1 | 40S | 7.3 | 20S | 4 | 20S | 6.2 | 20S |
| 178 | DDK1067(Dic) | 1.7 | 20MR | 3 | 10MS | 1.9 | 15S | 21.1 | 40S |
| 179 | HI8853 | 6.7 | 20S | 5 | 20MS | 2.8 | 20S | 18.2 | 40S |
| 180 | PDW367 | 19.3 | 40S | 7.3 | 20MS | 2.4 | 10S | 5.2 | 20MS |
| 180A | Infector | 80 | 80S | 80 | 80S | 76.7 | 90S | 77.8 | 90S |
| 181 | HW5305(Dic) | 5.4 | 30S | 5 | 20S | 0.9 | 10MS | 8.9 | 20S |
| 182 | MPO1403 | 4.8 | 20MS | 4 | 20MS | 0.9 | 10MS | 1.7 | 10S |
| 183 | MPO1404 | 4.4 | 20MS | 3.7 | 20MS | 1.2 | 10S | 9.6 | 30S |
| 184 | MACS4147 | 15.3 | 40S | 3.7 | 10S | 1.1 | 10S | 0.6 | 5S |
| 185 | MACS4146 | 9.1 | 20S | 4.3 | 20MS | 0.9 | 10MS | 5 | 40S |
| 186 | PWU8 | 31.5 | 80S | 14.3 | 40S | 2.8 | 10S | 12.7 | 60S |
| 187 | HI8737(C) | 12 | 30S | 7 | 20S | 1.3 | 10S | 3 | 10MS |
| 188 | NIDW1557 | 7.6 | 30S | 1.8 | 5S | 1.7 | 10S | 3.2 | 20S |
| 189 | DDK1066(Dic) | 1.3 | 5MS | 2.7 | 10MS | 1.1 | 5S | 20.1 | 60S |
| 190 | GW1371 | 7.5 | 20S | 4.7 | 15MS | 0.1 | TS | 3.8 | 20MS |

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| 191 | GW1370 | 11.8 | 60MS | 4.4 | 20MS | 0.3 | 5MR | 8.8 | 40S |
| 192 | DDW65 | 24.3 | 80S | 5.7 | 20S | 0.9 | 5S | 1.4 | 10MS |
| 193 | PDW314(C) | 31.2 | 80S | 8 | 20MS | 0.3 | 5MR | 4.1 | 20S |
| 194 | GW1369 | 18.3 | 60S | 4.7 | 20MS | 0.2 | TS | 7.9 | 30S |
| 195 | MACS3949(C) | 19.4 | 60MS | 4 | 10S | 1.1 | 10S | 7.3 | 20S |
| 196 | PBN1841 | 14 | 40S | 6.7 | 20S | 1.7 | 10S | 17.1 | 60S |
| 197 | UAS486 | 11.3 | 40S | 3.3 | 10S | 1.7 | 15S | 2.6 | 10S |
| 198 | AKDW5520 | 8.1 | 20MS | 5.7 | 20MS | 2.2 | 10S | 7.1 | 20S |
| 199 | NIDW1542 | 7.6 | 30S | 1.1 | 5MS | 2.2 | 15S | 0.4 | 5MR |
| 200 | MACS5064(Dic) | 3.5 | 20MS | 0.4 | 10R | 1.7 | 15S | 12.1 | 40S |
| 200A | Infector | 80 | 80S | 80 | 80S | 78.9 | 100S | 77.8 | 90S |
| 201 | DDK1029(Dic.C) | 2 | 20MR | 0.7 | 20R | 0.7 | 5S | 12.9 | 30S |
| 202 | JKW320 | 10.8 | 30S | 8 | 20MS | 6.4 | 20S | 7.6 | 20S |
| 203 | DBW466 | 13 | 40S | 2.7 | 10S | 7 | 40S | 8.7 | 40MS |
| 204 | JAUW719 | 23.5 | 60S | 3.4 | 20S | 4.4 | 10S | 13.8 | 40S |
| 205 | HD3488 | 18.8 | 60S | 8 | 20MS | 12.1 | 40S | 20.9 | 40S |
| 206 | HD3487 | 12 | 40S | 0.7 | 10MR | 3.4 | 15S | 5.1 | 20S |
| 207 | KRL2203 | 18.5 | 40S | 6.2 | 20MS | 7 | 40S | 15.2 | 40S |
| 208 | HD3486 | 2.8 | 20MS | 2.7 | 15MS | 4.8 | 20S | 10.9 | 40S |
| 209 | BRW3959 | 15.7 | 40S | 1.4 | 5MS | 1.1 | 10S | 13.2 | 40S |
| 210 | DBW467 | 29.8 | 60S | 3 | 10S | 6.1 | 30S | 6 | 20S |
| 211 | PBW955 | 31 | 60S | 1.4 | 5MS | 0.7 | 5S | 0.6 | 5S |
| 212 | DBW468 | 13 | 40S | 3.4 | 10S | 8.1 | 30S | 4.3 | 20MS |
| 213 | UP3147 | 11.3 | 40MS | 5.4 | 20S | 11.4 | 40S | 0.2 | 5MR |
| 214 | PBW954 | 52 | 80S | 17.3 | 20S | 9.3 | 40S | 4.9 | 40S |
| 215 | HD3485 | 31 | 80S | 11 | 20S | 12.2 | 40S | 7.2 | 20S |
| 216 | PBW956 | 24 | 60S | 8.4 | 20MS | 2.4 | 10S | 1.7 | 10S |
| 217 | HI1612(C) | 54.5 | 80S | 18.2 | 80S | 0.7 | 5S | 11.2 | 60S |
| 218 | WH1339 | 16 | 40S | 7.3 | 20MS | 12 | 50S | 8.5 | 20S |

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|---|---|---|---|---|---|---|---|---|---|
| 219 | WH1340 | 11 | 40MS | 6.3 | 10S | 7.2 | 30S | 15.6 | 60S |
| 220 | K2310 | 22.9 | 80S | 7 | 20MS | 2.7 | 10S | 17.7 | 40S |
| 220A | Infector | 80 | 80S | 80 | 80S | 77.8 | 100S | 78.9 | 90S |
| 221 | HUW861 | 22 | 60S | 13 | 20S | 23.4 | 50S | 20 | 40S |
| 222 | K1317(C)* | 23 | 60S | 11 | 20S | 15.7 | 40S | 10.7 | 40S |
| 223 | PBW644(C) | 18 | 40S | 6.3 | 10S | 14.2 | 40S | 20.2 | 60S |
| 224 | DBW465 | 18.3 | 30S | 2.7 | 10S | 4.8 | 20S | 8.9 | 40MS |
| 225 | PBW953 | 20.8 | 40S | 5.6 | 20S | 1.7 | 15S | 1.2 | 5S |
| 226 | NIAW3170(C) | 21.3 | 60S | 5.7 | 10S | 2.8 | 10S | 29.1 | 40S |
| 227 | GW563 | 2.4 | 10MS | 2.1 | 10S | 0.6 | 5S | 30.7 | 60S |
| 228 | DDW68(d) | 19.3 | 60S | 3.5 | 10S | 2.2 | 20S | 3.1 | 10S |
| 229 | MACS6851 | 3.8 | 20MS | 3.7 | 20S | 0.6 | 5S | 63.3 | 80S |
| 230 | HI8856(d) | 20.4 | 40S | 4.7 | 20S | 2.3 | 15S | 5.6 | 20S |
| 231 | HI8857(d) | 17.5 | 40S | 3.7 | 10S | 1.8 | 20MS | 2.7 | 10MS |
| 232 | PBN2115 | 8.1 | 20S | 3 | 10S | 14.2 | 60S | 30.4 | 60S |
| 233 | DBW469 | 9 | 20S | 5 | 10S | 8.7 | 30S | 31 | 60S |
| 234 | MACS6850 | 5 | 30MS | 2.4 | 10S | 4.6 | 40S | 22.4 | 80S |
| 235 | MP1405 | 2.2 | 10MS | 2.7 | 10S | 6.4 | 20S | 27.4 | 40S |
| 236 | GW1372(d) | 2.6 | 10MS | 5.1 | 20MS | 15.8 | 40S | 55.6 | 80S |
| 237 | UAS3034 | 13.5 | 20S | 5 | 10S | 8.5 | 30S | 37.3 | 60S |
| 238 | CG1052 | 12.1 | 20S | 11.7 | 20S | 23.4 | 90S | 62.2 | 60S |
| 239 | UAS487(d) | 7.9 | 20S | 5.3 | 20MS | 0.1 | TS | 3.1 | 20S |
| 240 | NIAW4533 | 5.3 | 10S | 2.7 | 10S | 0 | 0 | 22.7 | 60S |
| 240A | Infector | 77.5 | 80S | 83.3 | 100S | 82.2 | 100S | 77.8 | 90S |
| 241 | AKAW5441 | 10 | 20MS | 6.3 | 20MS | 9 | 40S | 70 | 90S |
| 242 | DBW110(C) | 15 | 40S | 9 | 20MS | 13.7 | 40S | 41.1 | 60S |
| 243 | MP3601 | 9.3 | 20MS | 13.3 | 20S | 27.9 | 70S | 38.9 | 60S |
| 244 | HI1700 | 0.9 | 5MS | 3 | 10MS | 2.2 | 10S | 52.2 | 80S |
| 245 | DBW470 | 15.3 | 40S | 7.8 | 20MS | 6.7 | 20S | 9.3 | 40MS |

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|---|---|---|---|---|---|---|---|---|---|
| 246 | HI1702 | 12.3 | 40S | 8.7 | 20MS | 10 | 30S | 27.2 | 60S |
| 247 | HI1605(C) | 19 | 60S | 16.7 | 40S | 24.1 | 60S | 24.6 | 40S |
| 248 | HI8627(d)(C) | 6.1 | 20MS | 5.4 | 20MS | 0.6 | 5S | 5.3 | 20S |
| 249 | HI1701 | 2.5 | 10S | 2 | 10S | 3 | 20S | 37.3 | 60S |
| 250 | NIDW1561(d) | 17.6 | 40S | 6.7 | 20MS | 1.1 | 10S | 6.8 | 20S |
| 251 | UAS446(d)(C) | 18.8 | 40S | 5.3 | 20MS | 1.7 | 15S | 3 | 20MS |
| 252 | HD3492 | 9.3 | 30S | 3 | 10MS | 1.1 | 10S | 62.2 | 80S |
| 253 | DBW473 | 18.8 | 40S | 4.3 | 20S | 7.8 | 40S | 11.8 | 40S |
| 254 | UP3148 | 32.1 | 80S | 8.7 | 40S | 2.7 | 20S | 9.3 | 20S |
| 255 | GW568 | 10 | 40S | 1 | 10MR | 0.1 | TS | 58.9 | 80S |
| 256 | HD3489 | 28 | 60S | 13.8 | 40S | 2.2 | 10S | 5.3 | 20S |
| 257 | PBW934 | 22.3 | 40S | 5.7 | 20MS | 9.5 | 40S | 4.3 | 20S |
| 258 | HD3491 | 25.5 | 60S | 7 | 20MS | 8.4 | 30S | 7.9 | 20S |
| 259 | PBW932 | 17 | 40S | 3.7 | 20S | 5.6 | 40S | 2.2 | 10S |
| 260 | DBW471 | 15 | 40MS | 4.1 | 10S | 12.8 | 50S | 11.3 | 40S |
| 260A | Infector | 80 | 80S | 83.3 | 100S | 82.2 | 100S | 77.8 | 90S |
| 261 | PBW935 | 24.3 | 60S | 4.7 | 10S | 5.7 | 20S | 5.9 | 20S |
| 262 | DBW474 | 14.7 | 40MS | 4.7 | 10S | 7.8 | 40S | 12.7 | 20S |
| 263 | PBW933 | 36.3 | 60S | 2.4 | 5MS | 12.5 | 40S | 1.7 | 10MS |
| 264 | DBW327(C) | 18.9 | 40S | 9.3 | 20MS | 10.8 | 40S | 17.4 | 40S |
| 265 | RAJ4591 | 36.5 | 80S | 8 | 20S | 0.6 | 5S | 2.2 | 10S |
| 266 | DBW472 | 8.7 | 30S | 5.9 | 20MS | 0.9 | 20MR | 8.2 | 20S |
| 267 | WH1333 | 18.8 | 40S | 5.5 | 20MS | 10 | 30S | 5.9 | 20S |
| 268 | MP1406 | 2 | 10MS | 0.7 | 10MR | 2.7 | 20S | 20.3 | 40S |
| 269 | DBW303(C) | 13.3 | 40S | 2.4 | 10S | 2.6 | 10S | 21.2 | 40S |
| 270 | DBW475 | 11.1 | 20S | 7 | 20S | 7.8 | 30S | 19.6 | 40S |
| 271 | GW564 | 6.4 | 20S | 6.3 | 20S | 0.6 | 10MR | 57.8 | 80S |
| 272 | HD3490 | 39.5 | 80S | 10 | 40S | 0.2 | TMS | 3.8 | 10S |
| 273 | PBW931 | 16.5 | 40S | 6.7 | 20S | 20 | 60S | 1.1 | 10S |

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|---|---|---|---|---|---|---|---|---|---|
| 274 | WH1334 | 12.7 | 40S | 5.2 | 20MS | 5.9 | 20S | 11.6 | 40S |
| 275 | DBW371(C) | 24.1 | 40S | 4.3 | 20S | 7.8 | 40S | 15.1 | 40S |
| 276 | DBW187(C) | 14.3 | 40MS | 4 | 10S | 5.2 | 20MS | 8.8 | 40MS |
| 277 | DBW327(C) | 15.9 | 40MS | 6.4 | 20MS | 15.2 | 40S | 18.4 | 60S |
| 278 | DBW438 | 22 | 40S | 3.4 | 10S | 8.9 | 40S | 10.1 | 40S |
| 279 | DBW372 (C) | 20 | 40S | 9.7 | 20S | 12.1 | 40S | 27.7 | 60S |
| 280 | PBW872(C) | 21.1 | 60S | 11 | 20S | 14.1 | 60S | 20.4 | 40S |
| 280A | Infector | 80 | 80S | 80 | 80S | 81.1 | 100S | 75.6 | 90S |
| 281 | DBW445 | 14.4 | 40S | 2.7 | 10MS | 7.9 | 40S | 13.4 | 60S |
| 282 | HD3461 | 5.7 | 20MS | 2 | 10S | 2.6 | 10S | 7.1 | 20S |
| 283 | HD3463 | 4.3 | 20MS | 1.7 | 10MS | 2.3 | 10S | 5.7 | 20MS |
| 284 | DBW434 | 20.8 | 60S | 11.3 | 20S | 8 | 30S | 13.3 | 60S |
| 285 | CG1044* | 19 | 60S | 13 | 40S | 26.2 | 90S | 67.8 | 80S |
| 286 | MP1399 | 15.3 | 40S | 12.3 | 40S | 6.9 | 20S | 41.2 | 60S |
| 287 | WH1320 | 13.5 | 20S | 7 | 20MS | 13 | 40S | 11.1 | 40S |
| 288 | GW322 (C) | 12.3 | 30S | 10 | 20S | 17.6 | 70S | 47.3 | 60S |
| 289 | GW543* | 12.8 | 40S | 4.4 | 20MS | 10.6 | 40S | 44 | 60S |
| 290 | PBW906 | 14.5 | 40S | 8 | 20S | 10.1 | 40S | 13.3 | 40S |
| 291 | DBW377(I) (C) | 10.8 | 20S | 7 | 20S | 10.2 | 50S | 10.7 | 40S |
| 292 | PBW929 | 15.5 | 30S | 2 | 10S | 2.1 | 10MS | 7.2 | 40S |
| 293 | DBW303(C) | 16.3 | 40S | 2.5 | 10S | 10.6 | 40S | 18 | 40S |
| 294 | DBW436 | 17.8 | 40MS | 2.7 | 10S | 8.8 | 40S | 12.7 | 60S |
| 295 | HD3493 | 8.4 | 20S | 2 | 10S | 0 | 0 | 5.3 | 20S |
| 296 | VL2058 | 11 | 20S | 5 | 20S | 14.8 | 60S | 11.6 | 40S |
| 297 | VL2057 | 1.8 | 5MS | 2.5 | 15MS | 5.9 | 20S | 19 | 40S |
| 298 | HPW499 | 19.8 | 60S | 14.3 | 40S | 16.2 | 60S | 17.4 | 60S |
| 299 | HS701 | 5.5 | 20MS | 2 | 10S | 2.4 | 20S | 19 | 60S |
| 300 | VL2055 | 17 | 40S | 7.7 | 20MS | 3.8 | 10S | 10.2 | 40S |
| 300A | Infector | 80 | 80S | 80 | 80S | 81.1 | 100S | 77.8 | 90S |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 301 | HPW502 | 22.3 | 80S | 11 | 20S | 17.7 | 80S | 19.7 | 40S |
| 302 | VL2056 | 25.3 | 80S | 6.7 | 20MS | 0 | 0 | 12.8 | 40S |
| 303 | SKW367 | 7.8 | 40MS | 2 | 20MR | 0.9 | 10MS | 1.9 | 10S |
| 304 | HPW501 | 36.3 | 100S | 3 | 10S | 8.3 | 40S | 10.2 | 40MS |
| 305 | HS507 (C) | 1.6 | 20MR | 8.5 | 20S | 12 | 30S | 9.3 | 20S |
| 306 | HS702 | 8.3 | 40S | 3.7 | 20S | 16.3 | 60S | 16.6 | 40S |
| 307 | HPW500 | 14.5 | 60S | 6.7 | 10S | 8.7 | 20S | 11.7 | 20S |
| 308 | HS700 | 17.6 | 60S | 6.7 | 20S | 13.6 | 60S | 4 | 10S |
| 309 | UP3149 | 15.8 | 40S | 8 | 20S | 24.2 | 70S | 5.6 | 20S |
| 310 | Vl3031 | 15.5 | 60S | 3.7 | 20MS | 7.6 | 20S | 3.8 | 10S |
| 311 | HS705 | 27.5 | 60S | 11.7 | 20S | 3.2 | 15S | 5.2 | 20S |
| 312 | HPW503 | 21.8 | 60S | 7 | 20S | 5.6 | 20S | 11.3 | 40S |
| 313 | Vl3035 | 7.3 | 20S | 8 | 20S | 19.9 | 70S | 20 | 40S |
| 314 | HPW504 | 19.5 | 60S | 14.7 | 40S | 31.6 | 80S | 3.3 | 20S |
| 315 | HPW505 | 38 | 80S | 17.3 | 40MS | 21.9 | 60S | 7.9 | 40S |
| 316 | VL892 (C) | 10.8 | 40S | 6.3 | 20MS | 16 | 60S | 18.9 | 60S |
| 317 | HS703 | 27 | 60S | 8.4 | 40S | 11.7 | 40S | 6.8 | 40S |
| 318 | VL3034 | 28.5 | 60S | 8.9 | 20S | 7.2 | 40S | 2 | 10S |
| 319 | VL3036 | 17.3 | 80S | 6.4 | 20S | 8 | 40S | 21.4 | 60S |
| 320 | HS698 | 2 | 20MR | 3.7 | 20S | 0 | 0 | 4.3 | 10S |
| 320A | Infector | 80 | 80S | 83.3 | 100S | 80 | 100S | 76.7 | 90S |
| 321 | HS704 | 1.8 | 5MS | 1 | 10MR | 1.1 | 5S | 2.6 | 10MS |
| 322 | HS490 (C) | 25 | 80S | 12.2 | 40S | 5.8 | 20MS | 16.6 | 40S |
| 323 | VL3033 | 54 | 100S | 15.3 | 40S | 14.8 | 60S | 12.5 | 40S |

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

## COOPERATORS

| NAME | CENTRES |
|---|---|
| FAYAZ AHMAD MOHIDDIN | KHUDWANI |
| K.K. MISHRA | ALMORA |
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| V.K. SINGH | DELHI |
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| JASPAL KAUR, RITU BALA | LUDHIANA |
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| R. S. BENIWAL | HISAR |
| M. K. PANDEY | JAMMU |
| P.S. SHEKHAWAT | DURGAPURA |
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| PRADEEP SHARMA, PREM LAL KASHYAP AND RAVINDRA KUMAR | KARNAL (COORDINATING UNIT) |

## PROGRAMME 2. RUSTS:BLACK, BROWN AND YELLOW

### 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 (2023-24)**

For identifying race specific adult plant resistance (APR), 146 AVT lines of wheat were screened against the most predominant and virulent pathotypes of *Puccinia triticina*, *P. striiformis*f. sp. *tritici*and *P. graminis* f. sp. *tritici* during 2023-24. Three pathotypes each of *P. triticina* (77-5, 77-9 and 104-2) and *P. striiformis* f. sp. *tritici* (46S119, 110S119 and 238S119), and *P. graminis* f. sp. *tritici* (11, 40A and 117-6) 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 nine pathotypes of three wheat rust pathogens is presented in Table 2.1.

**Table: 2.1. Race specific adult plant rust resistance (APR) of AVT entries at ICAR-IIWBR,RS, Shimla during 2023-24**

| S. No. | Variety/ line | APR Response | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Yellow rust | | | Brown rust | | | Black rust | | |
| | | 238S119 | 110S119 | 46S119 | 77-5 | 77-9 | 104-2 | 11 | 40A | 117-6 |
| 1. | HD3086 (C) | 5MS | 5S | 10S | 5R | 60S | 10S | 60S | 30S | 20S |
| 2. | HI1668* | 20MS | 5S | 20S | 0R | 10MR | 0R | 20MR | 0R | 0R |
| 3. | HD3494 | 0R | 0R | 0R | 0R | 10MS | 0R | 20MS | 0R | 0R |
| 4. | DBW417 | 20MS | 5S | 20S | 0R | 5MR | 0R | 20S | 20MS | 10MS |
| 5. | DBW88 (C) | 40S | NG | 60S | 0R | 5R | 0R | 10MR | 0R | 0R |
| 6. | PBW957 | 0R | 0R | 0R | 5R | 10MR | 5S | 10MS | 0R | 0R |
| 7. | DBW222(C)* | TR | 0R | 5MS | 0R | 0R | 0R | 5MS | 0R | 0R |
| 8. | DBW477 | 0R | 0R | 0R | 0R | 10S | 0R | 10MS | 0R | 5MS |
| 9. | HD3471 | 0R | 5MS | 5MS | 0R | 5MR | 0R | 0R | 0R | 0R |
| 10. | PBW916 | 0R | 0R | 0R | 0R | 5S | 5S | 30S | 5MS | 0R |
| 11. | DBW386* | 5R | 10S | 5S | 0R | 20S | 5S | 0R | 0R | 0R |
| 12. | PBW826 (C) | 10MR | 5S | TS | 0R | 40S | 5MS | 0R | 0R | 0R |
| 13. | DBW476 | 0R | 0R | 0R | 0R | 0R | 0R | 0R | 0R | 0R |
| 14. | HD2967 | 60S | 30S | 10MS | 0R | 30S | TS | 20MS | 0R | TMR |
| 15. | PBW725 | 0R | 0R | NG | 0R | 10MS | 0R | 10MS | 0R | 0R |
| 16. | HD3386 (I)(C) | 20S | 5S | 10S | 0R | 20MS | 0R | 20MS | 0R | 0R |
| 17. | PBW958 | 0R | 0R | 0R | 0R | 20MS | TS | 30S | 10MS | 0R |
| 18. | HD3455 | NG | 0R | 0R | 10R | 0R | 5S | 10MS | 5MS | 0R |
| 19. | HD3059 (C) | 20S | 20S | 20S | 5R | 20S | TS | 20MS | 10MS | 5MS |
| 20. | JKW261 (C) | 30S | 20S | 20S | 0R | 0R | 0R | 40S | 0R | 10MS |
| 21. | NW8071 | 5S | 20S | 10S | 0R | 10MR | 0R | 10MS | 0R | 0R |
| 22. | DBW173 (C) | 10MS | 10S | 10S | 5R | 30MR | 0R | 10MS | 0R | 0R |
| 23. | WH1324 | NG | NG | NG | 0R | 0R | 0R | 20MS | 0R | 0R |
| 24. | DBW422 | 10MS | 5S | 10S | 20R | 0R | 0R | 30S | 0R | 10MS |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 25. | RAJ4581 | 5MR | 0R | TMS | 5R | 5MR | 0R | 20S | 0R | 0R |
| 26. | HD3428 | 0R | 5S | 5MS | 0R | 0R | 0R | 10MS | 0R | 0R |
| 27. | HD3495 | 0R | 0R | 0R | 0R | 20S | 0R | 20MS | 0R | 0R |
| 28. | PBW771 (C) | 10S | 5S | 0R | 0R | 0R | 0R | 20S | 0R | 0R |
| 29. | PBW921 | 0R | 0R | 0R | 0R | 0R | 0R | 20MS | 0R | 0R |
| 30. | PBW644 (C) | 20S | 10S | 30S | 10R | 5MS | 0R | 20MS | 0R | 0R |
| 31. | HI1653 (C) | 20MS | 10S | 10S | TS | SMS | 0R | 10MS | 0R | 0R |
| 32. | PBW927 | 0R | 0R | 0R | 0R | 0R | 5S | 0R | 0R | 0R |
| 33. | HD3369 | 5S | TS | 0R | 0R | 10MR | 0R | 0R | 0R | 10MS |
| 34. | HD3468 | 20S | TR | 5MS | 0R | 20MS | 0R | 0R | 0R | 5MS |
| 35. | NIAW3170 (C) | NG | 20MS | TR | 0R | 30MR | 0R | 0R | TMS | 5MS |
| 36. | WH1326 | 20S | 10S | NG | 0R | 30MS | 0R | 30S | 0R | 5MR |
| 37. | DBW296 | 0R | 0R | 0R | 0R | 10R | 5R | 20MS | 0R | 10S |
| 38. | JKW304 | 0R | 0R | 0R | 0R | 5S | 0R | 40S | TMR | 0R |
| 39. | WH1402 (I)(C) | NG | 0R | NG | 5R | 0R | 0R | 10MS | TMR | 0R |
| 40. | PBW908 | 0R | 0R | 0R | 0R | 5R | 10R | 40S | TMS | 5MS |
| 41. | HP1978 | 0R | 5MR | 0R | 5R | 0R | 0R | 0R | 0R | 0R |
| 42. | HD3447 | TR | TS | 0R | 10R | 5R | 0R | 0R | TMR | 0R |
| 43. | PBW915 | 0R | 0R | 0R | 5R | 0R | 0R | 30S | TMS | 20MS |
| 44. | HD3388(I) (C) | 5S | TS | 0R | 20R | 0R | 0R | 20MS | 0R | 0R |
| 45. | UP3124 | 10S | 0R | 5S | 5MR | 0R | 0R | 10MS | 0R | NG |
| 46. | KRL2106 | 5S | 5MR | 5R | 5R | 0R | 0R | 20MS | 5MS | 0R |
| 47. | HD3249 (C) | 5MS | 10MS | TMS | 0R | 5R | 0R | 20MS | TMR | 0R |
| 48. | PBW913 | 0R | 0R | 0R | 0R | 0R | 0R | 20MS | 0R | 0R |
| 49. | HD3467 | 0R | 0R | 0R | 5R | 0R | 0R | 30S | 20MS | 0R |
| 50. | BCW29 | 0R | 20S | 0R | 0R | 20S | 0R | 20MS | 20MS | 0R |
| 51. | UP3123 | 20MS | 10MR | TMR | 5R | 5R | 0R | 30S | 0R | 0R |
| 52. | HI1563 (C) | 60S | 40S | 60S | 10R | 0R | 0R | 20MS | 0R | 0R |
| 53. | DBW107 (C)* | 20MS | 5MS | 20S | 0R | 30S | 10S | 60S | 20MS | 10MS |
| 54. | PBW833 (C) | 5S | 10S | 5S | 10R | 0R | 10S | 60S | 20MS | 10MS |
| 55. | WH1323 | NG | 20MS | 5S | 5R | 0R | 0R | 40M | 0R | 0R |
| 56. | HD3118 (C) | 0R | 5MS | 5S | 0R | 60S | 0R | 30MS | 0R | 0R |
| 57. | HI1621 (C) | 20S | 0R | 0R | 0R | 20S | 0R | 30MS | 0R | 10MS |
| 58. | HD3171 (C) | 40S | 20S | 5S | 0R | 0R | 0R | 40S | 10MS | 0R |
| 59. | HD3460 | 60S | 30S | 10S | 0R | 5MR | 0R | 40MS | 10MS | 0R |
| 60. | HD3293 (C) | 20MS | 5S | 0R | 0R | 30S | 5S | 30MS | 5MS | 0R |
| 61. | HI1612 (C) | TS | 5MS | 0R | 0R | 0R | 0R | 30S | 10MS | 20MS |
| 62. | K1317(C)** | 0R | 0R | 0R | 0R | 5S | 0R | 20MR | 10MS | 0R |
| 63. | VL2041 (C) | 10S | 10S | 10S | 5R | 5S | 0R | 10MS | 0R | 0R |
| 64. | HPW349 (C) | 10S | 0R | 0R | 5R | 0R | 0R | 30MS | 5MS | 20S |
| 65. | VL2059 | 0R | 0R | 0R | 0R | 0R | 0R | 0R | 0R | 0R |
| 66. | HS562 (C) | 0R | 5S | 0R | 5R | 5S | 0R | 20MS | 20MS | 20S |
| 67. | VL907 (C) | 0R | 5S | 5S | 0R | 0R | 0R | 0R | 0R | 0R |
| 68. | MACS6837 | 40S | 20S | 20S | 0R | 0R | 0R | 20MS | 10MS | 0R |
| 69. | MACS4125 (d) | 40MS | 20MS | 20MS | 0R | 0R | 10R | 20MS | 0R | TMS |
| 70. | MACS4135 (d) | 60MS | 20MS | 10S | 5R | 5R | 20MR | 0R | 0R | TMS |
| 71. | HI1669 | NG | 60S | 40S | 0R | 0R | 0R | 0R | 0R | 0R |
| 72. | HI1683 | NG | 60S | 40S | 10R | 5R | 0R | 0R | 0R | 0R |
| 73. | HI1684 | 10S | 40S | NG | 5R | 5R | 0R | 0R | 0R | TMS |
| 74. | HI8848 (d) | NG | 20MS | 5MR | 20MS | 5R | 30MR | 0R | 0R | 5MS |
| 75. | HI8849 (d) | 20S | 20MS | 5S | 0R | 0R | 0R | 0R | TMS | 0R |
| 76. | HI8850 (d) | 40MS | 40MS | 10MS | 0R | 0R | 0R | 0R | 0R | 5MS |
| 77. | GW554 | 80S | 80S | 60S | 0R | 20S | 0R | 0R | 0R | 0R |
| 78. | GW555 | 80S | 60S | 40S | 0R | 10R | 0R | 0R | 0R | 0R |
| 79. | MP3570 | 40S | 20S | 60S | 5R | 10MS | TMS | 0R | 0R | 0R |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 80. | MPO1395 | 40MR | 0R | 0R | 5R | 10R | 0R | 5MR | 0R | 0R |
| 81. | GW322 | 60S | 40S | 20S | 5R | 0R | 0R | 20MS | 0R | 0R |
| 82. | MACS6768 | 80S | 80S | 40S | 5R | 0R | 0R | 0R | 0R | 0R |
| 83. | HI1650 | 30MS | 10MS | 10S | NG | 5MR | 0R | 0R | 0R | 0R |
| 84. | GW547 (I) | 20MR | 10S | 10S | 5R | 5MR | 0R | 0R | 0R | 0R |
| 85. | HI8737 (d) | 40MR | 40MR | 40MS | 5R | 5R | 10MR | 20MS | TMR | 10MS |
| 86. | HI8713 (d) | 40S | 20MS | 30MS | 0R | 0R | 0R | 20MR | 0R | 5MS |
| 87. | HI1674 | 60S | 40S | 10S | 0R | 0R | 0R | 5MR | TMS | 0R |
| 88. | HI1687 | 80S | 40S | 20S | 0R | 0R | 0R | 0R | 0R | 0R |
| 89. | WSM138 | 20S | 20S | 40S | 0R | 0R | 0R | 0R | 0R | 0R |
| 90. | MACS6830 | 20S | 40S | 20S | NG | 0R | 0R | 0R | 0R | 0R |
| 91. | DBW425 | 5S | 10S | 5S | 0R | 10S | 0R | 40MR | 0R | 10S |
| 92. | GW556 | 80S | 80S | 5S | NG | 0R | 0R | 0R | 0R | 0R |
| 93. | HD2932* | 80S | 60S | TS | 10S | 60S | 5S | 40MR | 0R | 0R |
| 94. | HMP4010* | 80S | 60S | 10S | 0R | 30MS | 20S | 30MS | 0R | 0R |
| 95. | HI1634 | 80S | 60S | TR | 0R | 0R | 0R | 20MS | 0R | 0R |
| 96. | CG1029 | 80S | 80S | 20S | 0R | 0R | 0R | 20MR | 0R | 0R |
| 97. | DBW441M | 40S | 10S | 10S | 10R | 5R | 0R | 20MS | 0R | 0R |
| 98. | DBW428 | 5R | 0R | 0R | 0R | 0R | 0R | 20S | 10MR | 0R |
| 99. | DBW432 | 5R | TR | 0R | 0R | 5MR | 0R | 40S | 0R | 5MR |
| 100. | UAS3029 | 0R | 5S | 0R | 5R | 5S | 0R | 20MS | 0R | 0R |
| 101. | UAS484 (d) | 10MR | 0R | 5MR | 5R | TS | 10MR | 20MS | 0R | 5MS |
| 102. | NIAW4267 | 20S | 20S | 10S | 5R | 0R | 0R | 0R | 0R | 0R |
| 103. | HI8851 (d) | 20MR | 5S | 0R | 5R | 0R | 10MR | 0R | 10MS | 5MS |
| 104. | HI8852 (d) | 20MS | 0R | 0R | 10R | 5MR | 20MR | 0R | 0R | 5MR |
| 105. | MACS4131(d) | 10MS | 0R | 5S | 5R | 5R | 10R | 10MS | 0R | 10MS |
| 106. | MPO1398 (d) | 60MS | 20MS | TS | 10MR | 0R | 0R | 0R | 0R | 5MS |
| 107. | DBW110 | 30S | 20S | 5S | 10R | 5MR | 0R | 20MS | 0R | 0R |
| 108. | CG1036 | 40S | 60S | NG | 0R | 0R | 0R | 0R | 0R | 0R |
| 109. | HI1655* | 20MS | 20MR | NG | 0R | 0R | 0R | 10MS | 0R | 0R |
| 110. | HI8627 (d) | 20MS | 5S | 0R | 0R | 0R | 0R | 20MR | 0R | 10MS |
| 111. | HI8823 (d) | 10S | 10S | 10MS | 0R | 0R | 0R | 20MR | 0R | 10MS |
| 112. | DBW359 (I)* | 5S | 0R | 5S | 0R | 10R | 0R | 20MR | 0R | 10S |
| 113. | CG1040 (I) | 40S | 20S | 10S | 0R | 60S | 0R | 30MS | 0R | 0R |
| 114. | MACS6842 | 20MS | 20S | 10S | 0R | 5MR | 0R | 40MS | 0R | 0R |
| 115. | MACS6844 | 40S | 60S | 20S | 0R | 10S | 0R | 60MS | 0R | 0R |
| 116. | NIAW4364 | 30S | 20S | 0R | 0R | 0R | 0R | 60MS | 10MS | 0R |
| 117. | PBW891 | 10S | 20S | TS | 0R | 10MS | 0R | TMS | 0R | 0R |
| 118. | DBW443* | TMS | 5MS | 0R | 0R | 5S | 0R | 0R | 0R | 0R |
| 119. | DDW62(d) | 5S | 10R | 0R | 0R | 0R | 0R | 0R | 0R | 5MS |
| 120. | AKAW5100* | 10S | 20S | 20S | 0R | 0R | 0R | 0R | 0R | 0R |
| 121. | WH1306 | TMS | NG | TR | 0R | 0R | 0R | NG | NG | 10MS |
| 122. | NWS2222 | 40S | 10S | 20S | 0R | 0R | 0R | 20MS | 0R | 0R |
| 123. | UAS3026 | 60S | 10S | 60S | 5R | 30S | 0R | 5MS | 0R | 5MS |
| 124. | CG1045 | 10R | 10S | 10S | 0R | 20S | 0R | 40S | 0R | 5MR |
| 125. | MPO1395 (d) | 40MR | 0R | TMS | 0R | 5MR | 5R | 0R | 0R | 10MS |
| 126. | MACS6222 | 10S | 10S | 20S | 0R | 0R | 0R | 0R | 0R | 0R |
| 127. | MP1378 (I) | 30S | 10S | 30S | 0R | 0R | 0R | 0R | 0R | 0R |
| 128. | MACS3949 (d) | 10R | 10MR | 5MR | 0R | 0R | 5R | 0R | 0R | 0R |
| 129. | DBW426 | 10MR | 10S | 20MS | 5R | 0R | 0R | 30S | 5MS | 0R |
| 130. | MACS6829 | 40S | 20S | 40S | 0R | 0R | 0R | 0R | 0R | 0R |
| 131. | NIAW4114* | 60S | 60S | 80S | 0R | 0R | 0R | 0R | 0R | 0R |
| 132. | NIAW4120 | 80S | 80S | 60S | 0R | 0R | 0R | 0R | 0R | 0R |
| 133. | NIAW4432 | 20S | 20MS | 10S | 0R | 0R | 0R | 20MS | 0R | 0R |
| 134. | UAS3027 | 60S | 30S | 30S | 10MS | 0R | 0R | 30S | 0R | 0R |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 135. | LOK79 | 40S | 20S | 40S | 10R | 0R | 0R | 20MR | 0R | 0R |
| 136. | RAJ4083 (C) | 10R | 10MS | 40S | 5R | 0R | 0R | 20MS | 5MS | 0R |
| 137. | HD3090 (C) | 60S | 60S | 60S | 0R | 5MR | 0R | 20M | 0R | 0R |
| 138. | HI1633 (C) | 40S | 40S | 30S | 0R | 0R | 0R | 10MR | 0R | 0R |
| 139. | CG1047 | 60S | 40S | 40S | 10MS | 20MS | 5R | 60S | 0R | 10MS |
| 140. | GW1368(d) | 60S | 40S | 60S | 0R | 20MS | 10S | 20MR | 0R | 0R |
| 141. | HI1605 | 30S | 30S | 40S | 5R | 20S | 10MS | 20MS | 0R | 0R |
| 142. | NIAW3170 | 20MR | 30S | 0R | 5R | 0R | 5S | 30MS | 5MS | 20MS |
| 143. | UAS446(d) | 20MR | 0R | 20MR | 0R | 0R | 20MR | 60S | 0R | 10MS |
| 144. | NIDW1149 (d) | 0R | 0R | 10MR | 0R | 0R | 5R | 0R | 0R | 0R |
| 145. | HI1665 (I) | 80S | 20S | NG | 0R | 0R | 0R | 0R | 0R | 0R |
| 146. | UAS478 (d)(I) | 40MR | 20MS | 10MR | 0R | 0R | 0R | 0R | 0R | 10MS |

* Different seed lot to that of previous cropping season, NG-not germinated,

## Leaf rust

Sixty-three entries of AVT showed APR to one or the other pathotypes of *P. triticina.* APR to all the pathotypes (77-5, 77-9 and 104-2) of leaf rust pathogen was observed in 04 lines (AKAW5100*, DBW296, HD3171, HD3369). Thirteen entries had combined APR to 77-5 and 77- 9 while combined APR to 77-5 and 104-2 was recorded in two lines HS562 and RAJ4083. APR to individual pathotypes 77-5, 77-9 and 104-2 was observed in 23, 18 and 03 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 2023-24**

| Pathotypes | No. of Lines | Varieties/lines |
|---|---|---|
| 77-5, 77-9, 104-2 | 4 | AKAW5100*, DBW296, HD3171, HD3369 |
| 77-5, 77-9 | 13 | DBW88, DBW110, DBW417, DBW432, DBW441M, HI1668*, HPW349, MP3570, NIAW3170, NW8071, PBW957, RAJ4581,UP3123, |
| 77-5, 104-2 | 2 | HS562, RAJ4083, |
| 77-5, | 23 | BCW29, CG1040, CG1045, CG1047, DBW107*, DBW386*, DBW422, DBW425, DBW477, GW322, HD3059, HD3086, HD3386, HD3455, HD3495, HI1653, PBW725, PBW916, PBW958, VL2041,WH1402, WH1324, WH1326, |
| 77-9 | 18 | DBW222*, DBW359*, DBW476, GW1368, HD3249, HD3428,HD3460, HD3467, HD3471, JKW261, KRL2106, MACS6837, MACS6842, NWS2222, PBW913, PBW921, PBW927, VL907, |
| 104-2 | 3 | HI8627, HI8713, PBW644, |
| **Total** | **63** | |

* Different seed lot to that of previous cropping season

## Stripe rust

Fourty-five lines showed APR to different tested pathotypes of stripe rust pathogen. Among these, lines DBW428, HP1978, MACS3949 (D), MPO1395, NIDW1149 (D), UAS446 (D), and UAS484 (D) possessed APR to three major pathotypes of *P. striiformis* in India. Six lines had APR to 110S119. Fiveentries DBW222 (C)*, DBW296, HI8737 (D), K1317 (C)*, RAJ4581 possessed APR to both 110S119 and 238S119 (Table 2.3). Nine entries CG1045, DBW386*, DBW426, GW547 (I), HD3118, HD3428, HD3471, PBW826, and RAJ4083 (C) showed APR to 238S119.

**Table: 2.3. Race specific adult plant resistance (APR) response in AVT lines to virulent pathotypes of *Puccinia striiformis* f. sp. *tritici* during 2023-24**

| APR to pathotype | No. of lines | Detail |
|---|---|---|
| 238S119, 110S119 and 46S119 | 07 | DBW428, HP1978, MACS3949 (D), MPO1395 (D), NIDW1149 (D), UAS446 (D),UAS484 (D) |
| 238S119 and 110S119 | 05 | DBW222 (C)*, DBW296, HI8737 (D), K1317 (C)*, RAJ4581 |
| 110S119 and 46S119 | 05 | DDW62 (D), HI1621 (C), HPW349 (C), HI8852 (D), UP3123 |
| 238S119 and 46S119 | 06 | HD3447, HS562 (C), HI8851 (D), NIAW3170 (C), UAS478 (D)(I), UAS3029, |
| 238S119 | 09 | CG1045, DBW386*, DBW426, GW547 (I), HD3118, HD3428, HD3471, PBW826,RAJ4083 (C) |
| 110S119 | 06 | DBW359 (I)*, HD3468, HI1655*, KRL2106, MACS4131 (D), UP3124, |
| 46S119 | 07 | DBW443*, HD3369, HD3388, HD3460, HI1634, HI8627 (D), NIAW4364, |
| **Total** | **45** | |

* Different seed lot to that of previous cropping season

### Stem rust

Combined APR to *Pgt* pathotypes 11 & 40A was recorded in GW1368(d). Five entries (DBW222(C)*, DBW477, HD3428, HD3468, and UAS3026) had APR to pathotype 11. While APR to pathotype 40A was observed in two entries (HI1605 and PBW915), while eight entries exhibited APR to 117-6 (Table 2.4).

**Table: 2.4. Race specific adult plant resistance to the predominant and virulent pathotypes of *Puccinia graminis* f. sp. *tritici* (*Pgt*) in wheat lines of AVT during 2023-24**

| Pathotypes | No. of Lines | Varieties/lines |
|---|---|---|
| 11 & 40A | 01 | GW1368(d) |
| 11 | 05 | DBW222(C)*, DBW477, HD3428, HD3468, UAS3026 |
| 40A | 02 | HI1605, PBW915 |
| 117-6 | 08 | BCW29, DBW359(I), HI8849(d), HI8852(d), MACS4131(d), MPO1395(d), UAS478(d)(I), UP3123 |
| Total | **16** | |

* 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 andMahabaleshwar centers 2023-24.**

| S. No. | Entries | Leaf rust | | | Yellow rust | | | | | Stem rust | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Delhi | Ludhiana | | Delhi | | | Ludhiana | | Pune | | Indore | | Mahabaleshwar | |
| | | 77-5 | 77-5 | 77-9 | 238S119 | 46S119 | 110S119 | 46S119 | 238S119 | 11 | 40A | Gr11 | Gr40A | 11 | 40A |
| 1 | HD3086 (C) | 40S | 20S | 10S | 5MS | 5S | 5S | 0 | 5MS | 60S | 10S | 60S | 20MS | 10MS | 20S |
| 2 | HI1668* | 5S | 10S | 40S | 5MS | 10S | 10S | 0 | 10MS | 20S | 20S | 20S | TMR | 5S | 20MS |
| 3 | HD3494 | 10S | 10S | 60S | 0 | 0 | 0 | 0 | 0 | 10S | 0 | 10MS | 0 | R | R |
| 4 | DBW417 | 5M5 | 5MS | TS | 5MS | 5S | 5MS | TS | 10S | 20S | 10S | 40S | 20MS | TMS | 5MS |
| 5 | DBW88 (C) | TR | 5MS | 5S | 40S | 10S | 40S | 10S | 40S | 0 | 0 | 20MS | TMR | 10MS | R |
| 6 | PBW957 | 5S | 20S | 10S | 5MS | 0 | 0 | 0 | 5S | 0 | 0 | 20S | 0 | R | R |
| 7 | DBW222(C)* | 0 | 0 | 0 | 40S | 30S | 40S | 5S | 10S | 0 | 0 | 40S | 10S | R | R |
| 8 | DBW477 | 0 | 5S | 10S | 0 | 5MS | 0 | 0 | 0 | 0 | 0 | 40S | 10S | TMS | 5MS |
| 9 | HD3471 | 0 | 0 | 0 | 5MS | 0 | 5S | 10S | 10S | 0 | 0 | 20MS | 5MR | 5MS | R |
| 10 | PBW916 | 0 | 10S | 10S | 0 | 0 | 10S | 0 | 5MR | 0 | 0 | 40S | 10MS | 5S | R |
| 11 | DBW386* | 5S | 20S | 20S | 5MS | 5S | 5S | 0 | 10MS | 0 | 0 | 0 | 0 | 10MR | 5MR |
| 12 | PBW826 (C) | 5S | 10S | 10S | 5MS | 10S | 10S | 10S | 5S | 10S | 0 | 5MR | TMR | TMS | R |
| 13 | DBW476 | 0 | 10MS | 20S | 0 | 0 | 5S | 10S | 5S | 0 | 0 | 20S | TMR | R | R |
| 14 | HD2967 | 0 | 20S | 0 | 80S | 60S | 80S | 40S | 60S | 10S | 0 | 40S | 10S | 5S | TMS |
| 15 | PBW725 | 0 | 10S | 20S | 0 | 0 | 0 | 0 | 5MR | 10S | 0 | 40MS | 0 | 5MR | R |
| 16 | HD3386 (I)(C) | 0 | 40S | 40S | TS | 5MS | 5S | TS | 10S | 10S | 0 | 0 | 5MR | 5MS | R |
| 17 | PBW958 | 0 | 20S | 10S | 0 | 0 | 0 | 0 | 5MR | 10S | 0 | 40S | 5R | R | 10MS |
| 18 | HD3455 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10MR | 0 | 0 | 40MS | 10MS | R | R |
| 19 | HD3059 (C) | 0 | 5MS | 10MS | 40S | 40S | 40S | 20S | 40MS | 0 | 0 | 40MS | TMR | R | R |
| 20 | JKW261 (C) | 0 | TS | 5S | 5MS | 5S | 10S | 5S | 40S | 40S | 0 | 60S | 20S | 5S | R |
| 20A | Infector | 80S | 80S | 80S | 90S | 90S | 90S | 60S | 80S | 80S | 80S | 80S | 80S | 80S | 80S |
| 21 | NW8071 | 0 | 5S | 20S | TR | 0 | 0 | 0 | 40MS | 0 | 0 | 40S | 0 | 5MR | R |
| 22 | DBW173 (C) | 0 | 10S | 5S | 5MS | 0 | 0 | 0 | 20MS | 0 | 0 | 0 | 0 | R | R |
| 23 | WH1324 | 0 | 5S | 10S | 10MS | 0 | 5MR | 0 | 20MS | 0 | 0 | 20MS | TMR | 10MS | 20S |
| 24 | DBW422 | 10S | 5S | 40S | 5S | TMS | TR | 10S | 20S | 0 | 0 | 60S | 10S | 5MS | 10MS |
| 25 | RAJ4581 | 0 | 5S | 20S | 5MS | TR | 0 | 0 | 5MR | 0 | 0 | 20MS | 10MS | 5S | 10S |
| 26 | HD3428 | 0 | 0 | 5S | 10S | 0 | 5S | 0 | 5MR | 0 | 20S | 40S | TMS | R | 10MS |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | HD3495 | 10S | 20S | 20S | 0 | 0 | 0 | 0 | 5MS | 10S | 0 | 40S | 5S | R | 10MS |
| 28 | PBW771 (C) | 0 | 5S | 5MR | 5MS | TR | 0 | 0 | 20MS | 0 | 0 | 20MS | 10MR | R | R |
| 29 | PBW921 | 10S | 10S | 20S | 0 | 0 | 0 | 0 | TR | 0 | 0 | 40S | 10S | R | R |
| 30 | PBW644 (C) | 10S | 20S | 20S | 40S | 5S | 0 | 20S | 40S | 0 | 0 | 40S | 10S | 5MR | 10MS |
| 31 | HI1653 (C) | 5MS | 10S | 40S | 5MS | TR | 5S | 0 | 5MR | 10S | 0 | 20MS | 5MR | R | 10S |
| 32 | PBW927 | 0 | 5S | 20S | 0 | 0 | 0 | 0 | 5MR | 10S | 0 | 40S | 5MS | R | R |
| 33 | HD3369 | 0 | 5S | 0 | 5MS | 0 | 0 | 0 | TR | 10S | 0 | 0 | TMR | R | 10MS |
| 34 | HD3468 | 0 | 20S | 10S | 5MS | 5S | 5S | 0 | 10S | 0 | 0 | 20MS | 10S | R | R |
| 35 | NIAW3170 (C) | 0 | 0 | 0 | 10S | 30S | 10S | 10-20S | 40MS | 0 | 0 | 20MR | 5MR | 5MS | 10MS |
| 36 | WH1326 | 0 | 10S | 10S | 10S | 5MS | 10S | 10S | 20MS | 20S | 0 | 20MS | 5MR | 5MS | TMS |
| 37 | DBW296 | 0 | 5S | 0 | 5S | 0 | 5S | 0 | 0 | 20S | 0 | 0 | TMR | TMS | 5MS |
| 38 | JKW304 | 0 | 40S | 60S | 10S | 10S | 5S | 0 | 5MS | 10S | 10S | 40S | 10S | R | R |
| 39 | WH1402 (I)(C) | 0 | 0 | 0 | 0 | 0 | 5S | 0 | 0 | 10S | 0 | 40S | NG | R | R |
| 40 | PBW908 | 0 | 10S | 10MR | 0 | 0 | 0 | 0 | 0 | 20S | 10S | 60S | 20S | R | R |
| 40A | Infector | 80S | 80S | 80S | 90S | 90S | 90S | 60S | 80S | 80S | 80S | 80S | 80S | 80S | 80S |
| 41 | HP1978 | TR | TS | 0 | 0 | 10S | 5S | 0 | 0 | 20S | 10S | 40MR | TMR | R | R |
| 42 | HD3447 | TR | 0 | 0 | 0 | 0 | 0 | TR | 0 | 10S | 10S | 40MS | 5MR | TMS | 5MS |
| 43 | PBW915 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10S | 20S | 60S | 10S | R | 10MS |
| 44 | HD3388(I) (C) | 5S | 0 | 0 | 5R | 0 | 0 | 0 | 0 | 20S | 0 | 40S | 5MR | TMR | 5S |
| 45 | UP3124 | 5S | 5S | 60S | 5S | 0 | 0 | 0 | 10S | 40S | 0 | 40S | 5MS | R | 10MS |
| 46 | KRL2106 | TR | 10S | 20S | 10S | 10S | 5S | 10S | 20MS | 10S | 50S | 10S | 0 | R | TMS |
| 47 | HD3249 (C) | 5MR | 10S | 20S | 5MR | 10MR | 5MS | 10S | 10S | 20S | 0 | 20MS | 5MR | 5MS | 5S |
| 48 | PBW913 | 5MS | 10S | 20S | 0 | 0 | 0 | 0 | 0 | 30S | 0 | 40S | 5MR | 5S | TS |
| 49 | HD3467 | 0 | 10S | 40S | 0 | 0 | 0 | 0 | 0 | 30S | 0 | 40S | TMS | R | R |
| 50 | BCW29 | 5S | 5S | 60S | 0 | 0 | 0 | 5S | 20S | 40S | 10S | 20MS | 10S | TS | 10MS |
| 51 | UP3123 | 0 | 5S | 20S | 5S | 15S | TR | 0 | 5MS | 20S | 20S | 40S | 10S | R | 5S |
| 52 | HI1563 (C) | 0 | 0 | 0 | 80S | 60S | 60S | 60S | 80S | 0 | 0 | 5MR | 5R | R | R |
| 53 | DBW107 (C)* | 20S | 5S | 40S | 10S | 10S | 20S | 10S | 10MS | 0 | 0 | 40S | 20S | 10S | 5S |
| 54 | PBW833 (C) | 0 | 0 | 0 | 10S | 10MS | TR | 10S | 20MS | 10S | 10S | 40S | 20S | R | R |
| 55 | WH1323 | 0 | 10S | 40S | 10S | 10S | 5S | 5S | 5MS | 0 | 0 | 20MS | 5MS | R | R |
| 56 | HD3118 (C) | 20S | 0 | 60S | 20S | 0 | 0 | 10S | 5MS | 0 | 0 | 20MS | 5MR | R | R |
| 57 | HI1621 (C) | 20S | 0 | 40S | TMR | 20S | 10S | 5S | 5S | 0 | 0 | 40S | 10MS | 10S | 20S |
| 58 | HD3171 (C) | 10S | 40S | 60S | 10S | 5MS | 5S | 20-40S | 60S | 0 | 0 | 40S | 10MS | R | R |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 59 | HD3460 | 0 | 0 | TR | 10S | 20MS | TR | 10S | 20S | 0 | 0 | 40MS | 5MR | R | R |
| 60 | HD3293 (C) | 20S | 20S | 60S | 5MS | 5MR | 10S | 10S | 10-20S | 0 | 0 | 40S | 20S | R | R |
| 60A | Infector | 80S | 80S | 80S | 90S | 90S | 90S | 60S | 80S | 80S | 80S | 80S | 80S | 80S | 80S |
| 61 | HI1612 (C) | 5S | 0 | 10MS | 5MR | 0 | 5S | 5S | 10S | 20S | 20S | 40S | 40MS | 10S | 20S |
| 62 | K1317(C)* | 10MS | 0 | 5MS | 5S | 10S | 5S | 10S | 20S | 10S | 0 | 40MS | 10MR | TMR | 5MR |
| 63 | VL2041 (C) | 10MS | TS | 40S | 10S | 10S | 10S | 5S | 40S | 0 | 10S | 20S | 0 | 5S | 10MS |
| 64 | HPW349 (C) | 10MS | TS | 5S | 5MS | 5S | 0 | 5S | 10S | 0 | 10S | 40S | 5MR | 10S | TMS |
| 65 | VL2059 | 0 | 0 | 0 | 5MS | TR | TMS | 0 | 0 | 30S | 0 | 5MR | 5R | R | R |
| 66 | HS562 (C) | 10S | 20S | 20S | 5MS | 0 | 0 | 0 | 0 | 0 | 20S | 40S | 10S | R | 10S |
| 67 | VL907 (C) | 0 | 5S | 40S | 10S | 10S | 0 | TMS | 20MS | 30S | 0 | 5MR | 0 | TMR | 10S |
| 68 | MACS6837 | 5MR | TS | 20S | 40S | 40S | 40S | 40S | 60S | 0 | 0 | 40S | 10MS | 5MR | R |
| 69 | MACS4125 (d) | 5S | 0 | 0 | 5MS | 0 | 0 | 0 | 5MR | 0 | 0 | 10MR | 0 | R | 10S |
| 70 | MACS4135 (d) | 0 | 0 | 0 | 5MS | 0 | 0 | 0 | 10S | 0 | 0 | 0 | 0 | R | 5S |
| 71 | HI1669 | 0 | TMR | 0 | 90S | 60S | 80S | 40S | 80S | 0 | 0 | 5MR | 5R | R | R |
| 72 | HI1683 | 0 | 0 | 0 | 80S | 40S | 80S | 20S | 40MS | 0 | 0 | 5MR | 0 | R | R |
| 73 | HI1684 | 0 | 0 | 0 | 80S | 60S | 60S | 60S | 60S | 0 | 0 | 10MR | 5R | R | R |
| 74 | HI8848 (d) | 0 | 0 | 0 | 10MS | 5S | 5S | 20S | 10S | 0 | 0 | 10MS | 0 | R | R |
| 75 | HI8849 (d) | 0 | 0 | 0 | 20MS | 5S | 10MS | 10S | 10MS | 0 | 0 | 5MR | 0 | 5MS | 10MS |
| 76 | HI8850 (d) | TR | 0 | 0 | 10S | 10S | 10MS | 5S | 20S | 0 | 0 | 10MR | 0 | R | R |
| 77 | GW554 | 0 | 0 | 0 | 90S | 80S | 80S | 40S | 60S | 0 | 0 | 5MR | 5R | R | R |
| 78 | GW555 | 0 | 0 | 0 | 80S | 60S | 80S | 40S | 60S | 0 | 0 | 20MR | 5R | R | R |
| 79 | MP3570 | 40S | 10S | 20S | 60S | 0 | 80S | 40S | 60S | 0 | 0 | 40S | 20MS | 5MS | R |
| 80 | MPO1395 | 0 | 0 | 0 | 5MS | 0 | 0 | 5S | 20S | 0 | 0 | 20MR | 5R | 5S | R |
| 80A | Infector | 80S | 80S | 80S | 90S | 80S | 80S | 60S | 80S | 60S | 80S | 80S | 80S | 80S | 80S |
| 81 | GW322 | 0 | 5S | 0 | 60S | 40S | 60S | 20S | 40S | 0 | 0 | 20S | 10MR | TMS | R |
| 82 | MACS6768 | 5MR | 0 | 0 | 90S | 80S | 80S | 20MS | 60S | 0 | 0 | 20MR | 10MR | R | 10MR |
| 83 | HI1650 | 5MR | 0 | 0 | 40S | 20S | 40S | 10S | 40S | 0 | 0 | 5MR | 5MR | R | R |
| 84 | GW547 (I) | 0 | 0 | 0 | 40S | 20S | 40S | 10S | 10S | 0 | 0 | 5R | 5R | R | R |
| 85 | HI8737 (d) | 0 | 0 | 0 | 10MS | 5S | 5S | 10S | 5MS | 0 | 0 | 20S | 10S | 5MR | TMR |
| 86 | HI8713 (d) | 0 | 0 | 0 | 20S | 10S | 5MS | 20MS | 40S | 0 | 0 | 10MR | 0 | R | R |
| 87 | HI1674 | 0 | 0 | 0 | 60S | 40S | 40S | 60S | 60S | 10S | 0 | 5MR | 5MR | R | R |
| 88 | HI1687 | 0 | 0 | 0 | 60S | 40S | 60S | 60S | 60S | 0 | 0 | 10MR | 10MR | R | R |
| 89 | WSM138 | 0 | 0 | 0 | 40S | 20S | 40S | 40S | 40S | 0 | 0 | 5MR | 5MR | R | R |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 | MACS6830 | 0 | 0 | 0 | 80S | 60S | 60S | 60S | 80S | 0 | 0 | 5MR | 10MR | R | R |
| 91 | DBW425 | 0 | 20S | 80S | 5MS | 0 | 5MS | 10MS | 10S | 0 | 0 | 20MS | 10MS | R | 10S |
| 92 | GW556 | 0 | 0 | 0 | 60S | 80S | 90S | 60S | 60S | 40S | 0 | 5MR | 5MR | R | R |
| 93 | HD2932* | 0 | 20S | 60S | 60S | 60S | 90S | 40S | 60S | 0 | 0 | 10MS | 10MS | R | R |
| 94 | HMP4010* | 0 | 40S | 60S | 60S | 60S | 60S | 40S | 60S | 30S | 0 | 20S | 5MR | 5S | R |
| 95 | HI1634 | 0 | 0 | 0 | 40S | 30S | 60S | 40S | 40S | 0 | 0 | 10MR | 5MR | R | R |
| 96 | CG1029 | 0 | 0 | 0 | 90S | 90S | 90S | 60S | 60S | 0 | 0 | 10MR | 10MR | R | R |
| 97 | DBW441M | 0 | 5S | 20S | 20S | 20S | 40S | 60S | 60S | 0 | 0 | 40S | 10MS | 5MR | R |
| 98 | DBW428 | 0 | 0 | 0 | 5S | 5S | 10S | 0 | 0 | 60S | 0 | 0 | 5MR | R | R |
| 99 | DBW432 | 0 | 40S | 20S | 5MR | TR | 10MS | 0 | 5MR | 20S | 40S | 40S | 20S | R | R |
| 100 | UAS3029 | 0 | TS | 0 | 5S | 5S | 10MS | 10S | 10S | 40S | 20S | 40S | 20S | 5MR | R |
| 100A | Infector | 80S | 80S | 80S | 90S | 90S | 90S | 60S | 80S | 80S | 80S | 80S | 80S | 80S | 80S |
| 101 | UAS484 (d) | 0 | 0 | 0 | 5MS | 5S | 10S | 5S | 5MS | 10S | 0 | 20MR | 5R | R | R |
| 102 | NIAW4267 | 0 | 0 | 0 | 90S | 90S | 90S | 40S | 60S | 0 | 0 | 20MR | 20MR | R | R |
| 103 | HI8851 (d) | 0 | 0 | 0 | 5MR | 5MR | 10MR | 5S | 5MR | 0 | 0 | 5MR | 0 | R | R |
| 104 | HI8852 (d) | TR | 0 | 0 | 5MR | 10MR | 10MR | 0 | 5MS | 0 | 0 | 5MR | 0 | R | R |
| 105 | MACS4131(d) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10MS | 0 | R | R |
| 106 | MPO1398 (d) | 0 | 0 | 0 | 5MS | 10MS | 0 | 0 | 0 | 0 | 0 | 20MR | 0 | 10S | 10MS |
| 107 | DBW110 | 0 | 0 | 0 | 20S | 10MS | 10S | 40S | 60S | 0 | 0 | 20MS | 10MR | TMR | TMR |
| 108 | CG1036 | 0 | 0 | 0 | 60S | 90S | 60S | 60S | 80S | 0 | 0 | 10MR | 5MR | 5MR | TMR |
| 109 | HI1655* | 0 | 0 | 0 | 40S | 40S | 40S | 40MS | 40S | 0 | 0 | 5MR | 0 | R | R |
| 110 | HI8627 (d) | 0 | 0 | 0 | 10S | 10S | 10S | 10S | TS | 0 | 0 | 0 | 0 | R | R |
| 111 | HI8823 (d) | 0 | 0 | 0 | 10S | 10S | 5S | 20S | 10MS | 0 | 0 | TMR | 0 | 5MR | R |
| 112 | DBW359 (I)* | 10S | 20S | 40S | 10S | 0 | 5MS | 0 | 5MS | 0 | 0 | 20S | 10S | 5MS | 5S |
| 113 | CG1040 (I) | 10S | 5S | 60S | 20S | 10S | 10S | 40S | 40S | 0 | 0 | 40S | 20MS | 5MR | R |
| 114 | MACS6842 | 0 | 5S | 40S | 20S | 20S | 20S | 20S | 40S | 0 | 10S | 20S | 20MS | R | R |
| 115 | MACS6844 | 5MS | 0 | 0 | 60S | 40S | 60S | 60S | 80S | 0 | 0 | 40S | 20S | TMR | 5MR |
| 116 | NIAW4364 | 5MS | 40S | 60S | 40S | 5S | 60S | 10S | 20S | 30S | 20S | 40S | 20S | 5MS | R |
| 117 | PBW891 | 10S | 60S | 60S | 20S | 10S | 10S | 20S | 60S | 0 | 10S | 20MR | 10MR | R | R |
| 118 | DBW443* | 0 | 60S | 60S | TR | 0 | 5S | 5S | 5MR | 0 | 0 | 20MS | 5MR | R | R |
| 119 | DDW62(d) | 0 | 0 | 0 | TR | 0 | 0 | 0 | TR | 0 | 0 | 20MR | 5MR | R | R |
| 120 | AKAW5100* | 10S | 0 | 0 | 40S | 10S | 40S | 20MS | 40S | 0 | 0 | 0 | 5MR | R | R |
| 120A | Infector | 80S | 80S | 80S | 90S | 90S | 90S | 60S | 80S | 80S | 80S | 80S | 80S | 80S | 80S |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 121 | WH1306 | 0 | 20S | 20S | 5MS | 0 | 5S | 5S | 5MS | 0 | 20S | 20MS | 5MR | 10NS | 5MS |
| 122 | NWS2222 | 0 | 5S | 20S | 5S | 5S | 5S | 10S | 40S | 0 | 0 | 10MS | 10MR | R | TMR |
| 123 | UAS3026 | 10MS | TS | 0 | 40S | 20S | 40S | 40S | 40S | 0 | 20S | 20MS | 5MR | 10MS | TMR |
| 124 | CG1045 | 5MS | 10S | 5S | 5MS | 0 | 5S | 10MS | 5MR | 0 | 0 | 40S | 10S | R | R |
| 125 | MPO1395 (d) | 0 | 0 | 0 | TR | 0 | 0 | 0 | 0 | 0 | 10S | 10MR | 0 | R | 10MS |
| 126 | MACS6222 | 0 | 0 | 0 | 5S | 0 | 10S | TS | 20S | 0 | 0 | 10MR | TMR | TMS | R |
| 127 | MP1378 (I) | 0 | 0 | 0 | 40S | 40S | 40S | 40S | 60S | 0 | 0 | 20MR | 5MR | R | 10MS |
| 128 | MACS3949 (d) | 0 | 0 | 0 | 0 | 0 | 0 | 5S | 0 | 0 | 0 | 20MR | 0 | R | R |
| 129 | DBW426 | 0 | 0 | 0 | 5MS | 5MR | 5MR | 10MR | 5MS | 0 | 0 | 20MS | 10MS | R | R |
| 130 | MACS6829 | 0 | 0 | 0 | 80S | 40S | 80S | 40S | 60S | 0 | 0 | 10MR | 5R | R | R |
| 131 | NIAW4114* | 0 | 0 | 0 | 80S | 60S | 60S | 60S | 80S | 0 | 0 | 10MR | 5MR | R | 10MR |
| 132 | NIAW4120 | 0 | 0 | 0 | 80S | 60S | 80S | 60S | 80S | 0 | 0 | 5MR | TMR | R | R |
| 133 | NIAW4432 | 0 | 0 | 0 | 10S | 5MR | 0 | 10MS | 40S | 0 | 0 | 10MR | 5MR | R | R |
| 134 | UAS3027 | 0 | 0 | 0 | 40S | 10S | 40S | 40MS | 60S | 0 | 0 | 5MR | 5MR | R | 5MS |
| 135 | LOK79 | 0 | 0 | 0 | 60S | 40S | 40S | 40S | 80S | 0 | 0 | 5MR | 5R | R | R |
| 136 | RAJ4083 (C) | 0 | 0 | 0 | 40S | 10S | 60S | 20S | 60S | 0 | 0 | 5R | 0 | TMR | 10MS |
| 137 | HD3090 (C) | 0 | TS | 10MS | 40S | 20S | 40S | 40S | 80S | 0 | 0 | 10MR | 5MR | R | R |
| 138 | HI1633 (C) | 0 | 0 | TMS | 40S | 10MS | 40S | 40S | 60S | 0 | 0 | 5MR | 5R | R | R |
| 139 | CG1047 | 0 | 10S | 10S | 40S | 10S | 4S0 | 40S | 60S | 0 | 0 | 20S | 10MS | TMS | 5MS |
| 140 | GW1368(d) | 0 | 0 | 0 | 40S | 20S | 40S | 40S | 60S | 0 | 0 | 20S | 10S | R | R |
| 140A | Infector | 80S | 80S | 80S | 90S | 90S | 90S | 60S | 80S | 100S | 80S | 80S | 80S | 80S | 80S |
| 141 | HI1605 | 20S | 40S | 60S | 10S | 30S | 40S | 40S | 60S | 0 | 60S | 10MS | 20S | R | 10MS |
| 142 | NIAW3170 | 5MR | TS | 0 | 20S | 20S | 40S | 10S | 10S | 0 | 20S | 10MR | 20MR | 5MS | R |
| 143 | UAS446(d) | 0 | 0 | 0 | 5MS | 5MS | 20S | 0 | 5MS | 0 | 20S | 20MR | TMR | 5MS | 10S |
| 144 | NIDW1149 (d) | 0 | 0 | 0 | 0 | 0 | 10S | 0 | 0 | 0 | 0 | 20MR | TMR | 5S | TMS |
| 145 | HI1665 (I) | 0 | 0 | 0 | 80S | 60S | 60S | 40S | 80S | 0 | 0 | TR | 0 | R | R |
| 146 | UAS478 (d)(I) | 0 | 0 | 0 | 5S | 10S | 10S | 5S | 0 | 80S | 10S | 20MR | TMS | 20MS | 10MS |

## 2.2 Identification of slow ruster lines in AVT materials 2023-24

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 fieldlife of a cultivar. Genotypes possessing this kind of resistance should be particularly avoided in inoculums 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 | HD3494, PBW957, PBW916, PBW725, PBW958, HD3455, PBW921,PBW927, WH1402(I)(C), PBW908, PBW915, PBW913, HD3467, NIDW1149(d). |
| 0.1-10 | NIL |
| 10.1-100 | JKW304, VL2059, HS562 (C), MPO1398(d), PBW771(C), DBW477,HD3086(C), DBW296, MACS4131(d), MACS4135(d), PBW833(C) |
| 100.1-200 | UAS478(d)(I), HD3369, HD3388(I) (C), DDW62(d), HP1978, MPO1395(d), DBW173(C), HD3495, HI8850(d), DBW432, UAS446(d), HD3468, HD3447, MACS4125(d), CG1045, MACS6222, HI8852(d), WH1306*, NW8071, HI8737(d) |

## B. DURGAPURA

| AUDPC | Entries |
|---|---|
| 0 | HI1668, HD3494, PBW957, DBW477, PBW916, DBW476, PBW725,PBW958, HD3455, RAJ4581, HD3495, PBW921, PBW927, JKW304, WH1402(I)(C), PBW908, HP1978, HD3447, PBW915, PBW913, HD3467, BCW29, HD3118(C), VL2059, HS562 (C), MACS4131(d), DDW62(d), UAS446(d), NIDW1149(d), UAS478(d)(I). |
| 0.1-10 | HD3386(I)(C), HI1612 (C), DBW428, DBW386, WH1324, PBW771(C), HD3369, HD3468, WH1326, DBW296, UP3124, HD3249 (C),HI1621(C), K1317(C), HPW349 (C), MACS4125(d), MACS4135(d), DBW425, UAS484(d), HI8852(d), MPO1398(d), DBW359(I), WH1306*, CG1045, MACS3949(d), HD3388(I)(C). |
| 10.1-100 | HI8737(d), DBW417, HI8851(d), HD3086(C), HD3471, PBW826(C), NW8071, DBW173(C), DBW422, HD3428, HI1653(C), UP3123, DBW107(C), PBW833(C), WH1323, VL907 (C), HI8849(d), HI8850(d), MPO1395(d), DBW432, HI8627(d), DBW443*, MPO1395(d), HD3293 (C), DBW426, HI8848(d), HI8713(d), HI8823(d), NWS2222*, RAJ4083 (C), NIAW3170. |
| 100.1-200 | WSM138, HD3460, MACS6222, HI1605, HI1650, GW547(I), NIAW4432, HI1633 (C), DBW222(C), PBW644(C), HD3171 (C), VL2041 (C), UAS3029. |

## Leaf Rust

### A. Mahabaleshwar

| AUDPC | Entries |
|---|---|
| 0 | NIL |
| 0.1-10 | PBW725, DBW417, DBW88(C), PBW957, DBW222(C), HD3471, PBW916, JKW261(C), DBW173(C), RAJ4581, HD3428, HD3369, DBW296, WH1402(I)(C), PBW908, HP1978, KRL2106, HI1563(C), PBW833(C), WH1323, VL2059, MACS4125(d), HI1669*, GW554, GW555, HI1650, GW547(I), HI8713(d), HI1674*, HI1687, WSM138, MACS6830, GW556, HI1634, CG1029, DBW428, DBW432, UAS484(d), NIAW4267, HI8851(d), HI8852(d), DBW110, CG1036, HI1655, HI8823(d), DDW62(d), AKAW5100*, MACS6222, MP1378(I), DBW426, UAS3027, LOK79*, HI1633(C), GW1368(d), HI1665(I). |
| 10.1-100 | DBW386, HD3388(I) (C), HD3460, HI1683, HI8849(d), NIAW4120*, MACS6829, NIDW1149(d), MACS6768, NIAW4432, DBW476, PBW771(C), PBW927, VL907(C), HI1684, HI8850(d), NIAW4114*, PBW921, PBW826(C), HD3059(C), HI1653(C), HI8627(d), HI1668, WH1326, UP3124, CG1045, HD3090(C), UAS446(d), UAS478(d)(I), MACS6844, HI8737(d), MP3570, DBW425, DBW477, HD3386(I)(C), PBW958, HD3455, HD3447, HD3467, UP3123, HI8848(d), MPO1398(d), PBW891*, HD3494, BCW29, HS562(C), MACS6837, MACS4135(d), UAS3029, MACS3949(d), WH1306*, HD3468, NWS2222*, NW8071, WH1324, PBW915, HI1621(C), MACS4131(d), DBW359(I), CG1040(I), HD3495, PBW913, JKW304, K1317(C), HPW349(C), MPO1395(d), GW322, DBW443*, MPO1395(d), NIAW3170, HD3086(C), HD2967, NIAW3170(C), DBW422, MACS6842, HD3293(C), HI1612(C), VL2041(C), MP4010, DBW441M*, HI1605, PBW644(C). |
| 100.1-200 | DBW107(C), HD3118(C), CG1047, HD3249(C), NIAW4364, RAJ4083(C), HD3171(C), HD2932, UAS3026. |

### B. Ayodhya

| AUDPC | Entries |
|---|---|
| 0 | HD3455, HD3059(C), DBW173(C), PBW771(C), HD3369, NIAW3170(C), WH1402(I)(C), PBW908, PBW915, HD3388(I)(C), HD3249(C), UP3123, PBW833(C), HD3460, K1317(C), VL2059, MACS4125(d), MACS4135(d), HI1669*, HI1683, HI1684, HI8848(d), HI8849(d), HI8850(d), GW554, GW555, MPO1395(d), MACS6768, HI1650, GW547(I), HI8737(d), HI8713(d), HI1674*, HI1687, WSM138, MACS6830, GW556, HD2932, MP4010, HI1634, CG1029, DBW441M*, DBW428, UAS484(d), NIAW4267, HI8851(d), HI8852(d), MACS4131(d), MPO1398(d), DBW110, HI1655, HI8627(d), HI8823(d), DBW359(I), PBW891*, DBW443*, DDW62(d), AKAW5100*, MPO1395(d), MACS6222, MP1378(I), MACS3949(d), DBW426, MACS6829, NIAW4114*, NIAW4120*, NIAW4432, UAS3027, LOK79*, HD3090(C), HI1633(C), GW1368(d), NIAW3170, UAS446(d), NIDW1149(d), HI1665(I), UAS478(d)(I). |
| 0.1-10 | NIL |
| 10.1-100 | HP1978, HD3447, HI1563(C), HI1612(C), CG1036, HD3428, VL2041(C), PBW826(C), PBW927, CG1040(I), MACS6842, PBW921, KRL2106, HD3467, DBW422, BCW29, DBW432, HD3471, DBW88(C),NW8071, HD3495, WH1326, HPW349(C), HS562(C), NWS2222*, PBW913, PBW916, PBW644(C), UP3124, HD3293(C), MACS6837, HI1668, DBW477, PBW725, WH1323. |
| 100.1-200 | WH1324, RAJ4581, DBW476, RAJ4083(C), DBW222(C), HD3118(C), UAS3029, HI1653(C), DBW386, DBW107(C), HI1621(C), HD3086(C), HD2967, VL907(C), HD3171(C), CG1047, JKW261(C). |

### Stem Rust

### A. Indore

| AUDPC | Entries |
|---|---|
| 0 | DBW173(C), HD3369, DBW296. |
| 0.1-10 | VL 2059. |
| 10.1-100 | HI1634, HI8823(d), HI1665(I), K1317(C), HI8848(d), HI8850(d), HI8713(d), HI8851(d), HI1655, HI1683, MP1378(I), MACS4125(d), GW555, HI1674*, RAJ4083 (C), VL907 (C), HI1684, GW547(I), WSM138, HI8627(d), HI1633 (C), UAS446(d), UAS478(d)(I), WH1402(I)(C), HI1669*, MACS6768, HI8852(d), CG1036, NIAW3170(C), HP1978, MACS4135(d), GW554, HI1650, HI1687, GW556, AKAW5100*, MACS6222, NIAW4120*, LOK79*, HD3090(C), HI8849(d), CG1029, MACS3949(d). |
| 100.1-200 | MACS6829, KRL2106, HI1563 (C), WH1323, MPO1395(d), MACS6830, MPO1398(d), DBW426, DBW88 (C), PBW957, PBW771(C), PBW913, NIAW4267, MPO1395(d), NIAW4432, HD3428,HD3447, VL2041 (C). |

### B. Mahabaleshwar

| AUDPC | Entries |
|---|---|
| 0 | NIL |
| 0.1-10 | HD3059(C), DBW173(C), HI1563 (C), HD3293 (C), VL2059, HI1669*, |

| | |
|---|---|
| | GW554, GW555, HI1650, GW547(I), HI1674*, WSM138, DBW428,DBW432, DDW62(d), AKAW5100*, LOK79*, GW1368(d). |
| 10.1-100 | DBW222(C), DBW386, DBW476, VL907 (C), CG1029, MACS6829, HD3386(I)(C), PBW927, HD3468, JKW304, HP1978, HI1684, MACS6768, MACS6830, GW556, HI8851(d), HI8852(d), MACS4131(d), CG1036, HI1655, MACS6842, NIAW4432, HI1633 (C), HI1665(I), MACS6837, HI1683, HI1687, PBW891*, NWS2222*, PBW725, NW8071, HI8849(d), MP3570, NIAW4114*, NIAW4120*, HD3090 (C), HI1605, WH1402(I)(C), HI8713(d), NIAW4267, HI8627(d), HD3494, DBW417, DBW88 (C), PBW957, DBW477, PBW826(C), PBW958, HD3455, HD3428, PBW921, HD3171 (C), HI8848(d), HI8850(d), UAS484(d), HI8823(d), DBW443*, CG1045, MACS6222, DBW426, NIAW3170, PBW644(C). |
| 100.1-200 | HI1668, HD2967, JKW261(C), HI1653(C), PBW915, UP3124, DBW359(I), PBW771(C), PBW913, HD3467, WH1323, HI8737(d), HD2932, UAS3029, MACS6844, MPO1395(d), MP1378(I), HD3471, PBW916, HD3495, DBW296, HD3388(I)(C), KRL2106, BCW29, UP3123, MPO1395(d), DBW425, MP4010, WH1306*, CG1047, HD3460, MACS4135(d), GW322, HI1634, DBW441M*, DBW110, CG1040(I), NIAW4364, MACS3949(d), UAS3027, RAJ4083 (C), PBW908, HD3118(C). |

## COOPERATORS

| NAME | CENTRE |
|---|---|
| M. A. SUSHIR, V. M. SALI | MAHABALESHWAR |
| JASPAL KAUR | LUDHIANA |
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### 2.3. Seedling (all-stage) resistance to rusts and postulation of *Lr, Sr* and *Yr* genes in AVT material during 2023-24

#### 1) Seedling resistance test (SRT)

For identifying rust resistance sources, ~5500 wheat and barley lines were evaluated at seedling stage during 2023-24. Of these, 335 lines including 146 of AVT and 189 of NBDSN/EBDSN were subjected to multiple pathotypes screening under controlled light and temperature conditions. Seedling (all-stage) rust resistance remains effective throughout the life of wheat plants. Advanced wheat lines (146) were evaluated at seedling stage against 60 pathotypes of three *Puccinia* spp. on wheat. Fifteen pathotypes of stripe, 22 of stem and 23 of leaf rust pathogens that are most virulent and predominant were used for evaluation. Only entry VL2059 possessed resistance to all pathotypes of three rust pathogens. The wheat lines showing resistance to one or other rusts are given below in Table 2.6.

**Table: 2.6. Rust resistant wheat lines in AVT (2023-24)**

| Rusts | No. of lines | Variety/line |
|---|---|---|
| Brown, Black andYellow | 01 | VL2059 |
| Brown and Black | 27 | CG1029, DBW426, GW547(I), GW554, GW555, GW556, HD3090(C), HI1563(C), HI1633(C), HI1634,HI1650,HI1669, HI1674, HI1683, HI1684, HI1687, HP1978, LOK79, MACS6222, MACS6768,MACS6829, MACS6830, NIAW4114*,NIAW4120, NIAW4267, NIAW4432, WSM138 |
| Brown and Yellow | 01 | PBW908 |
| Black and Yellow | 02 | PBW916, WH1402(I)(C) |
| Brown only | 10 | CG1036, HI1665, MACS3949, MACS4125, MACS4131, MACS4135, MPO1398(d), PBW833, UAS446, UAS484 |
| Black only | 13 | AKAW5100*, CG1040(I), DBW110, DBW173(C), DBW443*, D3447, HI1655*, K1317(C)*, MACS6844, MP1378(I), PBW771(C), PBW891, VL907(C) |
| Yellow only | 14 | BCW29, DBW476, DBW477, HD3455, HD3494, JKW304, NW8071, PBW725, PBW913, PBW915, PBW921, PBW927, PBW957, PBW958 |

* Different seed lot to that of previous cropping season

Resistance to black and brown rusts was observed in 27 entries. Entries PBW916, WH1402(I)(C) were resistant to black and yellow rusts. Ten lines were found resistant to leaf rust, whereas thirteen to stem rust pathotypes. Fourteen entries conferred resistance to only yellow rust pathotypes (Table 2.6).

### Gene postulation (*Lr, Sr* and *Yr* genes) in AVT lines

#### *a. Yr* genes

Among the 146 lines of AVT, *Yr* genes were characterized in 80 lines. *Yr* genes were postulated in lines where differential interactions were observed and some cases tight linkage of *Yr* genes to other *Lr* and *Sr* genes also implicated the presence of a resistance gene. Three *Yr* genes viz. *Yr2*, *Yr9*, and *YrA* contributed to yellow rust resistance in Indian wheat material. Among the postulated *Yr* genes, the frequency of *Yr2* was maximum and it was characterized in 73 lines. *Yr9*was postulated in 10 entries (Table 2.7).

**Table: 2.7. Postulated *Yr*-gene in AVT wheat lines during 2023-24**

| *Yr*-gene | No. of lines | Variety/ line |
|---|---|---|
| *Yr2+* | 63 | CG1029, CG1040(I), CG1045, DBW107(C)*, DBW110, DBW222(C)*, DBW296, DBW359(I), DBW386*, DBW422, DBW441, DBW443*, GW547(I), GW554, GW555, HD2967, HD3059 (C), HD3086(C), HD3118 (C), HD3249(C), HD3293(C), HD3386(I)(C), HD3388(I)(C), HD3428, HD3447, HD3460, HD3468, HD3471, HI1563(C), HI1605, HI161(C), HI1621 (C), HI1653(C), HI1665(I), HI1668*, HI1674, HI8851(d), HI8852(d), HPW349(C), MACS3949(d), MACS4131(d), MACS6222, MACS6830, MACS6837, MACS6842, MP3570, HMP4010*, MPO1395, MPO1395(d), NIAW3170(C), NIAW4114*, NIAW4120, NIAW4364, NIAW4432, PBW644(C), PBW826 (C), PBW891, RAJ4083(C), RAJ4581, UAS3027, UP3123, WH1326, WSM138 |
| *Yr9+* | 10 | AKAW5100*, DBW173(C), HD3090(C), HI1633(C), HI1634, HI1650, MACS6768,MP1378 (I), PBW771(C), VL907(C) |
| *YrA+* | 07 | DBW425, DBW426, DBW432, HP1978, HS562 (C), KRL2106, UAS3029 |
| **Total** | **80** | |

* Different seed lot to that of previous cropping season

### *b. 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 121 AVT lines (Table 3).The frequency of *Sr2*, postulated based on morphological marker micro flecking, was maximum as it was postulated in 48AVT entries followed by *Sr11*, *Sr7b*, and *Sr13*which were characterized in 37, 35 and 34entries, respectively. *Sr31* linked with *Lr26* and *Yr9* and conferring resistance to all the known *Pgt* pathotypes in Indian subcontinent was postulated in ten AVT entries, while *Sr24* linked to *Lr24* was characterized in twenty-one entries. Other *Sr* genes i.e. *9b*, *9e*, and *8a* were characterized in 14, 6, and 3 lines while *Sr30* and *Sr5* in ten lines and *Sr8b* and *Sr28* were postulated in one line each. The *Sr* genes were characterized singly or in combination of up to three genes (Table 2.8).

**Table: 2.8. Postulated *Sr*-gene in AVT wheat lines during 2023-24**

| Sr genes | No. of Lines | Details of Lines |
|---|---|---|
| *Sr31+5+2+* | 1 | DBW173(C) |
| *Sr31+2+* | 5 | AKAW5100*, HI1633 (C), MACS6768, PBW771(C), VL907 (C) |
| *Sr31+* | 4 | HD3090 (C), HI1634, HI1650, MP1378(I), |
| *Sr24+2+* | 3 | CG1029, GW547(I), MACS6222 |
| *Sr24+* | 18 | GW554, GW555, GW556, HI1563 (C), HI1669, HI1674, HI1683, HI1684, HI1687,LOK79, MACS6829, MACS6830, NIAW4114*, NIAW4120, NIAW4267, NIAW4432, VL2059, WSM138 |
| *Sr30+8a+2+* | 1 | PBW826(C) |
| *Sr30+5+11+* | 1 | VL2041 (C) |
| *Sr30+5+2+* | 3 | HD3386(I)(C), UAS3027, WH1306 |
| *Sr30+5+* | 3 | NWS2222, UP3124, WH1323 |
| *Sr30+2+* | 2 | CG1045, HI1668* |
| *Sr28+* | 1 | HI1621(C) |
| *Sr8a+9b+11+* | 1 | HS562 (C) |
| *Sr8a+11+2+* | 1 | HD2967 |
| *Sr8a+2+* | 1 | NIAW3170(C) |
| *Sr8b+7b+2+* | 1 | DBW441M |
| *Sr5+9b+13+* | 1 | DBW425 |
| *Sr5+11+* | 1 | HI1605 |
| *Sr9e+13+* | 1 | HD3495 |
| *Sr9e+11+* | 1 | PBW921 |
| *Sr9e+2+* | 4 | DDW62(d), HI8713(d), HI8737(d), MPO1395(d) |
| *Sr9b+13+11+* | 6 | DBW386*, DBW422, DBW428, DBW432, PBW957, UAS3029 |
| *Sr9b+13+7b+* | 1 | KRL2106 |
| *Sr9b+13+2+* | 1 | MP3570 |
| *Sr9b+13+* | 2 | DBW417, UP3123 |
| *Sr9b+11+* | 1 | HD3118(C) |

| | | |
|---|---|---|
| *Sr9b+7b+2+* | 1 | DBW359(I) |
| *Sr13+11+7b+* | 3 | HI8627(d), PBW908, UAS3026 |
| *Sr13+11+* | 5 | HD3494, PBW913, PBW915, RAJ4581, WH1324 |
| *Sr13+7b+2+* | 1 | HI8852(d) |
| *Sr13+7b+* | 10 | BCW29, DBW296 ,DBW476, HD3388(I) (C), HD3455, HD3471 , HI8851(d), JKW304, PBW927, PBW958 |
| *Sr13+2+* | 1 | HD3293 (C) |
| *Sr13+* | 2 | HD3460, HD3369 |
| *Sr11+7b+2+* | 1 | HD3171 (C) |
| *Sr11+7b+* | 3 | HD3467, HD3468, PBW725 |
| *Sr11+2+* | 9 | DBW88 (C), GW322, HD3059(C), HD3249 (C), HI8823(d), NIDW1149(d), PBW644(C), RAJ4083 (C), UAS446(d) |
| *Sr11+* | 4 | HD2932*, JKW261(C), MACS4125(d), MACS4135(d) |
| *Sr7b+2+* | 10 | CG1036, HD3086(C), HI1612 (C), HI8848(d), HPW349 (C), MACS3949(d), MPO1398(d), PBW833(C), UAS478(d)(I), UAS484(d) |
| *Sr7b+* | 4 | HI1653(C), HI8849(d), HI8850(d), MACS4131(d) |
| *Sr2+* | 2 | HI1655*, HI1665(I) |
| Total | **121** | |

* Different seed lot to that of previous cropping season

## C. *Lr* genes

Eight *Lr* genes *Lr1*, *Lr3*, *Lr10*, *Lr13*, *Lr23*, *Lr24*, *Lr26,* and *Lr28* were characterized in 115 entries. *Lr13* was the most commonly postulated leaf rust resistance gene that was characterized, alone or in combination, in maximum number of lines (63) followed by *Lr10* (31 lines), and *Lr1* and *Lr23* (21 lines). *Lr24* that is linked with *Sr24* was postulated in 21 entries. *Lr26*, tightly linked with *Yr9* and *Sr31*, was characterized in 10 lines. *Lr28* was postulated only in PBW915. Resistance to leaf rust in seven entries was based on a combination of three different genes (Table 2.9).

**Table: 2.9. Postulated *Lr*-gene in AVT wheat lines during 2023-24**

| ***Lr genes*** | **No. of Lines** | **Details of Lines** |
|---|---|---|
| *Lr3+* | 2 | DBW359*, DBW425 |
| *Lr*13+ | 24 | BCW29, CG1040, CG1047, DBW222*, DBW417, DBW428, DBW441M, HD3249, HD3369, HD3447,HD3494, HI1605, HI1621, HI1668*, JKW304, K1317*, KRL2106, MACS6844, NIAW4364, NWS2222, RAJ4083, RAJ4581, VL2041, WH1326 |
| *Lr*13+1+ | 14 | CG1045, DBW422, DBW432, DBW443*, GW322, HD3428, MACS6842, HMP4010*, NW8071, PBW644, UAS3027, UP3123, WH1324, WH1402, |
| *Lr*13+3+ | 2 | HD3059, HD3388 |
| *Lr*13+10+ | 17 | DBW476, DBW477, HD3293, HD3386, HD3468, HD3471, HD3495, HPW349, MP3570, PBW725, PBW891, PBW913, PBW916, PBW921, PBW927, PBW957, PBW958 |
| *Lr13+10+1+* | 2 | DBW386*, NIAW3170 |
| *Lr*13+10+3+ | 2 | DBW88, HI1653 |
| *Lr*23+ | 8 | DBW107*, HD2967, HD3460, HI1612, HI8851, HI8852, NIDW1149, UAS478 |
| *Lr*23+1+ | 3 | HD3467, MACS6837, PBW826, |
| *Lr*23+10+ | 3 | UAS3026, UAS3029, UP3124 |
| *Lr*23+10+1+ | 1 | DBW110 |
| *Lr*23+10+3+ | 2 | HD3086,HS562, |
| *Lr23+13+* | 1 | JKW261, |
| *Lr*23+13+10+ | 2 | DBW296, HD3171 |
| *Lr*24+ | 21 | CG1029, GW547*, GW554, GW555, GW556, HI1563, HI1669*, HI1674*, HI1683, HI1684, HI1687, LOK79, MACS6222, MACS6829, MACS6830, NIAW4114*, NIAW4120, NIAW4267, NIAW4432, VL2059, WSM138 |
| *Lr*26+ | 7 | AKAW5100*, HD3090, HI1633, HI1634, HI1650, MACS6768, MP1378(I) |
| *Lr*26+10+ | 1 | VL907, |
| *Lr26+10+3+* | 1 | DBW173 |
| *Lr26+23+1+* | 1 | PBW771 |
| *Lr28+* | 1 | PBW915 |

| | | |
|---|---|---|
| Total | **115** | |
| * Different seed lot to that of previous cropping season | | |

**COOPERATORS**

| NAME | CENTRE |
|---|---|
| OP GANGWAR, PRAOD PRASAD, CHARU LATA, SUBODH KUMAR | RS , ICAR-IIWBR, KARNAL |

### B. Mahabaleshwar

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

**COOPERATORS**

| NAME | CENTRE |
|---|---|
| M. A. SUSHIR, V. M. SALI | MAHABALESHWAR |

# PROGRAMME 3. LEAF BLIGHT

## 3.1. LEAF BLIGHT SCREENING NURSERY (LBSN), 2023-24

The disease is causing leaf spot on foliar parts and mainly prevalent in north eastern plains zone (NEPZ) and Peninsular zone (PZ). In recent years, the incidence in NWPZ is increasing as the temperature during crop season rises above 25$^{o}$C. The grain yield losses may vary from10-50%. In addition to yield losses, the quality also deteriorates depending on the level of susceptibility of a cultivar against the pathogen. Since leaf blight occurs in all the wheat growing agro-climatic zones, deployment of resistant cultivars remains the most effective strategy for the management of disease.

**This nursery was planted at 14 centres listed below:**

| Zone | Test locations |
|---|---|
| NWPZ | Ludhiana, Karnal, Hisar, Pantnagar and Delhi (5) |
| NEPZ | Ayodhya, Varanasi, Sabour, Kalyani, RPCAU Pusa, Coochbehar, Shillongani (7) |
| PZ | Pune and Dharwad (7) |

The nursery was planted at 14 centers cited as above, the data from Dharwad was not considered due to poor/ erratic disease development, whereas data was not received from RPCAU Pusa and Shillongani.The entries were planted in one row each of 1m length and a row of a highly susceptible entryHD 3436 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 leafblight at various stages. The first digit indicates the score of blight on flag leaf (F) and seconddigit represents the score of penultimate leaf or flag-1 leaf (F-1) and the disease score scale (0-9) was as follows:

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

Amongst three stages, blight recorded at hard dough stage was most distinct in terms ofgiving 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 2023-24**

| S. No. | Entry | Ayodhya | Varanasi | Sabour | Pune | Kalyani | Coochbehar | Pantnagar | Hisar | Ludhiana | Karnal | Delhi | Avg. | HS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | HD3086(C) | 78 | 79 | 36 | 48 | 68 | 78 | 57 | 34 | 23 | 13 | 78 | 68 | 79 |
| 2 | HI1668* | 67 | 99 | 46 | 49 | 57 | 67 | 12 | 46 | 38 | 02 | 47 | 58 | 99 |
| 3 | HD3494 | 57 | 35 | 57 | 59 | 35 | 23 | 12 | 35 | 25 | 01 | 13 | 36 | 59 |
| 4 | DBW417 | 46 | 68 | 46 | 59 | 25 | 24 | 35 | 23 | 37 | 00 | 13 | 36 | 68 |
| 5 | DBW88 (C) | 46 | 78 | 46 | 79 | 57 | 56 | 36 | 36 | 37 | 13 | 15 | 58 | 79 |
| 6 | PBW957 | 45 | 78 | 46 | 89 | 68 | 67 | 13 | 24 | 36 | 24 | 25 | 57 | 89 |
| 7 | DBW222(C)* | 57 | 89 | 47 | 89 | 46 | 45 | 25 | 35 | 46 | 24 | 36 | 57 | 89 |
| 8 | DBW477 | 46 | 89 | 47 | 79 | 37 | 25 | 13 | 57 | 68 | 36 | 26 | 58 | 89 |
| 9 | HD3471 | 46 | 79 | 46 | 78 | 68 | 67 | 36 | 35 | 78 | 36 | 35 | 68 | 79 |
| 10 | PBW916 | 46 | 46 | 46 | 89 | 25 | 23 | 00 | 24 | 26 | 24 | 36 | 36 | 89 |
| 11 | DBW386* | 68 | 78 | 46 | 59 | 26 | 23 | 12 | 23 | 46 | 24 | 36 | 47 | 78 |
| 12 | PBW826(C) | 78 | 89 | 57 | 49 | 35 | 34 | 26 | 35 | 48 | 36 | 36 | 58 | 89 |
| 13 | DBW476 | 46 | 68 | 46 | 59 | 57 | 56 | 36 | 45 | 35 | 36 | 35 | 58 | 68 |
| 14 | HD2967 | 46 | 46 | 46 | 78 | 48 | 56 | 58 | 67 | 24 | 35 | 13 | 58 | 78 |
| 15 | PBW725 | 35 | 46 | 56 | 78 | 79 | 78 | 01 | 13 | 23 | 24 | 25 | 57 | 79 |
| 16 | HD3386(I)(C) | 67 | 78 | 56 | 78 | 26 | 24 | 36 | 23 | 38 | 35 | 47 | 47 | 78 |
| 17 | PBW958 | 57 | 78 | 56 | 59 | 57 | 57 | 47 | 35 | 25 | 35 | 13 | 58 | 78 |
| 18 | HD3455 | 68 | 89 | 45 | 56 | 57 | 56 | 24 | 24 | 45 | 36 | 47 | 57 | 89 |
| 19 | HD3059(C) | 46 | 68 | 56 | 79 | 56 | 45 | 24 | 35 | 23 | 46 | 14 | 57 | 79 |
| 20 | JKW261(C) | 57 | 68 | 57 | 78 | 35 | 24 | 01 | 73 | 25 | 37 | 25 | 46 | 78 |
| 20A | Infector | 89 | 35 | 79 | 99 | 69 | 68 | 78 | 78 | 89 | 68 | 78 | 89 | 99 |
| 21 | NW8071 | 57 | 57 | 57 | 79 | 36 | 34 | 23 | 13 | 35 | 35 | 25 | 47 | 79 |
| 22 | DBW173(C) | 46 | 57 | 56 | 78 | 47 | 45 | 36 | 35 | 23 | 13 | 14 | 47 | 78 |
| 23 | WH1324 | 57 | 69 | 45 | 76 | 57 | 56 | 37 | 23 | 23 | 35 | 25 | 57 | 76 |
| 24 | DBW422 | 67 | 89 | 46 | 78 | 35 | 34 | 24 | 45 | 67 | 47 | 47 | 57 | 89 |
| 25 | RAJ4581 | 68 | 99 | 46 | 76 | 46 | 45 | 24 | 23 | 89 | 24 | 58 | 67 | 99 |
| 26 | HD3428 | 46 | 89 | 47 | 78 | 58 | 56 | 26 | 24 | 35 | 13 | 25 | 57 | 89 |
| 27 | HD3495 | 57 | 68 | 46 | 78 | 25 | 24 | 24 | 45 | 68 | 35 | 13 | 47 | 78 |
| 28 | PBW771(C) | 78 | 89 | 45 | 56 | 35 | 34 | 35 | 23 | 89 | 37 | 78 | 57 | 89 |
| 29 | PBW921 | 78 | 68 | 57 | 78 | 36 | 35 | 38 | 45 | 79 | 38 | 13 | 58 | 79 |
| 30 | PBW644(C) | 57 | 57 | 36 | 99 | 36 | 35 | 14 | 57 | 35 | 35 | 12 | 47 | 99 |
| 31 | HI1653(C) | 78 | 78 | 46 | 78 | 58 | 56 | 24 | 23 | 89 | 46 | 25 | 68 | 89 |
| 32 | PBW927 | 67 | 89 | 46 | 78 | 57 | 56 | 13 | 14 | 69 | 36 | 13 | 57 | 89 |
| 33 | HD3369 | 67 | 89 | 57 | 78 | 58 | 57 | 36 | 24 | 79 | 35 | 13 | 68 | 89 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 34 | HD3468 | 57 | 89 | 57 | 59 | 48 | 46 | 24 | 67 | 57 | 46 | 25 | 58 | 89 |
| 35 | NIAW3170(C) | 46 | 78 | 57 | 59 | 49 | 46 | 00 | 23 | 38 | 57 | 89 | 58 | 89 |
| 36 | WH1326 | 56 | 79 | 46 | 58 | 46 | 45 | 24 | 24 | 78 | 68 | 12 | 57 | 79 |
| 37 | DBW296 | 57 | 57 | 36 | 57 | 48 | 45 | 13 | 23 | 78 | 35 | 14 | 47 | 78 |
| 38 | JKW304 | 46 | 46 | 36 | 56 | 37 | 35 | 26 | 24 | 79 | 58 | 78 | 58 | 79 |
| 39 | WH1402(I)(C) | 46 | 68 | 56 | 56 | 36 | 34 | 13 | 34 | 78 | 46 | 25 | 47 | 78 |
| 40 | PBW908 | 67 | 89 | 56 | 58 | 58 | 56 | 24 | 13 | 24 | 35 | 47 | 58 | 89 |
| 40A | Infector | 78 | 35 | 79 | 79 | 79 | 78 | 89 | 89 | 89 | 68 | 78 | 89 | 89 |
| 41 | HP1978 | 46 | 57 | 56 | 79 | 46 | 45 | 25 | 13 | 25 | 46 | 99 | 57 | 99 |
| 42 | HD3447 | 46 | 68 | 36 | 79 | 57 | 56 | 24 | 23 | 79 | 46 | 78 | 68 | 79 |
| 43 | PBW915 | 57 | 57 | 46 | 59 | 58 | 57 | 35 | 23 | 79 | 35 | 25 | 58 | 79 |
| 44 | HD3388(I) (C) | 35 | 68 | 46 | 79 | 37 | 34 | 25 | 24 | 45 | 57 | 78 | 57 | 79 |
| 45 | UP3124 | 35 | 68 | 47 | 89 | 46 | 45 | 26 | 35 | 69 | 46 | 13 | 57 | 89 |
| 46 | KRL2106 | 46 | 24 | 46 | 78 | 35 | 23 | 12 | 13 | 25 | 35 | 25 | 36 | 78 |
| 47 | HD3249 (C) | 46 | 79 | 45 | 99 | 57 | 56 | 26 | 34 | 35 | 57 | 57 | 68 | 99 |
| 48 | PBW913 | 35 | 57 | 57 | 56 | 46 | 45 | 48 | 45 | 38 | 35 | 25 | 57 | 57 |
| 49 | HD3467 | 46 | 57 | 36 | 89 | 47 | 45 | 24 | 57 | 45 | 35 | 14 | 57 | 89 |
| 50 | BCW29 | 57 | 68 | 57 | 79 | 35 | 34 | 26 | 56 | 26 | 24 | 13 | 47 | 79 |
| 51 | UP3123 | 67 | 78 | 57 | 68 | 46 | 45 | 24 | 12 | 58 | 57 | 57 | 57 | 78 |
| 52 | HI1563 (C) | 78 | 79 | 57 | 79 | 48 | 46 | 68 | 67 | 89 | 68 | 99 | 79 | 99 |
| 53 | DBW107(C)* | 46 | 89 | 57 | 57 | 46 | 46 | 36 | 34 | 35 | 69 | 57 | 58 | 89 |
| 54 | PBW833(C) | 57 | 68 | 46 | 59 | 36 | 34 | 24 | 13 | 35 | 57 | 14 | 47 | 68 |
| 55 | WH1323 | 46 | 89 | 46 | 56 | 56 | 56 | 24 | 23 | 48 | 69 | 67 | 67 | 89 |
| 56 | HD3118(C) | 78 | 89 | 46 | 49 | 57 | 56 | 57 | 12 | 47 | 46 | 47 | 68 | 89 |
| 57 | HI1621(C) | 67 | 99 | 46 | 59 | 68 | 67 | 69 | 35 | 12 | 57 | 98 | 78 | 99 |
| 58 | HD3171 (C) | 46 | 89 | 57 | 79 | 57 | 56 | 37 | 45 | 89 | 68 | 14 | 68 | 89 |
| 59 | HD3460 | 46 | 57 | 57 | 89 | 47 | 46 | 25 | 45 | 24 | 35 | 47 | 57 | 89 |
| 60 | HD3293 (C) | 46 | 68 | 57 | 87 | 37 | 35 | 25 | 13 | 45 | 57 | 35 | 57 | 87 |
| 60A | Infector | 78 | 35 | 79 | 89 | 79 | 68 | 79 | 89 | 89 | 68 | 78 | 89 | 89 |
| 61 | HI1612 (C) | 57 | 46 | 57 | 78 | 25 | 23 | 12 | 12 | 24 | 24 | 25 | 36 | 78 |
| 62 | K1317(C)* | 57 | 57 | 57 | 89 | 78 | 78 | 24 | 13 | 79 | 13 | 89 | 68 | 89 |
| 63 | VL2041 (C) | 35 | 35 | 56 | 57 | 25 | 14 | 36 | 67 | 24 | 13 | 57 | 46 | 67 |
| 64 | HPW349 (C) | 46 | 68 | 56 | 89 | 57 | 56 | 14 | 23 | 25 | 35 | 14 | 57 | 89 |
| 65 | VL2059 | 35 | 99 | 57 | 89 | 68 | 67 | 12 | 24 | 89 | 57 | 67 | 68 | 99 |
| 66 | HS562 (C) | 46 | 47 | 57 | 99 | 58 | 56 | 37 | 23 | 23 | 35 | 14 | 57 | 99 |
| 67 | VL907 (C) | 46 | 78 | 57 | 79 | 37 | 35 | 24 | 34 | 57 | 35 | 13 | 47 | 79 |
| 68 | MACS6837 | 46 | 89 | 57 | 79 | 46 | 45 | 24 | 78 | 79 | 68 | 13 | 68 | 89 |
| 69 | MACS4125(d) | 78 | 58 | 57 | 59 | 68 | 67 | 12 | 35 | 68 | 68 | 47 | 68 | 78 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 70 | MACS4135(d) | 89 | 99 | 56 | 79 | 36 | 34 | 26 | 36 | 25 | 68 | 35 | 58 | 99 |
| 71 | HI1669 | 89 | 99 | 56 | 89 | 37 | 35 | 35 | 67 | 89 | 68 | 36 | 69 | 99 |
| 72 | HI1683 | 67 | 99 | 56 | 47 | 37 | 36 | 79 | 68 | 89 | 79 | 35 | 69 | 99 |
| 73 | HI1684 | 78 | 99 | 56 | 59 | 58 | 57 | 68 | 69 | 89 | 79 | 47 | 79 | 99 |
| 74 | HI8848(d) | 78 | 58 | 45 | 89 | 59 | 56 | 89 | 24 | 79 | 68 | 35 | 69 | 89 |
| 75 | HI8849(d) | 89 | 57 | 57 | 89 | 48 | 46 | 24 | 35 | 79 | 46 | 35 | 68 | 89 |
| 76 | HI8850(d) | 89 | 46 | 57 | 89 | 37 | 35 | 13 | 23 | 69 | 68 | 36 | 58 | 89 |
| 77 | GW554 | 89 | 79 | 56 | 59 | 46 | 45 | 78 | 68 | 79 | 79 | 57 | 79 | 89 |
| 78 | GW555 | 78 | 99 | 57 | 58 | 68 | 67 | 69 | 67 | 89 | 68 | 35 | 79 | 99 |
| 79 | MP3570 | 67 | 99 | 57 | 99 | 69 | 67 | 35 | 45 | 89 | 68 | 35 | 79 | 99 |
| 80 | MPO1395 | 67 | 89 | 57 | 57 | 47 | 45 | 24 | 69 | 89 | 46 | 47 | 68 | 89 |
| 80A | Infector | 89 | 46 | 79 | 99 | 69 | 67 | 79 | 89 | 89 | 68 | 78 | 89 | 99 |
| 81 | GW322 | 67 | 89 | 57 | 59 | 25 | 25 | 58 | 67 | 79 | 68 | 79 | 68 | 89 |
| 82 | MACS6768 | 57 | 99 | 57 | 79 | 47 | 57 | 47 | 56 | 89 | 79 | 78 | 79 | 99 |
| 83 | HI1650 | 67 | 89 | 57 | 79 | 56 | 56 | 58 | 35 | 89 | 68 | 47 | 78 | 89 |
| 84 | GW547(I) | 57 | 99 | 46 | 89 | 57 | 57 | 26 | 57 | 89 | 68 | 58 | 79 | 99 |
| 85 | HI8737(d) | 78 | 69 | 56 | 79 | 59 | 56 | 13 | 68 | 89 | 35 | 58 | 69 | 89 |
| 86 | HI8713(d) | 78 | 57 | 57 | 89 | 46 | 46 | 37 | 57 | 57 | 46 | 47 | 68 | 89 |
| 87 | HI1674 | 89 | 99 | 57 | 89 | 57 | 56 | 46 | 58 | 89 | 68 | 68 | 79 | 99 |
| 88 | HI1687 | 89 | 99 | 57 | 79 | 57 | 57 | 68 | 67 | 89 | 57 | 47 | 79 | 99 |
| 89 | WSM138 | 78 | 47 | 57 | 79 | 79 | 78 | 36 | 37 | 89 | 46 | 67 | 79 | 89 |
| 90 | MACS6830 | 57 | 46 | 57 | 79 | 69 | 67 | 24 | 67 | 89 | 79 | 89 | 79 | 89 |
| 91 | DBW425 | 67 | 46 | 67 | 78 | 59 | 56 | 79 | 67 | 89 | 46 | 25 | 69 | 89 |
| 92 | GW556 | 35 | 79 | 67 | 78 | 47 | 46 | 68 | 23 | 89 | 79 | 89 | 69 | 89 |
| 93 | HD2932* | 46 | 89 | 57 | 79 | 58 | 56 | 89 | 24 | 89 | 79 | 13 | 69 | 89 |
| 94 | HMP4010* | 35 | 99 | 47 | 79 | 57 | 57 | 47 | 34 | 89 | 79 | 25 | 68 | 99 |
| 95 | HI1634 | 46 | 99 | 47 | 79 | 68 | 68 | 69 | 45 | 89 | 68 | 47 | 79 | 99 |
| 96 | CG1029 | 46 | 99 | 46 | 79 | 58 | 57 | 37 | 46 | 89 | 68 | 67 | 69 | 99 |
| 97 | DBW441M | 46 | 57 | 46 | 59 | 68 | 68 | 13 | 57 | 89 | 68 | 34 | 68 | 89 |
| 98 | DBW428 | 46 | 46 | 46 | 57 | 56 | 56 | 24 | 35 | 89 | 46 | 13 | 57 | 89 |
| 99 | DBW432 | 35 | 69 | 57 | 57 | 57 | 57 | 13 | 36 | 89 | 57 | 14 | 58 | 89 |
| 100 | UAS3029 | 46 | 47 | 57 | 56 | 57 | 56 | 01 | 37 | 89 | 35 | 13 | 57 | 89 |
| 100A | Infector | 89 | 35 | 79 | 79 | 69 | 68 | 78 | 89 | 89 | 79 | 78 | 89 | 89 |
| 101 | UAS484(d) | 78 | 58 | 57 | 59 | 35 | 25 | 12 | 57 | 78 | 13 | 25 | 47 | 78 |
| 102 | NIAW4267 | 78 | 79 | 57 | 56 | 57 | 56 | 24 | 58 | 89 | 79 | 58 | 69 | 89 |
| 103 | HI8851(d) | 67 | 57 | 56 | 78 | 35 | 26 | 12 | 24 | 45 | 35 | 25 | 46 | 78 |
| 104 | HI8852(d) | 67 | 89 | 46 | 79 | 46 | 45 | 01 | 35 | 45 | 24 | 35 | 57 | 89 |
| 105 | MACS4131(d) | 57 | 79 | 46 | 79 | 45 | 45 | 23 | 34 | 89 | 46 | 36 | 57 | 89 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 106 | MPO1398(d) | 57 | 57 | 46 | 49 | 36 | 25 | 13 | 36 | 89 | 13 | 25 | 47 | 89 |
| 107 | DBW110 | 67 | 46 | 56 | 89 | 35 | 25 | 25 | 25 | 89 | 68 | 14 | 57 | 89 |
| 108 | CG1036 | 67 | 99 | 56 | 79 | 68 | 68 | 36 | 45 | 89 | 79 | 89 | 79 | 99 |
| 109 | HI1655* | 78 | 99 | 56 | 78 | 58 | 57 | 25 | 46 | 89 | 46 | 47 | 69 | 99 |
| 110 | HI8627(d) | 78 | 89 | 57 | 78 | 58 | 68 | 37 | 36 | 89 | 35 | 35 | 69 | 89 |
| 111 | HI8823(d) | 46 | 99 | 57 | 79 | 58 | 57 | 14 | 34 | 89 | 46 | 25 | 68 | 99 |
| 112 | DBW359(I) | 57 | 69 | 57 | 79 | 59 | 57 | 24 | 25 | 89 | 24 | 47 | 69 | 89 |
| 113 | CG1040(I) | 46 | 89 | 46 | 45 | 58 | 56 | 25 | 56 | 89 | 68 | 78 | 68 | 89 |
| 114 | MACS6842 | 46 | 99 | 46 | 57 | 59 | 57 | 12 | 45 | 89 | 57 | 25 | 68 | 99 |
| 115 | MACS6844 | 35 | 99 | 46 | 59 | 48 | 46 | 35 | 36 | 89 | 79 | 58 | 69 | 99 |
| 116 | NIAW4364 | 46 | 46 | 46 | 59 | 35 | 34 | 37 | 34 | 89 | 68 | 58 | 57 | 89 |
| 117 | PBW891 | 35 | 68 | 46 | 78 | 35 | 25 | 24 | 35 | 45 | 68 | 36 | 47 | 78 |
| 118 | DBW443* | 35 | 58 | 46 | 89 | 27 | 26 | 35 | 35 | 79 | 13 | 25 | 47 | 89 |
| 119 | DDW62(d) | 46 | 57 | 57 | 49 | 35 | 25 | 01 | 37 | 78 | 02 | 35 | 47 | 78 |
| 120 | AKAW5100** | 46 | 89 | 57 | 78 | 36 | 26 | 36 | 57 | 78 | 04 | 67 | 58 | 89 |
| 120A | Infector | 89 | 46 | 79 | 78 | 69 | 68 | 89 | 78 | 89 | 68 | 78 | 89 | 89 |
| 121 | WH1306 | 35 | 57 | 57 | 59 | 46 | 45 | 36 | 13 | 68 | 47 | 14 | 47 | 68 |
| 122 | NWS2222 | 35 | 89 | 57 | 59 | 47 | 46 | 24 | 46 | 78 | 24 | 25 | 58 | 89 |
| 123 | UAS3026 | 46 | 99 | 46 | 79 | 45 | 25 | 26 | 47 | 89 | 35 | 36 | 58 | 99 |
| 124 | CG1045 | 46 | 99 | 47 | 79 | 34 | 25 | 37 | 56 | 78 | 13 | 36 | 57 | 99 |
| 125 | MPO1395(d) | 78 | 89 | 45 | 79 | 37 | 45 | 24 | 57 | 89 | 02 | 47 | 58 | 89 |
| 126 | MACS6222 | 57 | 99 | 45 | 79 | 67 | 57 | 23 | 56 | 89 | 03 | 47 | 68 | 99 |
| 127 | MP1378(I) | 67 | 46 | 56 | 79 | 35 | 25 | 13 | 45 | 89 | 13 | 56 | 57 | 89 |
| 128 | MACS3949(d) | 67 | 47 | 56 | 79 | 36 | 26 | 24 | 45 | 89 | 13 | 13 | 47 | 89 |
| 129 | DBW426 | 78 | 89 | 57 | 46 | 35 | 26 | 26 | 57 | 89 | 02 | 25 | 57 | 89 |
| 130 | MACS6829 | 67 | 99 | 57 | 79 | 47 | 45 | 12 | 56 | 78 | 02 | 47 | 58 | 99 |
| 131 | NIAW4114* | 67 | 99 | 45 | 79 | 48 | 46 | 14 | 56 | 89 | 13 | 78 | 68 | 99 |
| 132 | NIAW4120 | 89 | 99 | 57 | 79 | 46 | 46 | 35 | 45 | 89 | 13 | 78 | 68 | 99 |
| 133 | NIAW4432 | 67 | 99 | 57 | 59 | 47 | 45 | 47 | 56 | 89 | 13 | 78 | 68 | 99 |
| 134 | UAS3027 | 45 | 99 | 57 | 79 | 46 | 45 | 58 | 56 | 89 | 13 | 78 | 68 | 99 |
| 135 | LOK79 | 46 | 99 | 57 | 79 | 48 | 35 | 37 | 35 | 89 | 13 | 57 | 58 | 99 |
| 136 | RAJ4083 (C) | 46 | 89 | 46 | 79 | 58 | 56 | 46 | 46 | 79 | 02 | 36 | 68 | 89 |
| 137 | HD3090 (C) | 47 | 99 | 46 | 99 | 37 | 36 | 35 | 47 | 79 | 24 | 47 | 58 | 99 |
| 138 | HI1633 (C) | 46 | 99 | 57 | 99 | 58 | 57 | 69 | 45 | 89 | 03 | 47 | 69 | 99 |
| 139 | CG1047 | 35 | 79 | 57 | 79 | 45 | 46 | 47 | 56 | 79 | 13 | 78 | 68 | 79 |
| 140 | GW1368(d) | 79 | 99 | 57 | 79 | 59 | 68 | 58 | 67 | 89 | 02 | 13 | 69 | 99 |
| 140A | Infector | 89 | 35 | 79 | 99 | 79 | 68 | 89 | 78 | 89 | 79 | 78 | 89 | 99 |
| 141 | HI1605 | 78 | 69 | 57 | 99 | 58 | 56 | 23 | 35 | 89 | 02 | 68 | 68 | 99 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 142 | NIAW3170 | 78 | 79 | 57 | 59 | 57 | 57 | 26 | 56 | 89 | 13 | 13 | 68 | 89 |
| 143 | UAS446(d) | 67 | 47 | 57 | 48 | 45 | 45 | 13 | 46 | 89 | 24 | 47 | 57 | 89 |
| 144 | NIDW1149(d) | 67 | 89 | 56 | 79 | 56 | 57 | 24 | 45 | 89 | 01 | 25 | 67 | 89 |
| 145 | HI1665(I) | 78 | 89 | 56 | 79 | 57 | 68 | 36 | 57 | 89 | 25 | 13 | 68 | 89 |
| 146 | UAS478(d)(I) | 78 | 57 | 56 | 69 | 58 | 45 | 35 | 56 | 79 | 24 | 13 | 58 | 79 |
| 147 | PBW 893 | 57 | 89 | 56 | 59 | 59 | 56 | 24 | 45 | 89 | 13 | 24 | 58 | 89 |

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

The disease progress may account for different resistance components like latent period, size of spots, and number of spores 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. Ayodhya**

| AUDPC | Entries |
|---|---|
| Upto 100 | Nil |
| 101 - 500 | DBW417, PBW957, DBW477, PBW725, HD3059(C), HD3428, JKW304, HP1978, HD3447, HD3388(I) (C), UP3124, KRL2106, HD3249 (C), PBW913, DBW107(C)*, WH1323, HD3460, HD3293 (C), VL2041 (C), HPW349 (C), VL2059, VL907 (C), MACS6837, GW556, HD2932*, HMP4010*, HI1634, DBW441M, DBW428, DBW432, CG1040(I), MACS6844, NIAW4364, PBW891, DBW443*, DDW62(d), WH1306, NWS2222, UAS3027, LOK79, RAJ4083 (C), CG1047 |

**B. Varanasi**

| AUDPC | Entries |
|---|---|
| Upto 100 | KRL2106 |
| 101 - 500 | HD3494, PBW916, HD2967, PBW725, JKW304, WH1402(I)(C), HP1978, PBW915, UP3124, HD3467, BCW29, PBW833(C), HD3460, HI1612 (C), VL2041 (C), WSM138, DBW425, NIAW4364, PBW891 and MP1378(I) |

**C. Sabour**

| AUDPC | Entries |
|---|---|
| Upto 100 | Nil |
| 101 - 500 | Nil |

## D. Pune

| AUDPC | Entries |
|---|---|
| Upto 100 | Nil |
| 101 - 500 | Nil |

## E. Kalyani

| AUDPC | Entries |
|---|---|
| Upto 100 | Nil |
| 101 - 500 | DBW417, PBW916, DBW386*, HD3386(I)(C), HD3495, HI1612 (C), VL2041 (C) and GW322 |

## F. Pantnagar

| AUDPC | Entries |
|---|---|
| Upto 100 | HI1668*, HD3494, PBW957, PBW916, DBW386*, PBW725, JKW261(C), NW8071, PBW644(C), PBW927, NIAW3170(C), DBW296, WH1402(I)(C), KRL2106, HI1612 (C), VL2059, MACS4125(d), HI8850(d), HI8737(d), DBW441M, UAS3029, UAS484(d), HI8851(d), HI8852(d), MPO1398(d), MACS6842, DDW62(d), MACS6222, MP1378(I), MACS6829, UAS446(d) |
| 101 - 500 | DBW417, DBW88 (C), DBW222(C)*, DBW477, HD3471, PBW826(C), DBW476, HD2967, HD3386(I)(C), PBW958, HD3455, HD3059(C), DBW173(C), WH1324, DBW422, RAJ4581, HD3428, HD3495, PBW771(C), PBW921, HI1653(C), HD3369, HD3468, WH1326, JKW304, PBW908, HP1978, HD3447, PBW915, HD3388(I) (C), UP3124, HD3249 (C), PBW913, HD3467, BCW29, UP3123, DBW107(C)*, PBW833(C), WH1323, HD3118(C), HD3171 (C), HD3460, HD3293 (C), K1317(C)*, VL2041 (C), HPW349 (C), HS562 (C), VL907 (C), MACS6837, MACS4135(d), HI1669, HI8849(d), MP3570, MPO1395, MACS6768, HI1650, GW547(I), HI8713(d), HI1674, WSM138, MACS6830, HMP4010*, CG1029, DBW428, DBW432, NIAW4267, MACS4131(d), DBW110, CG1036, HI1655*, HI8627(d), HI8823(d), DBW359(I), CG1040(I), MACS6844, NIAW4364, PBW891, DBW443*, AKAW5100*, WH1306, NWS2222, UAS3026, CG1045, MPO1395(d), MACS3949(d), DBW426, NIAW4114*, NIAW4120, NIAW4432, UAS3027, LOK79, RAJ4083 (C), HD3090 (C), CG1047, HI1605, NIAW3170, NIDW1149(d), HI1665(I), UAS478(d)(I) and PBW 893 |

## G. Ludhiana

| AUDPC | Entries |
|---|---|
| Upto 100 | Nil |
| 101 - 500 | HD3086(C), HI1668*, HD3494, DBW417, DBW88 (C), PBW957,DBW222(C)*, PBW916, PBW826(C), DBW476, HD2967, PBW725, HD3386(I)(C), PBW958, HD3455, HD3059(C), JKW261(C), NW8071, |

| | |
|---|---|
| | DBW173(C), WH1324, DBW422, HD3428, PBW644(C), PBW927, HD3468, NIAW3170(C), PBW908, HP1978, PBW915, HD3388(I)(C), UP3124, KRL2106, HD3249 (C), PBW913, HD3467, BCW29, DBW107(C)*, PBW833(C) WH1323, HD3118(C), HI1621(C), HD3460, HD3293 (C), HI1612 (C), VL2041 (C), HPW349 (C), HS562 (C), VL907 (C), MACS4135(d), HI8713(d), HI8851(d), HI8852(d),<br>PBW891 and NWS2222 |

## COORDINATORS

| NAME | LOCATION |
|---|---|
| JASPAL KAUR, RITU BALA | LUDHIANA |
| RS BENIWAL | HISAR |
| DEEP SHIKHA | PANTNAGAR |
| MS GUJAR | DELHI |
| SP SINGH, VP CHAUDHARY | AYODHYA |
| S S VAISH | VARANASI |
| CS AZAD | SABOUR |
| RAGHUNATH MANDAL | KALYANI |
| SATYAJIT HEMBRAM | COOCHBEHAR |
| SUDHIR NAVATHE | PUNE |
| GURUDATT M HADGE | DHARWAD |
| PRADEEP SHARMA, PREM LAL KASHYAP, RAVINDRA KUMAR | KARNAL (COORDINATING UNIT) |

# PROGRAMME 4. KARNAL BUNT

## 4.1 KARNAL BUNT SCREENING NURSERY (KBSN) 2023-24

Wheat entries along with checks were evaluated for resistance to Karnal bunt at multilocation (Ludhiana, New Delhi, Hisar, Pantnagar, Karnal, Jammu and Malan) during 2023-24 crop season under artificially inoculated conditions. Data from Malan was not received. To determine the response of genotypes to Karnal bunt, earheads were injected with hypodermic syringe with adequate amount of inoculum (10,000 allantoids/ml water) at crop growth stage 49. The local isolates were used at all the test centres. Five earheads were inoculated in each entry during evening hours. After inoculation, high humidity was maintained for proper development of disease. The disease incidence in the earheads was recorded at crop maturity and was calculated by reckoning the infected and the total number of grains (both diseased and healthy) of 5 earheads per entry. Entries showing response of upto 5 percent coefficient of infection (average) were rated as resistant. KB incidence of AVT entries and checks of all centres is given in Table 4.1 and average KB incidence of all centres is also given in Table 1.3. The resistant entries identified are listed below.

**AVTs 2023-24**

**Free from infection:** Nil

**Resistant (average incidence upto 5%):**
DBW417, DBW477, HD3455, DBW173(C), HD3447, HD3118(C), MACS6837, MACS4125(d), MACS4135(d), HI8848(d), MPO1395, GW322, HD2932*, DBW441M, UAS3029, UAS484(d), HI8852(d), MACS4131(d), DBW110, HI1655*, MACS6842, NIAW4364, AKAW5100*, MACS3949(d), UAS3027, HI1605, UAS446(d) and NIDW1149(d)

**Table: 4.1. Karnal bunt incidence in KBSN entries evaluated under artificially inoculated conditions at multilocation during 2023-24**

| S. No. | Entry | Karnal bunt incidence (%) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Hisar | Ludhiana | Karnal | Delhi | Pantnagar | Jammu | HS | ACI |
| 1 | HD3086(C) | 8.1 | 8.0 | 11.9 | 39.5 | 2.0 | 7.1 | 39.5 | 12.8 |
| 2 | HI1668* | 5.3 | 8.0 | 11.3 | 18.4 | 0.0 | 5.0 | 18.4 | 8.0 |
| 3 | HD3494 | 6.6 | 2.3 | 11.0 | 19.0 | 1.5 | 3.3 | 19.0 | 7.3 |
| 4 | DBW417 | 6.5 | 1.1 | 0.0 | 13.1 | 0.7 | 7.5 | 13.1 | 4.8 |
| 5 | DBW88 (C) | 8.3 | 0.0 | 7.4 | 62.0 | 1.5 | 4.1 | 62.0 | 13.9 |
| 6 | PBW957 | 9.6 | 5.3 | 2.3 | 48.7 | 0.3 | 5.1 | 48.7 | 11.9 |
| 7 | DBW222(C)* | 8.4 | 3.8 | 9.5 | 4.2 | 1.2 | 4.3 | 9.5 | 5.2 |
| 8 | DBW477 | 11.2 | 3.7 | 4.6 | 9.3 | 0.1 | 0.3 | 11.2 | 4.9 |
| 9 | HD3471 | 12.4 | 6.7 | 13.3 | 47.7 | 0.0 | 1.3 | 47.7 | 13.6 |
| 10 | PBW916 | 11.9 | 6.0 | 14.0 | 23.6 | 0.0 | 4.3 | 23.6 | 10.0 |
| 11 | DBW386* | 5.6 | 2.1 | 5.5 | 18.0 | 1.4 | 6.1 | 18.0 | 6.4 |
| 12 | PBW826(C) | 5.4 | 5.1 | 2.3 | 36.8 | 2.0 | 0.0 | 36.8 | 8.6 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 13 | DBW476 | 6.3 | 2.2 | 9.5 | 39.0 | 2.1 | 0.0 | 39.0 | 9.8 |
| 14 | HD2967 | 8.7 | 37.0 | 5.1 | 19.3 | 1.0 | 1.3 | 37.0 | 12.1 |
| 15 | PBW725 | 9.4 | 6.5 | 5.5 | 35.9 | 0.0 | 0.0 | 35.9 | 9.5 |
| 16 | HD3386(I)(C) | 5.8 | 5.6 | 9.8 | 36.6 | 1.3 | 0.0 | 36.6 | 9.8 |
| 17 | PBW958 | 6.2 | 1.1 | 7.8 | 50.6 | 3.0 | 0.0 | 50.6 | 11.5 |
| 18 | HD3455 | 5.3 | 0.0 | 0.0 | 22.0 | 2.1 | 0.0 | 22.0 | 4.9 |
| 19 | HD3059(C) | 6.6 | 41.7 | 3.6 | 32.5 | 0.1 | 2.3 | 41.7 | 14.5 |
| 20 | JKW261(C) | 7.3 | 10.8 | 0.0 | 28.2 | 0.2 | 3.3 | 28.2 | 8.3 |
| 20A | Infector | 16.6 | 21.3 | 36.2 | 35.5 | 4.1 | 17.6 | 36.2 | 21.9 |
| 21 | NW8071 | 6.3 | 0.0 | 6.2 | 28.5 | 0.0 | 8.4 | 28.5 | 8.2 |
| 22 | DBW173(C) | 6.5 | 3.7 | 2.0 | 6.6 | 0.0 | 0.0 | 6.6 | 3.1 |
| 23 | WH1324 | 7.1 | 11.0 | 18.4 | 40.0 | 1.2 | 2.5 | 40.0 | 13.4 |
| 24 | DBW422 | 9.3 | 13.8 | 6.7 | 34.9 | 1.1 | 7.1 | 34.9 | 12.1 |
| 25 | RAJ4581 | 11.5 | 26.4 | 15.2 | 82.1 | 2.2 | 8.6 | 82.1 | 24.3 |
| 26 | HD3428 | 8.2 | 4.6 | 15.1 | 27.3 | 3.1 | 6.1 | 27.3 | 10.7 |
| 27 | HD3495 | 9.7 | 8.2 | 6.2 | 31.1 | 0.4 | 0.0 | 31.1 | 9.3 |
| 28 | PBW771(C) | 11.8 | 0.0 | 12.8 | 84.6 | 0.1 | 6.4 | 84.6 | 19.3 |
| 29 | PBW921 | 12.1 | 4.5 | 15.5 | 12.5 | 1.9 | 6.3 | 15.5 | 8.8 |
| 30 | PBW644(C) | 6.7 | 4.5 | 5.7 | 2.8 | 2.1 | 12.3 | 12.3 | 5.7 |
| 31 | HI1653(C) | 8.4 | 10.3 | 10.6 | 22.4 | 2.4 | 4.4 | 22.4 | 9.7 |
| 32 | PBW927 | 6.9 | 2.5 | 24.1 | 62.7 | 1.1 | 7.1 | 62.7 | 17.4 |
| 33 | HD3369 | 9.1 | 0.0 | 7.9 | 20.9 | 2.1 | 0.0 | 20.9 | 6.7 |
| 34 | HD3468 | 8.6 | 5.3 | 16.1 | 71.1 | 1.0 | 7.6 | 71.1 | 18.3 |
| 35 | NIAW3170(C) | 11.4 | 0.0 | 0.0 | 22.6 | 0.8 | 3.3 | 22.6 | 6.4 |
| 36 | WH1326 | 11.7 | 11.1 | 9.0 | 40.8 | 0.9 | 4.1 | 40.8 | 12.9 |
| 37 | DBW296 | 12.2 | 3.0 | 0.0 | 66.7 | 2.1 | 3.3 | 66.7 | 14.5 |
| 38 | JKW304 | 8.5 | 0.0 | 0.0 | 53.0 | 0.0 | 7.6 | 53.0 | 11.5 |
| 39 | WH1402(I)(C) | 9.6 | 0.0 | 0.0 | 20.9 | 2.5 | 5.1 | 20.9 | 6.4 |
| 40 | PBW908 | 10.2 | 5.2 | 0.0 | 27.9 | 0.0 | 4.5 | 27.9 | 8.0 |
| 40A | Infector | 10.4 | 25.6 | 41.1 | 40.0 | 5.0 | 18.4 | 41.1 | 23.4 |
| 41 | HP1978 | 6.7 | 1.2 | 3.2 | 39.5 | 1.8 | 0.0 | 39.5 | 8.7 |
| 42 | HD3447 | 7.4 | 3.2 | 0.0 | 1.1 | 3.2 | 2.5 | 7.4 | 2.9 |
| 43 | PBW915 | 6.2 | 10.0 | 18.5 | 50.3 | 1.5 | 6.6 | 50.3 | 15.5 |
| 44 | HD3388(I) (C) | 4.9 | 29.2 | 3.0 | 52.0 | 1.7 | 6.6 | 52.0 | 16.2 |
| 45 | UP3124 | 7.8 | 30.0 | 9.1 | 6.6 | 3.0 | 3.3 | 30.0 | 10.0 |
| 46 | KRL2106 | 8.3 | 0.0 | 0.0 | 28.1 | 4.3 | 5.1 | 28.1 | 7.6 |
| 47 | HD3249 (C) | 3.6 | 0.0 | 7.9 | 22.9 | 3.1 | 0.0 | 22.9 | 6.3 |
| 48 | PBW913 | 3.2 | 13.6 | 9.8 | 49.1 | 2.9 | 5.5 | 49.1 | 14.0 |
| 49 | HD3467 | 5.8 | 16.7 | 1.7 | 38.4 | 1.0 | 2.5 | 38.4 | 11.0 |
| 50 | BCW29 | 6.1 | 0.0 | 2.0 | 47.9 | 1.5 | 0.0 | 47.9 | 9.6 |
| 51 | UP3123 | 8.2 | 6.8 | 5.8 | 30.6 | 0.5 | 8.2 | 30.6 | 10.0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 52 | HI1563 (C) | 6.7 | 15.4 | 14.0 | 19.5 | 1.6 | 8.6 | 19.5 | 11.0 |
| 53 | DBW107(C)* | 9.2 | 2.8 | 2.4 | 32.6 | 1.4 | 7.7 | 32.6 | 9.3 |
| 54 | PBW833(C) | 11.3 | 2.3 | 14.2 | 98.8 | 1.0 | 13.3 | 98.8 | 23.5 |
| 55 | WH1323 | 13.1 | 3.0 | 0.0 | 6.2 | 1.4 | 13.3 | 13.3 | 6.2 |
| 56 | HD3118(C) | 10.6 | 0.0 | 0.0 | 10.2 | 0.8 | 6.2 | 10.6 | 4.6 |
| 57 | HI1621(C) | 12.2 | 0.0 | 0.0 | 28.2 | 1.1 | 1.3 | 28.2 | 7.1 |
| 58 | HD3171 (C) | 13.7 | 0.0 | 5.4 | 10.7 | 1.3 | 0.0 | 13.7 | 5.2 |
| 59 | HD3460 | 13.8 | 11.2 | 1.7 | 53.3 | 2.4 | 0.0 | 53.3 | 13.7 |
| 60 | HD3293 (C) | 11.6 | 0.0 | 1.7 | 79.1 | 0.6 | 3.3 | 79.1 | 16.0 |
| 60A | Infector | 18.1 | 20.0 | 45.6 | 30.5 | 5.4 | 21.2 | 45.6 | 23.5 |
| 61 | HI1612 (C) | 12.4 | 0.0 | 6.1 | 29.2 | 0.0 | 8.2 | 29.2 | 9.3 |
| 62 | K1317(C)* | 11.7 | 8.0 | 4.7 | 46.4 | 2.9 | 10.5 | 46.4 | 14.0 |
| 63 | VL2041 (C) | 14.1 | 10.0 | 0.6 | 3.1 | 2.0 | 5.1 | 14.1 | 5.8 |
| 64 | HPW349 (C) | 5.7 | 0.0 | 0.0 | 89.6 | 1.4 | 7.7 | 89.6 | 17.4 |
| 65 | VL2059 | 4.4 | 34.7 | 0.0 | 15.6 | 1.1 | 0.0 | 34.7 | 9.3 |
| 66 | HS562 (C) | 8.2 | 0.0 | 1.1 | 40.8 | 1.1 | 7.1 | 40.8 | 9.7 |
| 67 | VL907 (C) | 10.9 | 0.0 | 2.2 | 35.8 | 1.6 | 8.6 | 35.8 | 9.8 |
| 68 | MACS6837 | 8.6 | 0.0 | 0.0 | 13.4 | 2.1 | 3.3 | 13.4 | 4.6 |
| 69 | MACS4125(d) | 9.3 | 2.2 | 3.7 | 0.0 | 3.0 | 4.5 | 9.3 | 3.8 |
| 70 | MACS4135(d) | 6.8 | 0.0 | 0.0 | 0.0 | 1.6 | 1.3 | 6.8 | 1.6 |
| 71 | HI1669 | 5.2 | 11.3 | 4.0 | 30.2 | 3.1 | 4.6 | 30.2 | 9.7 |
| 72 | HI1683 | 6.4 | 0.0 | 3.2 | 43.9 | 0.7 | 2.1 | 43.9 | 9.4 |
| 73 | HI1684 | 6.6 | 26.3 | 2.1 | 27.5 | 0.0 | 5.3 | 27.5 | 11.3 |
| 74 | HI8848(d) | 8.3 | 0.0 | 3.3 | 11.5 | 1.5 | 0.0 | 11.5 | 4.1 |
| 75 | HI8849(d) | 9.5 | 3.8 | 9.1 | 48.6 | 1.1 | 0.0 | 48.6 | 12.0 |
| 76 | HI8850(d) | 2.7 | 0.0 | 0.0 | 36.7 | 2.9 | 3.3 | 36.7 | 7.6 |
| 77 | GW554 | 2.4 | 0.0 | 1.3 | 31.7 | 0.7 | 2.5 | 31.7 | 6.4 |
| 78 | GW555 | 2.3 | 40.0 | 0.0 | 43.5 | 0.0 | 0.0 | 43.5 | 14.3 |
| 79 | MP3570 | 9.3 | 10.0 | 3.5 | 15.7 | 2.0 | 1.3 | 15.7 | 7.0 |
| 80 | MPO1395 | 10.3 | 0.0 | 1.4 | 0.0 | 0.0 | 6.4 | 10.3 | 3.0 |
| 80A | Infector | 18.3 | 19.6 | 54.2 | 31.5 | 4.9 | 18.6 | 54.2 | 24.5 |
| 81 | GW322 | 11.6 | 0.0 | 0.0 | 8.9 | 2.5 | 0.0 | 11.6 | 3.8 |
| 82 | MACS6768 | 6.7 | 11.3 | 0.0 | 72.5 | 1.7 | 2.2 | 72.5 | 15.7 |
| 83 | HI1650 | 9.3 | 8.3 | 1.4 | 30.4 | 3.0 | 4.1 | 30.4 | 9.4 |
| 84 | GW547(I) | 8.6 | 2.5 | 0.0 | 58.8 | 1.9 | 5.6 | 58.8 | 12.9 |
| 85 | HI8737(d) | 11.2 | 3.3 | 5.1 | 7.3 | 0.0 | 4.8 | 11.2 | 5.3 |
| 86 | HI8713(d) | 12.6 | 7.1 | 9.7 | 1.7 | 0.2 | 3.3 | 12.6 | 5.8 |
| 87 | HI1674 | 8.4 | 3.3 | 4.0 | 25.8 | 1.7 | 0.0 | 25.8 | 7.2 |
| 88 | HI1687 | 9.3 | 13.3 | 0.0 | 20.9 | 2.1 | 0.0 | 20.9 | 7.6 |
| 89 | WSM138 | 8.7 | 3.3 | 4.0 | 76.1 | 1.1 | 1.3 | 76.1 | 15.7 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 90 | MACS6830 | 11.6 | 5.0 | 41.3 | 30.0 | 0.9 | 4.1 | 41.3 | 15.5 |
| 91 | DBW425 | 12.8 | 12.9 | 0.0 | 9.2 | 1.8 | 8.2 | 12.9 | 7.5 |
| 92 | GW556 | 8.3 | 2.2 | 0.0 | 44.1 | 0.9 | 7.1 | 44.1 | 10.4 |
| 93 | HD2932* | 11.8 | 0.0 | 0.0 | 4.3 | 0.6 | 5.1 | 11.8 | 3.6 |
| 94 | HMP4010* | 12.4 | 0.0 | 0.0 | 38.6 | 2.9 | 4.1 | 38.6 | 9.7 |
| 95 | HI1634 | 7.3 | 20.0 | 0.0 | 39.1 | 2.7 | 4.0 | 39.1 | 12.2 |
| 96 | CG1029 | 14.1 | 8.3 | 0.0 | 6.6 | 1.4 | 4.1 | 14.1 | 5.8 |
| 97 | DBW441M | 13.7 | 0.0 | 0.0 | 3.7 | 2.1 | 2.3 | 13.7 | 3.6 |
| 98 | DBW428 | 5.3 | 0.0 | 0.0 | 24.4 | 0.0 | 2.5 | 24.4 | 5.4 |
| 99 | DBW432 | 6.8 | 0.0 | 0.0 | 23.2 | 0.0 | 7.8 | 23.2 | 6.3 |
| 100 | UAS3029 | 9.6 | 1.9 | 0.0 | 10.5 | 3.3 | 1.3 | 10.5 | 4.4 |
| 100A | Infector | 18.2 | 20.8 | 39.9 | 28.0 | 5.0 | 20.1 | 39.9 | 22.0 |
| 101 | UAS484(d) | 12.5 | 2.0 | 0.0 | 3.5 | 2.1 | 0.0 | 12.5 | 3.3 |
| 102 | NIAW4267 | 11.1 | 0.0 | 4.2 | 24.4 | 2.1 | 0.0 | 24.4 | 7.0 |
| 103 | HI8851(d) | 10.9 | 0.0 | 0.0 | 24.5 | 0.0 | 4.1 | 24.5 | 6.6 |
| 104 | HI8852(d) | 8.2 | 0.0 | 0.0 | 5.5 | 1.5 | 8.2 | 8.2 | 3.9 |
| 105 | MACS4131(d) | 6.5 | 6.7 | 0.0 | 7.8 | 1.7 | 4.3 | 7.8 | 4.5 |
| 106 | MPO1398(d) | 6.3 | 5.0 | 11.9 | 5.6 | 2.0 | 4.3 | 11.9 | 5.8 |
| 107 | DBW110 | 6.4 | 8.0 | 0.0 | 10.5 | 1.1 | 0.0 | 10.5 | 4.3 |
| 108 | CG1036 | 3.2 | 0.0 | 0.0 | 32.7 | 1.6 | 4.1 | 32.7 | 6.9 |
| 109 | HI1655* | 3.4 | 0.0 | 0.0 | 18.9 | 1.3 | 0.0 | 18.9 | 3.9 |
| 110 | HI8627(d) | 3.9 | 6.0 | 14.8 | 89.6 | 2.6 | 0.0 | 89.6 | 19.5 |
| 111 | HI8823(d) | 3.1 | 0.0 | 16.1 | 6.3 | 2.1 | 8.2 | 16.1 | 6.0 |
| 112 | DBW359(I) | 5.7 | 0.0 | 2.9 | 40.5 | 1.3 | 6.2 | 40.5 | 9.4 |
| 113 | CG1040(I) | 3.3 | 11.9 | 0.0 | 29.2 | 0.2 | 10.5 | 29.2 | 9.2 |
| 114 | MACS6842 | 1.1 | 0.0 | 1.3 | 18.8 | 0.7 | 2.1 | 18.8 | 4.0 |
| 115 | MACS6844 | 1.5 | 0.0 | 5.5 | 52.6 | 1.0 | 0.0 | 52.6 | 10.1 |
| 116 | NIAW4364 | 5.7 | 0.0 | 0.0 | 14.7 | 1.9 | 2.1 | 14.7 | 4.1 |
| 117 | PBW891 | 6.2 | 7.1 | 3.3 | 50.9 | 0.0 | 0.0 | 50.9 | 11.2 |
| 118 | DBW443* | 8.3 | 7.5 | 0.0 | 50.0 | 0.3 | 8.2 | 50.0 | 12.4 |
| 119 | DDW62(d) | 5.6 | 0.0 | 3.6 | 21.8 | 2.2 | 0.0 | 21.8 | 5.5 |
| 120 | AKAW5100** | 5.1 | 2.5 | 0.0 | 13.0 | 3.2 | 0.0 | 13.0 | 4.0 |
| 120A | Infector | 21.3 | 23.9 | 47.9 | 25.5 | 4.9 | 19.6 | 47.9 | 23.9 |
| 121 | WH1306 | 9.3 | 0.0 | 8.6 | 29.1 | 1.1 | 0.0 | 29.1 | 8.0 |
| 122 | NWS2222 | 8.6 | 8.3 | 8.5 | 19.9 | 1.3 | 3.3 | 19.9 | 8.3 |
| 123 | UAS3026 | 12.5 | 10.8 | 0.0 | 28.6 | 2.0 | 8.1 | 28.6 | 10.3 |
| 124 | CG1045 | 11.4 | 33.0 | 11.3 | 30.8 | 0.0 | 0.0 | 33.0 | 14.4 |
| 125 | MPO1395(d) | 10.3 | 6.4 | 2.3 | 37.6 | 3.7 | 7.3 | 37.6 | 11.3 |
| 126 | MACS6222 | 8.9 | 0.0 | 5.2 | 41.3 | 2.0 | 4.1 | 41.3 | 10.3 |
| 127 | MP1378(I) | 11.1 | 0.0 | 3.4 | 47.4 | 2.1 | 5.1 | 47.4 | 11.5 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 128 | MACS3949(d) | 8.3 | 0.0 | 0.0 | 0.0 | 1.1 | 5.1 | 8.3 | 2.4 |
| 129 | DBW426 | 9.1 | 0.0 | 5.8 | 13.7 | 0.0 | 8.1 | 13.7 | 6.1 |
| 130 | MACS6829 | 8.3 | 6.7 | 31.9 | 8.2 | 0.0 | 7.5 | 31.9 | 10.4 |
| 131 | NIAW4114* | 6.3 | 60.7 | 13.9 | 12.4 | 0.6 | 5.2 | 60.7 | 16.5 |
| 132 | NIAW4120 | 7.5 | 10.0 | 8.1 | 88.2 | 1.8 | 3.4 | 88.2 | 19.8 |
| 133 | NIAW4432 | 11.5 | 11.1 | 3.4 | 3.4 | 1.9 | 0.0 | 11.5 | 5.2 |
| 134 | UAS3027 | 12.5 | 0.0 | 0.0 | 2.7 | 0.6 | 8.4 | 12.5 | 4.0 |
| 135 | LOK79 | 5.6 | 13.3 | 11.4 | 65.5 | 1.1 | 7.4 | 65.5 | 17.4 |
| 136 | RAJ4083 (C) | 8.7 | 0.0 | 5.3 | 28.3 | 1.1 | 1.3 | 28.3 | 7.5 |
| 137 | HD3090 (C) | 7.2 | 21.0 | 5.4 | 91.3 | 1.9 | 0.0 | 91.3 | 21.1 |
| 138 | HI1633 (C) | 9.2 | 11.8 | 4.9 | 44.0 | 1.2 | 1.3 | 44.0 | 12.1 |
| 139 | CG1047 | 10.2 | 7.4 | 0.0 | 21.6 | 0.5 | 0.0 | 21.6 | 6.6 |
| 140 | GW1368(d) | 8.6 | 0.0 | 0.0 | 25.9 | 0.3 | 0.0 | 25.9 | 5.8 |
| 140A | Infector | 24.0 | 19.2 | 54.0 | 41.2 | 4.7 | 19.3 | 54.0 | 27.1 |
| 141 | HI1605 | 9.3 | 4.6 | 0.0 | 7.6 | 2.3 | 0.0 | 9.3 | 4.0 |
| 142 | NIAW3170 | 8.4 | 0.0 | 2.9 | 17.3 | 2.1 | 2.5 | 17.3 | 5.5 |
| 143 | UAS446(d) | 3.6 | 0.0 | 0.0 | 10.4 | 0.8 | 2.5 | 10.4 | 2.9 |
| 144 | NIDW1149(d) | 4.2 | 0.0 | 6.0 | 9.7 | 1.1 | 3.6 | 9.7 | 4.1 |
| 145 | HI1665(I) | 6.1 | 0.0 | 31.0 | 72.0 | 0.4 | 0.0 | 72.0 | 18.3 |
| 146 | UAS478(d)(I) | 6.7 | 26.0 | 0.0 | 4.8 | 1.2 | 0.3 | 26.0 | 6.5 |
| 147 | HS 691 | 8.6 | 0.0 | 9.1 | 20.1 | 0.4 | 0.3 | 20.1 | 6.4 |

## COOPERATORS

| NAME | CENTRE |
|---|---|
| RITU BALA | LUDHIANA |
| DEEPSHIKHA | PANT NAGAR |
| M.S. SAHARAN | DELHI |
| R. S. BENIWAL | HISAR |
| M. K. PANDEY | JAMMU |
| PRADEEP SHARMA, PREM LAL KASHYAP, & RAVINDRA KUMAR | KARNAL (COORDINATING UNIT) |

## PROGRAMME 5. LOOSE SMUT

### 5.1 Evaluation of AVT material (2022-23) 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 (2022-23), were inoculated with local isolates of loose smut pathogen using 'Go go' method at hot spot locations like Almora, Hisar, Durgapura and Ludhiana. The inoculated seeds were sown again during 2023-24 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, 2022-23

**Free (No infection at any location):** Nil

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

**Table: 5.1. Percent Loose Smut infection in the entries of AVTs of year 2022-23 expressed during 2023-24 crop season**

| S. No. | Entry Name | Loose smut incidence (%) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Almora | Hisar | Durgapura | Ludhiana | HS | AV |
| 1 | HS691 | 0.0 | 21.1 | 0.5 | 0.0 | 21.1 | 5.4 |
| 2 | HS692 | 34.7 | 33.3 | 14.4 | 2.5 | 34.7 | 21.2 |
| 3 | VL3028 | 32.7 | 64.3 | 5.7 | 1.9 | 64.3 | 26.1 |
| 4 | HPW484 | 67.8 | 46.6 | 28.6 | 1.5 | 67.8 | 36.1 |
| 5 | VL907(C) | 37.0 | 65.0 | 1.9 | 0.0 | 65.0 | 26.0 |
| 6 | VL892(C) | 26.4 | 55.0 | 16.6 | 6.8 | 55.0 | 26.2 |
| 7 | HPW349(C) | 51.0 | 63.3 | 18.8 | 5.3 | 63.3 | 34.6 |
| 8 | HS562(C) | 32.6 | 48.1 | 8.5 | 3.3 | 48.1 | 23.1 |
| 9 | VL2041(I)(C) | 25.0 | 52.5 | 14.2 | 7.8 | 52.5 | 24.9 |
| 10 | PBW887 | 45.6 | 66.6 | 6.7 | 1.3 | 66.6 | 30.1 |
| 11 | PBW889 | 43.8 | 65.0 | 4.3 | 0.0 | 65.0 | 28.3 |
| 12 | HD3386 | 51.4 | 72.2 | 3.6 | 0.0 | 72.2 | 31.8 |
| 13 | HD3470 | 59.1 | 61.1 | 2.9 | 11.6 | 61.1 | 33.7 |
| 14 | HI1668 | 70.4 | 83.3 | 5.6 | 11.1 | 83.3 | 42.6 |
| 15 | DBW386 | 46.7 | 65.0 | 4.1 | 10.5 | 65.0 | 31.6 |
| 16 | UP3102 | 64.0 | 85.0 | 10.5 | 8.6 | 85.0 | 42.0 |
| 17 | HD3428 | 7.3 | 43.3 | 4.5 | 3.2 | 43.3 | 14.6 |
| 18 | PBW893 | 14.2 | 55.0 | 0.0 | 6.1 | 55.0 | 18.8 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 19 | K2108 | 55.3 | 86.6 | 24.3 | 21.8 | 86.6 | 47.0 |
| 20 | HD3059(C) | 43.4 | 66.6 | 14.6 | 5.7 | 66.6 | 32.6 |
| 20A | Infector (Solanika) | 42.4 | 86.6 | 44.8 | 24.1 | 86.6 | 49.5 |
| 21 | DBW173(C) | 49.7 | 64.0 | 5.6 | 0.0 | 64.0 | 29.8 |
| 22 | PBW771(C) | 45.2 | 15.0 | 40.9 | 0.0 | 45.2 | 25.3 |
| 23 | JKW261(C) | 45.2 | 81.1 | 13.2 | 42.2 | 81.1 | 45.4 |
| 24 | WH1402 | 44.3 | 83.3 | 12.7 | Miss | 83.3 | 46.8 |
| 25 | WH1311 | 56.5 | 42.7 | 29.4 | Miss | 56.5 | 42.9 |
| 26 | UP3111 | 57.8 | 85.0 | 18.1 | 0.0 | 85.0 | 40.2 |
| 27 | PBW899 | 66.2 | 65.0 | 23.3 | 3.3 | 66.2 | 39.4 |
| 28 | PBW644(C) | 29.0 | 73.3 | 0.0 | 0.0 | 73.3 | 25.6 |
| 29 | DBW296(C) | 38.8 | 46.6 | 19.1 | 0.0 | 46.6 | 26.1 |
| 30 | HD3369(I)(C) | 33.0 | 35.0 | 17.4 | 3.6 | 35.0 | 22.3 |
| 31 | HI1653(I)(C) | 25.6 | 45.0 | 23.9 | 2.5 | 45.0 | 24.2 |
| 32 | HI1654(I)(C) | 59.9 | 48.0 | 27.6 | 6.7 | 59.9 | 35.5 |
| 33 | HD3388 | 54.5 | 33.3 | 33.5 | 0.0 | 54.5 | 30.3 |
| 34 | HD3471 | 0.0 | 46.4 | 0.0 | 0.0 | 46.4 | 11.6 |
| 35 | HD3249(C) | 40.4 | 55.0 | 7.9 | 0.0 | 55.0 | 25.8 |
| 36 | HD3086(C) | 60.5 | 45.0 | 23.6 | 6.4 | 60.5 | 33.9 |
| 37 | HD2967(C) | 15.2 | 56.6 | 6.1 | 4.0 | 56.6 | 20.5 |
| 38 | DBW222(C) | 70.8 | 53.3 | 42.2 | 3.3 | 70.8 | 42.4 |
| 39 | PBW826(I)(C) | 46.2 | 62.5 | 16.2 | 14.0 | 62.5 | 34.7 |
| 40 | DBW398 | 0.0 | 46.6 | 11.6 | 0.0 | 46.6 | 14.5 |
| 40A | Infector (Solanika) | 35.9 | 86.0 | 38.1 | 22.5 | 86.0 | 45.6 |
| 41 | HI1612(C) | 26.5 | 45.0 | 10.1 | 0.0 | 45.0 | 20.4 |
| 42 | K1317(C) | 69.8 | 55.0 | 24.3 | 0.0 | 69.8 | 37.3 |
| 43 | HD3171(C) | 75.7 | 66.6 | 36.5 | 14.0 | 75.7 | 48.2 |
| 44 | HD3293(C) | 6.1 | 62.5 | 44.9 | 10.0 | 62.5 | 30.9 |
| 45 | DBW252(C) | 78.4 | 81.1 | 28.8 | 8.7 | 81.1 | 49.3 |
| 46 | NWS2194 | 24.2 | 82.5 | 10.7 | 25.0 | 82.5 | 35.6 |
| 47 | HI1669 | 49.7 | 87.3 | 30.1 | 0.0 | 87.3 | 41.8 |
| 48 | HI1670 | 96.3 | 93.3 | 16.3 | 21.0 | 96.3 | 56.7 |
| 49 | GW547 | 67.2 | 45.0 | 8.8 | 13.2 | 67.2 | 33.5 |
| 50 | GW513(C) | 57.7 | 62.5 | 48.7 | 5.4 | 62.5 | 43.6 |
| 51 | HI1636 (C) | 31.0 | 83.3 | 26.0 | 3.3 | 83.3 | 35.9 |
| 52 | HI1650(I)(C) | 54.8 | 86.6 | 10.0 | 7.5 | 86.6 | 39.7 |
| 53 | MACS6768(I)(C) | 16.8 | 65.0 | 18.2 | 15.4 | 65.0 | 28.8 |
| 54 | HI1674 | 23.9 | 66.6 | 24.0 | 2.4 | 66.6 | 29.2 |
| 55 | AKAW5104 | 57.2 | 84.0 | 14.7 | 2.6 | 84.0 | 39.6 |
| 56 | HD2932(C) | 29.6 | 65.0 | 18.0 | 9.0 | 65.0 | 30.4 |
| 57 | MP4010(C) | 46.1 | 63.3 | 11.9 | 23.0 | 63.3 | 36.1 |
| 58 | HI1634(C) | 53.2 | 83.3 | 41.6 | 8.2 | 83.3 | 46.6 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 59 | CG1029(C) | 40.8 | 86.6 | 4.5 | 5.6 | 86.6 | 34.4 |
| 60 | DBW359 | 53.8 | 26.6 | 22.4 | 5.4 | 53.8 | 27.0 |
| 60A | Infector (Solanika) | 31.3 | 84.0 | 42.6 | 23.5 | 84.0 | 45.3 |
| 61 | DBW441 | 45.8 | 62.5 | 5.1 | 31.0 | 62.5 | 36.1 |
| 62 | DBW442 | 49.0 | 83.3 | 14.5 | 7.3 | 83.3 | 38.5 |
| 63 | CG1040 | 67.4 | 80.0 | 15.3 | 7.4 | 80.0 | 42.5 |
| 64 | MP3288(C) | 57.9 | 67.0 | 25.3 | 19.1 | 67.0 | 42.3 |
| 65 | DBW110(C) | 42.0 | 42.7 | 20.3 | 36.6 | 42.7 | 35.4 |
| 66 | CG1036(I)(C) | 56.6 | 35.0 | 3.5 | 3.4 | 56.6 | 24.6 |
| 67 | HI1655(I)(C) | 35.2 | 33.3 | 3.6 | 10.7 | 35.2 | 20.7 |
| 68 | UAS3020 | 0.0 | 55.0 | 0.0 | 0.0 | 55.0 | 13.8 |
| 69 | UAS3021 | 0.0 | 65.0 | 0.0 | 1.2 | 65.0 | 16.6 |
| 70 | MACS6811 | 42.6 | 75.0 | 34.4 | 4.6 | 75.0 | 39.1 |
| 71 | MACS6809 | 8.7 | 65.0 | 2.3 | 31.7 | 65.0 | 26.9 |
| 72 | NIAW4183 | 16.7 | 45.0 | 26.3 | 0.0 | 45.0 | 22.0 |
| 73 | NIAW4153 | 28.2 | 35.0 | 7.3 | 3.5 | 35.0 | 18.5 |
| 74 | AKAW5314 | 73.2 | 65.0 | 21.2 | 15.9 | 73.2 | 43.8 |
| 75 | AKAW5100 | 59.3 | 66.6 | 22.8 | 6.3 | 66.6 | 38.7 |
| 76 | MP1378 | 28.1 | 45.0 | 0.0 | 5.3 | 45.0 | 19.6 |
| 77 | MP1386 | 78.0 | 63.0 | 15.3 | 26.0 | 78.0 | 45.6 |
| 78 | DBW443 | 56.3 | 88.0 | 7.8 | 6.0 | 88.0 | 39.5 |
| 79 | DBW444 | 20.4 | 65.0 | 22.9 | 4.0 | 65.0 | 28.1 |
| 80 | HD3469 | 12.1 | 83.3 | 4.1 | 13.3 | 83.3 | 28.2 |
| 80A | Infector (Solanika) | 34.7 | 84.0 | 42.8 | 23.0 | 84.0 | 46.1 |
| 81 | NWS2222 | 55.8 | 85.0 | 17.8 | 0.0 | 85.0 | 39.7 |
| 82 | PWU15 | 42.3 | 65.0 | 15.6 | 9.8 | 65.0 | 33.2 |
| 83 | WH1306 | 82.8 | 75.0 | 78.5 | 27.4 | 82.8 | 65.9 |
| 84 | PBW891 | 32.1 | 76.0 | 8.0 | 0.0 | 76.0 | 29.0 |
| 85 | HI8841(d) | 51.8 | 60.0 | 13.8 | 15.0 | 60.0 | 35.1 |
| 86 | UP3083 | 41.1 | 63.3 | 15.9 | 10.9 | 63.3 | 32.8 |
| 87 | MACS3949(d)(C) | 27.8 | 65.0 | 12.6 | 3.2 | 65.0 | 27.2 |
| 88 | HI8826(d)(I)(C) | 23.7 | 62.5 | 16.7 | 6.8 | 62.5 | 27.4 |
| 89 | MACS4100(d)(I)(C) | 60.0 | 46.6 | 6.7 | 17.1 | 60.0 | 32.6 |
| 90 | MACS6222 (C) | 67.9 | 56.2 | 46.1 | 0.0 | 67.9 | 42.6 |
| 91 | HI1672 | 87.9 | 62.5 | 31.0 | 1.6 | 87.9 | 45.7 |
| 92 | HI1673 | 82.2 | 44.0 | 6.4 | 8.1 | 82.2 | 35.2 |
| 93 | HI1675 | 22.1 | 56.0 | 1.4 | 10.5 | 56.0 | 22.5 |
| 94 | DBW394 | 63.8 | 65.0 | 40.8 | 1.0 | 65.0 | 42.7 |
| 95 | DBW395 | 48.8 | 86.6 | 18.9 | 23.2 | 86.6 | 44.4 |
| 96 | MACS6814 | 44.9 | 45.0 | 15.2 | 0.0 | 45.0 | 26.3 |
| 97 | MACS6805 | 27.5 | 55.0 | 38.3 | 0.0 | 55.0 | 30.2 |
| 98 | NIAW4114 | 62.5 | 66.6 | 16.3 | 0.0 | 66.6 | 36.3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 99 | NIAW4120 | 36.1 | 65.0 | 30.3 | 0.0 | 65.0 | 32.8 |
| 100 | UAS3022 | 27.6 | 83.3 | 30.3 | 7.3 | 83.3 | 37.1 |
| 100A | Infector (Solanika) | 40.1 | 85.0 | 44.3 | 17.1 | 85.0 | 46.6 |
| 101 | UAS3023 | 48.5 | 33.3 | 28.2 | 8.1 | 48.5 | 29.5 |
| 102 | MP3557 | 71.1 | 55.0 | 29.9 | 0.0 | 71.1 | 39.0 |
| 103 | MP3556 | 32.6 | 83.3 | 11.9 | 0.0 | 83.3 | 32.0 |
| 104 | PBW897 | 34.2 | 62.5 | 26.2 | 0.0 | 62.5 | 30.7 |
| 105 | MP1388 | 20.9 | 42.7 | 23.4 | 0.0 | 42.7 | 21.8 |
| 106 | GW542 | 20.3 | 84.0 | 15.1 | 0.0 | 84.0 | 29.9 |
| 107 | GW538 | 36.4 | 42.7 | 22.9 | 0.0 | 42.7 | 25.5 |
| 108 | WH1310 | 58.4 | 45.0 | 24.1 | 0.0 | 58.4 | 31.9 |
| 109 | LOK79 | 21.5 | 65.0 | 4.8 | 0.0 | 65.0 | 22.8 |
| 110 | RAJ4083(C) | 26.7 | 85.0 | 17.6 | 0.0 | 85.0 | 32.3 |
| 111 | HD3090(C) | 5.4 | 30.0 | 19.3 | 0.0 | 30.0 | 13.7 |
| 112 | HI1633(C) | 48.5 | 75.0 | 40.4 | 0.9 | 75.0 | 41.2 |
| 113 | UAS478(d) | 35.9 | 25.0 | 12.6 | 5.4 | 35.9 | 19.7 |
| 114 | UAS481(d) | 41.9 | 45.0 | 25.0 | 9.2 | 45.0 | 30.3 |
| 115 | HI1665 | 99.3 | 35.0 | 27.4 | 6.7 | 99.3 | 42.1 |
| 116 | HI8840(d) | 43.4 | 75.0 | 23.4 | 2.4 | 75.0 | 36.0 |
| 117 | DBW397 | 60.9 | 66.6 | 17.2 | 2.0 | 66.6 | 36.7 |
| 118 | DDW61(d) | 43.0 | 75.0 | 10.5 | 9.2 | 75.0 | 34.4 |
| 119 | NIAW4028 | 64.0 | 45.0 | 27.5 | 16.2 | 64.0 | 38.2 |
| 120 | HI1605(C) | 45.2 | 85.0 | 18.7 | 9.0 | 85.0 | 39.5 |
| 120A | Infector (Solanika) | 42.9 | 86.6 | 38.5 | 17.1 | 86.6 | 46.3 |
| 121 | NIAW3170(C) | 48.9 | 83.3 | 16.0 | 19.2 | 83.3 | 41.9 |
| 122 | UAS446(d)(C) | 57.1 | 65.0 | 30.6 | 11.2 | 65.0 | 41.0 |
| 123 | NIDW1149(d)(C) | 4.3 | 81.1 | 8.7 | 33.3 | 81.1 | 31.9 |
| 124 | DBW380 | 55.5 | 32.0 | 43.4 | 2.7 | 55.5 | 33.4 |
| 125 | DBW370(I)(C) | 44.7 | 66.6 | 20.8 | 0.0 | 66.6 | 33.0 |
| 126 | DBW371(I)(C) | 52.2 | 36.0 | 35.4 | 2.6 | 52.2 | 31.6 |
| 127 | DBW372(I)(C) | 80.3 | 85.0 | 43.6 | 0.0 | 85.0 | 52.2 |
| 128 | PBW872(I)(C) | 28.0 | 22.2 | 8.9 | 6.3 | 28.0 | 16.4 |
| 129 | DBW377 | 69.4 | 85.0 | 12.5 | 5.4 | 85.0 | 43.1 |
| 130 | CG1044 | 83.5 | 86.6 | 25.5 | 0.0 | 86.6 | 48.9 |
| 131 | GW543 | 33.3 | 43.3 | 10.4 | 0.0 | 43.3 | 21.8 |
| 132 | DBW187(C) | 29.7 | 65.0 | 18.8 | 23.5 | 65.0 | 34.2 |
| 133 | DBW303(C) | 66.7 | 42.7 | 28.5 | 16.1 | 66.7 | 38.5 |
| 134 | GW322(C) | 42.8 | 33.3 | 17.0 | 11.8 | 42.8 | 26.2 |

## COOPERATORS

| NAME | CENTRE |
|---|---|
| RITU BALA | LUDHIANA |
| KK MISHRA | ALMORA |
| PS SHELHAWAT | DURGAPURA |
| RS BENIWAL | HISAR |
| PRADEEP SHARMA, PREM LAL KASHYAP, & RAVINDRA KUMAR | KARNAL (COORDINATING UNIT) |

# 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 2023-24 crop season, 148 entries of AVTs and promising entries were screened against powderymildew at hot spot locations in NHZ and NWPZ *viz*., Almora, Shimla, Pantnagar, 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 given below.

**AVTs 2023-24**

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

WH1324, HD3249 (C), MACS4125(d), UAS484(d), MPO1398(d), DBW110, DBW359(I), CG1040(I), MACS6842 and WH1306. Besides the entries with average score upto 3 are HI1668*, HD3455, JKW261(C), NW8071, DBW173(C), NIAW3170(C), WH1326, HP1978, UP3123, HI1612 (C), UAS3029, PBW891, DDW62(d) and NIDW1149(d) 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 multilocation during 2023-24**

| S. No. | Entry | Powdery Mildew Score (0-9) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Almora | Shimla | Pantnagar | Wellington | Dhaulakuan | Malan | Jammu | HS | AV |
| 1 | HD3086(C) | 3 | 1 | 3 | 4 | 6 | 6 | 5 | 6 | 4 |
| 2 | HI1668* | 3 | 1 | 3 | 6 | 4 | 3 | 4 | 6 | 3 |
| 3 | HD3494 | 1 | 1 | 5 | 4 | 6 | 3 | 5 | 6 | 4 |
| 4 | DBW417 | 3 | 1 | 3 | 5 | 4 | 6 | 5 | 6 | 4 |
| 5 | DBW88 (C) | 3 | 3 | 5 | 6 | 6 | 6 | 7 | 7 | 5 |
| 6 | PBW957 | 3 | 3 | 5 | 5 | 9 | 6 | 7 | 9 | 5 |
| 7 | DBW222(C)* | 2 | 1 | 5 | 5 | 9 | 6 | 7 | 9 | 5 |
| 8 | DBW477 | 3 | 1 | 5 | 5 | 9 | 6 | 6 | 9 | 5 |
| 9 | HD3471 | 3 | 0 | 7 | 3 | 6 | 3 | 3 | 7 | 4 |
| 10 | PBW916 | 5 | 0 | 5 | 5 | 6 | 3 | 6 | 6 | 4 |
| 11 | DBW386* | 3 | 3 | 5 | 4 | 6 | 9 | 5 | 9 | 5 |
| 12 | PBW826(C) | 3 | 3 | 5 | 4 | 4 | 3 | 5 | 5 | 4 |
| 13 | DBW476 | 3 | 5 | 5 | 5 | 4 | 6 | 7 | 7 | 5 |
| 14 | HD2967 | 1 | 0 | 3 | 3 | 9 | 3 | 7 | 9 | 4 |
| 15 | PBW725 | 1 | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 5 |
| 16 | HD3386(I)(C) | 3 | 3 | 1 | 5 | 4 | 5 | 7 | 7 | 4 |
| 17 | PBW958 | 5 | 5 | 5 | 7 | 6 | 6 | 5 | 7 | 6 |
| 18 | HD3455 | 1 | 3 | 1 | 3 | 6 | 3 | 5 | 6 | 3 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 19 | HD3059(C) | 1 | 5 | 0 | 6 | 6 | 6 | 7 | 7 | 4 |
| 20 | JKW261(C) | 3 | 0 | 0 | 5 | 6 | 3 | 5 | 6 | 3 |
| 20A | Infector | 5 | 5 | 9 | 7 | 9 | 9 | 5 | 9 | 7 |
| 21 | NW8071 | 1 | 0 | 1 | 5 | 4 | 3 | 7 | 7 | 3 |
| 22 | DBW173(C) | 3 | 1 | 1 | 5 | 2 | 3 | 7 | 7 | 3 |
| 23 | WH1324 | 3 | 1 | 3 | 5 | 1 | 3 | 4 | 5 | 3 |
| 24 | DBW422 | 1 | 7 | 3 | 6 | 1 | 4 | 4 | 7 | 4 |
| 25 | RAJ4581 | 3 | 7 | 1 | 6 | 1 | 6 | 7 | 7 | 4 |
| 26 | HD3428 | 3 | 5 | 5 | 7 | 1 | 3 | 7 | 7 | 4 |
| 27 | HD3495 | 3 | 7 | 5 | 6 | 4 | 9 | 5 | 9 | 6 |
| 28 | PBW771(C) | 3 | 7 | 7 | 9 | 7 | 6 | 5 | 9 | 6 |
| 29 | PBW921 | 1 | 3 | 5 | 6 | 2 | 3 | 5 | 6 | 4 |
| 30 | PBW644(C) | 3 | 3 | 3 | 5 | 2 | 6 | 4 | 6 | 4 |
| 31 | HI1653(C) | 3 | 7 | 0 | 6 | 2 | 6 | 8 | 8 | 5 |
| 32 | PBW927 | 3 | 1 | 3 | 5 | 2 | 6 | 9 | 9 | 4 |
| 33 | HD3369 | 3 | 1 | 1 | 4 | 2 | 6 | 7 | 7 | 3 |
| 34 | HD3468 | 3 | 3 | 5 | 5 | 8 | 3 | 5 | 8 | 5 |
| 35 | NIAW3170(C) | 1 | 3 | 0 | 4 | 4 | 6 | 5 | 6 | 3 |
| 36 | WH1326 | 1 | 1 | 3 | 4 | 6 | 3 | 3 | 6 | 3 |
| 37 | DBW296 | 3 | 3 | 1 | 3 | 2 | 9 | 6 | 9 | 4 |
| 38 | JKW304 | 3 | 5 | 3 | 6 | 6 | 9 | 5 | 9 | 5 |
| 39 | WH1402(I)(C) | 3 | 5 | 0 | 5 | 7 | 6 | 1 | 7 | 4 |
| 40 | PBW908 | 3 | 3 | 1 | 5 | 2 | 9 | 7 | 9 | 4 |
| 40A | Infector | 5 | 7 | 8 | 7 | 9 | 9 | 9 | 9 | 8 |
| 41 | HP1978 | 3 | 3 | 0 | 2 | 2 | 3 | 7 | 7 | 3 |
| 42 | HD3447 | 3 | 0 | 0 | 2 | 2 | 6 | 8 | 8 | 3 |
| 43 | PBW915 | 5 | 7 | 3 | 5 | 6 | 9 | 9 | 9 | 6 |
| 44 | HD3388(I) (C) | 3 | 5 | 3 | 3 | 4 | 6 | 7 | 7 | 4 |
| 45 | UP3124 | 3 | 5 | 1 | 5 | 6 | 6 | 4 | 6 | 4 |
| 46 | KRL2106 | 3 | 5 | 5 | 3 | 6 | 6 | 3 | 6 | 4 |
| 47 | HD3249 (C) | 3 | 3 | 1 | 4 | 4 | 3 | 3 | 4 | 3 |
| 48 | PBW913 | 1 | 5 | 0 | 5 | 4 | 6 | 8 | 8 | 4 |
| 49 | HD3467 | 3 | 5 | 3 | 3 | 4 | 9 | 7 | 9 | 5 |
| 50 | BCW29 | 3 | 5 | 5 | 5 | 9 | 6 | 7 | 9 | 6 |
| 51 | UP3123 | 3 | 3 | 1 | 4 | 6 | 3 | 3 | 6 | 3 |
| 52 | HI1563 (C) | 3 | 5 | 7 | 6 | 8 | 3 | 3 | 8 | 5 |
| 53 | DBW107(C)* | 3 | 5 | 5 | 8 | 8 | 6 | 7 | 8 | 6 |
| 54 | PBW833(C) | 1 | 5 | 5 | 7 | 6 | 6 | 5 | 7 | 5 |
| 55 | WH1323 | 3 | 3 | 7 | 7 | 6 | 6 | 4 | 7 | 5 |
| 56 | HD3118(C) | 3 | 1 | 3 | 5 | 6 | 3 | 5 | 6 | 4 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 57 | HI1621(C) | 1 | 3 | 1 | 5 | 6 | 6 | 5 | 6 | 4 |
| 58 | HD3171 (C) | 3 | 3 | 3 | 3 | 6 | 3 | 7 | 7 | 4 |
| 59 | HD3460 | 3 | 5 | 0 | 5 | 9 | 1 | 7 | 9 | 4 |
| 60 | HD3293 (C) | 3 | 3 | 3 | 3 | 6 | 1 | 7 | 7 | 4 |
| 60A | Infector | 5 | 7 | 9 | 7 | 9 | 9 | 9 | 9 | 8 |
| 61 | HI1612 (C) | 3 | 3 | 1 | 5 | 6 | 1 | 3 | 6 | 3 |
| 62 | K1317(C)* | 3 | 5 | 3 | 8 | 4 | 3 | 6 | 8 | 5 |
| 63 | VL2041 (C) | 3 | 5 | 5 | 4 | 4 | 1 | 5 | 5 | 4 |
| 64 | HPW349 (C) | 3 | 3 | 3 | 6 | 6 | 3 | 5 | 6 | 4 |
| 65 | VL2059 | 3 | 5 | 5 | 5 | 8 | 6 | 7 | 8 | 6 |
| 66 | HS562 (C) | 3 | 3 | 1 | 7 | 8 | 3 | 7 | 8 | 5 |
| 67 | VL907 (C) | 3 | 3 | 3 | 6 | 6 | 1 | 7 | 7 | 4 |
| 68 | MACS6837 | 3 | 0 | 1 | 6 | 6 | 1 | 7 | 7 | 3 |
| 69 | MACS4125(d) | 1 | 1 | 3 | 5 | 2 | 1 | 5 | 5 | 3 |
| 70 | MACS4135(d) | 3 | 5 | 5 | 6 | 6 | 1 | 5 | 6 | 4 |
| 71 | HI1669 | 3 | 3 | 7 | 7 | 8 | 3 | 7 | 8 | 5 |
| 72 | HI1683 | 3 | 1 | 5 | 5 | 9 | 1 | 5 | 9 | 4 |
| 73 | HI1684 | 3 | 3 | 5 | 6 | 9 | 3 | 5 | 9 | 5 |
| 74 | HI8848(d) | 1 | 7 | 7 | 9 | 9 | 1 | 7 | 9 | 6 |
| 75 | HI8849(d) | 2 | 7 | 5 | 9 | 8 | 3 | 5 | 9 | 6 |
| 76 | HI8850(d) | 1 | 7 | 7 | 9 | 7 | 1 | 3 | 9 | 5 |
| 77 | GW554 | 3 | 3 | 5 | 9 | 8 | 6 | 5 | 9 | 6 |
| 78 | GW555 | 3 | 1 | 3 | 9 | 8 | 3 | 5 | 9 | 5 |
| 79 | MP3570 | 1 | 0 | 3 | 9 | 6 | 3 | 5 | 9 | 4 |
| 80 | MPO1395 | 3 | 5 | 1 | 9 | 6 | 3 | 6 | 9 | 5 |
| 80A | Infector | 5 | 5 | 7 | 9 | 9 | 9 | 9 | 9 | 8 |
| 81 | GW322 | 2 | 3 | 7 | 9 | 9 | 6 | 5 | 9 | 6 |
| 82 | MACS6768 | 3 | 5 | 5 | 9 | 9 | 6 | 6 | 9 | 6 |
| 83 | HI1650 | 2 | 5 | 5 | 9 | 9 | 3 | 5 | 9 | 5 |
| 84 | GW547(I) | 1 | 3 | 5 | 5 | 6 | 1 | 5 | 6 | 4 |
| 85 | HI8737(d) | 3 | 9 | 7 | 8 | 6 | 1 | 5 | 9 | 6 |
| 86 | HI8713(d) | 2 | 5 | 5 | 8 | 8 | 6 | 3 | 8 | 5 |
| 87 | HI1674 | 3 | 1 | 3 | 9 | 8 | 6 | 5 | 9 | 5 |
| 88 | HI1687 | 3 | 0 | 1 | 9 | 6 | 3 | 5 | 9 | 4 |
| 89 | WSM138 | 3 | 1 | 5 | 9 | 6 | 1 | 6 | 9 | 4 |
| 90 | MACS6830 | 3 | 5 | 0 | 9 | 6 | 3 | 6 | 9 | 5 |
| 91 | DBW425 | 3 | 5 | 3 | 5 | 4 | 1 | 4 | 5 | 4 |
| 92 | GW556 | 2 | 7 | 3 | 5 | 8 | 3 | 6 | 8 | 5 |
| 93 | HD2932* | 1 | 3 | 5 | 9 | 6 | 3 | 4 | 9 | 4 |
| 94 | HMP4010* | 3 | 7 | 5 | 9 | 9 | 6 | 5 | 9 | 6 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 95 | HI1634 | 3 | 5 | 7 | 6 | 9 | 3 | 5 | 9 | 5 |
| 96 | CG1029 | 1 | 1 | 5 | 6 | 8 | 6 | 5 | 8 | 5 |
| 97 | DBW441M | 3 | 5 | 3 | 9 | 6 | 6 | 2 | 9 | 5 |
| 98 | DBW428 | 2 | 1 | 3 | 6 | 6 | 6 | 3 | 6 | 4 |
| 99 | DBW432 | 3 | 0 | 0 | 9 | 6 | 1 | 4 | 9 | 3 |
| 100 | UAS3029 | 1 | 3 | 3 | 5 | 6 | 3 | 3 | 6 | 3 |
| 100A | Infector | 5 | 5 | 7 | 7 | 9 | 9 | 8 | 9 | 7 |
| 101 | UAS484(d) | 3 | 1 | 3 | 4 | 0 | 1 | 3 | 4 | 2 |
| 102 | NIAW4267 | 2 | 3 | 5 | 6 | 8 | 3 | 3 | 8 | 4 |
| 103 | HI8851(d) | 1 | 5 | 7 | 9 | 2 | 1 | 7 | 9 | 5 |
| 104 | HI8852(d) | 2 | 5 | 5 | 5 | 6 | 1 | 5 | 6 | 4 |
| 105 | MACS4131(d) | 3 | 7 | 5 | 9 | 2 | 1 | 4 | 9 | 4 |
| 106 | MPO1398(d) | 2 | 3 | 3 | 3 | 2 | 1 | 5 | 5 | 3 |
| 107 | DBW110 | 3 | 1 | 3 | 2 | 4 | 1 | 5 | 5 | 3 |
| 108 | CG1036 | 3 | 3 | 1 | 3 | 8 | 3 | 7 | 8 | 4 |
| 109 | HI1655* | 2 | 5 | 3 | 5 | 4 | 3 | 7 | 7 | 4 |
| 110 | HI8627(d) | 1 | 3 | 5 | 5 | 4 | 1 | 7 | 7 | 4 |
| 111 | HI8823(d) | 3 | 5 | 7 | 9 | 6 | 3 | 4 | 9 | 5 |
| 112 | DBW359(I) | 2 | 1 | 0 | 3 | 2 | 1 | 4 | 4 | 2 |
| 113 | CG1040(I) | 3 | 3 | 1 | 4 | 4 | 3 | 4 | 4 | 3 |
| 114 | MACS6842 | 2 | 3 | 0 | 3 | 4 | 3 | 2 | 4 | 2 |
| 115 | MACS6844 | 3 | 0 | 5 | 3 | 4 | 6 | 5 | 6 | 4 |
| 116 | NIAW4364 | 3 | 0 | 0 | 4 | 2 | 6 | 6 | 6 | 3 |
| 117 | PBW891 | 3 | 3 | 3 | 3 | 2 | 6 | 4 | 6 | 3 |
| 118 | DBW443* | 3 | 5 | 1 | 5 | 2 | 6 | 6 | 6 | 4 |
| 119 | DDW62(d) | 3 | 5 | 0 | 3 | 2 | 1 | 6 | 6 | 3 |
| 120 | AKAW5100** | 3 | 7 | 1 | 5 | 7 | 6 | 5 | 7 | 5 |
| 120A | Infector | 3 | 3 | 8 | 8 | 9 | 9 | 8 | 9 | 7 |
| 121 | WH1306 | 1 | 0 | 1 | 4 | 0 | 3 | 4 | 4 | 2 |
| 122 | NWS2222 | 1 | 5 | 0 | 9 | 9 | 1 | 3 | 9 | 4 |
| 123 | UAS3026 | 1 | 3 | 0 | 7 | 6 | 6 | 5 | 7 | 4 |
| 124 | CG1045 | 3 | 5 | 1 | 7 | 4 | 6 | 6 | 7 | 5 |
| 125 | MPO1395(d) | 1 | 0 | 3 | 9 | 6 | 1 | 4 | 9 | 3 |
| 126 | MACS6222 | 1 | 5 | 0 | 7 | 9 | 9 | 4 | 9 | 5 |
| 127 | MP1378(I) | 3 | 7 | 0 | 8 | 9 | 9 | 5 | 9 | 6 |
| 128 | MACS3949(d) | 1 | 7 | 3 | 9 | 9 | 9 | 5 | 9 | 6 |
| 129 | DBW426 | 1 | 7 | 1 | 5 | 8 | 6 | 3 | 8 | 4 |
| 130 | MACS6829 | 1 | 0 | 5 | 5 | 8 | 6 | 7 | 8 | 5 |
| 131 | NIAW4114* | 3 | 3 | 5 | 6 | 8 | 9 | 6 | 9 | 6 |
| 132 | NIAW4120 | 3 | 1 | 3 | 9 | 8 | 9 | 3 | 9 | 5 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 133 | NIAW4432 | 1 | 3 | 3 | 3 | 9 | 6 | 6 | 9 | 4 |
| 134 | UAS3027 | 1 | 5 | 1 | 4 | 8 | 9 | 5 | 9 | 5 |
| 135 | LOK79 | 1 | 5 | 5 | 7 | 9 | 5 | 6 | 9 | 5 |
| 136 | RAJ4083 (C) | 1 | 1 | 3 | 9 | 9 | 6 | 6 | 9 | 5 |
| 137 | HD3090 (C) | 3 | 3 | 7 | 9 | 9 | 3 | 6 | 9 | 6 |
| 138 | HI1633 (C) | 3 | 5 | 1 | 9 | 9 | 9 | 6 | 9 | 6 |
| 139 | CG1047 | 1 | 3 | 5 | 9 | 9 | 6 | 5 | 9 | 5 |
| 140 | GW1368(d) | 1 | 7 | 5 | 9 | 9 | 6 | 4 | 9 | 6 |
| 140A | Infector | 5 | 9 | 9 | 8 | 9 | 9 | 9 | 9 | 8 |
| 141 | HI1605 | 1 | 5 | 5 | 9 | 8 | 6 | 4 | 9 | 5 |
| 142 | NIAW3170 | 1 | 1 | 3 | 4 | 8 | 3 | 6 | 8 | 4 |
| 143 | UAS446(d) | 1 | 5 | 1 | 5 | 8 | 3 | 5 | 8 | 4 |
| 144 | NIDW1149(d) | 3 | 1 | 1 | 3 | 8 | 3 | 5 | 8 | 3 |
| 145 | HI1665(I) | 1 | 3 | 3 | 6 | 6 | 9 | 5 | 9 | 5 |
| 146 | UAS478(d)(I) | 3 | 0 | 3 | 4 | 9 | 6 | 5 | 9 | 4 |
| 147 | BL 3028 | 3 | 0 | 3 | 5 | 9 | 9 | 5 | 9 | 5 |
| 148 | PBW 893 | 1 | 1 | 5 | 4 | 6 | 6 | 6 | 6 | 4 |

## COOPERATORS

| NAME | CENTRE |
|---|---|
| SUMAN KUMAR | MALAN |
| R. S. BENIWAL | HISAR |
| SHIWALI DHIMAN | DHAULAKUAN |
| OP GANGWAR, PRAMOD PRASAD | SHIMLA |
| KK MISHRA | ALMORA |
| DEEPSHIKHA | PANTNAGAR |
| MK PANDEY | JAMMU |
| PRADEEP SHARMA, PREM LAL KASHYAP & RAVINDRA KUMAR | (COORDINATING UNIT), KARNAL |

## PROGRAMME 7. REGION SPECIFIC DISEASES OF LIMITED IMPORTANCE

### FUSARIUM HEAD BLIGHT (FHB) OR HEAD SCAB

AVT entries along with checks were evaluated under artificially inoculated conditions at Coochbehar, Kalyani, Delhi, Gurdaspur and Karnal. Disease scoring scale (0-5) has been used. A total 146 entries were evaluated and entry-wise reaction of AVTs entries (2023-24) has been given in Tables 7.1. On the basis of highest score (≥2.0) HD3447 and HP1978 were found resistant. Data from Dhaulakuan centre was not received. Data of Wellington centre was rejected due to erratic disease.

**Test Locations:** Coochbehar, Kalyani, Delhi, Gurdaspur and Karnal

**Table: 7.1. Performance of AVTs material against head scab (% incidence) under multilocational testing during 2023-24**

| S. No. | Entry name | Head Scab Severity (0-5 Scale) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Coochbehar | Kalyani | Gurdaspur | Delhi | Karnal | AV | HS |
| 1 | HD3086(C) | 1 | 2 | 2 | 3 | 3 | 2 | 3 |
| 2 | HI1668 | 1 | 2 | 3 | 3 | 4 | 3 | 4 |
| 3 | HD3494 | 2 | 2 | 3 | 2 | 3 | 2 | 3 |
| 4 | DBW417 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 5 | DBW88 (C) | 1 | 1 | 3 | 3 | 3 | 2 | 3 |
| 6 | PBW957 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 7 | DBW222(C) | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 8 | DBW477 | 2 | 2 | 2 | 3 | 4 | 3 | 4 |
| 9 | HD3471 | 1 | 1 | 2 | 3 | 3 | 2 | 3 |
| 10 | PBW916 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 11 | DBW386 | 1 | 2 | 4 | 3 | 3 | 3 | 4 |
| 12 | PBW826(C) | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 13 | DBW476 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| 14 | HD2967 | 2 | 2 | 4 | 3 | 3 | 3 | 4 |
| 15 | PBW725 | 1 | 2 | 2 | 3 | 3 | 2 | 3 |
| 16 | HD3386(I)(C) | 1 | 2 | 4 | 3 | 3 | 3 | 4 |
| 17 | PBW958 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 18 | HD3455 | 1 | 2 | 3 | 3 | 4 | 3 | 4 |
| 19 | HD3059(C) | 1 | 1 | 4 | 3 | 4 | 3 | 4 |
| 20 | JKW261(C) | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 20A | Infector | 3 | 3 | 5 | 4 | 4 | 4 | 5 |
| 21 | NW8071 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 22 | DBW173(C) | 2 | 2 | 3 | 3 | 4 | 3 | 4 |
| 23 | WH1324 | 1 | 2 | 2 | 2 | 3 | 2 | 3 |
| 24 | DBW422 | 2 | 2 | 4 | 3 | 4 | 3 | 4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 25 | RAJ4581 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 26 | HD3428 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 27 | HD3495 | 2 | 2 | 2 | 2 | 3 | 2 | 3 |
| 28 | PBW771(C) | 1 | 2 | 4 | 3 | 4 | 3 | 4 |
| 29 | PBW921 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 30 | PBW644(C) | 1 | 2 | 2 | 3 | 3 | 2 | 3 |
| 31 | HI1653(C) | 1 | 1 | 3 | 3 | 3 | 2 | 3 |
| 32 | PBW927 | 1 | 2 | 4 | 3 | 4 | 3 | 4 |
| 33 | HD3369 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 34 | HD3468 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 35 | NIAW3170(C) | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 36 | WH1326 | 1 | 2 | 2 | 3 | 3 | 2 | 3 |
| 37 | DBW296 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 38 | JKW304 | 2 | 2 | 4 | 3 | 3 | 3 | 4 |
| 39 | WH1402(I)(C) | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| 40 | PBW908 | 2 | 2 | 5 | 3 | 3 | 3 | 5 |
| 40A | Infector | 3 | 3 | 5 | 5 | 5 | 4 | 5 |
| 41 | HP1978 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| 42 | HD3447 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| 43 | PBW915 | 1 | 2 | 2 | 3 | 3 | 2 | 3 |
| 44 | HD3388(I) (C) | 1 | 2 | 5 | 3 | 3 | 3 | 5 |
| 45 | UP3124 | 2 | 2 | 3 | 2 | 2 | 2 | 3 |
| 46 | KRL2106 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| 47 | HD3249 (C) | 1 | 2 | 2 | 4 | 4 | 3 | 4 |
| 48 | PBW913 | 1 | 1 | 2 | 3 | 3 | 2 | 3 |
| 49 | HD3467 | 1 | 2 | 2 | 3 | 3 | 2 | 3 |
| 50 | BCW29 | 1 | 2 | 3 | 2 | 2 | 2 | 3 |
| 51 | UP3123 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 52 | HI1563 (C) | 2 | 2 | 3 | 4 | 4 | 3 | 4 |
| 53 | DBW107(C) | 2 | 2 | 5 | 3 | 3 | 3 | 5 |
| 54 | PBW833(C) | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 55 | WH1323 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| 56 | HD3118(C) | 1 | 2 | 5 | 3 | 3 | 3 | 5 |
| 57 | HI1621(C) | 1 | 2 | 2 | 3 | 3 | 2 | 3 |
| 58 | HD3171 (C) | 1 | 2 | 2 | 3 | 3 | 2 | 3 |
| 59 | HD3460 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 60 | HD3293 (C) | 1 | 2 | 3 | 2 | 2 | 2 | 3 |
| 60A | Infector | 3 | 3 | 5 | 5 | 5 | 4 | 5 |
| 61 | HI1612 (C) | 1 | 2 | 2 | 3 | 4 | 2 | 4 |
| 62 | K1317(C) | 1 | 2 | 3 | 3 | 3 | 2 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 63 | VL2041 (C) | 2 | 2 | 2 | 2 | 3 | 2 | 3 |
| 64 | HPW349 (C) | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 65 | VL2059 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 66 | HS562 (C) | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 67 | VL907 (C) | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| 68 | MACS6837 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| 69 | MACS4125(d) | 2 | 2 | 3 | 4 | 4 | 3 | 4 |
| 70 | MACS4135(d) | 1 | 2 | 3 | 2 | 2 | 2 | 3 |
| 71 | HI1669 | 1 | 2 | 5 | 3 | 4 | 3 | 5 |
| 72 | HI1683 | 1 | 1 | 3 | 3 | 3 | 2 | 3 |
| 73 | HI1684 | 2 | 2 | 4 | 3 | 4 | 3 | 4 |
| 74 | HI8848(d) | 2 | 2 | 5 | 3 | 5 | 3 | 5 |
| 75 | HI8849(d) | 2 | 2 | 3 | 4 | 4 | 3 | 4 |
| 76 | HI8850(d) | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 77 | GW554 | 2 | 2 | 5 | 3 | 3 | 3 | 5 |
| 78 | GW555 | 1 | 2 | 5 | 4 | 4 | 3 | 5 |
| 79 | MP3570 | 1 | 2 | 5 | 3 | 3 | 3 | 5 |
| 80 | MPO1395 | 1 | 2 | 3 | 4 | 4 | 3 | 4 |
| 80A | Infector | 3 | 3 | 5 | 5 | 5 | 4 | 5 |
| 81 | GW322 | 2 | 2 | 4 | 3 | 4 | 3 | 4 |
| 82 | MACS6768 | 2 | 2 | 4 | 3 | 4 | 3 | 4 |
| 83 | HI1650 | 2 | 2 | 4 | 4 | 4 | 3 | 4 |
| 84 | GW547(I) | 1 | 2 | 4 | 3 | 4 | 3 | 4 |
| 85 | HI8737(d) | 1 | 2 | 3 | 3 | 4 | 3 | 4 |
| 86 | HI8713(d) | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 87 | HI1674 | 2 | 2 | 4 | 3 | 4 | 3 | 4 |
| 88 | HI1687 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 89 | WSM138 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 90 | MACS6830 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 91 | DBW425 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 92 | GW556 | 2 | 2 | 4 | 3 | 3 | 3 | 4 |
| 93 | HD2932 | 1 | 2 | 4 | 3 | 4 | 3 | 4 |
| 94 | MP4010 | 2 | 2 | 5 | 3 | 3 | 3 | 5 |
| 95 | HI1634 | 2 | 2 | 5 | 3 | 3 | 3 | 5 |
| 96 | CG1029 | 1 | 2 | 5 | 3 | 3 | 3 | 5 |
| 97 | DBW441M | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 98 | DBW428 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 99 | DBW432 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 100 | UAS3029 | 2 | 2 | 2 | 3 | 4 | 3 | 4 |
| 100A | Infector | 3 | 3 | 5 | 5 | 5 | 4 | 5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 101 | UAS484(d) | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 102 | NIAW4267 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 103 | HI8851(d) | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 104 | HI8852(d) | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 105 | MACS4131(d) | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 106 | MPO1398(d) | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 107 | DBW110 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 108 | CG1036 | 2 | 2 | 5 | 3 | 3 | 3 | 3 |
| 109 | HI1655 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 110 | HI8627(d) | 2 | 2 | 2 | 4 | 4 | 3 | 4 |
| 111 | HI8823(d) | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| 112 | DBW359(I) | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| 113 | CG1040(I) | 2 | 2 | 3 | 3 | 4 | 3 | 4 |
| 114 | MACS6842 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 115 | MACS6844 | 2 | 2 | 4 | 3 | 3 | 3 | 4 |
| 116 | NIAW4364 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 117 | PBW891 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 118 | DBW443 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 119 | DDW62(d) | 2 | 2 | 3 | 4 | 4 | 3 | 4 |
| 120 | AKAW5100 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| 120A | Infector | 3 | 3 | 5 | 4 | 5 | 4 | 5 |
| 121 | WH1306 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| 122 | NWS2222 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 123 | UAS3026 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 124 | CG1045 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |
| 125 | MPO1395(d) | 2 | 2 | 3 | 4 | 4 | 3 | 4 |
| 126 | MACS6222 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| 127 | MP1378(I) | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 128 | MACS3949(d) | 1 | 2 | 3 | 4 | 4 | 3 | 4 |
| 129 | DBW426 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 130 | MACS6829 | 1 | 2 | 5 | 3 | 4 | 3 | 5 |
| 131 | NIAW4114 | 1 | 2 | 5 | 3 | 4 | 3 | 5 |
| 132 | NIAW4120 | 2 | 2 | 5 | 3 | 4 | 3 | 5 |
| 133 | NIAW4432 | 1 | 2 | 4 | 3 | 3 | 3 | 4 |
| 134 | UAS3027 | 1 | 2 | 4 | 3 | 4 | 3 | 4 |
| 135 | LOK79 | 2 | 2 | 5 | 3 | 4 | 3 | 5 |
| 136 | RAJ4083 (C) | 2 | 2 | 3 | 4 | 4 | 3 | 4 |
| 137 | HD3090 (C) | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 138 | HI1633 (C) | 2 | 2 | 4 | 3 | 3 | 3 | 4 |
| 139 | CG1047 | 2 | 2 | 5 | 3 | 3 | 3 | 5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 140 | GW1368(d) | 2 | 2 | 5 | 4 | 4 | 3 | 4 |
| 140A | Infector | 3 | 3 | 5 | 4 | 5 | 4 | 5 |
| 141 | HI1605 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 142 | NIAW3170 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 143 | UAS446(d) | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| 144 | NIDW1149(d) | 1 | 2 | 5 | 3 | 4 | 3 | 5 |
| 145 | HI1665(I) | 2 | 2 | 5 | 3 | 4 | 3 | 5 |
| 146 | UAS478(d)(I) | 2 | 2 | 3 | 3 | 3 | 3 | 3 |

## COOPERATORS

| NAME | CENTRE |
|---|---|
| JASPAL KAUR | GURDASPUR |
| RAGUNATH MANDAL | KALYANI |
| M.S. SAHARAN | DELHI |
| SATYAJIT HEMBRAM | COOCHVIHAR |
| PRADEEP SHARMA, PREM LAL KASHYAP, & RAVINDRA KUMAR | KARNAL (COORDINATING UNIT) |

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

**Test Locations**: Ludhiana, Hisar and Durgapura

Flag smut is soil and externally seed bone disease caused by *Urocyctis agropyri*. The sporesof the pathogen can survive for longer period in the soil. A total 146 entries were screened and entry-wise reaction of AVTs (2023-24) has been given in Table 7.2.

The entries NIDW1149(d), HI1605, NIAW4364, MACS6842 were found free at all the tested locations.

**Table: 7.2. Performance of AVTs entries against flag smut (% incidence) under multilocational testing during 2023-24**

| S. No. | Entry | Flag smut incidence (%) | | | | |
|---|---|---|---|---|---|---|
| | | Ludhiana | Hisar | Durgapura | HS | AV |
| 1 | HD3086(C) | 7.14 | 6.30 | 3.93 | 7.14 | 5.79 |
| 2 | HI1668 | NG | 6.40 | 0.00 | 6.40 | 3.20 |
| 3 | HD3494 | 1.98 | 9.20 | 0.00 | 9.20 | 3.73 |
| 4 | DBW417 | 0.00 | 5.70 | 3.09 | 5.70 | 2.93 |
| 5 | DBW88 (C) | 0.00 | 5.40 | 0.00 | 5.40 | 1.80 |
| 6 | PBW957 | 1.96 | 7.30 | 0.95 | 7.30 | 3.40 |
| 7 | DBW222(C) | 0.00 | 9.10 | 0.00 | 9.10 | 3.03 |
| 8 | DBW477 | 1.16 | 8.40 | 0.00 | 8.40 | 3.19 |
| 9 | HD3471 | 0.00 | 6.30 | 0.00 | 6.30 | 2.10 |
| 10 | PBW916 | 10.20 | 6.50 | 2.65 | 10.20 | 6.45 |
| 11 | DBW386 | 2.33 | 8.60 | 2.11 | 8.60 | 4.35 |
| 12 | PBW826(C) | 0.00 | 6.40 | 0.67 | 6.40 | 2.36 |
| 13 | DBW476 | 0.00 | 8.10 | 0.00 | 8.10 | 2.70 |
| 14 | HD2967 | 0.95 | 5.50 | 0.00 | 5.50 | 2.15 |
| 15 | PBW725 | 0.00 | 5.60 | 0.00 | 5.60 | 1.87 |
| 16 | HD3386(I)(C) | 1.33 | 8.20 | 3.51 | 8.20 | 4.35 |
| 17 | PBW958 | 1.20 | 9.70 | 0.00 | 9.70 | 3.63 |
| 18 | HD3455 | 0.00 | 8.40 | 0.00 | 8.40 | 2.80 |
| 19 | HD3059(C) | 2.60 | 5.40 | 0.00 | 5.40 | 2.67 |
| 20 | JKW261(C) | 4.65 | 6.20 | 1.75 | 6.20 | 4.20 |
| 20A | Infector | 11.32 | 28.33 | 7.32 | 28.33 | 15.66 |
| 21 | NW8071 | 0.00 | 11.20 | 0.00 | 11.20 | 3.73 |
| 22 | DBW173(C) | 3.39 | 12.40 | 1.12 | 12.40 | 5.64 |
| 23 | WH1324 | 0.00 | 9.90 | 0.00 | 9.90 | 3.30 |
| 24 | DBW422 | 0.00 | 7.60 | 2.94 | 7.60 | 3.51 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 25 | RAJ4581 | 0.00 | 6.70 | 0.00 | 6.70 | 2.23 |
| 26 | HD3428 | 1.59 | 5.80 | 0.00 | 5.80 | 2.46 |
| 27 | HD3495 | 1.30 | 8.50 | 0.00 | 8.50 | 3.27 |
| 28 | PBW771(C) | 0.00 | 5.40 | 0.00 | 5.40 | 1.80 |
| 29 | PBW921 | 0.00 | 4.10 | 0.00 | 4.10 | 1.37 |
| 30 | PBW644(C) | 0.83 | 11.10 | 0.00 | 11.10 | 3.98 |
| 31 | HI1653(C) | 1.79 | 12.80 | 2.11 | 12.80 | 5.57 |
| 32 | PBW927 | 3.64 | 8.30 | 2.96 | 8.30 | 4.97 |
| 33 | HD3369 | 1.69 | 8.50 | 0.00 | 8.50 | 3.40 |
| 34 | HD3468 | 6.12 | 11.40 | 0.00 | 11.40 | 5.84 |
| 35 | NIAW3170(C) | 2.91 | 11.60 | 3.23 | 11.60 | 5.91 |
| 36 | WH1326 | 0.00 | 9.70 | 0.00 | 9.70 | 3.23 |
| 37 | DBW296 | 3.57 | 14.30 | 0.68 | 14.30 | 6.18 |
| 38 | JKW304 | 17.46 | 8.70 | 3.74 | 17.46 | 9.97 |
| 39 | WH1402(I)(C) | 0.00 | 11.20 | 1.48 | 11.20 | 4.23 |
| 40 | PBW908 | 10.61 | 9.60 | 2.30 | 10.61 | 7.50 |
| 40A | Infector | 12.05 | 24.20 | 8.80 | 24.20 | 15.02 |
| 41 | HP1978 | 7.41 | 8.60 | 3.19 | 8.60 | 6.40 |
| 42 | HD3447 | 0.00 | 6.40 | 0.00 | 6.40 | 2.13 |
| 43 | PBW915 | 0.00 | 5.20 | 0.00 | 5.20 | 1.73 |
| 44 | HD3388(I) (C) | 3.26 | 3.40 | 0.00 | 3.40 | 2.22 |
| 45 | UP3124 | 0.00 | 5.70 | 0.00 | 5.70 | 1.90 |
| 46 | KRL2106 | 8.89 | 8.60 | 0.00 | 8.89 | 5.83 |
| 47 | HD3249 (C) | 0.00 | 6.80 | 0.00 | 6.80 | 2.27 |
| 48 | PBW913 | 0.00 | 9.10 | 0.00 | 9.10 | 3.03 |
| 49 | HD3467 | 3.23 | 10.20 | 1.35 | 10.20 | 4.93 |
| 50 | BCW29 | 1.23 | 12.10 | 0.00 | 12.10 | 4.44 |
| 51 | UP3123 | 0.00 | 13.30 | 0.00 | 13.30 | 4.43 |
| 52 | HI1563 (C) | 2.22 | 3.40 | 0.00 | 3.40 | 1.87 |
| 53 | DBW107(C) | 5.80 | 4.20 | 0.00 | 5.80 | 3.33 |
| 54 | PBW833(C) | 2.94 | 3.50 | 0.00 | 3.50 | 2.15 |
| 55 | WH1323 | 0.00 | 5.70 | 0.00 | 5.70 | 1.90 |
| 56 | HD3118(C) | 0.00 | 8.20 | 0.00 | 8.20 | 2.73 |
| 57 | HI1621(C) | 0.00 | 11.70 | 0.00 | 11.70 | 3.90 |
| 58 | HD3171 (C) | 0.00 | 12.50 | 0.00 | 12.50 | 4.17 |
| 59 | HD3460 | 5.63 | 10.60 | 2.75 | 10.60 | 6.33 |
| 60 | HD3293 (C) | 0.00 | 11.40 | 0.75 | 11.40 | 4.05 |
| 60A | Infector | 16.90 | 25.00 | 4.89 | 25.00 | 15.60 |
| 61 | HI1612 (C) | 1.35 | 12.20 | 6.82 | 12.20 | 6.79 |
| 62 | K1317(C) | 3.45 | 3.60 | 4.35 | 4.35 | 3.80 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 63 | VL2041 (C) | 0.00 | 5.40 | 0.00 | 5.40 | 1.80 |
| 64 | HPW349 (C) | 0.00 | 6.80 | 0.93 | 6.80 | 2.58 |
| 65 | VL2059 | 3.45 | 8.10 | 0.00 | 8.10 | 3.85 |
| 66 | HS562 (C) | 0.00 | 8.10 | 0.00 | 8.10 | 2.70 |
| 67 | VL907 (C) | 2.86 | 8.10 | 0.00 | 8.10 | 3.65 |
| 68 | MACS6837 | 0.00 | 5.20 | 0.00 | 5.20 | 1.73 |
| 69 | MACS4125(d) | 0.00 | 6.70 | 0.00 | 6.70 | 2.23 |
| 70 | MACS4135(d) | 0.00 | 6.50 | 0.00 | 6.50 | 2.17 |
| 71 | HI1669 | 4.88 | 6.50 | 0.00 | 6.50 | 3.79 |
| 72 | HI1683 | 0.00 | 6.50 | 0.00 | 6.50 | 2.17 |
| 73 | HI1684 | NG | 6.50 | 1.40 | 6.50 | 3.95 |
| 74 | HI8848(d) | NG | 8.30 | 0.00 | 8.30 | 4.15 |
| 75 | HI8849(d) | 0.00 | 6.10 | 0.00 | 6.10 | 2.03 |
| 76 | HI8850(d) | 0.00 | 5.30 | 0.00 | 5.30 | 1.77 |
| 77 | GW554 | 3.45 | 5.30 | 0.00 | 5.30 | 2.92 |
| 78 | GW555 | 0.00 | 3.20 | 0.00 | 3.20 | 1.07 |
| 79 | MP3570 | 0.00 | 2.50 | 0.00 | 2.50 | 0.83 |
| 80 | MPO1395 | 0.00 | 5.40 | 0.00 | 5.40 | 1.80 |
| 80A | Infector | 22.22 | 20.40 | 5.90 | 22.22 | 16.17 |
| 81 | GW322 | 8.53 | 8.30 | 3.06 | 8.53 | 6.63 |
| 82 | MACS6768 | 2.99 | 7.10 | 0.00 | 7.10 | 3.36 |
| 83 | HI1650 | 4.76 | 5.40 | 0.00 | 5.40 | 3.39 |
| 84 | GW547(I) | 3.23 | 6.40 | 0.00 | 6.40 | 3.21 |
| 85 | HI8737(d) | 0.00 | 8.20 | 0.00 | 8.20 | 2.73 |
| 86 | HI8713(d) | 1.08 | 8.10 | 0.00 | 8.10 | 3.06 |
| 87 | HI1674 | 2.70 | 9.40 | 0.00 | 9.40 | 4.03 |
| 88 | HI1687 | 7.69 | 11.40 | 1.95 | 11.40 | 7.01 |
| 89 | WSM138 | 3.23 | 10.70 | 0.00 | 10.70 | 4.64 |
| 90 | MACS6830 | 1.52 | 8.60 | 0.00 | 8.60 | 3.37 |
| 91 | DBW425 | 2.44 | 9.30 | 1.39 | 9.30 | 4.38 |
| 92 | GW556 | 0.00 | 10.70 | 0.00 | 10.70 | 3.57 |
| 93 | HD2932 | 0.00 | 8.50 | 0.00 | 8.50 | 2.83 |
| 94 | MP4010 | 2.17 | 12.60 | 0.00 | 12.60 | 4.92 |
| 95 | HI1634 | 3.45 | 10.50 | 5.32 | 10.50 | 6.42 |
| 96 | CG1029 | 16.36 | 11.10 | 4.14 | 16.36 | 10.53 |
| 97 | DBW441M | 0.00 | 14.20 | 1.57 | 14.20 | 5.26 |
| 98 | DBW428 | 3.03 | 13.30 | 0.66 | 13.30 | 5.66 |
| 99 | DBW432 | 1.64 | 12.50 | 2.42 | 12.50 | 5.52 |
| 100 | UAS3029 | 2.33 | 11.70 | 3.09 | 11.70 | 5.71 |
| 100A | Infector | 10.31 | 15.20 | 5.49 | 15.20 | 10.33 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 101 | UAS484(d) | 0.00 | 11.10 | 0.00 | 11.10 | 3.70 |
| 102 | NIAW4267 | 10.81 | 5.00 | 4.65 | 10.81 | 6.82 |
| 103 | HI8851(d) | 0.00 | 6.20 | 0.00 | 6.20 | 2.07 |
| 104 | HI8852(d) | 0.00 | 6.00 | 0.00 | 6.00 | 2.00 |
| 105 | MACS4131(d) | 2.94 | 0.00 | 0.00 | 2.94 | 0.98 |
| 106 | MPO1398(d) | 2.74 | 0.00 | 0.00 | 2.74 | 0.91 |
| 107 | DBW110 | 0.00 | 8.40 | 0.00 | 8.40 | 2.80 |
| 108 | CG1036 | 0.00 | 10.60 | 0.00 | 10.60 | 3.53 |
| 109 | HI1655 | 14.93 | 8.30 | 3.03 | 14.93 | 8.75 |
| 110 | HI8627(d) | 0.00 | 6.30 | 0.00 | 6.30 | 2.10 |
| 111 | HI8823(d) | 0.00 | 3.40 | 0.00 | 3.40 | 1.13 |
| 112 | DBW359(I) | 0.75 | 6.10 | 0.00 | 6.10 | 2.28 |
| 113 | CG1040(I) | 0.00 | 3.70 | 0.00 | 3.70 | 1.23 |
| 114 | MACS6842 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 115 | MACS6844 | 0.00 | 5.50 | 1.81 | 5.50 | 2.44 |
| 116 | NIAW4364 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 117 | PBW891 | 0.00 | 0.00 | 4.71 | 4.71 | 1.57 |
| 118 | DBW443 | 0.00 | 5.30 | 0.00 | 5.30 | 1.77 |
| 119 | DDW62(d) | 0.00 | 5.40 | 0.00 | 5.40 | 1.80 |
| 120 | AKAW5100 | 4.58 | 0.00 | 0.00 | 4.58 | 1.53 |
| 120A | Infector | 10.31 | 16.60 | 4.63 | 16.60 | 10.51 |
| 121 | WH1306 | 1.14 | 5.60 | 0.00 | 5.60 | 2.25 |
| 122 | NWS2222 | 1.59 | 5.60 | 2.22 | 5.60 | 3.14 |
| 123 | UAS3026 | 0.00 | 5.40 | 0.00 | 5.40 | 1.80 |
| 124 | CG1045 | 0.00 | 8.60 | 0.00 | 8.60 | 2.87 |
| 125 | MPO1395(d) | 0.00 | 6.30 | 0.00 | 6.30 | 2.10 |
| 126 | MACS6222 | 2.58 | 8.40 | 5.63 | 8.40 | 5.54 |
| 127 | MP1378(I) | 0.00 | 9.30 | 0.00 | 9.30 | 3.10 |
| 128 | MACS3949(d) | 0.00 | 11.40 | 0.00 | 11.40 | 3.80 |
| 129 | DBW426 | 0.00 | 8.60 | 0.00 | 8.60 | 2.87 |
| 130 | MACS6829 | 8.93 | 12.10 | 0.00 | 12.10 | 7.01 |
| 131 | NIAW4114 | 0.00 | 10.10 | 0.00 | 10.10 | 3.37 |
| 132 | NIAW4120 | 2.13 | 9.20 | 0.00 | 9.20 | 3.78 |
| 133 | NIAW4432 | 0.00 | 6.10 | 0.00 | 6.10 | 2.03 |
| 134 | UAS3027 | 2.63 | 0.00 | 2.15 | 2.63 | 1.59 |
| 135 | LOK79 | 0.00 | 8.30 | 0.00 | 8.30 | 2.77 |
| 136 | RAJ4083 (C) | 0.00 | 5.40 | 0.00 | 5.40 | 1.80 |
| 137 | HD3090 (C) | 1.49 | 0.00 | 3.67 | 3.67 | 1.72 |
| 138 | HI1633 (C) | 0.00 | 0.00 | 1.75 | 1.75 | 0.58 |
| 139 | CG1047 | 3.13 | 0.00 | 1.19 | 3.13 | 1.44 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 140 | GW1368(d) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 140A | Infector | 16.67 | 15.20 | 3.78 | 16.67 | 11.88 |
| 141 | HI1605 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 142 | NIAW3170 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 143 | UAS446(d) | 1.20 | 0.00 | 0.00 | 1.20 | 0.40 |
| 144 | NIDW1149(d) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 145 | HI1665(I) | NG | 6.20 | 0.00 | 6.20 | 3.10 |
| 146 | UAS478(d)(I) | 0.00 | 9.10 | 0.00 | 9.10 | 3.03 |

## COOPERATORS

| NAME | CENTRE |
|---|---|
| PS SHEKHAWAT | DURGAPURA |
| RS BENIWAL | HISAR |
| RITU BALA | LUDHIANA |
| PRADEEP SHARMA, PREM LAL KASHYAP, & RAVINDRA KUMAR | KARNAL (COORDINATING UNIT) |

## FOOT ROT (*Sclerotium rolfsii*)

AVT entries were evaluated at Dharwad center. AVTs (2023-24) 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 2023-24**

**Free**
NIL

**Highly resistant (upto 5 % disease):**
NIL

**Resistant (5-10 % disease):**
NIAW3170(C), HS700, HI8849(d), HI8850(d), GW554, DBW428,

**Table: 7.3. Performance of AVTs material against foot rot (% incidence) at Dharwad during 2023-24**

| Sr. No. | Entry | Foot rot incidence (%) Dharwad |
|---|---|---|
| 1 | PBW644(C) | 12.50 |
| 2 | HI1653(C) | 22.22 |
| 3 | PBW927 | 25.00 |
| 4 | HD3369 | 31.25 |
| 5 | HD3468 | 27.78 |
| 6 | NIAW3170(C) | 6.25 |
| 7 | WH1326 | 38.89 |
| 8 | DBW296 | 35.00 |
| 9 | JKW304 | 35.00 |
| 10 | WH1402(I)(C) | 33.33 |
| 11 | PBW908 | 30.00 |
| 12 | HP1978 | 12.50 |
| 13 | HD3447 | 25.00 |
| 14 | PBW915 | 16.67 |
| 15 | HD3388(I) (C) | 27.78 |
| 16 | UP3124 | 16.67 |
| 17 | KRL2106 | 35.00 |
| 18 | HD3249 (C) | 25.00 |
| 19 | PBW913 | 11.11 |
| 20 | HD3467 | 25.00 |
| 21 | Infector | 16.67 |
| 22 | BCW29 | 27.78 |
| 23 | UP3123 | 16.67 |
| 24 | HI1563 (C) | 15.00 |
| 25 | DBW107(C) | 35.00 |
| 26 | PBW833(C) | 16.67 |
| 27 | WH1323 | 31.25 |
| 28 | HD3118(C) | 30.00 |
| 29 | HI1621(C) | 25.00 |
| 30 | HD3171 (C) | 16.67 |
| 31 | HD3460 | 25.00 |
| 32 | HD3293 (C) | 27.78 |
| 33 | HI1612 (C) | 16.67 |
| 34 | K1317(C) | 20.00 |
| 35 | VL2041 (C) | 38.89 |
| 36 | HPW349 (C) | 22.22 |
| 37 | VL2059 | 11.11 |
| 38 | HS562 (C) | 33.33 |
| 39 | VL907 (C) | 30.00 |
| 40 | HD3493 | 30.00 |
| 41 | VL2058 | 22.22 |
| 42 | Infector | 16.67 |
| 43 | VL2057 | 25.00 |
| 44 | HPW499 | 30.00 |
| 45 | HS701 | 11.11 |
| 46 | VL2055 | 16.67 |
| 47 | HPW502 | 27.78 |
| 48 | VL2056 | 35.00 |
| 49 | SKW367 | 22.22 |
| 50 | HPW501 | 27.78 |

| | | |
|---|---|---|
| 51 | HS507 (C) | 22.22 |
| 52 | HS702 | 44.44 |
| 53 | HPW500 | 45.00 |
| 54 | HS700 | 6.25 |
| 55 | UP3149 | 12.50 |
| 56 | Vl3031 | 30.00 |
| 57 | HS705 | 38.89 |
| 58 | HPW503 | 35.00 |
| 59 | Vl3035 | 30.00 |
| 60 | HPW504 | 12.50 |
| 61 | HPW505 | 16.67 |
| 62 | VL892 (C) | 22.22 |
| 63 | Infector | 38.89 |
| 64 | HS703 | 33.33 |
| 65 | VL3034 | 22.22 |
| 66 | VL3036 | 33.33 |
| 67 | HS698 | 27.78 |
| 68 | HS704 | 25.00 |
| 69 | HS490 (C) | 30.00 |
| 70 | VL3033 | 38.89 |
| 71 | MACS6837 | 35.00 |
| 72 | MACS4125(d) | 30.00 |
| 73 | MACS4135(d) | 27.78 |
| 74 | HI1669* | 38.89 |
| 75 | HI1683 | 27.78 |
| 76 | HI1684 | 16.67 |
| 77 | HI8848(d) | 11.11 |
| 78 | HI8849(d) | 6.25 |
| 79 | HI8850(d) | 5.56 |
| 80 | GW554 | 7.14 |
| 81 | GW555 | 18.75 |
| 82 | MP3570 | 27.78 |
| 83 | MPO1395 | 35.00 |
| 84 | Infector | 35.00 |
| 85 | GW322 | 38.89 |
| 86 | MACS6768 | 22.22 |
| 87 | HI1650 | 16.67 |
| 88 | GW547(I) | 15.00 |
| 89 | HI8737(d) | 30.00 |
| 90 | HI8713(d) | 27.78 |
| 91 | HI1674* | 16.67 |
| 92 | HI1687 | 12.50 |
| 93 | WSM138 | 25.00 |
| 94 | MACS6830 | 35.00 |

| | | |
|---|---|---|
| 95 | DBW425 | 35.00 |
| 96 | GW556 | 25.00 |
| 97 | HD2932 | 33.33 |
| 98 | MP4010 | 16.67 |
| 99 | HI1634 | 38.89 |
| 100 | CG1029 | 30.00 |
| 101 | DBW441M* | 25.00 |
| 102 | DBW428 | 6.25 |
| 103 | DBW432 | 12.50 |
| 104 | UAS3029 | 33.33 |
| 105 | Infector | 16.67 |
| 106 | UAS484(d) | 37.50 |
| 107 | NIAW4267 | 40.00 |
| 108 | HI8851(d) | 35.00 |
| 109 | HI8852(d) | 33.33 |
| 110 | MACS4131(d) | 30.00 |
| 111 | MPO1398(d) | 38.89 |
| 112 | DBW110 | 40.00 |
| 113 | CG1036 | 22.22 |
| 114 | HI1655 | 12.50 |
| 115 | HI8627(d) | 16.67 |
| 116 | HI8823(d) | 22.22 |
| 117 | DBW359(I) | 25.00 |
| 118 | CG1040(I) | 38.89 |
| 119 | MACS6842 | 27.78 |
| 120 | MACS6844 | 35.00 |
| 121 | NIAW4364 | 25.00 |
| 122 | PBW891* | 18.75 |
| 123 | DBW443* | 22.22 |
| 124 | DDW62(d) | 15.00 |
| 125 | AKAW5100* | 38.89 |
| 126 | Infector | 31.25 |
| 127 | WH1306* | 18.75 |
| 128 | NWS2222* | 16.67 |
| 129 | UAS3026 | 30.00 |
| 130 | CG1045 | 16.67 |
| 131 | MPO1395(d) | 16.67 |
| 132 | MACS6222 | 30.00 |
| 133 | MP1378(I) | 25.00 |
| 134 | MACS3949(d) | 22.22 |
| 135 | DBW426 | 30.00 |
| 136 | MACS6829 | 35.00 |
| 137 | NIAW4114* | 25.00 |
| 138 | NIAW4120* | 12.50 |

| | | |
|---|---|---|
| 139 | NIAW4432 | 38.89 |
| 140 | UAS3027 | 38.89 |
| 141 | LOK79* | 33.33 |
| 142 | RAJ4083 (C) | 38.89 |
| 143 | HD3090 (C) | 27.78 |
| 144 | HI1633 (C) | 25.00 |
| 145 | CG1047 | 18.75 |
| 146 | GW1368(d) | 25.00 |

## COOPERATORS

| NAME | CENTRE |
|---|---|
| GURUDATT M HEGDE | DHARWAD |
| PRADEEP SHARMA, PREM LAL KASHYAP, & RAVINDRA KUMAR | KARNAL (COORDINATING UNIT) |

# PROGRAMME 8. CROP HEALTH

## 8.1 PRE-HARVEST CROP HEALTH MONITERING

During 2023-24, 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. 29 (Issues 1 to 5) which was issued during the crop season and also uploaded on ICAR-IIWBR website (www.iiwbr.icar.gov.in). Stripe (yellow) rust of wheat was first reported on 24$^{th}$ January, 2024 from RS Pura (Jammu) on an unknown variety and at Badyal Qazian on HD2967. Subsequently, the stripe rust was observed in 4 fields of villages Niku Nangal and Dhokli in district Ropar (Punjab) on February 8, 2024. After that the incidence of the stripe rust was also observed in villages Chandpur Bela, Dher Raipur, Mehakpur in Ropar. Stripe rust symptoms were observed on some local cultivars in village Rawaikhal and adjoining wheat growing areas of District Bageshwar (Uttarakhand) on 06.03.2024. Low incidence of stripe and leaf rust was reported during March 28-29, 2024 from farmers' fields of Hansi, Shekhupur, Narnaund and other villages in Hisar (Haryana). Leaf (brown) rust was first observed from the farmers' field in the Pune and Satara districts (Maharashtra) during 2$^{nd}$ and 4$^{th}$ week of January 2024. The occurrence of leaf rust in farmer's fields of Dewas, Indore, Sehore and Dhar districts of Madhya Pradesh was observed in February. The infection of leaf rust was noticed in some fields of Banaskantha district of Gujarat on off type wheat plants on 16$^{th}$ Feb., 2024. In Bihar leaf rust was noticed in farmer's field of Sabour, Barari, Jagdishpur, Goradih, and Nathnagar. The stem (black) rust occurrence was first reported from different villages in Dharwad district (Karnataka) during the second fortnight of January, 2024. Consequently, the stem rust incidence was also reported from Belagavi, Bagalkote, Dharwad and Gadag districts. First incidence of stem rust from Maharashtra during the season was reported from Umbarkhed village (Niphad) on 31st January 2024. Leaf rust and stem rust was also observed on-off types and varieties from private companies during 2nd and 3rd week of February 2024 from the farmers' fields in Pune, Satara and Sangli districts. The overall crop health status was excellent in all the wheat growing areas of the country.

### Training for Human Resource development

To bring more uniformity in disease creation and data recording, training was organized on "Streamlining data recording and reporting under AICRP on wheat and Barley" from March 11-15, 2024 at ICAR-IIWBR, Karnal jointly with Crop Improvement section. The scientists and technical workers of research institutes and private companies involved in disease and insect pest recording participated in the training programme.

### Advisory for stripe rust management

During the current season 2023-24, 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 programmes.

### Preparedness to wheat blast

Survey was conducted during the cropping season 2023-24 in 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 348 entries were screened against blast at Jessore at two different dates of sowing during 2022-23.

Out of these, five found free from infection and 12 are categorized resistance on the basis of average disease upto 10% infection. The details are given as below:

| Wheat blast reaction | Genotypes | Total |
|---|---|---|
| 0 (free) | DBW447, DBW448, DBW449, PBW942, PBW943 | 5 |
| Upto 10 resistant) | UP3141, DBW455, DBW454, NIAW4621, HP1981, DBW446, K2301, JKW317, HUW859, RAUW107, HUW861, QYT2310 | 12 |
| Total | | 17 |

**Post harvest surveys**

The post harvest grain analysis for presence of kanal bunt and black point in grains of farmer's 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) status in 2023-24**

A total of 8100 grain samples collected from various mandies in different zones and were analyzed at cooperating centers (Table 8.1). The overall 6.56% samples were found infected. The samples from Hisar showed maximum infection (47.05%).

**Table: 8.1. Karnal bunt situation in the country during 2023-24 crop seasons**

| State | Total Samples | Infected Samples | Infected samples (%) | Range of infection (%) |
|---|---|---|---|---|
| Punjab | 3053 | 17 | 0.006 | 0.00 -0.05 |
| Haryana | 2764 | 376 | 13.60 | 0.00-7.3 |
| Rajasthan | 430 | 129 | 30.00 | 0.1-5.0 |
| Uttrakhand | 991 | 10 | 1.00 | 0.00-0.25 |
| Gujarat | 222 | 0 | -- | -- |
| Madhya Pradesh | 386 | 0 | -- | -- |
| Maharashtra | 204 | 0 | -- | -- |
| Karnataka | 50 | 0 | -- | -- |
| **Overall** | **8100** | **532** | **6.56** | **0.00-7.3** |

**Haryana**

A total of 1464 samples collected by IIWBR from Haryana and analysed for presence of KB and found that 2.67% samples were infected with KB and range of infection was 0–7.3% (Table 8.2).

**Table: 8.2. Status of Karnal bunt in Karnal and adjoining distrcts of Haryana during 2023-24 crop season**

| Districts | Total samples | Infected samples | Infected samples (%) | Range of grain infection (% ) |
|---|---|---|---|---|
| Ambala | 296 | 1 | 0.33 | 0.0-0.7 |
| Kurukshetra | 307 | 1 | 0.32 | 0.0-0.3 |
| Karnal | 404 | 5 | 1.23 | 0.2-7.3 |
| Kaithal | 344 | 2 | 0.58 | 0.3-0.4 |
| Panipat | 159 | 0 | 0 | 0.0-0.3 |
| Rohtak | 150 | 0 | 0 | 0.0-0.4 |
| Sonipat | 118 | 0 | 0 | 0.0-0.0 |
| Yamaunanagar | 228 | 0 | 0 | 0.0-0.0 |
| **Overall** | **2006** | **9** | **0.44** | **0.0-7.3** |

(ICAR-IIWBR)

## Hisar

A total 758 grain samples were also collected from different districts of Haryana by cooperating center CCSHAU, Hisar. These samples were analyzed for Karnal bunt infection. Out of the 758 sample, 367 found infected and the percentage of infected samples was 48.42. The range of infection was 0.05 –0.95% (Table 8.3).

**Table: 8.3. Status of Karnal bunt in Karnal and adjoining districts of Haryana during 2023-24 crop seasons**

| Location[1] | No of samples showing different level of Karnal bunt incidence (%) | | | | | | Total samples | Samples infected (%) | Mean incidence | Range of incidence (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 0.1-1.0 | 1.1-5.0 | 5.1-10 | 10-25 | >25 | | | | |
| Hisar | 28 | 08 | | | | | 36 | 22.22 | 0.091 | 0.05-0.50 |
| Fatehabad | 30 | 21 | | | | | 51 | 41.17 | 0.056 | 0.05-0.35 |
| Sirsa | 54 | 26 | | | | | 80 | 48.14 | 0.097 | 0.05-0.55 |
| Rohtak | 50 | 23 | | | | | 73 | 31.50 | 0.029 | 0.05-0.25 |
| Bhiwani | 30 | 14 | | | | | 44 | 31.81 | 0.039 | 0.05-0.40 |
| Charkhi Dadri | 14 | 51 | | | | | 65 | 78.46 | 0.179 | 0.05-0.95 |
| Mahendergarh | 16 | 60 | 3 | | | | 79 | 79.74 | 0.21 | 0.05-2.40 |
| Rewari | 17 | 31 | | | | | 48 | 64.58 | 0.162 | 0.05-0.85 |
| Jhajjar | 28 | 31 | | | | | 59 | 52.54 | 0.068 | 0.05-0.35 |
| Gurugram | 37 | 51 | | | | | 88 | 57.95 | 0.074 | 0.05-0.75 |
| Nuh | 27 | 16 | | | | | 43 | 37.20 | 0.055 | 0.05-0.25 |
| Palwal | 30 | 23 | | | | | 53 | 43.39 | 0.036 | 0.05-0.35 |
| Faridabad | 30 | 9 | | | | | 39 | 23.07 | 0.013 | 0.05-0.25 |
| Mean | 391 | 364 | 3 | | | | 758 | 47.05 | 0.085 | 0.05-0.24 |

(RS Beniwal)

## Rajasthan

A total of 430 wheat grain samples were collected from 13 different grain mandies of Alwar, Dausa, Jaipur and Tonk districts of Rajasthan during Rabi, 2023-24 to know the status of KB and black point diseases of wheat. The data revealed that among the total 430 wheat grain samples analyzed for KB, 129 samples (30.0%) were infected with Karnal bunt showing infection range 0.1- 3.6 percent. The highest KB infection (3.6%) was observed in a sample collected from Lalsot (Dausa) mandi. The samples collected from Bansur mandi showed maximum KB incidence (61.29%) followed by Khertal (47.73%), Lalsot (40.54%), Kotputli (37.5%), Bandikui (33.33%), Deoli (33.33%), Mandawari (30.0%), Dausa (28.95%), Bassi (23.08%), Tonk (16.13%), Alwar (14.0%), Niwai (10.0%) and Chaksu (9.09%) mandi. There is drastic reduction of KB incidence in samples collected from Alwar mandi which is known for KB prone areas, where as the samples collected from Deoli mandi which known for low incidence of KB, showed measurable increased in the KB incidence during this season. However, among a total 129 KB infected samples, 117 samples (90.7 %) were falling in the range of 0.1-1.0 percent disease incidence and only 9.3 per cent samples were falling in the range of 1.1-5.0 KB incidence. None of the sample was found in the infection range of 5.0-10 per cent.

**Table: 8.4. Status of Karnal bunt during Rabi, 2023-24 in Rajasthan**

| S.N. | Location | Samples showing KB incidence (%) | | | | | Per cent | Mean KB | Range of incidence (%) |
|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 0.1-1 | 1.1-5.0 | 5.1-10 | Total sample | infected samples | incidence | |
| District: Alwar | | | | | | | | | |
| 1 | Alwar | 43 | 7 | 0 | 0 | 50 | 14 | 0.03 | 0.1-0.7 |
| 2 | Khertal | 23 | 21 | 0 | 0 | 44 | 47.73 | 0.084 | 0.1-0.6 |
| 3 | Bansur | 12 | 15 | 4 | 0 | 31 | 61.29 | 0.381 | 0.1-2.1 |
| Total | | 78 | 43 | 4 | 0 | 125 | 37.6 | 0.00396 | 0.1-2.1 |
| District: Dausa | | | | | | | | | |
| 4 | Dausa | 27 | 11 | 0 | 0 | 38 | 28.95 | 0.076 | 0.1-0.9 |
| 5 | Bandikui | 10 | 5 | 0 | 0 | 15 | 33.33 | 0.06 | 0.1-0.4 |
| 6 | Lalsot | 22 | 12 | 3 | 0 | 37 | 40.54 | 0.332 | 0.1-3.6 |
| 7 | Mandawari | 21 | 9 | 0 | 0 | 30 | 30 | 0.09 | 0.1-0.9 |
| Total | | 80 | 37 | 3 | 0 | 120 | 33.33 | 0.00465 | 0.1-3.6 |
| District: Jaipur | | | | | | | | | |
| 8 | Bassi | 20 | 6 | 0 | 0 | 26 | 23.08 | 0.0577 | 0.1-0.5 |
| 9 | Chaksu | 20 | 2 | 0 | 0 | 22 | 9.09 | 0.0455 | 0.1-0.9 |
| 10 | Kotputli | 10 | 4 | 2 | 0 | 16 | 37.5 | 0.306 | 0.1-2.8 |
| Total | | 50 | 12 | 2 | 0 | 64 | 21.88 | 0.136 | 0.1-2.8 |
| District: Tonk | | | | | | | | | |
| 11 | Tonk | 26 | 5 | 0 | 0 | 31 | 16.13 | 0.0226 | 0.1-0.3 |
| 12 | Deoli | 40 | 17 | 3 | 0 | 60 | 33.33 | 0.1783 | 0.1-2.5 |
| 13 | Niwai | 27 | 3 | 0 | 0 | 30 | 10 | 0.0133 | 0.1-0.2 |
| Total | | 93 | 25 | 3 | 0 | 121 | 23.14 | 0.0714 | 0.1-2.5 |
| Grand total | | 301 | 117 | 12 | 0 | 430 | 30 | 0.0129 | 0.1-3.6 |

(P. S. Shekhawat)

**Punjab**

Out of 3053, only 17 samples (0.55 percent samples) were found to be infected with KB. District Pathankot showed the maximum KB infected samples. The samples collected from Amritsar, Bathinda, Gurdaspur, Kapurthall, Ludhiana, Ropar and Sangrur districts showed the KB infection in a very few samples as depicted inTable 8.5. An overall infection in rest of the districts ranged between 0.00 to 0.05 (Pathankot) with average infection in the state 0.001. There was a considerable decrease in the incidence as well as the severity of the disease over the last year.

**Table: 8.5. Karnal bunt spectrum in Punjab during 2023-24**

| S. No | District | Total Samples | Infected Samples | % infected samples | % Average infection |
|---|---|---|---|---|---|
| 1 | Amritsar | 136 | 2 | 1.45 | 0.130 |
| 2 | Barnala | 149 | 0 | 0.00 | 0.000 |
| 3 | Bathinda | 209 | 1 | 0.48 | 0.000 |
| 4 | Faridkot | 41 | 0 | 0.00 | 0.000 |
| 5 | Fatehgarh Sahib | 164 | 0 | 0.00 | 0.000 |
| 6 | Fazilka | 95 | 0 | 0.00 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 7 | Ferozepur | 173 | 0 | 0.00 | 0.000 |
| 8 | Gurdaspur | 104 | 2 | 1.89 | 0.004 |
| 9 | Hoshiarpur | 153 | 0 | 0.00 | 0.000 |
| 10 | Jallandhar | 236 | 0 | 0.00 | 0.000 |
| 11 | Kapurthala | 171 | 2 | 1.16 | 0.001 |
| 12 | Ludhiana | 285 | 1 | 0.35 | 0.000 |
| 13 | Malerkotla | 33 | 0 | 0.00 | 0.000 |
| 14 | Mansa | 101 | 0 | 0.00 | 0.000 |
| 15 | Moga | 202 | 0 | 0.00 | 0.000 |
| 16 | Mohali | 27 | 0 | 0.00 | 0.000 |
| 17 | Muktsar | 112 | 0 | 0.00 | 0.000 |
| 18 | Pathankot | 30 | 6 | 16.67 | 0.017 |
| 19 | Patiala | 171 | 0 | 0.00 | 0.000 |
| 20 | Ropar | 87 | 2 | 2.25 | 0.002 |
| 21 | Sangrur | 128 | 1 | 0.78 | 0.000 |
| 22 | Nawanshar | 87 | 0 | 0.00 | 0.001 |
| 23 | Tarantarn | 159 | 0 | 0.00 | 0.000 |
| | Overall | 3053 | 17 | 0.55 | 0.001 |

(Jaspal Kaur, Ritu Bala)

## Uttarakhand

A total 991 wheat samples were analyzed, out of which 10 samples had Karnal bunt infection (Table 8.6). These samples were collected from the seed growers of four districts of Uttarakhand namely, Udham Singh Nagar, Nainital, Dehradun and Haridwar.

**Table 8.6: Status of Karnal bunt in different districts of Uttarakhand during 2023-2024 crop season**

| Districts | Total samples | No. of infected samples | No. of disease free samples | % infected Samples | No. of samples in different range of infection | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Below 0.25% | 0.26-1% | 1.1-5% | 5.1-10% |
| 1.Udham Singh Nagar | | | | | | | | |
| a) Pantnagar | 133 | 3 | 130 | 2.25 | 3 | 0 | 0 | 0 |
| b) Gadarpur | 247 | 1 | 246 | 0.40 | 1 | 0 | 0 | 0 |
| c) Rudrapur | 129 | 4 | 125 | 3.10 | 4 | 0 | 0 | 0 |
| d) Bajpur | 39 | 0 | 39 | 0 | 0 | 0 | 0 | 0 |
| e) Khatima | 194 | 1 | 193 | 0.51 | 1 | 0 | 0 | 0 |
| 2. Dehradun | 45 | 1 | 44 | 2.22 | 1 | 0 | 0 | 0 |
| 3.Haridwar | 92 | 0 | 92 | 0 | 0 | 0 | 0 | 0 |
| 4. Nainital (Kotabagh) | 112 | 0 | 112 | 0 | 0 | 0 | 0 | 0 |
| Total | 991 | 10 | 981 | 1.00 | 10 | 0 | 0 | 0 |

(Deepshikha)

## Madhya Pradesh

A total of 386 wheat grain samples collcted from different mandies of Madhya Pradesh were the analysis of Karnal bnt infections and none of the samples found infected with the disease (Table 8.7).

**Table: 8.7. Status of Karnal bunt during Rabi, 2023-24 in Madhya Pradesh**

| District | Tehsil | Total samples | Infected samples | Infected samples (%) | Range of infection |
|---|---|---|---|---|---|
| Dewas | Dewas | 107 | 0 | - | - |
| | Bagali | 4 | 0 | -- | -- |
| | Tokh-Kurd | 58 | 0 | -- | -- |
| | Hatpipalia | 1 | 0 | -- | -- |
| | Udayanagar | 3 | 0 | | |
| | Sonkatch | 28 | 0 | -- | -- |
| | Satwas | 1 | 0 | | |
| Indore | Indore | 38 | 0 | -- | -- |
| | Hatod | 45 | 0 | -- | -- |
| | Sanwer | 26 | 0 | -- | -- |
| | Malharganj | 4 | 0 | | |
| | Khudel | 12 | 0 | | |
| | Rau | 3 | 0 | | |
| | Depalpur | 35 | 0 | -- | -- |
| | Kanadia | 6 | 0 | | |
| Ujjain | Ujjain | 5 | 0 | -- | -- |
| | Taiana | 5 | 0 | -- | -- |
| Shajapur | Shajapur | 2 | 0 | -- | -- |
| | Momman Babidiya | 1 | 0 | | |
| | Gulana | 1 | 0 | -- | -- |
| Dhar | Dhar | 1 | 0 | -- | -- |
| | **Overall** | 386 | 0 | -- | -- |

(T.L. Prakasha)

## Gujarat

A total of 222 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, 2023-24 in Gujarat**

| S. N. | Location | Total no. of Sample | Infected samples | Per cent infected samples | Range of infection |
|---|---|---|---|---|---|
| 1 | Visnagar | 07 | 0 | -- | -- |
| 2 | Mehsana | 07 | 0 | -- | -- |
| 3 | Kadi | 23 | 0 | -- | -- |
| 4 | Kalol | 06 | 0 | -- | -- |
| 5 | Mansa | 06 | 0 | -- | -- |
| 6 | Himmatnagar | 07 | 0 | -- | -- |
| 7 | Khedbrahma | 11 | 0 | -- | -- |
| 8 | Vijapur | 11 | 0 | -- | -- |
| 9 | Talod | 17 | 0 | -- | -- |
| 10 | Palanpur | 13 | 0 | -- | -- |
| 11 | Kukarvada | 12 | 0 | -- | -- |
| 12 | Dahegam | 12 | 0 | -- | -- |
| 13. | Junagadh | 90 | | | |
| **Overall** | | **222** | **0** | -- | -- |

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

**Maharashtra**

A total of 204 seed samples were collected and examined from different locations of Maharashtra during 2023-24. All the samples were found free from karnal bunt incidence (Table 8.9).

**Table: 8.9. Status of Karnal bunt during Rabi, 2023-24 in Maharashtra**

| Sr. No. | Location | | Total samples | Infected | Per cent infected samples | Range of infection |
|---|---|---|---|---|---|---|
| | Tahasil | District | | | | |
| 1 | Yeola | Nashik | 17 | 0 | 0 | -- |
| 2 | Niphad | Nashik | 35 | 0 | 0 | -- |
| 3 | Nashik | Nashik | 24 | 0 | 0 | -- |
| 4 | Dindori | Nashik | 16 | 0 | 0 | -- |
| 5 | Kopargaon | Ahmednagar | 14 | 0 | 0 | -- |
| 6 | Rahuri | Ahmednagar | 8 | 0 | 0 | -- |
| 7 | Rahata | Ahmednagar | 13 | 0 | 0 | -- |
| 8 | Sangamner | Ahmednagar | 15 | 0 | 0 | -- |
| 9 | Nandurbar | Nandurbar | 10 | 0 | 0 | -- |
| 10 | Shahada | Nandurbar | 12 | 0 | 0 | -- |
| 11 | Pune | Pune | 40 | 0 | 0 | -- |
| | **Total** | | **204** | **0** | **0** | -- |

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

## Karnataka

A total of 50 samples were collected from Dharwad, Bijapur, Belagavi, Bagalkot and Gadag districts during 2023-24. All the samples were free from Karnal bunt incidence.

(Gurudatt M Hegde)

## Pathotypes distribution of rust pathogens in India and Nepal during 2023-24

A total of 858 samples collected from eleven Indian states and Nepal were analyzed during 2023-24.

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

During this crop year, 173 stripe rust samples of wheat were analyzed from six Indian states (Himachal Pradesh, Punjab, Haryana, Uttarakhand, Uttar Pradesh and Rajasthan) and Nepal. A total of nine pathotypes {238S119, 110S119, 46S119, T (47S103), P (46S103), 78S84, 110S84, 79S68, and 6S0} of wheat stripe rust pathogen were identified. Stripe rust pathogen populations were avirulent to *Yr5, Yr10, Yr15, Yr16, Yr32,* and *YrSP*. Most of the stripe rust samples of wheat were analyzed from Punjab (67) followed by Uttar Pradesh (21) and Uttarakhand (20). During the cropping season frequency of pathotype 238S119 was maximum (36.4%) followed by 110S119 and 46S119 (Table 1). The frequency of 46S119 (virulent on *Yr2*, *Yr3*, *Yr4*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr18*, *Yr19*, *Yr21*, *Yr22*, *Yr23*, *Yr25*, and *YrA*) increased to 26.0%. Other pathotypes were identified in low frequency (<4%, Table 8.10).

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

A total of 208 black rust samples received from Gujarat, Himachal Pradesh, Madhya, Pradesh, Maharashtra, Karnataka, Uttar Pradesh, Uttarakhand and Tamil Nadu; and Nepal were pathotyped on wheat differentials. Eight pathotypes 11, 15-1, 21, 21-1, 21A-2, 40A, 40- 2 and 40-3 of *Puccinia graminis* f. sp. *tritici* (*Pgt*) were identified. The *Pgt* population was avirulent to *Sr26*, *Sr27*, *Sr31, Sr32, Sr35, Sr39, Sr40, Sr43, SrTt3* and *SrTmp*. Maximum number of samples was pathotyped from Karnataka (61) followed by Tamil Nadu (51) and Gujarat (28) (Table 8.11). 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* and *Sr*McN, was recorded in 47.5 % of the samples. Pathotypes 40A and 40-2 were identified in 21% and 14% of the samples. Pathotypes 15-1 and 21 were identified in two samples while pathotype 21-1 was found in only one sample collected from Uttarakhand.

**Leaf rust of wheat (*Puccinia triticina*)**

A total of 477 samples of wheat leaf rust were pathotyped from 10 statesof India and neighboring country Nepal. Among the 26 pathotypes of *Puccinia triticina* that were identified in these samples, pathotype 77-9 (121R60-1) was the most widely distributed and occurred in 44.8% of the samples followed by 52-4 (121R60-1, 7) in 22.3% samples (Table 3). Pathotype 77-5 (121R63-1), that remained the most predominant for more than 20 years was observed in 9.5% samples only. The remaining 15 pathotypes were identified in 75 samples only. In Nepal, fourteen pathotypes were identified in 76 samples. Pathotype 77-9 was the most predominant and recorded in 47.4 % samples received from Nepal (Table 8.12).

**Table: 8.10. Pathotype distribution of wheat yellow rust pathogen (*Puccinia striiformis*f. sp. *tritici*) in India and Nepal during 2023-24**

| S. No. | State/UT/Country | No. of isolates Analyzed | Pathotype | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 238S119 | 110S119 | 46S119 | T (47S103) | P (46S103) | 78S84 | 110S84 | 79S68 | 6S0 |
| **1.** | Himachal Pradesh | 19 | 10 | 5 | 2 | 2 | - | - | - | - | - |
| **2.** | Punjab | 67 | 20 | 19 | 22 | - | 3 | 1 | - | - | 2 |
| **3.** | Haryana | 2 | - | - | 1 | - | 1 | - | - | - | - |
| **4.** | Uttarakhand | 20 | 9 | 7 | 4 | - | - | - | - | - | - |
| **5.** | Uttar Pradesh | 21 | 8 | 5 | 3 | - | - | 2 | 1 | - | 2 |
| **6.** | Rajasthan | 18 | 4 | 8 | 5 | - | 1 | - | - | - | |
| **Other country** | | | | | | | | | | | |
| **1** | Nepal | 26 | 12 | 1 | 8 | 3 | 1 | - | - | 1 | |
| **Total** | | **173** | **63** | **45** | **45** | **5** | **6** | **3** | **1** | **1** | **4** |

NB: In Barley yellow rust (*Puccinia striiformis* f. sp. *hordei*), pathotype 57 (0S0) was confirmed in the only sample collected from villageDangar, Bilaspur (H.P.) during 2023-24.

**Table: 8.11. Pathotype distribution of stem rust (*P. graminis*f. sp. *tritici*) in India and Nepal during 2023-24**

| S. No. | States/Countries | Number of isolates analyzed | Pathotype*¥ | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **11** | **15-1** | **21** | **21-1** | **21A-2** | **40A** | **40-2** | **40-3** |
| **1** | Gujarat | 28 | 28 | - | - | - | - | - | - | - |
| **2** | Himachal Pradesh | 2 | 1 | | 1 | | | | | |
| **3** | Madhya Pradesh | 26 | 20 | | | | | 6 | | |
| **4** | Maharashtra | 27 | 10 | 2 | | | | 5 | 7 | 3 |
| **5** | Karnataka | 61 | 34 | | | | | 4 | 15 | 8 |
| **6** | Uttar Pradesh | 7 | 3 | | | | | | 4 | |
| **7** | Uttarakhand | 4 | | | 1 | 1 | 2 | | | |
| **8** | Tamil Nadu | 51 | 3 | | | | | 29 | 3 | 16 |
| **9** | Nepal | 2 | | | | | 2 | | | |
| **Total** | | **208** | 99 | 2 | 2 | 1 | 4 | 44 | 29 | 27 |

*Indian binomial names ¥North American equivalents 11 (79G31*; RRTSF¥), 15-1 (123G15; TKTSF), 21 (9G5; CHMQC), 21-1 (24G5; CKMSC), 21A-2 (75G5; CCTJC),40A (62G29; PTHSC), 40-2 (58G13-3; PKRSC), 40-3 (127G29; PTKSF) based on Jin *et al*., *Plant Dis*. 2008,92: 923-6.

**Table: 8.12. Pathotype distribution of brown rust (*Puccinia triticina*) in India and Nepal during 2023-24**

| S. No. | State/Country | No. of isolates Analyzed | PATHOTYPES | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 12(5R5) | 12-1(5R37 | 12-2(1R5) | 12-3 (49R37) | 12-4(69R13) | 12-5 (29R45) | 12-6(5R45) | 12-8(49R45) | 17 (61R24) | 20-1(93R57) | 77-1 (109R63) | 77-3 (125R55) | 77-4 (125R23-1 | 77-5 (121R63-1) | 77-6(121R55-1) | 77-9 (121R60-1) | 77-11(125R28) | 77A(109R31) | 52-4 (121R60-1,7) | 104-1(21R31-1) | 104-2 (21R55) | 104-3(21R63) | 104A (21R31) | 162(93R7) | 162A (93R15) | 1 R31 |
| **1.** | Himachal Pradesh | 16 | | | | | | | | | | | 1 | | | 2 | | 7 | | | 5 | | 1 | | | | | |
| **2.** | Punjab | 38 | | | | | | | | | | | | | | 3 | | 23 | | | 12 | | | | | | | |
| **3.** | Haryana | 4 | | | | | | | | | | | | | | | | 3 | | | | 1 | | | | | | |
| **4.** | Uttar Pradesh | 27 | | | | | | | | | | | | | | 1 | | 9 | 1 | | 16 | | | | | | | |
| **5.** | Uttarakhand | 78 | | | | 8 | 2 | 1 | 2 | 1 | | | | 1 | | 4 | | 36 | 1 | | 19 | | | 1 | 1 | | | 1 |
| **6.** | Madhya Pradesh | 72 | 1 | 1 | 5 | | 2 | | | | | | | | | 11 | 2 | 29 | 1 | 1 | 12 | 2 | 2 | | | 3 | | |
| **7.** | Rajasthan | 6 | | | | 1 | | | | | | | | | | | | 2 | 1 | | 1 | | | | 1 | | | |
| **8.** | Maharashtra | 10 | | | | | | | | | | | 1 | | | | | 4 | | | 5 | | | | | | | |
| **9.** | Karnataka | 6 | | | | | | | | | | | | | | 1 | | 1 | | | | | 1 | | 2 | | | 1 |
| **10.** | Tamil Nadu | 144 | | | | 2 | | 1 | | | 1 | 3 | 1 | | 1 | 46 | 1 | 64 | 1 | | 20 | 1 | 1 | | | 1 | | |
| **11.** | Nepal | 76 | | 1 | | 4 | 1 | 1 | | 1 | | | | 4 | | 7 | 1 | 36 | 1 | | 16 | | | 1 | | | 1 | 1 |
| **Total** | | **477** | **1** | **2** | **5** | **15** | **5** | **3** | **2** | **2** | **1** | **3** | **3** | **5** | **1** | **75** | **4** | **214** | **6** | **1** | **106** | **4** | **5** | **2** | **4** | **4** | **1** | **3** |

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## 56th Wheat Disease Monitoring Nursery (WDMN) 2023-24

Wheat disease monitoring nursery (earlier trap plot nursery/TPN) is a logistic effective tool for monitoring the occurrence of wheat diseases especially rusts across different wheat growing zones of India. In addition, it helps in knowing the seasonal progress of the diseases in all the zones. Samples analyzed from WDMN gives an overview of area wise natural distribution and load of different rust races. The nursery also helps in understanding the area wise progress of wheat diseases and the performance of different disease resistance genes. The 56th wheat disease monitoring nursery was conducted at 38 locations, covering all the major wheat growing areas in the country, especially those situated near the bordering areas to the neighbouring countries. The data have been received from 33 locations (Table 8.13).

**Table: 8.13. List of co-operators and locations where WDMN was planted during 2023-24**

| State | Co-operators | Location |
|---|---|---|
| **Northern Hills andHigh-Altitude Zone** | | |
| Himachal Pradesh | R. Devlash<br>Head, ICAR-IIWBR, RS, Shimla<br>Dharam Pal<br>Hanif Khan | Bajaura Flowerdale,<br>Shimla<br>IARI, RS, Tutikandi, Shimla<br>IIWBR, RS, Dalang Maidan |
| Uttarakhand | K.K. Mishra | Hawalbagh (Almora) |
| Jammu & Kashmir | F. A. Mohiddin | Khudwani |
| **North Western Plains Zone** | | |
| Jammu & Kashmir | M.K. Pandey | Udhaywalla (Jammu)<br>Kathua<br>Rajouri |
| Haryana | Rajender Singh Beniwal | Hisar |
| Himachal Pradesh | ShiwaliDhiman | Dhaulakuan |
| Rajasthan | P.S. Shekhawat | Bassi (Durgapura, Jaipur) |
| Punjab | Jaspal Kaur | Gurdaspur<br>Ludhiana<br>Langroya<br>Abohar |
| Uttarakhand | Deepshikha and Kanak Srivastava | Pantnagar |
| **North Eastern Plains Zone** | | |
| Bihar | C. S. Azad<br>K.K. Singh | Sabour<br>Pusa |
| Jharkhand | H.C. Lal | Kanke, Ranchi |
| Uttar Pradesh | V.K.Yadav & Charul Kanchan<br>V. P. Chaudhary&S.P. Singh | Araul (Kanpur)<br>Kumarganj, Ayodhya |
| West Bengal | RaghunathMandal | BCKV, Kalyani |
| **Central Zone** | | |
| Chhattisgarh | S.K. Jain | Baronda, Raipur |
| Gujarat | RonakThakkarIB<br>Kapadiya | Ladol (Vijapur)<br>Mangrol (Junagadh) |

| | | |
|---|---|---|
| Madhya Pradesh | Prakasha T.L.<br>K.K. Mishra | Indore<br>Khojanpur (Powarkheda) |
| **Peninsular and Southern Hills Zone** | | |
| Maharashtra | Sudhir Navathe<br>B.C. Game, B.M. Ilhe<br>Swati G Bharad and B. D. Gite | A.R.S. Baner, (Pune)<br>ARS, Niphad<br>Akola |
| Karnataka | Gurudatt M. Hegde | UgarKhurd (Dharwad) |
| **Tamil Nadu** | M.Sivasamy | Wellington |

There were 20 (21 for High Altitude Zone and North Hills Zone) entries in the nursery during 2023-24. Of these, first 15 entries were common to all zones, rest of the five (six for High Altitude Zone and North Hills Zone) entries were zone specific varieties. The detailed updated constituent of WDMN for 2023-24 crop season was as given below:

**Common set of varieties for all zones**

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

**Zone specific varieties**

**i) North Western Plains Zone**

WH1105, HD3086, HD3226, DPBW621-50 and PBW757

**ii) North Eastern Plains Zone**

K 8804, HD2888, DBW187, HUW468 and NW1014

**iii) Central Zone**

HI8663, HI1544, LOK-1, GW366 and GW322

**iv) Peninsular and Southern Hills Zone**

MACS2496, Bijaga Yellow, HW971, HD2501 and HW2022 (*Sr24/Lr24*)

**v) Northern Hills and High Altitude Zone**

HPW349, VL892, HS420, Sonalika, HS507 and Barley Local

Seeds of all the entries along with the data booklets containing sowing plan, procedures and data sheets were sent to co-operators early in the season to ensure timely planting of the nursery. Each entry of the nursery was planted in two consecutive rows with two rows of Agra local as spreader row covering the periphery of nursery area. Observations on diseases were generally recorded up to five times during the crop season. The co-operators were advised to plant wheat disease monitoring nursery in time, in isolation and away from the inoculated fields. The disease situation was monitored at regular intervals and the rust disease samples from these nurseries were analyzed at ICAR-IIWBR, Regional Station, Flowerdale, Shimla.

**Disease incidence in WDMN**

Information on wheat disease situation was received from Dhaulakuan, Bajaura, Tutikandi(Shimla), Dalang Maidan, Flowerdale (Shimla) & in Himachal Pradesh, Udhaywalla (Jammu), Kathua, Rajouri& Khudwani in Jammu & Kashmir, Pantnagar & Almora in Uttarakhand, Gurdaspur, Langroya, Ludhiana &Abohar in Punjab, Hisar (Haryana), Pusa &Sabour (Bihar), Ranchi (Jharkhand), Kanpurand Ayodhya in Uttar Pradesh, Kalyani (West Bengal), Vijapur & Junagadh in Gujarat, Indore & Powarkheda in Madhya Pradesh, Raipur (Chattisgarh), Jaipur (Rajasthan), Pune, Niphad & Akola in Maharashtra, Dharwad(Karnataka) and Wellington (Tamil Nadu). The occurrence of wheat blast and *Sr31*virulences (Ug99 type of pathotypes) of black rust was not reported from any of the wheat growing zones of

India. Yellow rust was noticed at all the locations of NHZ and NWPZ except IARI, Tutikandi Facility and IIWBR, RS, Shimla.It was not reported from any other zones includingNEPZ and SHZ. More than 40S severity of yellow rust was reported from all the locations of NHZ and NWPZ except Durgapura where maximum yellow rust severity was 5S on Agra Local. At leastsix entries of WDMN had ≥ 40S severity at Almora, Bajaura, Khudwani, Dalang, Kathua, Jammu, Dhaulakuan, Gurdaspur, Ludhiana and Langroya.

Brown rust was reported from twelve locations of NHZ and NWPZ *viz.* Almora and Pantnagar in Uttarakhand, Flowerdale in Himachal Pradesh, Rajouri, Kathua and Jammu (Jammu), Hisar (Haryana), Abohar, Gurdaspur, Langroya and Ludhiana in Punjab, Jaipur (Rajasthan).It was reported from all the locations of NEPZ except Kalyani and Ranchi. In central zone brown rust appeared at Vijapur, Indore and Powarkheda and in PZ and SHZ only at Pune and Wellington. At Durgapurabrown rust appeared only on HD2329 (TS), Lal Bahadur (TS), WH147 (TMS) and RNB1001 while at Shimla it was reported only on three entries i.e. PBW752 (10S), Agra Local (20S) and Lal Bahadur (15S) while other entries were brown rust free. Of the 33 locations of WDMNs black rust was observed at Vijapur, Indore and Powarkheda inCZ, Dharwad in PZ and Wellington in SHZ. All the entries of WDMN were black rust free in NHZ, NWPZ, PZ and NEPZ.Leaf blight wasreported from WDMNs planted at Rajouri, Kathua, Jammu (Udhaywalla), Sabaur, Pusa, Kalyani, Ranchi, Ayodhya, Kanpur, and Niphad. Powdery mildew was observed only at Almora, Rajouri, Kathua, Jammu, Dhaulakuan and Wellington.

**Appearance of wheat rusts in WDMN**

The data on first appearance of the wheat diseases on WDMN was not available for most of the locations. As per the available data, yellow rust on WDMN was first observed at Jammu (06.01.24) followed by Kathua (10.01.24), Dhaulakuan (14.02.24), Almora and Hisar (01.03.24), (Durgapura) (13.03.24), Bajaura (25.03.24) and Kathua (26.03.24). Brown rust was first observed at Wellington (05.01.24), followed by Pantnagar (06.02.24), Indore (07.02.24), Powarkheda (11.02.24), Kanpur (15.02.24), Vijapur and Pune (17.02.24), Jammu and Faizabad (01.03.24), Kathua (02.03.24), Sabour (05.03.24), Hisar (12.03.24), Durgapura (13.03.24), Almora (18.03.24), and Rajouri (20.04.24). Black rust was first observed at Wellington and Dharwad on 20.01.24 followed by Vijapur (09.02.24), Powarkheda (25.02.24) and Indore (28.02.24).

**Varietal Performance against wheat rusts**

**High Altitude and Northern Hills Zone**

Maximum severity of yellow rust was observed at Dhaulakuan, where fourteen entries of WDMN were showing more than 40S severity of yellow rust. Thirteen entries at Dalang, ten entries at Almora and Bajaura exhibited ≥40S yellow rust severity.WDMN entry Barley local was yellow rust free at all the NHZ locations. Agra Local had ≥40S yellow rust severity at all the locations of NHA.PBW752 was yellow rust free at all the locations of NHZ except Khudwani (20MR) and Dalang (20MR). WDMN entryKharchia Mutantwas highly susceptible and had more than 40S yellow rust severity at all the locations of NHZ except Flowerdale and Tutikandi in Shimla. More than 40S yellow rust severity was observed on HD2329, Agra local, Kharchia Mutant and Lal Bahadur at all the locations of NHZ wherever yellow rust appeared. Brown rust appeared only at Flowerdale and Almora in NHZ. Only three WDMN entries *viz.* PBW752 (10S), Agra Local (20S) and Lal Bahadur (15S) had brown rust infection at Flowerdale whereas at Almora nineentries *viz.* Agra Local (TS), Lal Bahadur (TR), WL1562 (5S), HD2204 (20S), WH147 (20S), Kharchia Mutant (20S), VL892 (10S), HS420 (5S), and Sonalika (20S), were showing brown rust infection. Black rust was not reported from NHZ.

**North Western Plain Zone**

Yellow rust was observed at all the locations of NWPZ however only one WDMN entry {Agra Local (5S) had yellow rust infection at Durgapura. PBW752 was yellow rust free at all the locations of NWPZ except Hisar (10S), Dhaulakuan (20S) and Pantnagar (5S). Agra Local had ≥40S yellow rust severity at all the locations of NWPZ except Rajouri (20S), Durgapura (5S), Abohar (20S) and Pantnagar (20S).Yellow rust severity was very high at Dhaulakuan, Jammu, Gurdaspur, Ludhiana, and Langroyain NWPZ, where at least eight entries had more than 40S severity of yellow rust. Similarly, three entries at

Rajouri, six in Kathua had more than 40S yellow rust severity. WDMN entry PBW757 was yellow rust free at all the locations except Hisar (10S), Dhaulakuan (20S), and Langroya (TMR). 100S severity of yellow rust was observed on Kharchia Mutant at Pantnagar. More than 40S severity of yellow rust was reported on HD2329 from all the locations of NWPZ except Durgapura (0), Abohar (5S) and Pantnagar (0). Brown rust appeared at all the locations of NWPZ except Dhaulakuan. Minimum brown rust incidence was reported from Durgapura where only HD2329 (TS), Lal Bahadur (TS), WH147 (TMS) and RNB1001 (TS) were infected with brown rust. Highest brown rust severity in NWPZ was recorded from Pantnagar, where 11 entries had ≥ 40S severity, of which four entries (HD2329, Agra Local, Lal Bahadur, and HD3085 had 100S severity of brown rust. Similarly, at Hisar more than 40S brown rust severity was observed on nine entries with 100S brown rust severity on Kharchia Mutant. Black rust was not reported from any of the locations in NWPZ.

**North Eastern Plain Zone**

Yellow rust was not observed on any of the entries of WDMN planted at NEPZ. Brown rust appeared at all the locations of NEPZ except Ranchi and Kalyani. Maximum brown rust severity was recorded from Sabour and Pusa where at least five WDMN entries had ≥ 30S severity of brown rust. Only nine entries had brown rust infection at Sabour with highest disease severity of 50S on Lal Bahadur. Likewise, seven entries had brown rust infection at Kanpur with HD2329 and Kharchia Mutant exhibiting maximum brown rust severity (40S). WDMN entry Lal Bahadur had ≥ 50S severity of brown rust at all the locations of NEPZ except Kanpur (20S). WDMN entry DL784-3-3 was brown rust free at all the locations of NEPZ. Black rust did not appear on any of the entries of WDMN in this zone.

**Central Zone**

Yellow rust did not appear in this zone. Brown rust was observed at all the locations of CZ except Junagarh (Gujarat). All the entries of WDMN were brown rust free at Vijapur except HD2329 (5R) and Lal Bahadur (5R). At Powarkheda Agra Local (20S), C306 (20S), WH147 (10S), DL784-3 (20S), LOK-1 (40S) and GS322 (40S) were the only entries showing brown rust infection. At Indore only ten entries were infected with brown rust with Lal Bahadur (80S) exhibiting maximum brown rust severity. Black rust was observed at Vijapur, Indore and Powarkheda in central zone. At Vijapur black rust appeared only on Agra Local (TR) and all other entries were black rust free. Sex entries viz., Agra Local (20S), C306 (10S), WH147 (10S), DL784-3 (10S), LOK-1 (10S) and GW322 (10S) had black rust infection at Powarkheda others were free from infection.

**Peninsular Zone and Southern Hill Zone**

Yellow rust did not appear on any of the locations in these zones. Brown rust appeared only Pune in PZ and Wellington in SHZ. All the entries of WDMN were brown rust free at Akola, Niphad and Dharwad in PZ. Maximum brown rust severity was observed at Wellington,where all the entries except HD2021 (0), HW2008 (0), HP1633 (10MS), DL784-3 (5MR), RNB2001 (0), MACS2496 (20S), Bijaga Yellow (10MS), HW971 (20S), HD2501 (20S) and HW2022 (0) had more than 40S severity of brown rust. At Pune Nine WDMN entries were brown rust free while three entries Agra Local (60S), Lal Bahadur (60S) and WH147 (40Shad) ≥ 40S severity of brown rust.

Black rust was observed only at Dharwad (PZ) and Wellington (SHZ), where all the entries had black rust infection. Nine WDMN entries had ≥80S black rust severity at Wellington withHD2329, Agra local, HD2204 exhibiting 100S severity of black rust. Fourteen WDMNentries at Dharwad had ≥40S severity of black rust. Six entries i.e. Agra Local, Lal Bahadur, C306, Kharchia Mutant, and HP1633 had ≥80S severity ofblack rust at both the locations.

**Other diseases**

**Blights**

Information on foliar blights was received from ten locations. Earliest record of blight was from Ranchi (28.12.24) followed by Niphad (31.01.24), Kalyani and Faizabad (05.02.24), Sabour (12.02.24), Jammu (01.03.24), Kathua (02.03.24) and Rajouri (20.04.24).Leaf blight was not reported from any of the locations in the Northern Hills Zone. All the entries had LB

Infection at Rajouri, Kathua and Jammu except HD2204, C306 and WH147 at Rajouri. LB severity was maximum at Jammu with 17 entries showing ≥23 score of the disease. All WDMN entries were infected with leaf blight at all the locations in NEPZ except at Kanpur, where nine entries were leaf blight free. Maximum severity of leaf blight was recorded at Kalyani, where all WDMN entries had more than 58 score of leaf blight, whereas the LB severity was minimum at Kanpur where ≤36 score was recorded on infected entries.In central zone leaf blight was not observed.In PZ and SHZ blight was reported only from Niphad, where it was reported only on two entries i.e. HD2204 (02) and HP1633 (14).

**Powdery mildew**

Powdery mildew was reported only from five locations *viz*. Almora, Kathua, Rajouri, Jammu,and Dhaulakuan in NHZ and NWPZ. It was not observed in NEPZ, CZ, and PZ, whereas all the entries had powdery mildew infection at Wellington in SHZ. Powdery mildew was first detectedat Wellington (28.12.24) followed by Dhaulakuan (14.02.24), Jammu (01.03.24), Kathua (02.03.24) and Rajouri (08.04.24). All the entries of WDMN were showing powdery mildew symptoms at Rajouri, Kathua, Wellington and Dhaulakuan, whereas only one entry (DPBW621-50) was powdery mildew free at Jammu. Maximum powdery mildew severity was recorded at Dhaulakuan where allWDMN entries had disease score of 6 or more. The minimum severity of powdery mildew was observed at Wellington, where only six entries exhibited a severity level between 5 and 6. All other entries had severity levels ranging from 1 to 4

**Loose smut**

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

**Wheat Disease Sitautaion in SAARC countries**

Under the umbrella of Regional Station, ICAR-IIWBR, Shimla and CIMMYT, Delhi, SAARC wheat disease monitoring nursery is being conducted in SAARC countries with the objectives similar to the wheat disease monitoring nursery (WDMN) in India. During 2023-24, SAARC-wheat disease monitoring nursery was planted at 27 locations across the six SAARC countries (Table 8.14).

**Table: 8.14. Detail of SAARC-Wheat disease monitoring nursery locations during 2023-24.**

| S. No. | Country/ Locations | Contact person |
|---|---|---|
| 1. | Nepal (3 sets) | CIMMYT, Delhi* |
| 2. | Bangladesh (5 sets) | CIMMYT, Delhi |
| 3. | Pakistan (2 sets) | CIMMYT, Delhi |
| 4. | Bhutan (1 set) | CIMMYT, Delhi |
| 5. | Afghanistan (1set) | CIMMYT, Delhi |
| 6. | India (15 sets) | In-Charge, RS, ICAR-IIWBR, Shimla |
| **Total** | **27 locations** | |
| *Coordinator: Dr. A.K. Joshi, CIMMYT, Delhi. | | |

Information on wheat diseases in SAARC Wheat Disease Monitoring Nursery has been received from allthe locations in India (Table 8.15) and Nepal. Data from other locations of Bangladesh, Pakistan, Bhutan and Afghanistan is awaited.

**Table: 8.15. Locations (data received from) of SAARC Wheat disease monitoring nursery in India during 2023-24**

| State | Co-operator | Locations |
|---|---|---|
| **Delhi** | VKSingh | Delhi |
| **Himachal Pradesh** | ShiwaliDhiman | Dhaulakuan |
| **Jammu & Kashmir** | MK Pandey | Jammu (Udhaywalla)Kathua<br>Rajouri |

| | | |
|---|---|---|
| **Punjab** | Jaspal Kaur | Ludhiana<br>Gurdaspur<br>Langroya<br>Ropar |
| **Uttar Pradesh** | VP Chaudhary&SP Singh | Kumarganj, Ayodhya |
| **Bihar** | KK Singh | Pusa |
| **Rajasthan** | PS Shekhawat | Bassi (Durgapura) |
| **Tamil Nadu** | M Sivasamy | Wellington |
| **Uttarakhand** | Deepshikha<br>K. K. Mishra | Pantnagar<br>Almora |

The SAARC wheat disease monitoring nursery comprised of 20 lines contributed by fourSAARC countries (Table 8.16).

**Table:8.16. Composition of SAARC wheat disease monitoring nursery**

| S. No. | Variety | S. No. | Variety |
|---|---|---|---|
| 1. | Annapurna-1 | 11. | Punjab 85 |
| 2. | WL1562 | 12. | Chakwal 86 |
| 3. | HD2204 | 13. | Faisalabad 85 |
| 4. | PBW343 | 14. | Inquilab 91 |
| 5. | HD2687 | 15. | Faisalabad 83 |
| 6. | HD2189 | 16. | Rawal 87 |
| 7. | HP1633 | 17. | Kohsar |
| 8. | RAJ3765 | 18. | Bakhtawar 94 |
| 9. | PBW660 | 19. | Gourab |
| 10. | Pak81 | 20. | Susceptible Check |

## Wheat Disease Situation in SAARC countries

### Disease situation in India

### Rusts

SAARC nursery was planted at 12 locations of NHZ and NWPZ, Ayodhya and Pusa in NEPZ and Wellingtonin SHZ (Table 8.17). Yellow rust was observed at all the SAARC-WDMN nursery locations in India except Ayodhya, Pusa and Wellington. Yellow rust was first observed at Kathua (10.01.24) followed by Pantnagar (09.02.24), Durgapura (13.02.24), Dhaulakuan (14.02.24), Rajouri (26.02.24), Delhi (28.02.24) and Almora (01.03.24). All the entries of SAARC nursery were infected with yellow rust at Jammu, Kathua, Dhaulakuan, Gurdaspur, Langroya and Ludhiana. More than eight entries of SAARC-WDMN had ≥ 40S severity of yellow rust at Almora, Jammu, Kathua, Dhaulakuan, Ludhiana, Langroya and Gurdaspur. Maximum yellow rust severity was at Jammu, where all the entries except HD2687 (20S), PBW660 (10S), Punjab 85 (20MS), Chakwal 86 (5MS),had ≥ 40S severity of yellow rust.Yellow rust appeared only on two entries (PBW343 and susceptible check)at Durgapura and five entries {PBW343 (50S), HD2687 (10S), Inquilab 91 (TR), Kohsar (5S) and susceptible check (60S)} at Delhi. SAARC-WDMN entry PBW660 was the least sensitive to yellow rust as it were yellow rust free at six locations. Two entries (Susceptible check and PBW 343) were most susceptible for yellow rust as they had more than 40S severity of yellow rust at least at nine locations. Yellow rust severity was more than 40S at all the locations except Abohar (20R) and Durgapura (TS).

Brown rust was observed at all the SAARC nursery locations except Ropar, Ludhiana and Dhaulakuan (Table 8.17). First report of brown rust was from Pantnagar (05.02.24) followed by Wellington (12.02.24), Durgapura (13.02.24), Jammu and Ayodhya (01.03.24), Kathua (02.03.24), Almora (18.03.24), Delhi (27.03.24), and Rajouri (20.04.24). All theentries of SAARC-WDMN were brown rust free at Langroya except Annapurna (20S) and at Delhi except WL1562 (TR) and susceptible check (20S). Similarly, at Durgapura brown rust appeared only on Pak81 (TS), Faisalabad 85 (TS), Rawal87 (TMS) and susceptible check (5S) while at Rajouri it appeared on Pak81 (TS), Inquilab 91 (5S) and S. check (5S). SAARC-WDMN entry Bhaktwar94 was brown rust free at all the locations except Pantnagar (30S), Kathua (TMS), Gusdaspur (10S) and Wellington (20S) whereas HP1633, PBW660, Chakwal 86, Faisalabad 83 and Gourab were brown rust free at eight locations. Brown rust appeared onsusceptible check at all the locations except Abohar and Langroya. Maximum brown rust severity was reported from Pantnagar and Wellington where all the entries were infected with brown rust of which fourteen entries had ≥ 30S severity of the disease. Annapurna and Susceptible check had 100S severity of brown rust at Pantnagar. At Ayodhya and Pusa at least six entries had ≥ 30S severity of brown rust. Black rust was observed only at Wellington, where all the entries were showing black rust symptoms. Black rust severity at Wellington was ranging from 10MR on PBW343 and to 80S on HP1633 and susceptible check (Table 8.17).

### Blights

Leaf Blight of wheat was observed only at five locations (Jammu, Kathua, Rajouri, Ayodhya and Pusa) of SAARC nursery, where all the entries except Annapurna-1, WL1562, HD2204, PBW343, HD2687, HD2189, PBW660, Pak 81, Punjab 85, Chakwal 86, Faisalabad 85,Inquilab 91, Faisalabad 83, Rawal 87, Kohsar and Gourab were infected with leaf blight. Maximum leaf blight severity was observed at Ayodhya, where 13 entries had ≥ 56 leaf blight disease severity (56 to 78) (Table 8.18).

### Powdery mildew

Powdery mildew (PM) was reported only from six SAARC-WDMN locations i.e. Almora, Jammu, Kathua, Rajouri, Wellington and Dhaulakuan, where all the entries had powdery mildew infection except PBW660, Bhaktawar 94, Gourab at Kathua. Maximum PM severity was observed at Dhaulakuan where all the entries of the nursery had equal or more than 6 powdery mildew score. Entry Inquilab 91 was the most sensitive to powdery mildew as it had 9, 7 and 9 PM score at Jammu, Rajouri and Dhaulakuan, respectively (Table 8.19).

### Loose Smut

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

### Disease situation in Nepal

SAARC-WDMN was planted at seven locations (Hardinath, Rampur, Parwanipur, Bhairahawa, Nepalgunj, Surkhet, and Kabre) in Nepal. Brown rust was observed at all the locations except Kabre, while yellow rust was observed at Hardinath, Bhairahawa, Nepalgunj, Surkhet, and Kabre (Table 8.20). Brown rust appeared on all the entries of SAARC-WDMN at Nepalgunj. Likewise, yellow appeared on all the entries at Kabre. Highest brown rust severity was observed at Hardinath, where twelve entries had ≥20S severity of brown rust. At Kabre all the SAARC-WDMN entries, except Faisalabad 85 (10MR), had ≥20MR severity of yellow rust (Table 8.20). Data from other SAARC countries i.e. Bangladesh, Pakistan, Bhutan and Afghanistan are awaited.

**(Cooperators: Pramod Prasad, O.P Gangwar, Charu Lata, Jayanth Kallugudi and Subodh Kumar)**

Regional Station, ICAR-IIWBR, Flowerdale, Shimla

## Table: 8.17. Incidence of rusts on SAARC Wheat Disease Monitoring Nursery in India during 2023-24

| S.No. | Varieties | Yellow | | | | | | | | | | | | Brown | | | | | | | | | | | | | Black |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ABO | ALM | DEL | DKN | DUR | GUR | JAM | KAT | LAN | LUD | PAN | RAJ | ABO | ALM | DEL | DUR | FBD | GUR | JAM | KAT | LAN | PAN | PUS | RAJ | WEL | WEL |
| 1 | Annapurna | 10S | 60S | 0 | 40S | 0 | 40S | 60S | 20S | 60S | 40S | 10S | 40S | TS | 40S | 0 | 0 | 30S | 0 | 20S | 40S | 20S | 100S | 30S | 0 | 60S | 40S |
| 2 | WL1562 | TS | 0 | 0 | 20S | 0 | 10S | 60S | 20S | 5S | 20S | 15S | 20S | TS | 0 | TR | 0 | 5S | 0 | 10MS | 10S | 0 | 30S | 0 | 0 | 40S | 20S |
| 3 | HD2204 | TS | 10S | 0 | 60S | 0 | 40S | 40S | 40S | 10S | 20S | 10S | 20S | TS | 0 | 0 | 0 | 20S | 0 | 10MS | 20S | 0 | 80S | 20S | 0 | 60S | 60S |
| 4 | PBW343 | 20S | 40S | 50S | 40S | TS | 40S | 60S | 60S | 60S | 60S | 40S | 40S | 20S | 0 | 0 | 0 | 30S | 0 | 5S | 10S | 0 | 30S | 30S | 0 | 40S | 10MR |
| 5 | HD2687 | TS | 20S | 10S | 40S | 0 | 40S | 20S | 40S | 40S | 20S | 20S | 5S | TS | 5S | 0 | 0 | TS | 10S | 0 | 10S | 0 | 60S | 40S | 0 | 60S | 20MR |
| 6 | HD2189 | 5S | 20S | 0 | 40S | 0 | 5S | 40S | 10S | 40S | 10MS | 15S | 10S | TS | 5S | 0 | 0 | TS | 20S | 0 | 0 | 0 | 40S | 40S | 0 | 60S | 20S |
| 7 | HP1633 | 20S | 40S | 0 | 20S | 0 | 20S | 60S | 40S | 60S | 20S | 40S | 20S | 5S | 0 | 0 | 0 | 30S | 0 | 5MS | 0 | 0 | 15S | 0 | 0 | 20MS | 80S |
| 8 | RAJ3765 | 10S | 80S | 0 | 40S | 0 | 60S | 60S | 10S | 60S | 60S | 60S | 10S | TS | 0 | 0 | 0 | 20S | 0 | 0 | 10S | 0 | 10S | 30S | 0 | 40S | 60S |
| 9 | PBW660 | 0 | 0 | 0 | 20S | 0 | 10S | 10MS | 10MS | 20S | 20S | 0 | 0 | 0 | 0 | 0 | 0 | 5S | 0 | TMS | 5S | 0 | 15S | 0 | 0 | 10MS | 20MR |
| 10 | PAK81 | TS | 40S | 0 | 40S | 0 | 40S | 40S | 40S | 40S | 60S | 5S | 20S | TS | 10S | 0 | TS | 0 | 0 | 20S | 40S | 0 | 60S | 30S | TS | 60S | 20S |
| 11 | Punjab85 | 0 | 0 | 0 | 20S | 0 | 5S | 20MS | 10MS | 10S | 5S | 0 | 10S | 0 | 0 | 0 | 0 | 5S | 20S | 5MS | 10S | 0 | 20S | 5S | 0 | 10MS | 40S |
| 12 | Chakwal86 | 0 | TS | 0 | 20S | 0 | 10S | 5MS | 10S | 10S | 10S | 0 | TMS | 0 | 0 | 0 | 0 | 30S | 10S | 0 | 10MS | 0 | 5S | 0 | 0 | 20MS | 60S |
| 13 | Faisalabad85 | 5S | 40S | 0 | 80S | 0 | 40S | 40S | 60S | 60S | 40S | 15S | 20S | 0 | TS | 0 | TS | 30S | 0 | 20S | 10S | 0 | 70S | 20S | 0 | 80S | 60S |
| 14 | Inquilab91 | 20S | 40S | TR | 80S | 0 | 40S | 40S | 40S | 60S | 60S | 0 | 20S | 10S | 5S | 0 | 0 | 10S | 0 | 20S | 40S | 0 | 90S | 20S | 5S | 80S | 60S |
| 15 | Faisalabad83 | 5S | 10S | 0 | 40S | 0 | 40S | 40S | 20S | 20S | 20S | 15S | 20S | 0 | 0 | 0 | 0 | 20S | 0 | 0 | 10S | 0 | 50S | 10S | 0 | 60S | 80S |
| 16 | Rawal87 | 0 | 10S | 0 | 40S | 0 | 20S | 40S | 40S | 20S | 10S | 5S | 5S | 0 | 10S | 0 | TMS | 0 | 20S | 20S | 40S | 0 | 50S | 20S | 0 | 60S | 10S |
| 17 | Kohsar | 5S | 10S | 5S | 40S | 0 | 20S | 40S | 40S | 20S | 20S | 0 | 10S | 0 | 5S | 0 | 0 | 10S | 0 | 0 | 10S | 0 | 60S | 10S | 0 | 40S | 20S |
| 18 | Bakhtawar94 | 0 | TS | 0 | 20S | 0 | 20S | 40S | 40S | 10S | 10S | 0 | 20S | 0 | 0 | 0 | 0 | 0 | 10S | 0 | TMS | 0 | 30S | 0 | 0 | 20S | 20S |
| 19 | Gourab | 20S | TS | 0 | 60S | 0 | 60S | 40S | 10S | 40S | 60S | 15S | 0 | 10S | 0 | 0 | 0 | 0 | 0 | TMS | 10S | 0 | 10S | 0 | 0 | 20S | 60S |
| 20 | Susceptible check | 20S | 60S | 60S | 80S | TS | 80S | 60S | 40S | 60S | 60S | TS | 40S | 0 | 20S | 20S | 5S | 60S | 10S | 40S | 60S | 0 | 100S | 40S | 5S | 60S | 80S |
| | **Date of first Appearance** | - | 01.03.2024 | 28.02.2024 | 14.02.2024 | 13.03.2024 | - | 06.01.2024 | 10.012024 | - | - | 09.02.2024 | 26.02.2024 | - | 18/03/2024 | 27.03.2024 | 13.03.2024 | 01.03.2024 | - | 01.03.2024 | 02.03.2024 | - | 05.2.2024 | - | 20.04.2024 | 05.01.2024 | 20.01.2024 |

*ABO=Abohar, ALM= Almora, DEL=New Delhi, DKN=Dhaulakuan, GUR=Gurdaspur, JAM=Jammu, KAT=Kathua, LAN= Langroya LUD=Ludhiana, PAN=Pantnagar,RAJ=Rajouri, FBD= Faizabad, PUS= Pusa, WEL=Wellington

**Table: 8.18. Incidence of Leaf blight in SAARC Wheat Disease Monitoring Nursery during 2023-24 in India**

| S. No. | Varieties | Faizabad | Jammu | Kathua | Rajouri | Pusa |
|---|---|---|---|---|---|---|
| 1 | Annapurna | 57 | 35 | 35 | 0 | 34 |
| 2 | WL1562 | 68 | 56 | 13 | 0 | 45 |
| 3 | HD2204 | 78 | 57 | 13 | 0 | 45 |
| 4 | PBW343 | 56 | 35 | 13 | 0 | 35 |
| 5 | HD2687 | 67 | 47 | 13 | 0 | 34 |
| 6 | HD2189 | 57 | 46 | 23 | 0 | 34 |
| 7 | HP1633 | 57 | 56 | 25 | 12 | 45 |
| 8 | RAJ3765 | 68 | 46 | 24 | 16 | 34 |
| 9 | PBW660 | 46 | 24 | 24 | 0 | 23 |
| 10 | PAK81 | 47 | 35 | 15 | 0 | 34 |
| 11 | Punjab85 | 67 | 24 | 23 | 0 | 23 |
| 12 | Chakwal86 | 57 | 24 | 35 | 0 | 23 |
| 13 | Faisalabad85 | 46 | 35 | 24 | 0 | 23 |
| 14 | Inquilab91 | 46 | 24 | 24 | 0 | 34 |
| 15 | Faisalabad83 | 68 | 35 | 12 | 0 | 45 |
| 16 | Rawal87 | 46 | 25 | 25 | 0 | 34 |
| 17 | Kohsar | 57 | 24 | 34 | 0 | 23 |
| 18 | Bakhtawar94 | 46 | 13 | 24 | 12 | 23 |
| 19 | Gourab | 46 | 35 | 12 | 0 | 34 |
| 20 | Susceptible check | 78 | 46 | 24 | 12 | 34 |
| **Date of first appearance** | | 05.02.2024 | 01.03.2024 | 02.03.2024 | 20.04.2024 | - |

**Table: 8.19. Incidence of Powdery Mildew in SAARC Wheat Disease Monitoring Nursery during 2023-24 in India**

| S.No. | Varieties | Powdery Mildew severity | | | | | |
|---|---|---|---|---|---|---|---|
| | | Almora | Dhaulakuan | Jammu | Kathua | Rajouri | Wellington |
| 1 | Annapurna | 3 | 6 | 3 | 4 | 5 | 1 |
| 2 | WL1562 | 3 | 6 | 5 | 2 | 5 | 2 |
| 3 | HD2204 | 5 | 9 | 6 | 4 | 7 | 1 |
| 4 | PBW343 | 7 | 9 | 5 | 7 | 5 | 2 |
| 5 | HD2687 | 7 | 9 | 7 | 4 | 4 | 4 |
| 6 | HD2189 | 3 | 6 | 7 | 3 | 3 | 2 |
| 7 | HP1633 | 4 | 9 | 3 | 3 | 3 | 3 |
| 8 | RAJ3765 | 6 | 9 | 3 | 5 | 5 | 3 |
| 9 | PBW660 | 5 | 6 | 3 | 0 | 2 | 4 |
| 10 | PAK81 | 3 | 6 | 5 | 5 | 5 | 1 |
| 11 | Punjab85 | 6 | 6 | 7 | 2 | 7 | 2 |
| 12 | Chakwal86 | 3 | 9 | 3 | 4 | 3 | 1 |
| 13 | Faisalabad85 | 5 | 9 | 2 | 5 | 5 | 5 |
| 14 | Inquilab91 | 7 | 9 | 9 | 2 | 7 | 2 |
| 15 | Faisalabad83 | 3 | 9 | 7 | 2 | 7 | 1 |
| 16 | Rawal87 | 3 | 9 | 7 | 7 | 5 | 3 |
| 17 | Kohsar | 1 | 6 | 7 | 3 | 7 | 2 |
| 18 | Bakhtawar94 | 1 | 6 | 7 | 0 | 5 | 1 |
| 19 | Gourab | 1 | 6 | 6 | 0 | 7 | 3 |
| 20 | Susceptible check | 3 | 6 | 5 | 5 | 5 | 6 |
| **Date of first appearance** | | - | 14.02.2024 | 16.02.2024 | 02.03.2024 | 08.04.2024 | 18.12.2023 |

Table: 8.20. Incidence of wheat diseases on SAARC wheat disease monitoring nursery in Nepal during 2023-24.

| SN | Variety | NWRP, Bhairahawa | | DoAR, Nepalgunj | | DoAR, Surkhet | | NRRP, Hardinath | | DoAR, Parwanipur | | HCRP, Kabre | NMRP, Rampur |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Leaf Rust | Yellow Rust | Leaf rust | Yellow Rust | Leaf rust | Yellow Rust | Leaf Rust | Yellow Rust | Leaf Rust | Yellow Rust | Yellow Rust | Leaf Rust |
| 1 | Annapurna-1 | 40 MS | 0 | 15 MS | 0 | 60 S | 20 S | 80 MS | 10 MS | 5 MR | 0 | 20 MR | 20 MR |
| 2 | WL1567 | 40 MS | 0 | 5 MR | 0 | 0 | 60 S | 60 MS | 0 | TR | 0 | 60 MS | 10 MR |
| 3 | HD2204 | 20 MS | 5 MR | TMR | 40 MS | 0 | 80 S | 80 MS | 5 MS | 0 | 0 | 60 MS | 10 MR |
| 4 | PBW343 | 0 | 10 MR | TMR | 10 MR | 0 | 60 S | 0 | 0 | 0 | 0 | 30 MS | 15 MS |
| 5 | HD2687 | T MR | 0 | TMR | 0 | 0 | 10 MS | 30 MS | 0 | 0 | 0 | 20 MS | 10 MS |
| 6 | HD2189 | 15 MS | 0 | 5 MS | 0 | 40 S | 40 S | 20 MS | 0 | 0 | 0 | 30 MS | TR |
| 7 | HP1633 | 5 MS | 0 | TMR | 0 | 20 S | 70 S | 10 MS | 0 | 0 | 0 | 20 MR | 0 |
| 8 | Raj 3765 | 25 MS | 0 | 15 MR | 0 | 10 MS | 0 | 30 MS | 0 | 0 | 0 | 20 MR | 20 MR |
| 9 | PBW373 | T MR | 0 | 5 MR | 20 S | T R | 0 | 90 MS | 0 | 0 | 0 | 20 MS | TR |
| 10 | Pak 81 | 40 MS | 0 | TMR | 0 | 40 S | 80 S | 60 MS | 10 MS | 0 | 0 | 20 MS | 5 MR |
| 11 | Punjab 85 | 10 MS | 0 | TMR | 30 MSS | 0 | 90 S | 40 MS | 10 MS | 0 | 0 | 60 MS | 10 MS |
| 12 | Chakwal 86 | 5 MR | 5 MR | TMR | 40 S | 0 | 100 S | 0 | 10 MS | 0 | 0 | 60 MS | 5 MR |
| 13 | Faisalabad 85 | T MR | 5 MR | TMR | 0 | 0 | 60 S | TR | 10 MS | 0 | 0 | 10 MR | TR |
| 14 | Inquilab 91 | 15 MS | 5MR | TMS | 0 | 70 S | 50 S | 20MS | 0 | 0 | 0 | 60 MS | TR |
| 15 | Faisalabad 83 | 5 MR | 5 MR | T MR | 0 | 60 S | 90 S | 0 | 0 | 0 | 0 | 60 MS | 5 MR |
| 16 | Rawal 87 | 25 MS | 0 | 10 MS | 5 MR | 90 S | 90 S | 80 MS | 0 | 0 | 0 | 30 MS | 60 MS |
| 17 | Kohsar | 40 S | 0 | 10 MSS | 5MR | 40 S | 90 S | 60 MS | 0 | 10 MR | 0 | 40 MS | 20 MS |
| 18 | Bakhtwar 94 | 60 MS | 5 MR | 5 MS | 0 | 40 S | 60 S | 80 MS | 0 | 0 | 0 | 30 MS | 40 S |
| 19 | Gourab | 5 MS | 0 | 5 MR | 5MR | 100 S | 100 S | 15MS | 0 | 0 | 0 | 30 MS | 5 MR |
| 20 | Susceptible Check | 25 MS | 5 MS | 5 MR | 25 MS | 0 | 100 S | 20MS | 0 | 10 MR | 0 | 60 MS | 80 S |

# PROGRAMME 9. INTEGRATED PEST MANGEMENT IN WHEAT

## HOST RESISTANCE AGAINST DISEASES

### I. Elite Multiple Disease Screening Nursery (EMDSN), 2023-24

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 80 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:** Junagadh Mahableshwar, Pune, Indore, Niphad, Powarkheda, Vijapur, Dharwad and Wellington
**Leaf rust (S):** Junagadh Mahableshwar, Pune, Indore, Niphad, Powarkheda, Vijapur, Dharwad and Wellington
**Leaf rust (N)**: Ayodhya, Durgapura, Luhdiana, Pantnagar, Karnal, Kanpur, Delhi and Jammu
**Stripe rust:** Durgapura, Luhdiana, Gurdaspur, Pantnagar, Karnal, Bajaura, Hisar, Delhi, Dhaulakuan, Almora, Malan, Jammu, Kudwani
**Karnal bunt**: Malan, Jammu, Ludhiana, Karnal, Hisar, Delhi, Pantnagar
**Loose smut**: Malan, Almora, Ludhiana, Hisar and Durgapura
**Leaf blight**: Ayodhya, Varanasi, RPCAU PUSA, Sabour, Kalyani, Coochbehar, Pune, Dhrwad
**Powdery mildew**: Malan, Dhaulakaun, Almora, Shimla, Jammu, Pantnagar, and Wellington
**Flag smut**: Ludhiana, Hisar and Durgapura
**Head scab**: Dhaulakuan, Gurdaspur, Karnal, Kalyani, Wellington, Dharwad and Delhi,
**Cereal cyst nematode**: Hisar and Durgapura

Data not considered due to erratic disease/ data not received:
**Stem rust:** Wellington and Vijapur
**Leaf rust (S)**: Powerkhera, Pune, Wellington, Dharwad and Vijapur
**Leaf rust (N):** Ayodhya, Ludhiana, Kanpur, Delhi and Jammu
**Stripe rust**: Ludhiana, Delhi, Gurdaspur, Almora, Malan, Jammu and Khudwani

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:** 80

**Resistant sources identified**

**Resistant to all three rusts + HS + FS**
DBW 386
**Resistant to all three rusts**
NIAW 4120
**Resistant to stripe rust and leaf rust**
DBW394
**Resistant to stripe rust + leaf rust + KB + FS**

PBW 893 and DDW 61(d)

**Resistant to stripe rust + leaf rust + PM + FS**

HI 1665 and PBW 889

**Resistant to stripe rust + leaf rust + FS**

HI1669 and NIAW 4028 and HI 8840(d)

**Resistant to leaf rust and stem rust**

DBW443, HI1672

**Resistant to leaf rust + stem rust + KB +FS**

PWU15

**Resistant to leaf rust + stem rust + PM+FS**

LOK 79

**Resistant to leaf rust + stem rust + FS**

DBW 444, NIAW 4183, HI 1673, HI 1675 and PBW 897

**Resistant to stem rust + stripe rust+ HS**

NIAW4153

**Resistant to stem rust + stripe rust + FS**

VL 2041 and GW547

**Table: 9.1. Entries tested in Elite multiple disease screening nursery (2023-24)**

| S. No. | Entry | RUSTS | | | | | | | | LB | | KB | | PM | | FS | | FHB | CCN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | South | | | | North | | | | 0-9(DD) | | % | | 0-9 | | % | | 0-5 | |
| | | Stem | | Leaf | | Leaf | | Stripe | | | | | | | | | | | |
| | | HS | ACI | HS | ACI | HS | ACI | HS | ACI | HS | AV. | HS | AV. | HS | AV | HS | AV | HS | HS |
| 1 | UP3102 | 40S | 19.7 | 5S | 2.3 | 20S | 11.7 | 40S | 12.0 | 89 | 56 | 25.40 | 7.60 | 9 | 5 | 5.5 | 2.45 | 3 | S |
| 2 | PBW893 | 40S | 18.6 | 10S | 4.5 | 10S | 5.0 | 10MS | 3.0 | 68 | 46 | 9.10 | 4.40 | 6 | 5 | 6.3 | 2.1 | 3 | S |
| 3 | HD3388 | 80S | 36.3 | 10MS | 4.5 | 10MS | 4.0 | 40S | 11.4 | 79 | 57 | 12.40 | 4.90 | 5 | 4 | 5.8 | 1.93 | 3 | HS |
| 4 | DBW444 | 30S | 6.6 | 5S | 1.8 | 5S | 1.7 | 60S | 29.5 | 99 | 67 | 15.90 | 7.00 | 9 | 7 | 5.3 | 2.24 | 3 | S |
| 5 | HS691 | 40S | 18.3 | 10MS | 5.3 | 40S | 25.3 | 20MS | 3.8 | 58 | 46 | 32.50 | 9.30 | 3 | 2 | 10.42 | 5.71 | 3 | S |
| 6 | VL2041(I)(C) | 20MS | 6.3 | 5MS | 3.0 | 20S | 15.0 | 10S | 3.3 | 99 | 67 | 50.00 | 12.70 | 6 | 5 | 7.3 | 2.43 | 3 | S |
| 7 | DBW386 | 10MS | 2.6 | 5MS | 1.1 | 5MR | 0.7 | 15S | 2.5 | 68 | 56 | 27.40 | 11.70 | 6 | 5 | 9.52 | 5.34 | 2 | S |
| 8 | HD3428 | 60S | 32.0 | 10MS | 5.0 | 30S | 12.7 | 20S | 9.3 | 79 | 57 | 10.50 | 5.50 | 4 | 2 | 7.3 | 2.92 | 2 | S |
| 9 | K2108 | 40MS | 9.1 | 20S | 14.5 | 40S | 30.0 | 20S | 6.4 | 68 | 56 | 70.70 | 17.80 | 4 | 2 | 8.1 | 5.4 | 3 | HS |
| 10 | PBW826(I)(C) | 30S | 15.5 | 20S | 7.6 | 60S | 40.0 | 20MS | 3.5 | 69 | 45 | 41.80 | 13.90 | 4 | 3 | 6.4 | 2.93 | 2 | S |
| 11 | HI1669 | 60S | 20.6 | 10MS | 3.3 | 0 | 0.0 | TS | 0.2 | 58 | 46 | 42.10 | 13.50 | 7 | 5 | 7.97 | 4.82 | 3 | HS |
| 12 | HI1670 | 40MS | 14.0 | 5MS | 2.5 | 40S | 18.3 | 0 | 0.0 | 59 | 46 | 45.70 | 12.00 | 6 | 5 | 6.12 | 3.91 | 3 | S |
| 13 | GW547 | 10S | 6.7 | 20MS | 6.5 | 40S | 36.7 | 40S | 10.0 | 89 | 57 | 10.70 | 5.20 | 9 | 5 | 6.8 | 2.27 | 4 | S |
| 14 | HI1674 | 20S | 6.6 | 10MS | 3.9 | 40S | 23.3 | 40S | 19.8 | 78 | 56 | 46.70 | 11.20 | 4 | 3 | 8.7 | 3.35 | 3 | HS |
| 15 | NIAW4183 | 40MS | 6.9 | 5S | 2.3 | 20S | 6.7 | 60S | 35.0 | 99 | 67 | 24.30 | 11.00 | 9 | 6 | 5.2 | 2.41 | 5 | HS |
| 16 | NIAW4153 | 30MS | 6.6 | 10MS | 4.1 | 30S | 13.3 | 40S | 8.8 | 99 | 67 | 23.00 | 9.30 | 9 | 5 | 4.3 | 2.61 | 2 | S |
| 17 | AKAW5314 | 40S | 13.2 | 10MR | 1.1 | 40S | 22.7 | 40S | 21.5 | 79 | 56 | 8.20 | 5.70 | 5 | 3 | 6.2 | 2.07 | 3 | S |
| 18 | AKAW5100 | 30S | 10.9 | 5S | 3.3 | 40S | 21.7 | 40S | 19.0 | 78 | 56 | 43.60 | 11.50 | 4 | 2 | 6.1 | 2.45 | 4 | S |
| 19 | MP1378 | 40MS | 7.8 | 10MR | 1.5 | 40S | 21.7 | 90S | 55.8 | 78 | 67 | 35.20 | 11.40 | 9 | 3 | 7.3 | 3.57 | 4 | S |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | DBW443 | 40MS | 9.7 | TMR | 0.2 | 20 | 6.7 | 60S | 45.0 | 99 | 67 | 22.70 | 6.30 | 9 | 4 | 10.13 | 6.51 | 3 | S |
| 20A | Infector | 80S | 71.4 | 80S | 70.0 | 100S | 80.0 | 80S | 76.7 | 99 | 68 | 30.50 | 16.70 | 9 | 7 | 21.3 | 13.68 | 4.0 | S |
| 21 | PWU15 | 20S | 6.6 | R | 0.1 | 0 | 0.0 | 60S | 22.8 | 89 | 56 | 8.20 | 4.10 | 7 | 3 | 6.1 | 2.55 | 2 | S |
| 22 | PBW891 | 60S | 15.4 | 5MS | 3.5 | 60S | 33.3 | 60S | 28.5 | 79 | 56 | 12.40 | 4.90 | 9 | 5 | 6.3 | 3.28 | 3 | S |
| 23 | HI8841(d) | 40S | 15.5 | 20MS | 10.0 | 40S | 22.0 | 40S | 10.2 | 99 | 66 | 5.40 | 2.40 | 9 | 4 | 8.4 | 3.95 | 4 | S |
| 24 | HI1672 | 30MS | 9.4 | 10MR | 1.2 | 0 | 0.0 | 60S | 36.7 | 99 | 67 | 73.30 | 18.20 | 9 | 6 | 10.96 | 6.89 | 5 | S |
| 25 | HI1673 | 30MS | 6.9 | 20MS | 4.0 | 0 | 0.0 | 70S | 43.3 | 89 | 67 | 13.50 | 4.80 | 9 | 7 | 7.3 | 4.33 | 4 | S |
| 26 | HI1675 | 40MS | 9.2 | 10MR | 1.0 | 0 | 0.0 | 60S | 36.7 | 59 | 46 | 20.50 | 6.90 | 9 | 6 | 4.94 | 3.11 | 3 | S |
| 27 | DBW394 | 60S | 14.3 | 5S | 1.3 | 0 | 0.0 | 20S | 6.0 | 78 | 57 | 50.70 | 14.50 | 9 | 6 | 14.68 | 8.46 | 3 | S |
| 28 | DBW395 | 80S | 21.1 | 10S | 6.5 | 40S | 29.3 | 20MS | 4.4 | 89 | 57 | 17.50 | 5.70 | 8 | 5 | 6.2 | 2.78 | 4 | S |
| 29 | MACS6814 | 40S | 16.6 | 20MR | 3.5 | 40S | 30.0 | 20S | 7.1 | 69 | 57 | 21.40 | 8.60 | 9 | 5 | 8.1 | 2.7 | 5 | S |
| 30 | NIAW4114 | 40MS | 9.5 | 10S | 3.6 | 60S | 26.3 | 60S | 30.5 | 78 | 56 | 50.20 | 13.30 | 9 | 7 | 8.5 | 3.64 | 3 | S |
| 31 | NIAW4120 | 20MS | 5.7 | R | 0.1 | TMR | 0.1 | 20S | 9.8 | 89 | 56 | 35.50 | 11.30 | 9 | 6 | 19.23 | 9.68 | 5 | S |
| 32 | UAS3022 | 80S | 19.5 | 5MS | 2.0 | 20S | 16.0 | 40S | 15.0 | 99 | 67 | 23.40 | 6.60 | 9 | 4 | 6.06 | 4.52 | 4 | S |
| 33 | MP3557 | 60S | 14.9 | 10MS | 3.5 | 30S | 20.0 | 20MS | 2.7 | 99 | 56 | 30.10 | 11.70 | 6 | 5 | 6.38 | 3.96 | 2 | S |
| 34 | PBW897 | 40MS | 9.2 | 10MR | 1.0 | TMR | 0.1 | 40S | 14.5 | 89 | 67 | 29.80 | 10.40 | 7 | 6 | 5.3 | 3.7 | 2 | S |
| 35 | GW538 | 30S | 12.9 | 10MS | 5.0 | 30S | 17.0 | 40S | 22.3 | 99 | 66 | 26.80 | 10.20 | 9 | 6 | 6.8 | 4.52 | 5 | S |
| 36 | LOK79 | 20MS | 4.9 | 5S | 1.3 | 15M R | 4.1 | 20S | 11.0 | 89 | 56 | 40.50 | 12.50 | 4 | 3 | 6.2 | 3.24 | 3 | S |
| 37 | HI1665 | 80S | 28.6 | 5MS | 2.0 | 5S | 1.7 | 20MS | 4.7 | 99 | 67 | 50.70 | 11.40 | 4 | 3 | 5.1 | 2.41 | 3 | S |
| 38 | DBW397 | 40S | 16.9 | 5MS | 1.5 | 30S | 16.7 | 10S | 2.3 | 99 | 56 | 40.70 | 11.50 | 5 | 3 | 6.7 | 3.47 | 3 | HS |
| 39 | NIAW4028 | 40S | 12.6 | R | 0.1 | 20S | 6.7 | 10S | 2.3 | 58 | 57 | 73.20 | 22.10 | 7 | 6 | 6.82 | 3.74 | 3 | S |
| 40 | DBW377 | 40S | 13.2 | 10MS | 5.3 | 30S | 23.3 | 40S | 11.2 | 89 | 56 | 48.60 | 18.60 | 9 | 5 | 6.5 | 3.07 | 4 | HS |
| 40A | Infector | 80S | 60.0 | 80S | 65.0 | 90S | 76.7 | 80S | 75.0 | 99 | 78 | 21.60 | 17.40 | 9 | 7 | 20.8 | 12.86 | 4 | HS |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 41 | GW543 | 40S | 19.4 | 20MS | 10.7 | 60S | 30.0 | 60S | 19.7 | 79 | 56 | 73.30 | 22.50 | 9 | 4 | 8.1 | 4.02 | 4 | HS |
| 42 | DBW359 | 60S | 18.0 | 10S | 6.0 | 20S | 15.0 | 20S | 8.3 | 79 | 57 | 46.30 | 14.70 | 4 | 3 | 6.8 | 3.18 | 4 | S |
| 43 | MP3556 | 40MS | 12.9 | 10MS | 3.3 | 40S | 18.3 | 20MS | 6.4 | 68 | 57 | 28.20 | 14.60 | 4 | 3 | 5.2 | 3.1 | 3 | S |
| 44 | PBW889 | 60S | 30.3 | 10MR | 1.1 | 30S | 10.0 | 15S | 3.4 | 89 | 57 | 28.20 | 10.20 | 4 | 2 | 6.3 | 2.1 | 3 | S |
| 45 | HD3369 (I)(C) | 80S | 20.8 | 5MS | 1.1 | 40S | 21.0 | 15S | 3.9 | 78 | 57 | 43.90 | 16.70 | 9 | 5 | 6.5 | 2.17 | 3 | S |
| 46 | UAS478(d) | 80S | 45.7 | R | 0.1 | 40S | 14.7 | 20MS | 13.5 | 89 | 57 | 30.50 | 12.30 | 6 | 4 | 8.7 | 4.99 | 3 | S |
| 47 | HI8840(d) | 60S | 29.4 | 5MS | 1.6 | 20MR | 2.8 | 20S | 6.5 | 79 | 57 | 15.20 | 6.10 | 8 | 5 | 6.4 | 4.22 | 3 | S |
| 48 | DDW61(d) | 60S | 24.6 | R | 0.1 | 0 | 0.0 | 20S | 4.2 | 89 | 57 | 8.40 | 3.10 | 9 | 6 | 8.9 | 4.45 | 3 | S |
| 49 | EC 0598295 | 60S | 11.7 | 20MS | 4.1 | 0 | 0.0 | 80S | 41.7 | | | | | | | | | | |
| 50 | EC 933808 | 60S | 36.7 | 20MS | 6.0 | 0 | 0.0 | 60S | 46.0 | | | | | | | | | | |
| 51 | IC 624342 | 60S | 10.6 | R | 0.1 | 10MS | 1.3 | 60S | 28.8 | | | | | | | | | | |
| 52 | B2011\CIMCOG\6 | 60S | 13.4 | 5S | 2.3 | 10S | 3.3 | 20S | 16.7 | | | | | | | | | | |
| 53 | B2011\CIMCOG\32 | 80S | 18.9 | 5MR | 0.6 | 5S | 1.7 | 60S | 22.3 | | | | | | | | | | |
| 54 | B2011\CIMCOG\40 | 60S | 21.0 | 10MR | 1.1 | 30S | 10.1 | 60S | 17.7 | | | | | | | | | | |
| 55 | BW 20117 | 60S | 32.0 | 5MS | 1.1 | TMS | 0.3 | 40S | 27.5 | | | | | | | | | | |
| 56 | CITR 4905 | 60S | 25.3 | 10MS | 3.4 | 40S | 23.3 | 40S | 10.8 | | | | | | | | | | |
| 57 | CITR 4911 | 60S | 22.9 | 10S | 5.1 | 40S | 33.3 | 15S | 3.2 | | | | | | | | | | |
| 58 | CITR 7301 | 60S | 27.0 | 20S | 10.5 | 40S | 30.0 | 60S | 15.8 | | | | | | | | | | |
| 59 | CITR 11764 | 60S | 38.7 | 20MS | 8.0 | 60S | 40.0 | 40S | 16.2 | | | | | | | | | | |
| 60 | CPAN 4011 | 60S | 38.7 | 20MS | 9.0 | 40S | 26.7 | 80S | 46.7 | | | | | | | | | | |
| 60A | Infector | 80S | 63.3 | 80S | 75.0 | 100S | 80.0 | 80S | 75.0 | | | | | | | | | | |
| 61 | EIGN I (07-08) 17 | 60S | 31.3 | 10MS | 4.5 | 70S | 50.0 | 30S | 11.3 | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 62 | EIGN I (07-08) 62 | 60S | 25.3 | 20S | 7.1 | 60S | 53.3 | 80S | 19.3 | | | | | | | | | | |
| 63 | EIGN I (07-08) 66 | 60S | 19.5 | 40S | 17.0 | 90S | 70.0 | 15S | 4.9 | | | | | | | | | | |
| 64 | EIGN I (07-08) 73 | 60S | 27.4 | 20MS | 8.5 | 90S | 45.0 | 20S | 4.0 | | | | | | | | | | |
| 65 | EIGN I (07-08) 78 | 60S | 19.8 | 20MS | 7.5 | 90S | 50.0 | 40S | 11.1 | | | | | | | | | | |
| 66 | EIGN I (07-08) 79 | 60S | 30.7 | 10S | 4.0 | 60S | 46.7 | 10S | 3.7 | | | | | | | | | | |
| 67 | EIGN I (07-08) 83 | 60S | 27.4 | 40S | 15.5 | 70S | 50.0 | 20S | 5.5 | | | | | | | | | | |
| 68 | EIGN I (07-08) 89 | 60S | 32.0 | 20S | 8.5 | 60S | 40.0 | 10S | 3.2 | | | | | | | | | | |
| 69 | EIGN I (07-08) 97 | 80S | 38.0 | 5S | 2.8 | 50S | 30.0 | 20MS | 3.5 | | | | | | | | | | |
| 70 | IC 26756 | 40S | 22.0 | 60S | 21.1 | 60S | 66.7 | 15S | 4.0 | | | | | | | | | | |
| 71 | IC 28614 A | 40S | 18.4 | 20MS | 7.5 | 80S | 46.7 | 20S | 7.7 | | | | | | | | | | |
| 72 | IC 28644 | 40S | 22.4 | 10MS | 5.0 | 60S | 56.7 | 20MS | 6.8 | | | | | | | | | | |
| 73 | IC 28665 | 20S | 16.0 | 10MS | 4.5 | 50S | 31.7 | 20MS | 6.8 | | | | | | | | | | |
| 74 | IC 28886 B | 60S | 29.6 | 40S | 14.5 | 70S | 63.3 | 20MS | 6.8 | | | | | | | | | | |
| 75 | IC 29057 A | 20S | 10.0 | 10MS | 2.0 | 60S | 40.0 | 40S | 11.1 | | | | | | | | | | |
| 76 | IC 30290 B | 60S | 26.8 | 10S | 4.5 | 60S | 53.3 | 5S | 2.0 | | | | | | | | | | |
| 77 | IC 29075 B | 60S | 28.4 | 20MS | 8.5 | 50S | 36.7 | 20S | 5.3 | | | | | | | | | | |
| 78 | IC 35138 B | 60S | 25.6 | 20MS | 5.0 | 60S | 50.0 | 40S | 13.4 | | | | | | | | | | |
| 79 | EIGN I (07-08) 42 | 60S | 28.0 | 20S | 6.0 | 80S | 60.0 | 15S | 5.0 | | | | | | | | | | |
| 80 | IC 28669 A | 40S | 20.8 | 20MR | 2.0 | 70S | 36.7 | 20S | 10.0 | | | | | | | | | | |
| 80A | Infector | 80S | 72.0 | 80S | 70.0 | 100S | 86.7 | 90S | 78.3 | | | | | | | | | | |

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

## II. Screening of EMDSN 2022-23 entries against Loose smut

Thirty eight entries of EMDSN (2022-23) were inoculated with loose smut during 2022-23 crop season and expression of loose smut was observed during 2023-24 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 toloose smut (Table 9.2).

**Total entries:** 38
**Loose smut resistant sources identified:**
**Free:** Nil
**Loose smut resistant entries:**
HI8846, HI 8830 (d), WHD 965 (d), HI 8827 (d), VL3029, HI8839(d), GW547B, HI8847, and HS694

**Table: 9.2. Performance of elite multiple diseases screening nursery against Loose smut during 2023-24 crop season**

| S. No. | Entry | Loose Smut Incidence (%) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Ludhiana | Hisar | Almora | Durgapura | HS | AV |
| 1 | PBW870 | 8.67 | 20.20 | 49.30 | 9.13 | 49.30 | 21.80 |
| 2 | HI8846 | 0.00 | 15.50 | 2.65 | 0.00 | 15.50 | 4.50 |
| **3** | PBW902 | 12.31 | 30.10 | 52.69 | 45.03 | 52.69 | 35.00 |
| 4 | HI 8830 (d) | 0.00 | 20.00 | 0.00 | 0.00 | 20.00 | 5.00 |
| 5 | WHD 965 (d) | 0.00 | 15.30 | 0.00 | 0.00 | 15.30 | 3.80 |
| 6 | HI 8827 (d) | 0.00 | 12.20 | 0.00 | 0.00 | 12.20 | 3.10 |
| 7 | VL3029 | 0.00 | 15.50 | 0.00 | 0.00 | 15.50 | 3.90 |
| 8 | HI8839(d) | 0.00 | 16.10 | 0.00 | 0.00 | 16.10 | 4.00 |
| 9 | GW547[B] | 0.00 | 11.10 | 0.73 | 0.00 | 11.10 | 3.00 |
| 10 | HI1665 | 11.54 | 12.50 | 53.75 | 18.41 | 53.75 | 24.10 |
| 11 | NIAW4028 | 15.94 | 13.30 | 50.00 | 24.78 | 50.00 | 26.00 |
| 12 | GW532 | 6.90 | 40.00 | 0.00 | 0.00 | 40.00 | 11.70 |
| 13 | HI1655[Q]* | 5.41 | 20.50 | 36.41 | 6.45 | 36.41 | 17.20 |
| 14 | MACS6795 | 8.86 | 15.20 | 53.91 | 36.30 | 53.91 | 28.60 |
| 15 | HI1654* | 19.42 | 20.20 | 55.17 | 49.26 | 55.17 | 36.00 |
| 16 | WH1403 | 12.50 | 21.30 | 30.94 | 29.27 | 30.94 | 23.50 |
| 17 | HD3438 | 45.16 | 15.30 | 29.49 | 20.77 | 45.16 | 27.70 |
| 18 | HD3407* | 10.34 | 12.50 | 32.39 | 15.79 | 32.39 | 17.80 |
| 19 | HI8847 | Miss | 13.30 | 0.00 | 0.00 | 13.30 | 4.40 |
| 20 | CG 1036 | 0.00 | 36.00 | 59.14 | 46.60 | 59.14 | 35.40 |
| 20A | Infector check (Sonalika) | 22.73 | 82.50 | 25.59 | 45.51 | 82.50 | 44.10 |
| 21 | HI 1651 | 0.00 | 24.00 | 40.91 | 3.33 | 40.91 | 17.10 |
| 22 | WH1402 | 16.19 | 15.40 | 40.80 | 39.36 | 40.80 | 27.90 |
| 23 | HD3440 | 0.00 | 63.20 | 0.56 | 0.00 | 63.20 | 15.90 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 | HD3437 | 12.86 | 42.30 | 35.97 | 16.67 | 42.30 | 27.00 |
| 25 | VL2043 | 11.67 | 23.10 | 25.51 | 15.66 | 25.51 | 19.00 |
| 26 | VL2044 | 21.19 | 42.50 | 24.42 | 0.63 | 42.50 | 22.20 |
| 27 | HD3402 | 25.93 | 42.70 | 35.59 | 38.61 | 42.70 | 35.70 |
| 28 | HS694 | 0.00 | 15.50 | 0.71 | 0.00 | 15.50 | 4.10 |
| 29 | VL3028 | 0.00 | 23.30 | 13.40 | 6.19 | 23.30 | 10.70 |
| 30 | HD3392 | 15.66 | 62.50 | 14.08 | 9.89 | 62.50 | 25.50 |
| 31 | HPW 484 | 11.22 | 71.30 | 0.67 | 11.96 | 71.30 | 23.80 |
| 32 | HPW 487 | 6.67 | 62.50 | 11.81 | 15.15 | 62.50 | 24.00 |
| 33 | HPW 489 | 0.00 | 21.70 | 3.29 | 19.15 | 21.70 | 11.00 |
| 34 | HPW 493 | 2.48 | 66.60 | 23.38 | 17.42 | 66.60 | 27.50 |
| 35 | HPW 495 | 0.00 | 12.50 | 0.00 | 17.65 | 17.65 | 7.50 |
| 36 | HPW 496 | 6.49 | 36.60 | 27.78 | 12.93 | 36.60 | 21.00 |
| 37 | HPW 497 | 20.00 | 40.00 | 52.55 | 8.22 | 52.55 | 30.20 |
| 38 | HPW 498 | 7.14 | 83.30 | 51.67 | 15.32 | 83.30 | 39.40 |

HS= Highest score; AV= Average score

## COOPERATORS

| NAME | CENTRE |
|---|---|
| PS SHEKHAWAT | DURGAPURA |
| RS BENIWAL | HISAR |
| JASPAL KAUR, RITU BALA | LUDHIANA |
| KK MISHRA | ALMORA |
| PRADEEP SHARMA, PREM LAL KASHYAP, & RAVINDRA KUMAR | KARNAL (COORDINATING UNIT) |

## III. National Genetic Stock Nursery (NGSN), 2023-24

The NGSN comprising 27 entries with confirmed sources of high level of disease resistance were shared with19 breeding centers across different agro climatic zones of country for their utilization in breeding for resistance to biotic stresses. The 24 entries were utilized in the range of 4.17 – 37.50% by different breeding centers (Fig. 9.1). The most utilized entries at many centers were PBW902, PBW870 and HD3440 (Table 9.3). Durgapura center, utilized maximum 9 entries in their breeding programme followed by Ludhiana and ICAR-CSSRI, Karnal (Fig. 9.2).

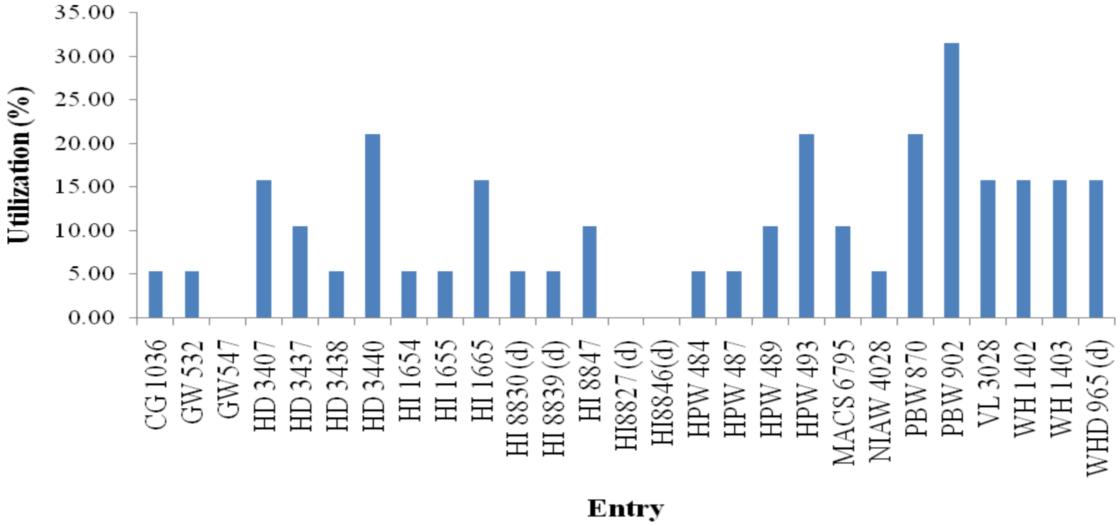


**Fig: 9.1. Percent utilization of promising resistant genotypes at different breeding centres in NGSN, 2023-24**

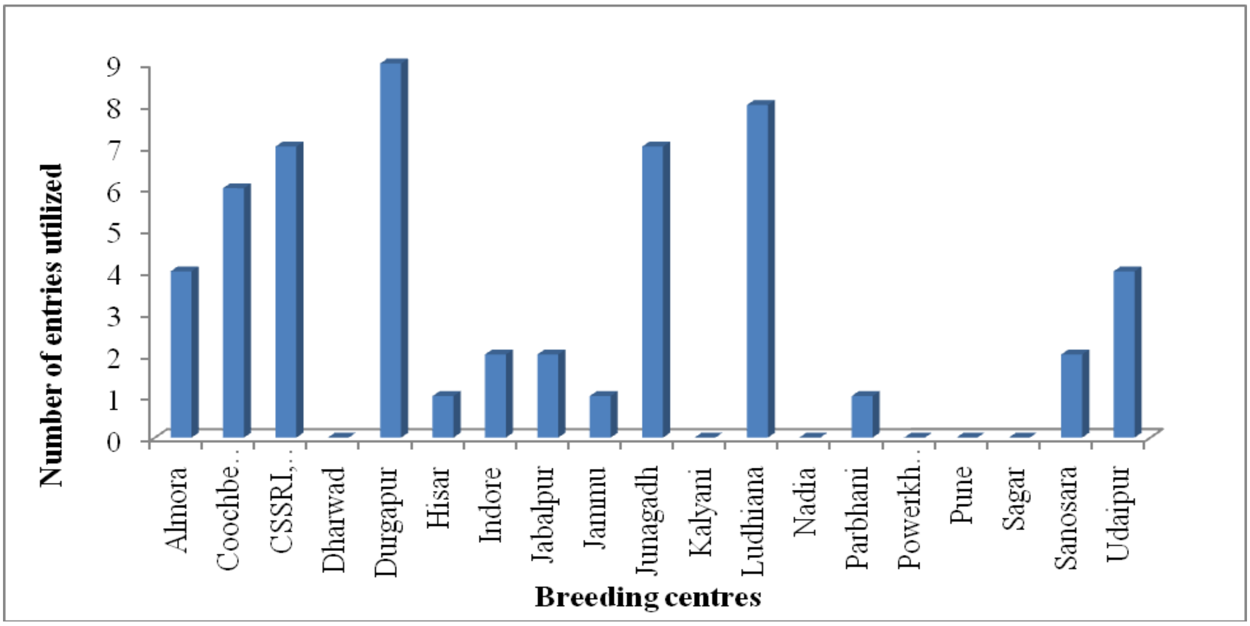


**Fig: 9.2. Centre wise utilization of promising resistant genotypes from NGSN, 2023-24**

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

| Genotypes | Almora | Coochbehar | CSSRI, Karnal | Dharwad | Durgapur | Hisar | Indore | Jabalpur | Jammu | Junagadh | Kalyani | Ludhiana | Nadia | Parbhani | Powerkhera | Pune | Sagar | Sanosara | Udaipur | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CG 1036** | | | | | | | | | | | | | | | | | | | **1** | **1** |
| GW 532 | | | | | | | | | | | | 1 | | | | | | | | 1 |
| GW547 | | | | | | | | | | | | | | | | | | | | 0 |
| HD 3407 | | 1 | | | | | | | | 1 | | | | | | | | | 1 | 3 |
| HD 3437 | | | | | | | | | | 1 | | 1 | | | | | | | | 2 |
| HD 3438 | | | | | | | | | | | | 1 | | | | | | | | 1 |
| HD 3440 | 1 | | | | 1 | | | | | 1 | | 1 | | | | | | | | 4 |
| HI 1654 | | | | | | | | | | | | | | | | | | | 1 | 1 |
| HI 1655 | | | | | | | | | | | | | | | | | | 1 | | 1 |
| HI 1665 | | | | | 1 | | | | | | | 1 | | | | | | 1 | | 3 |
| HI 8830 (d) | | | | | | | 1 | | | | | | | | | | | | | 1 |
| HI 8839 (d) | | | 1 | | | | | | | | | | | | | | | | | 1 |
| HI 8847 | | | 1 | | | 1 | | | | | | | | | | | | | | 2 |
| HI8827 (d) | | | | | | | | | | | | | | | | | | | | 0 |
| HI8846(d) | | | | | | | | | | | | | | | | | | | | 0 |
| HPW 484 | | | | | 1 | | | | | | | | | | | | | | | 1 |
| HPW 487 | | | | | | | | | | 1 | | | | | | | | | | 1 |
| HPW 489 | | 1 | 1 | | | | | | | | | | | | | | | | | 2 |
| HPW 493 | | 1 | 1 | | 1 | | | | | | | 1 | | | | | | | | 4 |
| MACS 6795 | | | | | 1 | | | | | | | 1 | | | | | | | | 2 |
| NIAW 4028 | | | | | | | | | | | | | | | | | | | 1 | 1 |
| PBW 870 | 1 | 1 | 1 | | | | | | | 1 | | | | | | | | | | 4 |
| PBW 902 | 1 | 1 | 1 | | 1 | | | 1 | | 1 | | | | | | | | | | 6 |
| VL 3028 | | 1 | | | 1 | | | 1 | | | | | | | | | | | | 3 |
| WH 1402 | | | | | 1 | | | | | 1 | | 1 | | | | | | | | 3 |
| WH 1403 | 1 | | 1 | | 1 | | | | | | | | | | | | | | | 3 |
| WHD 965 (d) | | | | | | | 1 | | 1 | | | | | 1 | | | | | | 3 |
| Total | 4 | 6 | 7 | 0 | 9 | 1 | 2 | 2 | 1 | 7 | 0 | 8 | 0 | 1 | 0 | 0 | 0 | 2 | 4 | 54 |

**Cooperators**: Prem Lal Kashyap, Ravindra Kumar, Arun Kumar Gupta Poonam Jasrotia,Pradeep Sharma

## Management of Diseases: Chemical Control

### Karnal bunt

### A) Ludhiana

Field trials were performed during the crop season 2023-24 to test the efficacy of six different fungicides *viz.*, Azoxystrobin 11% + Tebuconazole 18.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC,Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, and Tebuconazole 50% + Trifloxystrobin 25% WG along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] towards Karnal bunt disease in wheat. The study was laid out in randomized block design with three replications. The tested fungicides resulted in significantly low CI in comparison to the unsprayed plot i.e. 17.30 (Table 9.4). Highest level of protection (83.84%) from Karnal bunt disease was attained with the foliar application of Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC @0.1% and showed at par 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 thetested concentrations of the fungicides on wheat plants.

**Table:9.4. Chemical control of Karnal bunt of wheat at Ludhiana during 2023-24**

| Treatment | Description | Dose (%) | CI (%) | Disease reduction over control (%) | Yield (q $ha^{-1}$) | Yield gain (%) |
|---|---|---|---|---|---|---|
| $T_1$ | Azoxystrobin 11% + Tebuconazole 18.3% w/w SC | 0.1 | 5.42 | 68.72 | 55.56 | 36.95 |
| $T_2$ | Azoxystrobin 18.2% + Difenoconazole 11.4% w/wSC | 0.1 | 2.80 | 83.84 | 51.25 | 26.32 |
| $T_3$ | Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC | 0.1 | 5.23 | 69.82 | 54.05 | 33.23 |
| $T_4$ | Picoxystrobin 7.05% + Propiconazole 11.7% SC, | 0.1 | 3.18 | 81.65 | 47.47 | 17.01 |
| $T_5$ | Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, | 0.1 | 5.68 | 67.22 | 51.85 | 27.80 |
| $T_6$ | Tebuconazole 50% + Trifloxystrobin 25% WG, | 0.06 | 3.67 | 78.82 | 53.50 | 31.87 |
| $T_7$ | Propiconazole | 0.1 | 3.09 | 82.17 | 49.41 | 21.79 |
| $T_8$ | Tebuconazole | 0.1 | 3.27 | 81.13 | 49.30 | 21.52 |
| $T_9$ | Control | - | 17.33 | | 40.57 | |
| | CD (P=0.05) | | 2.46 | | 8.07 | |

CI: Coefficient of infection

### B) Hisar

Field trials were performed during the crop season 2023-24 to test the efficacy of six different fungicides *viz.*, Azoxystrobin 11% + Tebuconazole 18.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC,Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, and Tebuconazole 50% + Trifloxystrobin 25% WG along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] towards Karnal bunt disease in wheat. The study was laid out in randomized block design with three replications. The tested fungicides resulted in significantly low CI in comparison to the unsprayed plot i.e. 13.60 (Table 9.5). Highest level of protection (85.17%) from Karnal bunt disease was attained with the foliar application of Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC @ 0.1% and showed at par in comparison to standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)].

Similarly, percent yield gains were recorded higher in the plots treated with fungicidesin comparison to unsprayed plots (Table 9.5). No phytotoxicity was recorded with any of thetested concentrations of the fungicides on wheat plants.

**Table: 9.5. Chemical control of Karnal bunt of wheat at Hisar during 2023-24**

| Treatment | Description | Dose (%) | CI (%) | Disease reduction over control (%) | Yield (q $ha^{-1}$) | Yield gain (%) |
|---|---|---|---|---|---|---|
| T1 | Azoxystrobin 11% + Tebuconazole 18.3% w/w SC | 0.1 | 3.42 | 74.85 | 54.30 | 14.63 |
| T2 | Azoxystrobin 18.2% + Difenoconazole 11.4% w/wSC | 0.1 | 2.02 | 85.17 | 56.00 | 18.22 |
| T3 | Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC | 0.1 | 4.26 | 68.65 | 54.47 | 14.98 |
| T4 | Picoxystrobin 7.05% + Propiconazole 11.7% SC, | 0.1 | 3.14 | 76.89 | 54.73 | 15.54 |
| T5 | Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, | 0.1 | 3.68 | 72.96 | 54.33 | 14.70 |
| T6 | Tebuconazole 50% + Trifloxystrobin 25% WG, | 0.06 | 3.13 | 76.99 | 55.00 | 16.11 |
| T7 | Propiconazole | 0.1 | 3.07 | 77.45 | 55.80 | 17.80 |
| T8 | Tebuconazole | 0.1 | 3.27 | 75.96 | 55.70 | 17.58 |
| T9 | Control | - | 13.60 | | 47.37 | |
| | CD (P=0.05) | | 2.39 | | 1.72 | |

CI: Coefficient of infection

**C) Pantnagar**

Field trials were performed during the crop season 2023-24 to test the efficacy of six different fungicides *viz.*, Azoxystrobin 11% + Tebuconazole 18.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC,Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, and Tebuconazole 50% + Trifloxystrobin 25% WG along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] towards Karnal bunt disease in wheat. The study was laid out in randomized block design with three replications. The tested fungicides resulted in significantly low CI in comparison to the unsprayed plot i.e. 21.06 (Table 9.6). Highest level of protection (70.31%) from Karnal bunt disease was attained with the foliar application of Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC @ 0.1% and showed at par 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 9.6). No phytotoxicity was recorded with any of the tested concentrations of the fungicides on wheat plants.

**Table: 9.6 . Chemical control of Karnal bunt of wheat at Pantnagar during 2023-24**

| Treatment | Description | Dose (%) | CI (%) | Disease reduction over control (%) | Yield (q $ha^{-1}$) | Yield gain (%) |
|---|---|---|---|---|---|---|
| T1 | Azoxystrobin 11% + Tebuconazole 18.3% w/w SC | 0.1 | 9.29 | 55.89 | 47.49 | 21.52 |
| T2 | Azoxystrobin 18.2% + Difenoconazole 11.4% w/wSC | 0.1 | 6.25 | 70.31 | 48.26 | 23.50 |
| T3 | Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC | 0.1 | 8.98 | 57.37 | 46.97 | 20.18 |
| T4 | Picoxystrobin 7.05% + Propiconazole 11.7% SC, | 0.1 | 10.29 | 51.15 | 46.83 | 19.82 |
| T5 | Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, | 0.1 | 11.26 | 46.52 | 46.51 | 19.02 |
| T6 | Tebuconazole 50% + Trifloxystrobin 25% WG, | 0.06 | 12.98 | 38.37 | 44.28 | 13.30 |
| T7 | Propiconazole | 0.1 | 8.36 | 60.30 | 47.88 | 22.51 |
| T8 | Tebuconazole | 0.1 | 13.41 | 36.31 | 41.80 | 6.97 |
| T9 | Control | - | 21.06 | | 39.08 | |
| | CD (P=0.05) | | 9.29 | | 1.22 | |

CI: Coefficient of infection

## D) Karnal

Field trials were performed during the crop season 2023-24 to test the efficacy of six different fungicides *viz*., Azoxystrobin 11% + Tebuconazole 18.3% w/w SC, Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC, Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC,Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, and Tebuconazole 50% + Trifloxystrobin 25% WG along with standard recommended fungicide [Tebuconazole (0.1%) and Propiconazole (0.1%)] towards Karnal bunt disease in wheat. The study was laid out in randomized block design with three replications. The tested fungicides resulted in significantly low CI in comparison to the unsprayed plot i.e. 15.87 (Table 9.4). Highest level of protection (87.73%) from Karnal bunt disease was attained with the foliar application of Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC @ 0.1% and showed at parin 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 9.7). No phytotoxicity was recorded with any of the tested concentrations of the fungicides on wheat plants.

**Table:9.7. Chemical control of Karnal bunt of wheat at Karnal during 2023-24**

| Treatment | Description | Dose (%) | CI (%) | Disease reduction over control (%) | Yield (q $ha^{-1}$) | Yield gain (%) |
|---|---|---|---|---|---|---|
| T1 | Azoxystrobin 11% + Tebuconazole 18.3% w/w SC | 0.1 | 2.97 | 81.27 | 41.70 | 10.99 |
| T2 | Azoxystrobin 18.2% + Difenoconazole 11.4% w/wSC | 0.1 | 1.95 | 87.73 | 43.90 | 16.85 |
| T3 | Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC | 0.1 | 5.93 | 62.65 | 41.37 | 10.11 |
| T4 | Picoxystrobin 7.05% + Propiconazole 11.7% SC, | 0.1 | 5.29 | 66.65 | 42.50 | 13.12 |
| T5 | Pyraclostrobin 133g/l + Epoxiconaxole 50g/l SE, | 0.1 | 3.14 | 80.23 | 41.13 | 9.48 |
| T6 | Tebuconazole 50% + Trifloxystrobin 25% WG, | 0.06 | 4.21 | 73.45 | 41.40 | 10.19 |
| T7 | Propiconazole | 0.1 | 2.47 | 84.42 | 42.83 | 14.01 |
| T8 | Tebuconazole | 0.1 | 3.89 | 75.51 | 41.87 | 11.44 |
| T9 | Control | - | 15.87 | | 37.57 | |
| | CD (P=0.05) | | 1.80 | | 3.19 | |

CI: Coefficient of infection

## Loose smut of Wheat

### A.) Ludhiana

The efficacy of four different fungicide combinations (Imidacloprid 18.5% + Hexaconazole 1.5% FS, Carboxin 37.5% + Thiram 37.5 %WS, Difenoconazole 3% WS and Carbendazim 50% WP) as seed dresser were tested under field conditions for the management of loose smut of wheat during 2023-2024 at Ludhiana location. The experiment was conducted in randomized block design with three replications. Seed treatment with all the tested fungicides were found significantly superior in loose smut control over untreated check (25.92) with per cent disease severity ranging from 0.0- 25.92 % among different treatments (Table 9.8). Seed treatment of Difenoconazole 3% WS @ 2.5 g/ kg seed and Carboxin 37.5% + Thiram 37.5 %WS @ 3 g / Kg seed were found equally best among all the fungicide combinations and offer cent percent disease control. The yield was significantly more in all the fungicides treated plots over the untreated check. Highest yield gain of 43.93% and 43.67% was recorded over control check when seed was treated with Difenoconazole 3% WS WG @ 2.5 g/ kg seed and Carboxin 37.5% + Thiram 37.5 %WS @ 3 g / Kg seed, respectively. Phytotoxic symptoms were not observed with any of the fungicides used as seed dresser.

**Table 9.8: Chemical control of Loose smut of wheat at Ludhiana during 2023-24**

| Treatment | Description | Dose | Disease Severity (%) | Disease reduction over control (%) | Yield (q $ha^{-1}$) | Yield gain (%) |
|---|---|---|---|---|---|---|
| T1 | Imidacloprid 18.5% + Hexaconazole 1.5% FS | 0.2% | 6.40 | 75.31 | 48.52 | 25.46 |
| T2 | Carboxin 37.5% + Thiram 37.5 %WS | 3 g / Kg seed | 0.00 | 100.00 | 55.56 | 43.67 |
| T3 | Difenoconazole 3% WS | 2.5 g/ kg seed | 0.00 | 100.00 | 55.66 | 43.93 |
| T4 | Carbendazim 50% WP | 2 g /Kg seed | 1.46 | 94.38 | 52.78 | 36.49 |
| T5 | Control | - | 25.92 | | 38.67 | |
| | CD (P=0.05) | | 1.13 | | 5.18 | |

## B). Durgapura

The field experiments conducted at the Durgapura center during the Rabi 2023-2024 season evaluated various fungicide combinations as seed dressers for managing loose smut disease in wheat (Table 9.9). The study, conducted using a randomized block design with three replications, showed that all tested fungicides significantly outperformed the untreated control (28.19% disease severity). The seed treatment with Difenoconazole 3% WS at 2.5 g/kg followed by Carboxin 37.5% + Thiram 37.5% WS at 3 g/kg was particularly effective, resulting in the lowest disease severity and highest yield gains. The highest yield increase of 42.99% was observed with Difenoconazole treatment, followed by a 26.37% yield increase with Carboxin + Thiram treatment. No phytotoxic symptoms were observed with any fungicide treatment.

**Table:9.9. Chemical control of loose smut of wheat at Durgapura during 2023-24**

| Treatment | Description | Dose | Disease Severit y (%) | Disease reduction over control (%) | Yield (q $ha^{-1}$) | Yield gain (%) |
|---|---|---|---|---|---|---|
| T1 | Imidacloprid 18.5% + Hexaconazole 1.5% FS | 0.2% | 15.76 | 44.10 | 29.47 | 16.61 |
| T2 | Carboxin 37.5% + Thiram 37.5 %WS | 3 g / Kg seed | 8.99 | 68.10 | 31.93 | 26.37 |
| T3 | Difenoconazole 3% WS | 2.5 g/ kg seed | 2.79 | 90.10 | 36.13 | 42.99 |
| T4 | Carbendazim 50% WP | 2 g /Kg seed | 10.83 | 61.59 | 30.07 | 18.98 |
| T5 | Control | - | 28.19 | | 25.27 | |
| | CD (P=0.05) | | 4.59 | | 2.25 | |

## C). Karnal

Field efficacy of different fungicide combinations as seed dresser along with standard check fungicide (Carbendazim 50% WP @ 2 g /Kg seed) were tested under field conditions for the management of loose smut of wheat at Karanl location during 2023-2024. The experiment was arranged in randomized block design with three replications. Seed treatment with all the tested fungicides were found significantly superior in loose smut control over untreated check (27.01) with per cent disease severity ranging from 0.0-27.01 % among different treatments (Table 9.10). Seed treatment of Difenoconazole 3% WS @ 2.5 g/ kg seed and Carboxin 37.5% + Thiram 37.5% WS @ 3 g / Kg seed were found equally best among all the fungicide combinations and offer complete protection from loose smut infection in wheat seeds. The yield was significantly more in all the fungicides treated plots over the untreated check. Highest yield gain of 20.01% and 19.02%were recorded over control check when seed was treated with Difenoconazole 3% WS WG @ 2.5 g/ kg seed and Carboxin 37.5% + Thiram 37.5 %WS @ 3 g / Kg seed, respectively. Phytotoxic symptoms were not observed with any of the fungicides used as seed dresser.

**Table 9.10: Chemical control of loose smut of wheat at Karnal during 2023-24**

| Treatment | Description | Dose | Disease Severity (%) | Disease reduction over control (%) | Yield (q $ha^{-1}$) | Yield gain (%) |
|---|---|---|---|---|---|---|
| T1 | Imidacloprid 18.5% + Hexaconazole 1.5% FS | 0.2% | 1.50 | 94.44 | 24.27 | 3.40 |
| T2 | Carboxin 37.5% + Thiram 37.5 %WS | 3 g / Kg seed | 0.00 | 100.00 | 27.93 | 19.02 |
| T3 | Difenoconazole 3% WS | 2.5 g/ kg seed | 0.00 | 100.00 | 28.17 | 20.01 |
| T4 | Carbendazim 50% WP | 2 g /Kg seed | 2.75 | 89.82 | 23.52 | 0.20 |
| T5 | Control | - | 27.01 | | 23.47 | 3.40 |
| | CD (P=0.05) | | 0.91 | | 2.91 | |

### Management of Head scab through bioformulations

### A. Gurdaspur

An evaluation of three bioformulations viz., KUSH-PlantEX, KUSH-SalBoost, and KUSH- PhosphoBoost provided by ICAR-NBAIM, Mau, was conducted as seed dressers for wheat. The experiment was carried out during the 2023-24 cropping season at Guradpaur location to assess their impact on wheat growth promotion and biological management of head scab of wheat. The bioformulations were tested at three different dosages: 0.5, 1.0, and 2.0 ml per 100 g of wheat seed, following a randomized block design with three replications. All tested bioformulations significantly reduced disease severity compared to the unsprayed plots (Table 9.11). Wheat seeds treated with KUSH-PlantEX at 2 ml per 100 g of seed showed the lowest disease severity of head scab (62.47% disease severity), compared to in untreated wheat seeds (76.08% disease severity). The same treatment (KUSH-PlantEX @ 2 ml per 100 g) also resulted in the highest root volume (2.71 $cm^3$), root biomass (2.07 g), plant height (25.82 cm) and number of tillers (3.97 per plant) after 30 days of field sowing. All bioformulation-treated seeds showed a significant yield increase compared to the unsprayed control check (Table 9.11). No phytotoxic symptoms were observed at any tested concentration of the bioformulations on wheat plants.

**Table: 9.11. Management of Head scab through bioformulations at Gurdaspur during 2023- 24**

| Treat ment | Description | Dose (per 100 g seed) | Plant growth attributes after 30 days | | | | Head scab disease severity (%) | Yield gain (q/ha) |
|---|---|---|---|---|---|---|---|---|
| | | | Plant height (cm) | Numb er of tillers/ plant | Root biomas (g) | Root Volume ($cm^3$) | | |
| T1 | KUSH-PlantEX | 2 ml | 25.82 | 3.97 | 2.07 | 2.71 | 62.47 | 30.52 |
| T2 | KUSH-PlantEX | 1 ml | 24.43 | 3.35 | 1.96 | 2.00 | 63.61 | 28.13 |
| T3 | KUSH-PlantEX | 0.5 ml | 18.46 | 3.82 | 1.61 | 1.84 | 65.07 | 27.83 |
| T4 | KUSH-SalBoost | 2 ml | 21.69 | 2.82 | 1.23 | 2.25 | 63.73 | 27.10 |
| T5 | KUSH-SalBoost | 1 ml | 19.93 | 3.43 | 1.46 | 1.80 | 63.77 | 26.37 |
| T6 | KUSH-SalBoost | 0.5 ml | 19.65 | 3.47 | 1.29 | 2.33 | 70.81 | 26.69 |
| T7 | KUSH-PhosphoBoost | 2 ml | 20.70 | 3.37 | 1.39 | 1.80 | 70.30 | 26.24 |
| T8 | KUSH-PhosphoBoost | 1 ml | 17.62 | 3.03 | 1.40 | 2.18 | 68.89 | 25.81 |
| T9 | KUSH-PhosphoBoost | 0.5 ml | 18.49 | 3.00 | 1.24 | 2.13 | 71.07 | 27.44 |
| T10 | Control | | 17.56 | 2.83 | 1.17 | 1.68 | 76.08 | 21.36 |
| | CD (P=0.05) | | 2.44 | 0.41 | 0.44 | 0.47 | 6.47 | 2.98 |

## B. Ludhiana

Field evaluation of three bioformulations viz., KUSH-PlantEX, KUSH-SalBoost, and KUSH-PhosphoBoost provided by ICAR-NBAIM, Mau, was conducted as seed dressers for wheat. The experiment was carried out during the 2023-24 cropping season at Ludhiana location to assess their impact on wheat growth promotion and biological management of head scab of wheat. The bioformulations were tested at three different dosages: 0.5, 1.0, and 2.0 ml per 100 g of wheat seed, following a randomized block design with three replications. All tested bioformulations significantly reduced disease severity compared to the unsprayed plots (Table 9.12). Wheat seeds treated with KUSH-PlantEX at 2 ml per 100 g of seed showed the lowest disease severity of head scab (49.63% disease severity), compared to in untreated wheat seeds (65.33% disease severity). The same treatment (KUSH-PlantEX @ 2 ml per 100 g) also resulted in the highest root volume (9.78 $cm^3$), root biomass (10.17 g), Plant height (19.44 cm) and number of tillers (8.82 per plant) after 30 days of field sowing. All bioformulation-treated seeds showed a significant yield increase compared to the unsprayed control check (Table 9.12). No phytotoxic symptoms were observed at any tested concentration of the bioformulations on wheat plants.

**Table: 9.12. Management of head scab of wheat through bioformulations at Ludhiana during 2023-24**

| Treat ment | Description | Dose (per 100 g seed) | Plant growth attributes after 30days | | | | Head scab disease severity (%) | Yield gain (q/ha) |
|---|---|---|---|---|---|---|---|---|
| | | | Plant height (cm) | Numbe r of tillers | Root biomas (g) | Root Volume ($cm^3$) | | |
| T1 | KUSH-PlantEX | 2 ml | 19.44 | 8.82 | 10.17 | 9.78 | 49.63 | 32.74 |
| T2 | KUSH-PlantEX | 1 ml | 18.02 | 7.76 | 7.79 | 8.23 | 51.30 | 28.89 |
| T3 | KUSH-PlantEX | 0.5 ml | 16.77 | 7.41 | 5.46 | 5.11 | 60.18 | 22.74 |
| T4 | KUSH-SalBoost | 2 ml | 17.36 | 8.11 | 8.75 | 8.86 | 54.82 | 27.85 |
| T5 | KUSH-SalBoost | 1 ml | 17.20 | 8.02 | 7.07 | 7.73 | 54.00 | 25.63 |
| T6 | KUSH-SalBoost | 0.5 ml | 16.78 | 7.25 | 7.39 | 7.13 | 50.16 | 26.67 |
| T7 | KUSH-PhosphoBoost | 2 ml | 17.48 | 8.51 | 8.40 | 8.60 | 50.38 | 30.07 |
| T8 | KUSH-PhosphoBoost | 1 ml | 18.07 | 8.16 | 9.00 | 8.33 | 52.64 | 24.96 |
| T9 | KUSH-PhosphoBoost | 0.5 ml | 16.20 | 8.33 | 6.17 | 5.87 | 54.72 | 27.19 |
| T10 | Control | | 16.00 | 6.29 | 5.33 | 4.45 | 65.33 | 17.19 |
| | CD (P=0.05) | | 1.09 | 0.30 | 1.00 | 1.16 | 3.67 | 6.47 |

## C. Karnal

Field evaluation of three bioformulations viz., KUSH-PlantEX, KUSH-SalBoost, and KUSH-PhosphoBoost provided by ICAR-NBAIM, Mau, was conducted as seed dressers for wheat. The experiment was carried out during the 2023-24 cropping season at Karnal location to assess their impact on wheat growth promotion and biological management of head scab of wheat. The bioformulations were tested at three different dosages: 0.5, 1.0, and 2.0 ml per 100 g of wheat seed, following a randomized block design with three replications. All tested bioformulations significantly reduced disease severity compared to the unsprayed plots (Table 9.13). Wheat seeds treated with KUSH-PlantEX at 2 ml per 100 g of seed showed the lowest disease severity of head scab (48.90% disease severity), compared to in untreated wheat seeds (65.89% disease severity). The same treatment (KUSH-PlantEX @ 2 ml per 100 g) also resulted in the highest root volume (9.52 $cm^3$), root biomass (9.77 g), Plant height (19.22 cm) and number of tillers (8.75 per plant) after 30 days of field sowing. All bioformulation-treated seeds showed a significant yield increase compared to the unsprayed control check (Table 9.13). No phytotoxic symptoms were observed atany tested concentration of the bioformulations on wheat plants.

**Table: 9.13. Management of Head scab through bioformulations at Karnal during 2023-24**

| Treat ment | Description | Dose (per 100g seed) | Plant growth attributes after 30days | | | | Head scab disease severity (%) | Yield gain (q/ha) |
|---|---|---|---|---|---|---|---|---|
| | | | Plant height (cm) | Numbe r of tillers | Root biomas (g) | Root Volu me ($cm^3$) | | |
| T1 | KUSH-PlantEX | 2 ml | 19.22 | 8.75 | 9.77 | 9.52 | 48.90 | 33.19 |
| T2 | KUSH-PlantEX | 1 ml | 18.11 | 7.68 | 7.87 | 8.18 | 49.43 | 29.46 |
| T3 | KUSH-PlantEX | 0.5 ml | 16.52 | 7.45 | 5.68 | 5.43 | 59.14 | 28.50 |
| T4 | KUSH-SalBoost | 2 ml | 17.43 | 7.87 | 8.73 | 8.57 | 53.12 | 27.77 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| T5 | KUSH-SalBoost | 1 ml | 17.73 | 8.02 | 6.97 | 7.73 | 54.00 | 27.04 |
| T6 | KUSH-SalBoost | 0.5 ml | 16.62 | 7.17 | 7.53 | 7.25 | 51.07 | 27.36 |
| T7 | KUSH-PhosphoBoost | 2 ml | 17.17 | 8.52 | 8.25 | 8.60 | 49.45 | 26.91 |
| T8 | KUSH-PhosphoBoost | 1 ml | 18.40 | 8.10 | 9.05 | 8.47 | 51.22 | 26.81 |
| T9 | KUSH-PhosphoBoost | 0.5 ml | 16.30 | 8.22 | 6.28 | 5.89 | 53.18 | 28.10 |
| T10 | Control | | 16.12 | 6.28 | 5.42 | 4.73 | 65.89 | 21.69 |
| | CD (P=0.05) | | 1.22 | 0.87 | 1.00 | 1.15 | 5.13 | 3.18 |

**Leaf blight**

**A) Kalyani**

Field evaluation of three bioformulations viz., KUSH-PlantEX, KUSH-SalBoost, and KUSH-PhosphoBoost provided by ICAR-NBAIM, Mau, was conducted as seed dressers for wheat. The experiment was carried out during the 2023-24 cropping season at Kalyani location to assess their impact on wheat growth promotion and biological management of foliar blight of wheat. The bioformulations were tested at three different dosages: 0.5, 1.0, and 2.0 ml per 100 g of wheat seed, following a randomized block design with three replications. All tested bioformulations significantly reduced foliar blight disease severity compared to the unsprayed plots (Table 9.14). Wheat seeds treated with KUSH-PhosphoBoost at 2 ml per 100 g of seed showed the lowest disease severity of foliar blight scab (27), compared to in untreated wheat seeds (68). The same treatment (KUSH-PhosphoBoost @ 2 ml per 100 g) also resulted in the highest root biomass (4.17g), Plant height (29.06 cm) and number of tillers (11 per plant) after 30 days of field sowing. All bioformulation-treated seeds showed a significant yield increase compared to the unsprayed control check (Table 9.14). No phytotoxic symptoms were observed at any tested concentration of the bioformulations on wheat plants.

**Table: 9.14. Management of leaf blight through bioformulations at Kalyani during 2023-24**

| Treatment | Description | Dose (per 100 g seed) | Seed germination (%) | Plant growth attributes after 30 days | | | Leaf blight score (dd) | Yield gain (q/ha) |
|---|---|---|---|---|---|---|---|---|
| | | | | Plant height (cm) | Number of tillers/plant | Root biomas (g) | | |
| T1 | KUSH-PlantEX | 2 ml | 92.00 | 28.29 | 9.67 | 2.80 | 36 | 20.24 |
| T2 | KUSH-PlantEX | 1 ml | 91.00 | 28.07 | 9.33 | 2.55 | 35 | 21.10 |
| T3 | KUSH-PlantEX | 0.5 ml | 90.00 | 28.24 | 9.00 | 2.15 | 36 | 23.24 |
| T4 | KUSH-SalBoost | 2 ml | 90.67 | 28.43 | 8.67 | 2.22 | 35 | 21.39 |
| T5 | KUSH-SalBoost | 1 ml | 91.67 | 28.18 | 9.33 | 2.57 | 36 | 22.04 |
| T6 | KUSH-SalBoost | 0.5 ml | 91.00 | 28.63 | 10.00 | 2.64 | 36 | 22.09 |
| T7 | KUSH-PhosphoBoost | 2 ml | 94.67 | 29.06 | 11.00 | 4.17 | 27 | 27.93 |
| T8 | KUSH-PhosphoBoost | 1 ml | 90.00 | 28.52 | 8.00 | 3.51 | 36 | 19.00 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| T9 | KUSH-PhosphoBoost | 0.5 ml | 90.00 | 28.12 | 7.00 | 2.58 | 46 | 18.76 |
| T10 | Control | | 85.00 | 27.50 | 6.00 | 2.17 | **68** | 17.07 |
| | CD (P=0.05) | | 2.40 | 0.61 | 2.02 | 0.94 | | 5.68 |

## B) Dharwad

Field evaluation of three bioformulations viz., KUSH-PlantEX, KUSH-SalBoost, and KUSH-PhosphoBoost provided by ICAR-NBAIM, Mau, was conducted as seed dressers for wheat. The experiment was carried out during the 2023-24 cropping season at Dharwad location to assess their impact on wheat growth promotion and biological management of foliar blight of wheat. The bioformulations were tested at three different dosages: 0.5, 1.0, and 2.0 ml per 100 g of wheat seed, following a randomized block design with three replications. All tested bioformulations significantly reduced foliar blight disease severity compared to the unsprayed plots (Table 9.15). Wheat seeds treated with KUSH-PhosphoBoost at 2 ml per 100 g of seed showed the lowest disease severity of foliar blight scab (13), compared to in untreated wheat seeds (34). The same treatment (KUSH-PhosphoBoost @ 2 ml per 100 g) also resulted in the highest root biomass (0.71 g), root volume (5.59 $cm^3$), plant height (39.64 cm) and number of tillers (8.27 per plant) after 30 days of field sowing. All bioformulation-treated seeds showed a significant yield increase compared to the unsprayed control check (Table 9.15). No phytotoxic symptoms were observed at any tested concentration of the bioformulations on wheat plants.

**Table: 9.15. Management of Head scab through bioformulations at Dharward during 2023- 24**

| Treatment | Description | Dose (per 100 g seed) | Seed germination (%) | Plant growth attributes after30 days | | | | Leaf blight score (dd) | Yield gain (q/ha) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Plant height (cm) | Number of tillers | Root biomass (g) | Root Volume ($cm^3$) | | |
| T1 | KUSH-PlantEX | 2 ml | 97.67 | 37.18 | 6.67 | 0.46 | 4.13 | 23 | 14.59 |
| T2 | KUSH-PlantEX | 1 ml | 95.00 | 34.39 | 5.73 | 0.35 | 3.09 | 23 | 16.86 |
| T3 | KUSH-PlantEX | 0.5 ml | 98.00 | 37.36 | 6.67 | 0.47 | 4.25 | 23 | 16.35 |
| T4 | KUSH-SalBoost | 2 ml | 97.00 | 35.91 | 6.13 | 0.35 | 3.51 | 23 | 17.03 |
| T5 | KUSH-SalBoost | 1 ml | 97.33 | 35.98 | 6.20 | 0.36 | 4.04 | 23 | 17.40 |
| T6 | KUSH-SalBoost | 0.5 ml | 97.33 | 36.64 | 6.20 | 0.41 | 4.04 | 23 | 16.53 |
| T7 | KUSH-PhosphoBoost | 2 ml | 99.33 | 39.64 | 8.27 | 0.71 | 5.59 | 13 | 18.74 |
| T8 | KUSH-PhosphoBoost | 1 ml | 96.00 | 34.55 | 5.80 | 0.32 | 3.25 | 23 | 13.88 |
| T9 | KUSH-PhosphoBoost | 0.5 ml | 98.33 | 39.13 | 7.97 | 0.58 | 4.09 | 23 | 17.29 |
| T10 | Control | | 91.67 | 31.86 | 5.40 | 0.32 | 1.32 | **34** | 13.06 |
| | CD (P=0.05) | | 4.03 | 4.37 | 1.52 | 0.19 | 1.13 | | 1.87 |

### C) Pune

Field evaluation of three bioformulations viz., KUSH-PlantEX, KUSH-SalBoost, and KUSH-PhosphoBoost provided by ICAR-NBAIM, Mau, was conducted as seed dressers for wheat. The experiment was carried out during the 2023-24 cropping season at Pune location to assess their impact on wheat growth promotion and biological management of foliar blight of wheat. The bioformulations were tested at three different dosages: 0.5, 1.0, and 2.0 ml per 100 g of wheat seed, following a randomized block design with three replications. All tested bioformulations significantly reduced foliar blight disease severity compared to the unsprayed plots (Table 9.16). Wheat seeds treated with KUSH-PhosphoBoost at 2 ml per 100 g of seed showed the lowest disease severity of foliar blight scab (46), compared to in untreated wheat seeds (58). The same treatment (KUSH-PhosphoBoost @ 2 ml per 100 g) also resulted in the highest plant height (38 cm) and number of tillers (8.67 per plant) as well as 100% seed germination after 30 days of field sowing. All bioformulation-treated seeds showed a significant yield increase compared to the unsprayed control check (Table 9.16). No phytotoxic symptoms were observed at any tested concentration of the bioformulations on wheat plants.

**Table :9.16. Management of leaf blight through bioformulations at Pune during 2023-24**

| Treatment | Description | Dose (per 100 g seed) | Seed germination(%) | Plant growth attributes after 30 days | | Leaf blight score (dd) | Yield gain (q/ha) |
|---|---|---|---|---|---|---|---|
| | | | | Plant height (cm) | Number of tillers/plant | | |
| T1 | KUSH-PlantEX | 2 ml | 100.00 | 32.67 | 8.00 | **58** | 14.59 |
| T2 | KUSH-PlantEX | 1 ml | 100.00 | 31.33 | 7.67 | **68** | 16.86 |
| T3 | KUSH-PlantEX | 0.5 ml | 100.00 | 33.42 | 6.33 | **48** | 16.35 |
| T4 | KUSH-SalBoost | 2 ml | 100.00 | 32.67 | 8.33 | **48** | 17.03 |
| T5 | KUSH-SalBoost | 1 ml | 100.00 | 36.67 | 7.33 | **68** | 17.40 |
| T6 | KUSH-SalBoost | 0.5 ml | 100.00 | 33.33 | 8.00 | **68** | 16.53 |
| T7 | KUSH-PhosphoBoost | 2 ml | 100.00 | 38.00 | 8.67 | **46** | 18.74 |
| T8 | KUSH-PhosphoBoost | 1 ml | 100.00 | 35.33 | 6.00 | **56** | 13.88 |
| T9 | KUSH-PhosphoBoost | 0.5 ml | 100.00 | 35.15 | 5.00 | **59** | 17.29 |
| T10 | Control | | 96.33 | 31.50 | 6.00 | **68** | 13.06 |
| | CD (P=0.05) | | 0.84 | 2.97 | 1.97 | | 1.87 |

### D) Coochbehar

Field evaluation of three bioformulations viz., KUSH-PlantEX, KUSH-SalBoost, and KUSH-PhosphoBoost provided by ICAR-NBAIM, Mau, was conducted as seed dressers for wheat. The experiment was carried out during the 2023-24 cropping season at Coochbehar location to assess their impact on wheat growth promotion and biological management of foliar blight of wheat. The bioformulations were tested at three different dosages: 0.5, 1.0, and 2.0 ml per 100 g of wheat seed, following a randomized block design with three replications. All tested bioformulations significantly reduced foliar blight disease severity compared to the unsprayed plots (Table 9.17). Wheat seeds treated with KUSH-PhosphoBoost and KUSH-PlantEX at 2 ml per 100 g of seed showed the lowest disease severity of foliar blight scab (34), compared to in untreated wheat seeds (58). The treatment KUSH-PhosphoBoost @ 2 ml per 100 g) resulted in the highest root biomass (3.76g), plant height (29.93cm) and number of tillers (7.67 per plant) after 30 days offield sowing. All bioformulation-treated seeds showed a significant yield increase compared to theunsprayed control check (Table 9.17). No phytotoxic symptoms were observed at any tested concentration of the bioformulations on wheat plants.

**Table: 9.17. Management of leaf blight through bioformulations at Coochbehar during 2023-24**

| Treatment | Description | Dose (per 100 g seed) | Seed germination (%) | Plant growth attributes after 30 days | | | Leaf blight score (dd) | Yield gain (q/ha) |
|---|---|---|---|---|---|---|---|---|
| | | | | Plant height (cm) | Number of tillers/plant | Root biomas (g) | | |
| T1 | KUSH-PlantEX | 2 ml | 97.67 | 29.41 | 6.67 | 3.69 | **34** | 47.03 |
| T2 | KUSH-PlantEX | 1 ml | 97.67 | 27.58 | 5.00 | 2.98 | **35** | 45.42 |
| T3 | KUSH-PlantEX | 0.5 ml | 96.33 | 27.20 | 5.67 | 2.68 | **35** | 42.29 |
| T4 | KUSH-SalBoost | 2 ml | 97.67 | 29.10 | 6.00 | 3.70 | **35** | 47.07 |
| T5 | KUSH-SalBoost | 1 ml | 96.67 | 27.77 | 6.33 | 2.98 | **35** | 43.39 |
| T6 | KUSH-SalBoost | 0.5 ml | 95.67 | 27.15 | 6.67 | 2.56 | **45** | 40.21 |
| T7 | KUSH-PhosphoBoost | 2 ml | 97.67 | 29.93 | 7.67 | 3.76 | **34** | 47.08 |
| T8 | KUSH-PhosphoBoost | 1 ml | 96.67 | 29.03 | 4.67 | 2.91 | **36** | 43.96 |
| T9 | KUSH-PhosphoBoost | 0.5 ml | 96.67 | 27.50 | 6.00 | 2.82 | **46** | 41.92 |
| T10 | Control | | 86.00 | 26.58 | 5.00 | 1.29 | **58** | 37.42 |
| | CD (P=0.05) | | 2.43 | 0.74 | 1.54 | 1.33 | | 3.21 |

## E) Sabour

Field evaluation of three bioformulations viz., KUSH-PlantEX, KUSH-SalBoost, and KUSH-PhosphoBoost provided by ICAR-NBAIM, Mau, was conducted as seed dressers for wheat. The experiment was carried out during the 2023-24 cropping season at Sabour location to assess their impact on wheat growth promotion and biological management of foliar blight of wheat. The bioformulations were tested at three different dosages: 0.5, 1.0, and 2.0 ml per 100 g of wheat seed, following a randomized block design with three replications. All tested bioformulations significantly reduced foliar blight disease severity compared to the unsprayed plots (Table 9.18). Wheat seeds treated with KUSH-PhosphoBoost at 2 ml per 100 g of seed showed the lowest disease severity of foliar blight scab (24), compared to in untreated wheat seeds (79). The same treatment (KUSH-PhosphoBoost @ 2 ml per 100 g) also resulted in the highest plant height (8.87 cm), root biomass (3.17g), and number of tillers (8.33 per plant) after 30 days of field sowing. All bioformulation-treated seeds showed a significant yield increase compared to the unsprayed control check (Table 9.18). No phytotoxic symptoms were observed at any tested concentration of the bioformulations on wheat plants.

**Table: 9.18. Management of leaf blight through bioformulations at Sabour during 2023-24**

| Treatment | Description | Dose (per 100 g seed) | Seed germination (%) | Plant growth attributes after 30days | | | | Leaf blight score (dd) | Yield gain (q/ha) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Plant height (cm) | Number of tillers/plant | Root biomas (g) | Root Volume ($cm^3$) | | |
| T1 | KUSH-PlantEX | 2 ml | 91.00 | 9.40 | 4.67 | 1.98 | 2.87 | **45** | 45.47 |
| T2 | KUSH-PlantEX | 1 ml | 94.00 | 7.83 | 5.00 | 2.07 | 3.00 | **35** | 46.87 |
| T3 | KUSH-PlantEX | 0.5 ml | 93.67 | 7.33 | 5.67 | 2.00 | 2.90 | **36** | 45.93 |
| T4 | KUSH-SalBoost | 2 ml | 94.00 | 8.77 | 6.00 | 2.12 | 2.97 | **35** | 46.70 |
| T5 | KUSH-SalBoost | 1 ml | 90.33 | 8.73 | 5.00 | 1.97 | 2.90 | **36** | 45.20 |
| T6 | KUSH-SalBoost | 0.5 ml | 89.67 | 7.17 | 5.33 | 1.87 | 2.83 | **36** | 39.77 |
| T7 | KUSH-PhosphoBoost | 2 ml | 96.00 | 8.87 | 8.33 | 2.12 | 3.17 | **24** | 48.30 |
| T8 | KUSH-PhosphoBoost | 1 ml | 90.00 | 8.67 | 4.00 | 1.87 | 2.77 | **46** | 41.00 |
| T9 | KUSH-PhosphoBoost | 0.5 ml | 90.00 | 8.47 | 5.33 | 1.83 | 2.77 | **46** | 38.00 |
| T10 | Control | | 85.67 | 6.20 | 3.33 | 1.67 | 2.13 | **79** | 35.67 |
| | CD (P=0.05) | | 0.79 | 0.20 | 1.61 | 0.07 | 0.14 | | 4.55 |

## F) Ayodhya

Field evaluation of three bioformulations viz., KUSH-PlantEX, KUSH-SalBoost, and KUSH-PhosphoBoost provided by ICAR-NBAIM, Mau, was conducted as seed dressers for wheat. The experiment was carried out during the 2023-24 cropping season at Ayodhya location to assess their impact on wheat growth promotion and biological management of foliar blight of wheat. The bioformulations were tested at three different dosages: 0.5, 1.0, and 2.0 ml per 100 g of wheat seed, following a randomized block design with three replications. All tested bioformulations significantly reduced foliar blight disease severity compared to the unsprayed plots (Table 9.19). Wheat seeds treated with KUSH-PhosphoBoost at 2 ml per 100 g of seed showed the lowest disease severity of foliar blight scab (25), compared to in untreated wheat seeds (68). The same treatment (KUSH-PhosphoBoost @ 2 ml per 100 g) also resulted in the highest root biomass (1.16 g), Plant height (9.50 cm) and number of tillers (7.33 per plant) after 30 days of field sowing. All bioformulation-treated seeds showed a significant yield increase compared to the unsprayed control check (Table 9.19). No phytotoxic symptoms were observed at any tested concentration of the bioformulations on wheat plants.

**Table: 9.19. Management of leaf blight through bioformulations at Ayodhya during 2023-24**

| Treatment | Description | Dose (per 100 g seed) | Seed germination (%) | Plant growth attributes after 30 days | | | Leaf blight score (dd) | Yield gain (q/ha) |
|---|---|---|---|---|---|---|---|---|
| | | | | Plant height (cm) | Number of tillers/plant | Root biomas (g) | | |
| T1 | KUSH-PlantEX | 2 ml | 91.00 | 8.67 | 6.33 | 1.33 | **35** | 39.63 |
| T2 | KUSH-PlantEX | 1 ml | 90.00 | 8.20 | 6.00 | 1.24 | **36** | 38.20 |
| T3 | KUSH-PlantEX | 0.5 ml | 88.00 | 7.80 | 4.00 | 1.31 | **45** | 37.50 |
| T4 | KUSH-SalBoost | 2 ml | 90.00 | 8.23 | 5.67 | 1.18 | **35** | 38.91 |
| T5 | KUSH-SalBoost | 1 ml | 87.00 | 7.73 | 6.00 | 1.27 | **46** | 36.90 |
| T6 | KUSH-SalBoost | 0.5 ml | 86.00 | 7.37 | 5.33 | 1.14 | **47** | 36.48 |
| T7 | KUSH-PhosphoBoost | 2 ml | 95.00 | 9.50 | 7.33 | 1.16 | **25** | 41.12 |
| T8 | KUSH-PhosphoBoost | 1 ml | 93.00 | 9.07 | 7.00 | 1.15 | **34** | 40.36 |
| T9 | KUSH-PhosphoBoost | 0.5 ml | 91.00 | 8.60 | 6.67 | 1.50 | **35** | 39.81 |
| T10 | Control | | 83.00 | 6.30 | 3.67 | 1.38 | **68** | 33.77 |
| | CD (P=0.05) | | 2.05 | 0.21 | 1.11 | 0.19 | | 0.79 |

**Yield loss assessment in different varieties due to yellow rust disease in wheat Gurdaspur**

The field experiment was conducted during the 2023-24 rabi cropping season in Gurdashpur aimed to assess wheat yield losses caused by *Puccinia striiformis* f. sp. *tritici* (stripe rust) across six different wheat varieties (HD 3086, Agra Local, HD 2967, Unnat 343, PBW 725, and PBW 343) (Table 9.20) . The results indicated that there was a direct correlation between the level of stripe rust infection and yield loss in the wheat varieties. Different wheat varieties exhibited varying levels of resistance to stripe rust. PBW 725 was the most resistant variety, showing no infection and thus no yield loss under the conditions tested. PBW 343 experienced the highest yield loss of 84.03%, followed by Agra Local with a yield loss of 64.89%. This significant loss was observed even with the application of Tebuconazole 25.9% EC at 0.1% concentration, applied twice. All protected plots, where fungicides were applied, showed less ACI for yellow rust compared to unprotected plots. The yellow rust disease caused substantial yield losses, with a maximum of 84.03% in PBW 343 under protected conditions with optimal fungicide application. In contrast, the PBW 725 variety, which showed no infection, had zero yield loss.

**Table: 9.20. Yield loss assessment in different varieties due to yellow rust disease in wheat at Gurdashpur location during 2023-24**

| Variety | Protected Conditions | | Unprotected Conditions | | |
|---|---|---|---|---|---|
| | ACI | Yield (qha $^{-1}$) | ACI | Yield (qha $^{-1}$) | Yield loss (%) |
| HD 3086 | 0.73 | 59.48 | 60.00 | 30.05 | 49.48 |
| Agra local | 2.00 | 33.18 | 80.00 | 11.65 | 64.89 |
| HD 2967 | 3.67 | 45.88 | 80.00 | 25.25 | 44.97 |
| Unnat 343 | 0.00 | 61.38 | 12.00 | 57.30 | 6.65 |
| PBW 725 | 0.00 | 56.31 | 0.00 | 56.31 | 0.00 |
| PBW 343 | 3.67 | 48.23 | 86.67 | 7.70 | 84.03 |
| CD (P=0.05) | N/A | 4.78 | 9.67 | 4.49 | |

ACI: Average coefficient of infection

## B) Ludhiana

The field experiment was conducted during the 2023-24 rabi cropping season in Ludhiana to assess wheat yield losses caused by stripe rust disease across six different wheat varieties (HD 3086, Agra Local, HD 2967, Unnat 343, PBW 725, and PBW 343) (Table 9.21) . The results indicated that there was a direct correlation between the level of stripe rust infection and yield lossin the wheat varieties. Different wheat varieties exhibited varying levels of resistance to stripe rust. PBW 725 was the most resistant variety, showing no infection and thus no yield loss under the conditions tested. PBW 343 experienced the highest yield loss of 77.98%, followed by Agra Local with a yield loss of 69.35%. This significant loss was observed even with the application of Tebuconazole 25.9% EC at 0.1% concentration, applied twice. All protected plots, where fungicides were applied, showed less ACI compared to unprotected plots. The yellow rust disease caused substantial yield losses, with a maximum of 77.98% in PBW 343 under protected conditions with optimal fungicide application. In contrast, the PBW 725 variety, which showed noinfection, had zero yield loss.

**Table: 9.21. Yield loss assessment in different varieties due to yellow rust disease in wheat atLudhiana location during 2023-24**

| Variety | Protected Conditions | | Unprotected Conditions | | |
|---|---|---|---|---|---|
| | ACI | Yield (qha $^{-1}$) | ACI | Yield (qha $^{-1}$) | Yield loss (%) |
| HD 3086 | 0.00 | 57.36 | 60.00 | 45.04 | 21.48 |
| Agra local | 0.33 | 35.47 | 73.33 | 10.87 | 69.35 |
| HD 2967 | 2.00 | 47.23 | 80.00 | 24.19 | 48.78 |
| Unnat 343 | 0.00 | 52.41 | 9.33 | 47.12 | 10.09 |
| PBW 725 | 0.00 | 51.98 | 0.00 | 51.98 | 0.00 |
| PBW 343 | 1.33 | 44.59 | 80.00 | 9.82 | 77.98 |
| CD (P=0.05) | N/A | 6.22 | 10.57 | 3.82 | |

ACI: Average coefficient of infection

## C) Durgapura

The field experiment was conducted during the 2023-24 rabi cropping season in Durgapura to assess wheat yield losses caused by stripe rust disease across six different wheat varieties (HD 3086, Agra Local, HD 2967, Unnat 343, PBW 725, and PBW 343) (Table 9.22) . The results indicated that there was a direct correlation between the level of stripe rust infection and yield lossin the wheat varieties. Different wheat varieties exhibited varying levels of resistance to stripe rust. PBW 343 experienced the highest yield loss of 50.67%, followed by Agra Local with a yield loss of 34.45%. This significant loss was observed even with the application of Tebuconazole 25.9% EC at 0.1% concentration, applied twice. All protected plots, where fungicides wereapplied, showed less ACI compared to unprotected plots. The yellow rust disease caused substantial yield losses, with a maximum of 50.67% in PBW 343 under protected conditions with optimal fungicide application. In contrast, the HD 2967 variety showed minimum yield loss.

**Table: 9.22. Yield loss assessment in different varieties due to yellow rust disease in wheat at Durgapura location during 2023-24**

| Variety | Protected Conditions | | Unprotected Conditions | | Yield loss (%) |
|---|---|---|---|---|---|
| | ACI | Yield (qha $^{-1}$) | ACI | Yield (qha $^{-1}$) | |
| HD 3086 | 3.33 | 47.33 | 20.00 | 41.33 | 12.68 |
| Agra local | 13.33 | 28.07 | 80.00 | 18.40 | 34.45 |
| HD 2967 | 3.67 | 44.08 | 33.33 | 41.75 | 5.29 |
| Unnat 343 | 2.33 | 47.60 | 15.00 | 44.27 | 7.00 |

| | | | | | |
|---|---|---|---|---|---|
| PBW 725 | 0.00 | 48.57 | 0.00 | 44.57 | 8.24 |
| PBW 343 | 5.00 | 39.47 | 80.00 | 19.47 | 50.67 |
| CD (P=0.05) | 4.49 | 2.70 | 9.47 | 1.99 | |

ACI: Average coefficient of infection

**D) Pantnagar**

The field experiment was conducted during the 2023-24 rabi cropping season in Pantnagar to determine wheat yield losses caused by *Puccinia striiformis* f. sp. *tritici* across six different wheat varieties (HD 3086, Agra Local, HD 2967, Unnat 343, PBW 725, and PBW 343) (Table 9.23) . The results indicated that there was a direct correlation between the level of stripe rust infection and yield loss in the wheat varieties. Different wheat varieties exhibited varying levels of resistance to stripe rust. PBW 725 was the most resistant variety, showing less ACI and less yield loss under the conditions tested. PBW 343 experienced the highest yield loss of 84.03%, followed by Agra Local with a yield loss of 64.89%. This significant loss was observed even with the application of Tebuconazole 25.9% EC at 0.1% concentration, applied twice. All protected plots, where fungicides were applied, showed a ACI compared to unprotected plots. The yellow rust (stripe rust) disease caused substantial yield losses, with a maximum of 52.92% in PBW 343 followed by Agra local (45.56%) compared to protected conditions with optimal fungicide application. In contrast, the PBW 725 variety showed very low infection and negligible yield loss.

**Table: 9.23. Yield loss assessment in different varieties due to yellow rust disease in wheat at Pantnagar location during 2023-24**

| Variety | Protected Conditions | | Unprotected Conditions | | Yield loss (%) |
|---|---|---|---|---|---|
| | ACI | Yield (qha $^{-1}$) | ACI | Yield (qha $^{-1}$) | |
| HD 3086 | 6.67 | 45.03 | 16.67 | 43.23 | 4.00 |
| Agra local | 6.67 | 37.09 | 53.33 | 20.19 | 45.56 |
| HD 2967 | 11.67 | 44.35 | 33.33 | 42.70 | 3.72 |
| Unnat 343 | 5.33 | 47.88 | 18.33 | 47.30 | 1.21 |
| PBW 725 | 0.33 | 48.62 | 2.33 | 48.15 | 0.97 |
| PBW 343 | 13.33 | 48.24 | 66.67 | 22.71 | 52.92 |
| CD (P=0.05) | 5.99 | 2.35 | 7.07 | 1.40 | |

ACI: Average coefficient of infection

**E) Hisar**

The field experiment was conducted during the 2023-24 rabi cropping season in Hisar to assess wheat yield losses caused by *Puccinia striiformis* f. sp. *tritici* (stripe rust) across six different wheat varieties (HD 3086, Agra Local, HD 2967, Unnat 343, PBW 725, and PBW 343) (Table 9.24) . The results indicated that there was a direct correlation between the level of stripe rust infection and yield loss in the wheat varieties. Different wheat varieties exhibited varying levels ofresistance to stripe rust. Unnat 343 followed by PBW 725 was the most resistant variety, showing least infection and significantly low yield loss under the conditions tested. Agra Local experienced the highest yield loss of 35.77%, followed by PBW 343 with a yield loss of 34.39%. This significant loss was observed even with the application of Tebuconazole 25.9% EC at 0.1% concentration, applied twice. All protected plots, where fungicides were applied, showed least ACI compared to unprotected plots.

**Table: 9.24. Yield loss assessment in different varieties due to yellow rust disease in wheat at Hisar location during 2023-24**

| Variety | Protected Conditions | | Unprotected Conditions | | |
|---|---|---|---|---|---|
| | ACI | Yield (qha $^{-1}$) | ACI | Yield (qha $^{-1}$) | Yield loss (%) |
| HD 3086 | 3.67 | 44.19 | 13.33 | 37.51 | 15.12 |
| Agra local | 16.67 | 27.87 | 66.67 | 17.90 | 35.77 |
| HD 2967 | 6.67 | 45.08 | 46.67 | 40.75 | 9.61 |
| Unnat 343 | 3.67 | 44.27 | 16.67 | 42.27 | 4.52 |
| PBW 725 | 0.00 | 44.57 | 0.00 | 42.23 | 5.25 |
| PBW 343 | 5.00 | 37.80 | 66.67 | 24.80 | 34.39 |
| CD (P=0.05) | 4.36 | 2.34 | 15.42 | 3.16 | |

ACI: Average coefficient of infection

### F) Karnal

The field experiment was conducted during the 2023-24 rabi cropping season in Karnal to assess wheat yield losses caused by stripe rust across six different wheat varieties (HD 3086, Agra Local, HD 2967, Unnat 343, PBW 725, and PBW 343) (Table 9.25). The results indicated that there was a direct correlation between the level of stripe rust infection and yield loss in the wheat varieties. Different wheat varieties exhibited varying levels of resistance to stripe rust. PBW 725 was the most resistant variety, showing less infection (ACI = 0.0 under protected conditions and ACI=3.33 under unprotected conditions) and thus showed minimal yield loss. PBW 343 experiencedthe highest yield loss of 32.62%, followed by Agra Local with a yield loss of 30.28%. This significant loss was observed even with the application of Tebuconazole 25.9% EC at 0.1% concentration, applied twice. All protected plots, where fungicides were applied, showed a ACI compared to unprotected plots. The yellow rust (stripe rust) disease caused substantial yield losses, with a maximum of 32.62% in PBW 343 under protected conditions with optimal fungicide application. In contrast, the PBW 725 variety, which showed low infection and lowyield loss relative to other varieties.

**Table 9.25: Yield loss assessment in different varieties due to yellow rust disease in wheat atKarnal location during 2023-24**

| Variety | Protected Conditions | | Unprotected Conditions | | Yield loss (%) |
|---|---|---|---|---|---|
| | ACI | Yield (qha $^{-1}$) | ACI | Yield (qha $^{-1}$) | |
| HD 3086 | 4.00 | 53.02 | 73.33 | 45.60 | 13.99 |
| Agra local | 3.33 | 33.80 | 73.33 | 23.57 | 30.28 |
| HD 2967 | 3.67 | 43.56 | 60.00 | 38.63 | 11.31 |
| Unnat 343 | 0.00 | 45.41 | 53.33 | 42.03 | 7.44 |
| PBW 725 | 0.00 | 51.98 | 3.33 | 48.50 | 6.69 |
| PBW 343 | 6.67 | 44.59 | 17.33 | 30.04 | 32.62 |
| CD (P=0.05) | 3.39 | 6.06 | 11.74 | 5.25 | |

ACI: Average coefficient of infection

# PROGRAMME 10. WHEAT ENTOMOLOGY

## RESULTS OF COORDINATED ENTOMOLOGICAL EXPERIMENTS

The wheat entomology program focuses on three main areas: host plant resistance, integrated pest management (IPM), and stored grain pest management. During the 2023-24 crop season, research trials were conducted across all these entomological domains. In the host plant resistance area, trials included screening nurseries for resistance against foliar and root aphids, shoot fly, brown wheat mites, and conducting a multi-pest screening nursery. The integrated pest management component involved activities like surveying and monitoring insect pests and their natural enemies, as well as evaluating various management practices against major wheat insect pests. Additionally, studies were carried out on the prevalence and population dynamics of key wheat pests under different residue systems, effect of border crops on aphid incidence, along with the use of new chemical insecticides to manage foliar aphids and termites. The major findings from these 2023-24 experiments conducted at various AICRP centers are summarized 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 7.35 % of shoot fly entry was reported in entry CG1029. However, the highest shoot fly infestation index of 19.59 % was recorded in entry DBW222. At Ludhiana centre, the lowest infestation index of 4.42 % was reported on GW547 and the highest infestation index of 8.44% on Sonalika. At Dharwad location, the lowest shootfly index (8.75 %) was recorded on entry MPO1395 while highest infestation (40.83%) was observed on Raj4581. At Kanpur location, the lowest infestation 2.85 % was observed on DBW 386 and the highest infestation of 20.00% was recorded on entry PBW957 (Table A1-10.1a).

**(b) Brown wheat mite**

At Ludhiana, entry MP1386 recorded the minimum mite population of 9.00/10 $cm^2$ area while the maximum mite population of 15.67 /10 $cm^2$ was recorded in entry HD3468. 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, Kharibari and Pusa, four entries viz., PBW891, HD3118(C), NIAW4364 and DBW443 scored an average score of equal or below 3.5 and were in moderately resistance category (grade 3). Location-wise, at Ludhiana centre one entry entry, HD3293 (C) were found to be moderately resistance category (grade 3). Two entries at Karnal viz., DBW443 & DBW426 and two entries at Pusa viz., HI1674 and HI1655 gave resistance response (grade 2) (Table A1-10.1b)

**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 Kharibari, entries was 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 Kharibari.The infestation of aphids at Durgapura, Niphad, Khudwani was recorded to very low and therefore data was rejected.(Table A1-10.1b).

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

**(A2) Elite multiple disease screening nursery (EMDSN)**

**(a) Shoot fly:** The average infestation index of shootfly recorded at three locations (Ludhiana, Dharwad & Kanpur) and it was to be lowest (12.82 %) in entry HD3428 and the highest (19.24 %) for VL2041(I)(C). (Table A2-10.1a).

**(b) Brown wheat mite:** The lowest population of 8.00 brown wheat mites/10 $cm^2$ was recorded in entry NIAW4114 while HI1669 had the highest population of 16.00 mites/10 $cm^2$ at Ludhiana (Table A2-10.1a).

**(c) Foliar aphid:** Based on an average score of four locations (Ludhiana, Karnal, Pusa and Kharibari), only one entry entry viz., DBW395 showed moderate resistance response (grade 3) to foliar aphid. The rest of entries were found to be either susceptible (grade 4) or highly susceptible (grade 5) to foliar aphid (Table A2-10.1b).

**(d) Root aphid:** At Ludhiana, only one entry, DBW386 showed moderatly resistance response (grade 3) to root aphid. All other entries were found to be either susceptible (grade 4) or highly susceptible (grade 5) to root aphid (Table A2-10.1b).

**Table :A1-10.1a: Screening of AVT lines against Shootfly and Brown Wheat mite (Year-2023-24)**

| Entry No. | Entry | Shoot fly incidence (%) | | | | No. of brown wheat mites/10 cm sq area |
|---|---|---|---|---|---|---|
| | | Ludhiana | Dharwad | Kanpur | Average | Ludhiana |
| 1 | HD3086© | 5.22 | 32.17 | 14.28 | 17.22 | 13.33 |
| 2 | HI1668 | 4.83 | 21.25 | 17.14 | 14.41 | 13.33 |
| 3 | HD3494 | 5.32 | 23.08 | 20.00 | 16.13 | 11.33 |
| 4 | DBW417 | 6.16 | 19.63 | 14.28 | 13.36 | 13.00 |
| 5 | DBW88 © | 5.78 | 28.39 | 10.00 | 14.72 | 12.00 |
| 6 | PBW957 | 6.7 | 18.52 | 20.00 | 15.07 | 10.67 |
| 7 | DBW222(C) | 5.36 | 36.27 | 17.14 | 19.59 | 9.33 |
| 8 | DBW477 | 5.69 | 39.20 | 16.66 | 20.52 | 12.00 |
| 9 | HD3471 | 5.65 | 35.56 | 12.00 | 17.74 | 11.00 |
| 10 | PBW916 | 5.9 | 21.08 | 6.66 | 11.21 | 11.67 |
| 11 | DBW386 | 5.66 | 23.72 | 2.85 | 10.74 | 13.33 |
| 12 | PBW826© | 6.68 | 23.70 | 5.00 | 11.79 | 12.33 |
| 13 | DBW476 | 5.35 | 35.29 | 6.66 | 15.77 | 13.67 |
| 14 | HD2967 | 6.14 | 15.38 | 12.00 | 11.17 | 11.67 |
| 15 | PBW725 | 5.61 | 24.31 | 16.66 | 15.53 | 11.33 |
| 16 | HD3386(I)© | 6.09 | 23.73 | 5.00 | 11.61 | 12.00 |
| 17 | PBW958 | 5.23 | 11.20 | 13.63 | 10.02 | 13.33 |
| 18 | HD3455 | 6.08 | 16.02 | 18.18 | 13.43 | 12.00 |
| 19 | HD3059© | 5.97 | 39.42 | 8.00 | 17.80 | 12.33 |
| 20 | JKW261© | 5.35 | 24.19 | 9.37 | 12.97 | 11.67 |
| **20A** | **Infector** | **8.37** | **32.00** | **18.88** | **19.75** | **14.33** |
| 21 | NW8071 | 6.48 | 25.17 | 15.62 | 15.76 | 11.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 22 | DBW173© | 6.02 | 31.72 | 6.66 | 14.80 | 12.33 |
| 23 | WH1324 | 6.25 | 23.49 | 8.00 | 12.58 | 12.33 |
| 24 | DBW422 | 5.59 | 32.12 | 7.14 | 14.95 | 12.67 |
| 25 | RAJ4581 | 5.55 | 40.83 | 4.16 | 16.85 | 11.67 |
| 26 | HD3428 | 5.84 | 36.67 | 9.09 | 17.20 | 13.00 |
| 27 | HD3495 | 5.49 | 34.46 | 14.28 | 18.08 | 11.33 |
| 28 | PBW771© | 5.97 | 21.82 | 9.09 | 12.29 | 13.00 |
| 29 | PBW921 | 4.64 | 22.33 | 11.42 | 12.80 | 13.33 |
| 30 | PBW644© | 5.51 | 24.32 | 7.14 | 12.32 | 11.67 |
| 31 | HI1653© | 6.04 | 33.85 | 13.63 | 17.84 | 9.67 |
| 32 | PBW927 | 6 | 30.91 | 7.69 | 14.87 | 13.67 |
| 33 | HD3369 | 6.66 | 21.05 | 15.20 | 14.30 | 13.67 |
| 34 | HD3468 | 5.35 | 24.20 | 3.57 | 11.04 | **15.67** |
| 35 | NIAW3170© | 5.82 | 35.67 | 7.14 | 16.21 | 11.67 |
| 36 | WH1326 | 5.96 | 24.66 | 4.54 | 11.72 | 12.33 |
| 37 | DBW296 | 6.5 | 13.21 | 4.34 | 8.02 | 12.00 |
| 38 | JKW304 | 5.71 | 19.38 | 4.54 | 9.88 | 12.00 |
| 39 | WH1402(I)© | 5.8 | 19.41 | 4.16 | 9.79 | 10.67 |
| 40 | PBW908 | 5.5 | 38.00 | 14.28 | 19.26 | 14.00 |
| **40A** | **Infector** | **7.98** | **35.71** | **15.62** | **19.77** | **16.33** |
| 41 | HP1978 | 6.01 | 19.11 | 11.42 | 12.18 | 11.33 |
| 42 | HD3447 | 5.43 | 30.77 | 12.50 | 16.23 | 11.67 |
| 43 | PBW915 | 5.72 | 21.00 | 14.28 | 13.67 | 12.33 |
| 44 | HD3388(I) (C) | 4.7 | 25.63 | 9.37 | 13.23 | 12.00 |
| 45 | UP3124 | 5.52 | 17.84 | 14.28 | 12.55 | 12.67 |
| 46 | KRL2106 | 5.68 | 11.82 | 13.33 | 10.28 | 12.00 |
| 47 | HD3249 (C) | 5.18 | 36.96 | 12.50 | 18.21 | 9.67 |
| 48 | PBW913 | 6.03 | 38.33 | 9.37 | 17.91 | 12.67 |
| 49 | HD3467 | 5.37 | 33.33 | 12.50 | 17.07 | 14.67 |
| 50 | BCW29 | 5.65 | 35.17 | 14.28 | 18.37 | 10.67 |
| 51 | UP3123 | 5.52 | 19.70 | 14.28 | 13.17 | 10.33 |
| 52 | HI1563 (C) | 5.63 | 31.54 | 3.84 | 13.67 | 9.33 |
| 53 | DBW107(C) | 5.16 | 17.61 | 4.16 | 8.98 | **9.00** |
| 54 | PBW833(C) | 6.55 | 24.89 | 3.84 | 11.76 | 10.00 |
| 55 | WH1323 | 6.46 | 21.90 | 3.33 | 10.56 | 13.00 |
| 56 | HD3118(C) | 5.69 | 19.05 | 9.67 | 11.47 | 12.33 |
| 57 | HI1621(C) | 5.73 | 22.46 | 6.25 | 11.48 | 11.33 |
| 58 | HD3171 (C) | 5.59 | 16.54 | 3.57 | 8.57 | 13.00 |
| 59 | HD3460 | 6.42 | 15.51 | 11.42 | 11.12 | 13.00 |
| 60 | HD3293 (C) | 5.64 | 11.85 | 7.14 | 8.21 | 11.33 |
| **60A** | **Infector** | **8.01** | **26.90** | **18.18** | **17.70** | **16.00** |
| 61 | HI1612 (C) | 5.7 | 27.01 | 12.50 | 15.07 | 10.33 |
| 62 | K1317(C) | 5.02 | 13.03 | 10.17 | 9.41 | 11.67 |
| 63 | VL2041 (C) | 5.51 | 14.51 | 5.71 | 8.58 | 12.67 |
| 64 | HPW349 © | 5.75 | 20.00 | 9.09 | 11.61 | 13.00 |
| 65 | VL2059 | 6.16 | 14.55 | 15.62 | 12.11 | 11.67 |
| 66 | HS562 (C) | 4.86 | 25.53 | 14.28 | 14.89 | 11.33 |
| 67 | VL907 (C) | 6.62 | 26.25 | 11.42 | 14.76 | 11.00 |
| 68 | MACS6837 | 4.8 | 27.69 | 12.50 | 15.00 | 12.33 |
| 69 | MACS4125(d) | 4.98 | 11.05 | 10.71 | 8.91 | 11.33 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 70 | MACS4135(d) | 5.47 | 8.80 | 12.00 | 8.76 | 11.00 |
| 71 | HI1669 | 5.63 | 32.21 | 9.37 | 15.74 | 12.00 |
| 72 | HI1683 | 5.22 | 19.23 | 10.71 | 11.72 | 13.00 |
| 73 | HI1684 | 5.52 | 25.00 | 13.63 | 14.72 | 14.67 |
| 74 | HI8848(d) | 6.11 | 11.11 | 7.14 | 8.12 | 11.33 |
| 75 | HI8849(d) | 6.24 | 15.92 | 3.57 | 8.58 | 11.67 |
| 76 | HI8850(d) | 5.55 | 9.91 | 7.14 | 7.53 | 10.33 |
| 77 | GW554 | 5.72 | 31.85 | 9.37 | 15.65 | 12.00 |
| 78 | GW555 | 6.04 | 24.62 | 6.25 | 12.30 | 12.33 |
| 79 | MP3570 | 5.25 | 11.18 | 8.57 | 8.33 | 11.67 |
| 80 | MPO1395 | 6.11 | 8.75 | 12.50 | 9.12 | 13.00 |
| **80A** | **Infector** | **8.44** | **34.07** | **18.75** | **20.42** | **16.33** |
| 81 | GW322 | 5.13 | 19.29 | 12.50 | 12.31 | 11.67 |
| 82 | MACS6768 | 6.19 | 20.93 | 11.42 | 12.85 | 12.67 |
| 83 | HI1650 | 4.81 | 36.92 | 11.42 | 17.72 | 12.67 |
| 84 | GW547(I) | **4.42** | 19.42 | 14.28 | 12.71 | 12.00 |
| 85 | HI8737(d) | 6.01 | 13.83 | 3.33 | 7.72 | 10.33 |
| 86 | HI8713(d) | 6.3 | 35.65 | 5.71 | 15.89 | 10.67 |
| 87 | HI1674 | 5.93 | 33.08 | 7.14 | 15.38 | 11.00 |
| 88 | HI1687 | 6.34 | 37.14 | 11.42 | 18.30 | 10.33 |
| 89 | WSM138 | 7.05 | 22.52 | 9.37 | 12.98 | 12.33 |
| 90 | MACS6830 | 6.05 | 18.33 | 6.25 | 10.21 | 13.00 |
| 91 | DBW425 | 6.26 | 17.73 | 3.33 | 9.11 | 11.33 |
| 92 | GW556 | 6.37 | 37.50 | 7.14 | 17.00 | 13.00 |
| 93 | HD2932 | 5.51 | 11.43 | 7.69 | 8.21 | 11.67 |
| 94 | MP4010 | 6.37 | 15.38 | 7.14 | 9.63 | 12.33 |
| 95 | HI1634 | 5.78 | 15.38 | 6.66 | 9.27 | 11.00 |
| 96 | CG1029 | 5.6 | 12.90 | 3.57 | 7.36 | 14.33 |
| 97 | DBW441M | 6.14 | 17.78 | 14.28 | 12.73 | 11.00 |
| 98 | DBW428 | 5.47 | 13.53 | 12.50 | 10.50 | 14.00 |
| 99 | DBW432 | 5.23 | 20.77 | 8.33 | 11.44 | 12.33 |
| 100 | UAS3029 | 7.39 | 22.95 | 9.37 | 13.24 | 12.33 |
| **100A** | **Infector** | **8.07** | **39.52** | **18.18** | **21.92** | **15.67** |
| 101 | UAS484(d) | 5.94 | 12.00 | 12.50 | 10.15 | 14.67 |
| 102 | NIAW4267 | 5.28 | 20.95 | 10.00 | 12.08 | 9.33 |
| 103 | HI8851(d) | 4.98 | 24.83 | 9.37 | 13.06 | 14.00 |
| 104 | HI8852(d) | 5.95 | 12.67 | 12.50 | 10.37 | 12.67 |
| 105 | MACS4131(d) | 5.93 | 12.76 | 9.37 | 9.35 | 11.33 |
| 106 | MPO1398(d) | 6.19 | 21.19 | 12.12 | 13.17 | 11.67 |
| 107 | DBW110 | 4.57 | 37.86 | 11.42 | 17.95 | 11.67 |
| 108 | CG1036 | 5.71 | 29.60 | 12.50 | 15.94 | 14.00 |
| 109 | HI1655 | 5.94 | 20.57 | 10.34 | 12.28 | 12.33 |
| 110 | HI8627(d) | 5.64 | 16.40 | 11.42 | 11.15 | 11.00 |
| 111 | HI8823(d) | 6.57 | 17.27 | 10.71 | 11.52 | 13.33 |
| 112 | DBW359(I) | 4.84 | 40.00 | 10.34 | 18.39 | 12.00 |
| 113 | CG1040(I) | 6.66 | 29.61 | 11.53 | 15.93 | 13.67 |
| 114 | MACS6842 | 5.55 | 38.51 | 13.33 | 19.13 | 12.00 |
| 115 | MACS6844 | 6.18 | 35.03 | 3.57 | 14.93 | 10.67 |
| 116 | NIAW4364 | 6.04 | 27.16 | 10.71 | 14.64 | 12.67 |
| 117 | PBW891 | 5.09 | 30.53 | 6.89 | 14.17 | 14.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 118 | DBW443 | 5.95 | 30.62 | 3.33 | 13.30 | 13.00 |
| 119 | DDW62(d) | 5.73 | 32.88 | 7.14 | 15.25 | 10.00 |
| 120 | AKAW5100 | 5.53 | 28.00 | 7.69 | 13.74 | 11.67 |
| **120A** | **Infector** | **7.99** | **30.34** | **16.12** | **18.15** | **16.00** |
| 121 | WH1306 | 5.57 | 16.37 | 9.37 | 10.44 | 10.33 |
| 122 | NWS2222 | 5.48 | 36.36 | 9.09 | 16.98 | 11.00 |
| 123 | UAS3026 | 6.1 | 40.00 | 7.14 | 17.75 | 12.67 |
| 124 | CG1045 | 5.08 | 34.00 | 10.34 | 16.47 | 12.33 |
| 125 | MPO1395(d) | 5.12 | 35.48 | 4.54 | 15.05 | 12.67 |
| 126 | MACS6222 | 6.38 | 36.89 | 11.42 | 18.23 | 12.00 |
| 127 | MP1378(I) | 5.42 | 15.65 | 10.71 | 10.59 | 10.67 |
| 128 | MACS3949(d) | 5.59 | 24.10 | 11.53 | 13.74 | 13.00 |
| 129 | DBW426 | 5.36 | 23.85 | 9.37 | 12.86 | 15.00 |
| 130 | MACS6829 | 5.53 | 30.71 | 7.14 | 14.46 | 11.67 |
| 131 | NIAW4114 | 6.51 | 17.89 | 10.34 | 11.58 | 12.33 |
| 132 | NIAW4120 | 4.68 | 24.52 | 6.66 | 11.95 | 11.00 |
| 133 | NIAW4432 | 5.66 | 38.46 | 7.14 | 17.09 | 12.67 |
| 134 | UAS3027 | 5.65 | 19.20 | 3.57 | 9.47 | 11.33 |
| 135 | LOK79 | 8.1 | 35.79 | 7.69 | 17.19 | 11.67 |
| 136 | RAJ4083 (C) | 5.56 | 22.67 | 10.34 | 12.86 | 11.67 |
| 137 | HD3090 © | 5.74 | 16.41 | 12.32 | 11.49 | 14.00 |
| 138 | HI1633 © | 5.54 | 8.99 | 11.42 | 8.65 | 12.33 |
| 139 | CG1047 | 5.28 | 34.92 | 10.71 | 16.97 | 11.00 |
| 140 | GW1368(d) | 5.22 | 39.44 | 8.33 | 17.66 | 13.33 |
| **140a** | **Infector** | **6.93** | **30.06** | **18.18** | **18.39** | **16.67** |
| 141 | HI1605 | 6.22 | 12.50 | 9.37 | 9.36 | 12.33 |
| 142 | NIAW3170 | 5.5 | 21.33 | 11.42 | 12.75 | 12.67 |
| 143 | UAS446(d) | 6.15 | 13.79 | 10.71 | 10.22 | 10.33 |
| 144 | NIDW1149(d) | 5.37 | 21.43 | 9.37 | 12.06 | 11.67 |
| 145 | HI1665(I) | 6.14 | 12.11 | 8.57 | 8.94 | 12.67 |
| 146 | UAS478(d)(I) | 6.25 | 12.94 | 3.84 | 7.68 | 14.33 |

* Brown wheat mite screeing data rejected at Durgapura (Jaipur), Kanpur due to low infestation of themite. 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-2023-24)

| Entry No. | Entry | Foliar aphid score (1-5 scale) | | | | Average score | Maximum Score | Root aphid (No./plant) Ludhiana Centre only |
|---|---|---|---|---|---|---|---|---|
| | | Ludhiana | Karnal | Pusa | Kharibari | | | |
| 1 | HD3086© | 4 | 4 | 5 | 5 | 4.5 | 5 | 4 |
| 2 | HI1668 | 5 | 4 | 5 | 5 | 4.8 | 5 | 4 |
| 3 | HD3494 | 4 | 4 | 4 | 5 | 4.3 | 5 | 4 |
| 4 | DBW417 | 4 | 5 | 3 | 5 | 4.3 | 5 | 4 |
| 5 | DBW88 © | 4 | 3 | 3 | 5 | 3.8 | 5 | 4 |
| 6 | PBW957 | 4 | 3 | 3 | 5 | 3.8 | 5 | 4 |
| 7 | DBW222(C) | 5 | 3 | 3 | 5 | 4.0 | 5 | 4 |
| 8 | DBW477 | 4 | 5 | 3 | 5 | 4.3 | 5 | 4 |
| 9 | HD3471 | 4 | 4 | 3 | 5 | 4.0 | 5 | 4 |
| 10 | PBW916 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 11 | DBW386 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 12 | PBW826© | 5 | 3 | 3 | 5 | 4.0 | 5 | 4 |
| 13 | DBW476 | 5 | 4 | 4 | 4 | 4.3 | 5 | 4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 14 | HD2967 | 5 | 5 | 4 | 4 | 4.5 | 5 | 4 |
| 15 | PBW725 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 16 | HD3386(I)© | 5 | 5 | 4 | 4 | 4.5 | 5 | 4 |
| 17 | PBW958 | 5 | 5 | 4 | 5 | 4.8 | 5 | 4 |
| 18 | HD3455 | 5 | 4 | 4 | 4 | 4.3 | 5 | 4 |
| 19 | HD3059© | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 20 | JKW261© | 5 | 5 | 4 | 4 | 4.5 | 5 | 4 |
| **20A** | **Infector** | **5** | **5** | **5** | **5** | **5.0** | **5** | **5** |
| 21 | NW8071 | 5 | 5 | 5 | 4 | 4.8 | 5 | 4 |
| 22 | DBW173© | 5 | 5 | 5 | 4 | 4.8 | 5 | 4 |
| 23 | WH1324 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 24 | DBW422 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 25 | RAJ4581 | 4 | 4 | 3 | 5 | 4.0 | 5 | 4 |
| 26 | HD3428 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 27 | HD3495 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 28 | PBW771© | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 29 | PBW921 | 4 | 4 | 3 | 5 | 4.0 | 5 | 4 |
| 30 | PBW644© | 5 | 3 | 3 | 5 | 4.0 | 5 | 4 |
| 31 | HI1653© | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 32 | PBW927 | 5 | 5 | 3 | 4 | 4.3 | 5 | 4 |
| 33 | HD3369 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 34 | HD3468 | 5 | 5 | 3 | 4 | 4.3 | 5 | 4 |
| 35 | NIAW3170© | 5 | 5 | 4 | 5 | 4.8 | 5 | 4 |
| 36 | WH1326 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 37 | DBW296 | 4 | 5 | 4 | 5 | 4.5 | 5 | 5 |
| 38 | JKW304 | 4 | 4 | 4 | 5 | 4.3 | 5 | 4 |
| 39 | WH1402(I)© | 4 | 3 | 3 | 5 | 3.8 | 5 | 4 |
| 40 | PBW908 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| **40A** | **Infector** | **5** | **5** | **5** | **5** | **5.0** | **5** | **5** |
| 41 | HP1978 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 42 | HD3447 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 43 | PBW915 | 4 | 5 | 3 | 5 | 4.3 | 5 | 4 |
| 44 | HD3388(I) (C) | 5 | 5 | 3 | 5 | 4.5 | 5 | 5 |
| 45 | UP3124 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 46 | KRL2106 | 5 | 5 | 4 | 5 | 4.8 | 5 | 4 |
| 47 | HD3249 (C) | 4 | 4 | 3 | 5 | 4.0 | 5 | 4 |
| 48 | PBW913 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 49 | HD3467 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 50 | BCW29 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 51 | UP3123 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 52 | HI1563 (C) | 5 | 3 | 3 | 5 | 4.0 | 5 | 5 |
| 53 | DBW107(C) | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 54 | PBW833(C) | 4 | 5 | 3 | 5 | 4.3 | 5 | 4 |
| 55 | WH1323 | 5 | 4 | 3 | 4 | 4.0 | 5 | 5 |
| 56 | HD3118(C) | 3 | 3 | 3 | 5 | 3.5 | 5 | 4 |
| 57 | HI1621(C) | 4 | 4 | 3 | 5 | 4.0 | 5 | 5 |
| 58 | HD3171 (C) | 4 | 4 | 4 | 4 | 4.0 | 4 | 4 |
| 59 | HD3460 | 4 | 4 | 3 | 5 | 4.0 | 5 | 4 |
| 60 | HD3293 (C) | 3 | 4 | 3 | 5 | 3.8 | 5 | 4 |
| **60A** | **Infector** | **5** | **5** | **5** | **5** | **5.0** | **5** | **5** |
| 61 | HI1612 (C) | 5 | 5 | 3 | 4 | 4.3 | 5 | 4 |
| 62 | K1317(C) | 5 | 5 | 3 | 4 | 4.3 | 5 | 4 |
| 63 | VL2041 (C) | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 64 | HPW349 © | 5 | 3 | 4 | 5 | 4.3 | 5 | 4 |
| 65 | VL2059 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 66 | HS562 (C) | 4 | 4 | 4 | 5 | 4.3 | 5 | 5 |
| 67 | VL907 (C) | 5 | 4 | 4 | 5 | 4.5 | 5 | 4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 68 | MACS6837 | 5 | 5 | 3 | 4 | 4.3 | 5 | 4 |
| 69 | MACS4125(d) | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 70 | MACS4135(d) | 5 | 5 | 4 | 4 | 4.5 | 5 | 4 |
| 71 | HI1669 | 4 | 5 | 3 | 5 | 4.3 | 5 | 4 |
| 72 | HI1683 | 5 | 5 | 3 | 4 | 4.3 | 5 | 5 |
| 73 | HI1684 | 5 | 4 | 5 | 5 | 4.8 | 5 | 5 |
| 74 | HI8848(d) | 5 | 5 | 4 | 5 | 4.8 | 5 | 4 |
| 75 | HI8849(d) | 5 | 5 | 4 | 5 | 4.8 | 5 | 4 |
| 76 | HI8850(d) | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 77 | GW554 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 78 | GW555 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 79 | MP3570 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 80 | MPO1395 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| **80A** | **Infector** | **5** | **5** | **5** | **5** | **5.0** | **5** | **5** |
| 81 | GW322 | 5 | 5 | 5 | 4 | 4.8 | 5 | 4 |
| 82 | MACS6768 | 5 | 5 | 3 | 5 | 4.5 | 5 | 5 |
| 83 | HI1650 | 5 | 5 | 4 | 5 | 4.8 | 5 | 4 |
| 84 | GW547(I) | 5 | 5 | 4 | 5 | 4.8 | 5 | 4 |
| 85 | HI8737(d) | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 86 | HI8713(d) | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 87 | HI1674 | 5 | 3 | 2 | 5 | 3.8 | 5 | 4 |
| 88 | HI1687 | 4 | 5 | 4 | 5 | 4.5 | 5 | 4 |
| 89 | WSM138 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 90 | MACS6830 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 91 | DBW425 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 92 | GW556 | 5 | 5 | 4 | 5 | 4.8 | 5 | 4 |
| 93 | HD2932 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 94 | MP4010 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 95 | HI1634 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 96 | CG1029 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 97 | DBW441M | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 98 | DBW428 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 99 | DBW432 | 5 | 4 | 4 | 5 | 4.5 | 5 | 4 |
| 100 | UAS3029 | 5 | 5 | 4 | 5 | 4.8 | 5 | 4 |
| **100A** | **Infector** | **5** | **5** | **5** | **5** | **5.0** | **5** | **5** |
| 101 | UAS484(d) | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 102 | NIAW4267 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 103 | HI8851(d) | 3 | 5 | 3 | 5 | 4.0 | 5 | 4 |
| 104 | HI8852(d) | 4 | 5 | 3 | 5 | 4.3 | 5 | 4 |
| 105 | MACS4131(d) | 4 | 4 | 3 | 5 | 4.0 | 5 | 4 |
| 106 | MPO1398(d) | 4 | 5 | 4 | 5 | 4.5 | 5 | 4 |
| 107 | DBW110 | 4 | 4 | 3 | 5 | 4.0 | 5 | 4 |
| 108 | CG1036 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 109 | HI1655 | 5 | 4 | 2 | 5 | 4.0 | 5 | 4 |
| 110 | HI8627(d) | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 111 | HI8823(d) | 5 | 5 | 3 | 4 | 4.3 | 5 | 4 |
| 112 | DBW359(I) | 5 | 4 | 4 | 4 | 4.3 | 5 | 4 |
| 113 | CG1040(I) | 5 | 4 | 3 | 4 | 4.0 | 5 | 4 |
| 114 | MACS6842 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 115 | MACS6844 | 5 | 4 | 3 | 4 | 4.0 | 5 | 4 |
| 116 | NIAW4364 | 3 | 3 | 3 | 5 | 3.5 | 5 | 4 |
| 117 | PBW891 | 3 | 3 | 3 | 4 | 3.3 | 4 | 4 |
| 118 | DBW443 | 3 | 2 | 3 | 5 | 3.3 | 5 | 4 |
| 119 | DDW62(d) | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 120 | AKAW5100 | 5 | 4 | 4 | 5 | 4.5 | 5 | 4 |
| **120A** | **Infector** | **5** | **5** | **5** | **5** | **5.0** | **5** | **5** |
| 121 | WH1306 | 5 | 4 | 4 | 5 | 4.5 | 5 | 4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 122 | NWS2222 | 5 | 5 | 4 | 5 | 4.8 | 5 | 4 |
| 123 | UAS3026 | 5 | 4 | 4 | 5 | 4.5 | 5 | 4 |
| 124 | CG1045 | 5 | 5 | 4 | 5 | 4.8 | 5 | 4 |
| 125 | MPO1395(d) | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 126 | MACS6222 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 127 | MP1378(I) | 4 | 3 | 4 | 5 | 4.0 | 5 | 5 |
| 128 | MACS3949(d) | 4 | 4 | 4 | 5 | 4.3 | 5 | 4 |
| 129 | DBW426 | 5 | 2 | 3 | 5 | 3.8 | 5 | 4 |
| 130 | MACS6829 | 5 | 3 | 4 | 5 | 4.3 | 5 | 4 |
| 131 | NIAW4114 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 132 | NIAW4120 | 4 | 4 | 3 | 5 | 4.0 | 5 | 4 |
| 133 | NIAW4432 | 5 | 3 | 3 | 5 | 4.0 | 5 | 4 |
| 134 | UAS3027 | 4 | 4 | 3 | 5 | 4.0 | 5 | 4 |
| 135 | LOK79 | 5 | 3 | 4 | 5 | 4.3 | 5 | 4 |
| 136 | RAJ4083 (C) | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 137 | HD3090 © | 5 | 3 | 4 | 5 | 4.3 | 5 | 4 |
| 138 | HI1633 © | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 139 | CG1047 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 140 | GW1368(d) | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| **140a** | **Infector** | **5** | **5** | **5** | **5** | **5.0** | **5** | **5** |
| 141 | HI1605 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 142 | NIAW3170 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 143 | UAS446(d) | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 144 | NIDW1149(d) | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 145 | HI1665(I) | 5 | 3 | 4 | 5 | 4.3 | 5 | 4 |
| 146 | UAS478(d)(I) | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |

**Susceptible check :A- 9-30-1; *Data from Khudwani,Durgapura and Niphad not included due to lowaphid incidence*

## Table: A2-10.1a Screening of EMDSN (MPSN) nursery against shoot fly and brown wheat mite (Year-2023-24)

| Entry No. | Entry | Shoot fly incidence (%) | | | | No. of brown wheat mites/10 cm sq area |
|---|---|---|---|---|---|---|
| | | Ludhiana | Dharwad | Kanpur | Average | Ludhiana |
| 1 | UP3102 | 6.68 | 28.79 | 11.53 | 15.67 | 13.00 |
| 2 | PBW893 | 6.09 | 22.05 | 12.5 | 13.55 | 12.67 |
| 3 | HD3388 | 6.48 | 20.41 | 14.28 | 13.72 | 11.67 |
| 4 | DBW444 | 6.11 | 30.67 | 10.71 | 15.83 | 14.00 |
| 5 | HS691 | 5.55 | 30.30 | 9.09 | 14.98 | 10.67 |
| 6 | VL2041(I)(C) | 6.03 | 38.07 | 13.63 | 19.24 | 10.67 |
| 7 | DBW386 | 5.98 | 35.83 | 11.53 | 17.78 | 11.67 |
| 8 | HD3428 | 6.81 | 24.52 | 7.14 | 12.82 | 11.33 |
| 9 | K2108 | 6.2 | 29.94 | 4.54 | 13.56 | 13.67 |
| 10 | PBW826(I)(C) | 6.13 | 34.59 | 10.71 | 17.14 | 13.00 |
| 11 | HI1669 | 5.82 | 32.93 | 15.62 | 18.12 | 16.00 |
| 12 | HI1670 | 5.97 | 37.23 | 8.57 | 17.26 | 10.33 |
| 13 | GW547 | 6.25 | 26.84 | 11.11 | 14.73 | 13.67 |
| 14 | HI1674 | 5.73 | 26.47 | 14.28 | 15.49 | 11.00 |
| 15 | NIAW4183 | 6.15 | 29.19 | 13.63 | 16.32 | 11.67 |
| 16 | NIAW4153 | 6.68 | 28.57 | 12.5 | 15.92 | 9.33 |
| 17 | AKAW5314 | 6.36 | 37.14 | 7.14 | 16.88 | 11.33 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 18 | AKAW5100 | 6.07 | 24.12 | 14.28 | 14.82 | 14.33 |
| 19 | MP1378 | 7.67 | 23.59 | 10.71 | 13.99 | 11.33 |
| 20 | DBW443 | 6.06 | 30.91 | 10.71 | 15.89 | 11.00 |
| **20A** | Infector | 8.31 | 36.31 | 17.97 | 15.69 | 15.67 |
| 21 | PWU15 | 5.61 | 33.33 | 9.37 | 15.69 | 14.33 |
| 22 | PBW891 | 6.46 | 37.14 | 14.28 | 15.69 | 12.67 |
| 23 | HI8841(d) | 4.79 | 26.36 | 7.14 | 15.79 | 13.33 |
| 24 | HI1672 | 6.7 | 34.62 | 10.71 | 15.89 | 10.67 |
| 25 | HI1673 | 5.24 | 35.97 | 8.57 | 15.89 | 11.33 |
| 26 | HI1675 | 5.27 | 26.09 | 2.85 | 15.93 | 13.00 |
| 27 | DBW394 | 5.14 | 29.01 | 10.71 | 15.78 | 11.00 |
| 28 | DBW395 | 4.76 | 38.46 | 7.14 | 15.68 | 12.67 |
| 29 | MACS6814 | 7.11 | 32.35 | 3.12 | 15.82 | 12.33 |
| 30 | NIAW4114 | 4.89 | 37.22 | 12.5 | 15.92 | 8.00 |
| 31 | NIAW4120 | 6.36 | 30.85 | 14.28 | 15.87 | 10.00 |
| 32 | UAS3022 | 5.94 | 31.76 | 10.71 | 15.76 | 12.00 |
| 33 | MP3557 | 6.84 | 20.71 | 10.71 | 15.69 | 11.67 |
| 34 | PBW897 | 6.38 | 31.67 | 12.5 | 15.73 | 13.00 |
| 35 | GW538 | 6.72 | 32.59 | 11.42 | 15.74 | 11.00 |
| 36 | LOK79 | 6.61 | 35.33 | 13.33 | 15.72 | 14.00 |
| 37 | HI1665 | 6.46 | 32.48 | 12.5 | 15.71 | 12.33 |
| 38 | DBW397 | 6.15 | 35.76 | 9.37 | 15.65 | 14.67 |
| 39 | NIAW4028 | 7.08 | 21.47 | 8.57 | 15.69 | 12.33 |
| 40 | DBW377 | 7.45 | 22.35 | 7.14 | 15.77 | 11.00 |
| **40A** | Infector | 7.49 | 25.93 | 16.12 | 15.73 | 15.00 |
| 41 | GW543 | 5.46 | 28.80 | 12 | 15.73 | 13.67 |
| 42 | DBW359 | 5.18 | 20.67 | 7.14 | 15.73 | 11.33 |
| 43 | MP3556 | 6.02 | 23.43 | 11.42 | 15.78 | 10.33 |
| 44 | PBW889 | 5.52 | 36.15 | 9.37 | 15.83 | 13.67 |
| 45 | HD3369 (I)(C) | 5.72 | 30.30 | 10.71 | 15.83 | 11.33 |
| 46 | UAS478(d) | 6.89 | 32.38 | 11.42 | 15.85 | 11.00 |
| 47 | HI8840(d) | 6.8 | 28.65 | 7.14 | 15.77 | 10.00 |
| 48 | DDW61(d) | 6.14 | 30.41 | 10.71 | 15.72 | 10.67 |

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

**Table A2-10.1b: Screening of EMDSN nursery against foliar aphid and root aphid (Year-2023-24)**

| Entry No. | Entry | Foliar aphid score (1-5 scale) | | | | Average score | Maximum Score | Root aphid (No./plant) Ludhiana Centre only |
|---|---|---|---|---|---|---|---|---|
| | | Ludhiana | Karnal | Pusa | Kharibari | | | |
| 1 | UP3102 | 5 | 4 | 5 | 5 | 4.8 | 5 | 4 |
| 2 | PBW893 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 3 | HD3388 | 4 | 5 | 5 | 5 | 4.7 | 5 | 4 |
| 4 | DBW444 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 5 | HS691 | 5 | 5 | 3 | 5 | 4.5 | 5 | 4 |
| 6 | VL2041(I)(C) | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 7 | DBW386 | 5 | 5 | 5 | 5 | 5.0 | 5 | 3 |
| 8 | HD3428 | 5 | 4 | 5 | 5 | 4.7 | 5 | 4 |
| 9 | K2108 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 10 | PBW826(I)(C) | 5 | 5 | 5 | 4 | 4.7 | 5 | 4 |
| 11 | HI1669 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 12 | HI1670 | 5 | 4 | 5 | 5 | 4.7 | 5 | 4 |
| 13 | GW547 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 14 | HI1674 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 15 | NIAW4183 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 16 | NIAW4153 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 17 | AKAW5314 | 5 | 5 | 5 | 4 | 4.7 | 5 | 5 |
| 18 | AKAW5100 | 5 | 4 | 5 | 5 | 4.7 | 5 | 4 |
| 19 | MP1378 | 5 | 5 | 5 | 4 | 4.7 | 5 | 4 |
| 20 | DBW443 | 5 | 4 | 3 | 5 | 4.3 | 5 | 4 |
| 20A | Infector | 5 | 5 | 5 | 5 | 5.0 | 5 | 5 |
| 21 | PWU15 | 5 | 5 | 5 | 4 | 4.7 | 5 | 4 |
| 22 | PBW891 | 5 | 5 | 4 | 4 | 4.7 | 5 | 4 |
| 23 | HI8841(d) | 5 | 4 | 2 | 4 | 4.3 | 5 | 4 |
| 24 | HI1672 | 5 | 5 | 2 | 5 | 5.0 | 5 | 4 |
| 25 | HI1673 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 26 | HI1675 | 4 | 5 | 4 | 5 | 4.7 | 5 | 4 |
| 27 | DBW394 | 4 | 5 | 4 | 5 | 4.7 | 5 | 5 |
| 28 | DBW395 | 3 | 3 | 3 | 5 | 3.7 | 5 | 4 |
| 29 | MACS6814 | 4 | 4 | 2 | 5 | 4.3 | 5 | 4 |
| 30 | NIAW4114 | 5 | 4 | 4 | 5 | 4.7 | 5 | 4 |
| 31 | NIAW4120 | 4 | 5 | 5 | 5 | 4.7 | 5 | 4 |
| 32 | UAS3022 | 5 | 5 | 5 | 5 | 5.0 | 5 | 5 |
| 33 | MP3557 | 5 | 5 | 4 | 5 | 4.8 | 5 | 4 |
| 34 | PBW897 | 5 | 5 | 2 | 5 | 5.0 | 5 | 4 |
| 35 | GW538 | 5 | 4 | 5 | 5 | 4.7 | 5 | 4 |
| 36 | LOK79 | 5 | 4 | 5 | 5 | 4.7 | 5 | 4 |
| 37 | HI1665 | 5 | 4 | 5 | 5 | 4.7 | 5 | 5 |
| 38 | DBW397 | 4 | 5 | 3 | 5 | 4.3 | 5 | 4 |
| 39 | NIAW4028 | 5 | 5 | 5 | 5 | 5.0 | 5 | |
| 40 | DBW377 | 5 | 5 | 3 | 5 | 4.5 | 5 | |
| 40A | Infector | 5 | 5 | 5 | 5 | 5.0 | 5 | 5 |
| 41 | GW543 | 5 | 4 | 3 | 4 | 4.0 | 5 | 5 |
| 42 | DBW359 | 5 | 4 | 2 | 5 | 4.7 | 5 | 4 |
| 43 | MP3556 | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 44 | PBW889 | 5 | 4 | 5 | 5 | 4.7 | 5 | 4 |
| 45 | HD3369 (I)(C) | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |
| 46 | UAS478(d) | 4 | 4 | 5 | 5 | 4.3 | 5 | 4 |
| 47 | HI8840(d) | 5 | 5 | 2 | 5 | 5.0 | 5 | 5 |
| 48 | DDW61(d) | 5 | 5 | 5 | 5 | 5.0 | 5 | 4 |

*Susceptible check :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 were 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 pests of wheat and barley, survey of Punjab state were undertaken during 2023-24 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. Out of the total surveyed area, approx. 95% cropped area was free pink stem borer incidence, 1-5% pink stem borer incidence was recorded in about 3-4% area and 8-10% incidence in less than 1% area. About 1% area was found to be affected with general yellowing of the crop due to water stagnation in the fields. No serious infestation of armyworm was recorded during 2023-24 crop year.

**Centre: Niphad**

Survey was carried out in the villages of Nashik and adjoining district Ahemednagar, Beed, Parbhani, Hingoli and Buldhana of different crop stages on farmer's field during the January and February 2024. There were 36 samples were observed, medium incidence of aphids was recorded during the survey. The Coccinellids larvae, beetles and Crysoparla carnea predator adults were also observed. The incidence of Shoot fly, stem borer and jassids was recorded in low intensity also termite attack was also observed in some samples but was very low. (Table B1-10.2a).

**Centre: Kanpur**

In Kanpur, surveys were conducted in villages viz., Sani,Daleep Nagar and Kalimitti during 2023-24. Incidence of shootfly was recorded to be between 1 to 1.66 at these locations. The incidence of termite was observed 12-12.66 per cent on wheat varieties viz., PBW343 and HUW 234 of wheat. High infestation (30-55 aphid/tiller) of foliar aphid was on barley variety namely, 'Barley Local' at surveyed locations. The higher incidence of pink stem of 1.66% 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 infestations of foliar wheat aphids were reported in nearby location of Karnal viz., Indri, Kunjpua, Kathial, Racina, Jind. Early in the crop growth period, minor damage from termites and root aphids was also observed in Karnal and nearby locations. In some fields, pink stem borer and cutworm infestation was reported both at the beginning of the season in December and later in March. The overall incidence of aphids, termites, pink stem borers, and army worms was moderate, ranging between 2-5%. Termite and root aphid infestations were recorded at about 2-3% during November and December. Aphid infestations began appearing in January, starting with 5-6 aphids per tiller, but by February, the numbers had risen significantly, averaging 30-35 aphids per tiller in the fields. Natural enemies, coccinellid beetle grubs and adults and spiders were also observed in aphid-infested 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 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 2023-24. Each treatment was replicated five 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).

**Termite damage:** The termite damage recorded at seedling stage in different dates of sowing indicated that early sown wheat crop (first fortnight of Nov 2023) suffered more termite damage as compared to timely, late and very late sown crop. At earing stage, again termite damage was highest (2.46%) in early sown crop followed by timely (2.33%) and late sown (2.03%) and very late sown (1.86%) crop.

**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 dates of sowing ranged from 5.11-8.85, 3.79-6.63, 3.14-5.80 and 2.73-4.11 aphid/tiller.

**Foliar aphid incidence:** Foliar aphid incidence appeared in second week of February (6 SMW) in I, and II sowing dates whereas aphids were first recorded in third week of February (7 SMW) in III and IV 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) in early sown crop, 10th SMW in timely and late sown crop and 11th SMW in very late sown crop during 2023-24. (Table B2-10.2a).

**Centre: Karnal:** The experiment was conducted at Research farm of ICAR-IIWBR, Karnal under irrigated conditions. The wheat variety, HD 2967 was sown at four different dates of sowing at 15 days interval and no insecticide was applied for the management of any insect-pest (Table B2-10.2b).

**Aphid incidence:** The data revealed indicated that the incidence of root aphids were first started appearing on wheat crop during 51$^{st}$ standard week. Root aphid incidence D1, D2, D3 and D4 date of sown crops ranged from 0.89-1.78, 0.52-1.25, 0.21-1.21 and 0.25-1.85 aphids/tiller. The incidence of foliar aphid first appeared in 6$^{th}$ standard week in all sowing dates. The population reached to its peak during 9$^{th}$ Standard week in the month of February on D1 and on D2 sown crops with the incidence of 16.53 and 16.10 aphids/plant, respectively. The aphid population reached peaked during 10$^{th}$ standard weeks on D3 and D4 sown crops, respectively with aphid incidence of 15.43 and 13.32 aphids/plant, respectively.

**Termite damage:** The termite damage was first recorded at seedling stage on D1, D2, D3 and D4 sown crops. The termite damage ranged from 2.78-4.60, 2.57-428, 2.57-3.84 and 2.40-3.50 D1, D2, D3 and D4 date of sown crops, respectively. The early sown crop (first week of November) 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 2.43, 0.56, 0.87 and 1.09 % infestations on D1, D2, D3 and D4 date of sown crops, respectively during 51$^{th}$ standard week. The earlysown crop (first week of November) suffered more from pink stem borer damage as compared to timely, late andvery 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 2023, 15th December 2023 and 1st January 2024. 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 recorded from randomly selected fifteen tagged plants per plot taking their 10 cm twigs. The observations were taken at weekly intervals starting from 46$^{th}$ standard week and continuing upto 14$^{th}$ 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 2023-24 (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** | |
| Umbarkhed, Pimpalgaon B, Tal Niphad, Dist. Nashik 31.01.2024 | Irrigated | 02<br>01 | Unknown Private Variety , Booting stage 0.40 ha | Aphids<br>S. Borer | Minor<br>Minor | Medium<br>Low(0.5-1%) | Adults:*Coccinellids* Larvae and Beetles *Crysoperla carnia* |
| Devrai, Tal Pathardi, Dist. Ahemadnagar 07.02.2024 | Irrigated | 02<br>01 | Mahico-Mukut Milk stage-0.20ha<br>Booting 0.60 ha | Aphids<br>Shootfly | Major<br>Minor | Medium<br>Medium (2-45) | *Coccinellids* Larvae and Beetles *Crysoperla carnia* Adults |
| | | | Flowering stage | S. Borer | Minor | Very Low | |
| Yeli & Tintar vani, Tal Beed, Dist. Beed 07.02.2024 | Irrigated | 04 | Unknown Private Variety Booting Stage -0.60 ha Milk stage-0.40 ha | Aphids | Major | Medium to Heavy | *Coccinellids* Larvae and Beetles *Crysoperla carnia* Adults |
| | | 02 | | Jassids<br>S. Borer | Minor<br>Minor | Low<br>Very Low | |
| Khandvi, Tal Gevarai, Dist.Beed 07.02.2024 | Irrigated | 02 | Kohinoor, Dough stage | Aphids | Major | Medium | *Coccinellids* Larvae and Beetles *Crysoperla carnia* Adults |
| | | | | | | | |
| | | 01 | | S. Borer | Minor | V.Low(0.5-1%) | |
| Shrungarwadi, Tal Majagaon, Dist, Beed | Irrigated | 02 | Unknown Private Variety, Dough stage 0.50 ha | Aphids | Major | Low | *Coccinellids* Larvae and Beetles |
| 07.02.2024 | | 01 | | S. Borer | Minor | Low (1-2%) | |
| Majalgaon, Sothana & Kekarjwala, Tal Majalgaon, Beed 07.02.2024 | Irrigated | 02 | Unknown Private Variety, Dough stage 0.40 ha 0.40 ha | Aphids<br>Aphids | Major | Medium | *Coccinellids* Larvae and Beetles *Crysoperla carnia* Adults |
| | | 01 | | S. Borer | Minor | Low (0.5-1%) | |
| Asola, Tal. & Dist. Parbhani, 08.02.2024 | Irrigated | 01 | Unknown Private Variety 0.60 ha Milk Stage | Aphids | Major | Medium | *Coccinellids* Larvae and Beetles *Crysoperla carnia* Adults |
| | | 01 | | S. Borer | Minor | Very Low | |
| Wangarwadi, Tal. Audha Nagnath, Beed 08.02.2024 | Irrigated | 02 | Unknown Private Varieties Milk stage- 0.30ha Dough Stage- 0.30 ha | Aphids | Major | Medium to Heavy | *Coccinellids* Larvae and Beetles *Crysoperla carnia* Adults |
| | | 02 | | Jassids | Minor | Low | |
| | | 02 | | S. Borer | Minor | Low -1-2% | |
| Adgaon, Tal & Dist. Hingoli 08.02.2024 | Irrigated | 02 | Unknown Private Varieties Milk stage-0.80 ha Dough Stage | Aphids | Major | Medium | *Coccinellids* Larvae and Beetles *Crysoperla carnia* Adults |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | 01 | | Jassids | Minor | Low | |
| | | 01 | | S. Borer | Major | V. low 0.5 - 1 % | |
| Uprada, Tal. Chikhali, Dist. Buldhana 08.02.2024 | Irrigated | 02 | Unknown Private Varieties Milk Stage- 0.40ha | Aphids<br>Termite | Major<br>Minor | Mediu m<br>Minor | *Coccinellids* Larvae and Beetles<br>*Crysoperla carnia* Adults |
| | | 01 | | S. Borer | Minor | Medium - 5-6% | |

**Table: B1-10.2b. Survey of wheat and barley pests and their natural enemies during 2023-24 (Centre: Kanpur)**

| Locality and date of visit | Rainfed / Irrigated | No. of samples | Variety and stageof growth | Crop pest | | | Natural enemies | |
|---|---|---|---|---|---|---|---|---|
| | | | | Name | Status | Intensity (Attack % damage or population) | Name | Stage Parastization / Predation |
| 11/02/24 Sani (Koshmbi) | Irrigated | 10 | HD2967, K1006 | Pink stem borer | Minor | 1.0% | - | - |
| | Irrigated | 10 | HD2967,K1006 | Shootfly | Minor | 1.33% | - | - |
| | Irrigated | 10 | Barley local | Barlay aphid | Major | 55 aphids / p | *Coccinella-septumpuntata* | Adult |
| 18/02/24 Daleep Nagar (Kanpur Dehat) | Irrigated | 10 | PBW343,K1006 | Termite | Major | 12.66% | - | - |
| | Irrigated | 10 | HD2967, K1006 | Pink stem borer | Minor | 1.66% | - | - |
| | Irrigated | 10 | PBW343 | Shootfly | Minor | 1.33% | - | - |
| | Irrigated | 10 | K551 | Barley aphid | Major | 35-45 Aphids / p | *Coccinella-septumpuntata* | Adult |
| 28/02/24 Kalimitti (Unnao) | Irrigated | 10 | HD2967 | Termite | Major | 12.00% | - | - |
| | Irrigated | 10 | HD2967 | Shootfly | Minor | 1.33% | - | - |
| | Irrigated | 10 | K1055 | Barley aphid | Major | 50-55 Aphids / p | *Coccinella-septumpuntata* | Adult |
| | Irrigated | 10 | HD2967 | Pink stemborer | Minor | 1% | Swan | Adult |

**Table: B2-10.2a. Effect of sowing dates on population build of major insect-pests in wheat during 2023-24 (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 | I$^{st}$ DOS (1 Nov) | II$^{nd}$ DOS (16 Nov.) | III$^{rd}$ DOS (1Dec) | IV$^{th}$ DOS (16 Dec.) | I$^{st}$ DOS (1 Nov) | II$^{nd}$ DOS (16 Nov.) | III$^{rd}$ DOS (1 Dec) | IV$^{th}$ DOS (16 Dec.) | I$^{st}$ DOS (1 Nov) | II$^{nd}$ DOS (16 Nov.) | III$^{rd}$ DOS (1 Dec) | IV$^{th}$ DOS (16 Dec.) |
| 50 | 0.00 | 94.71 | 41.43 | 21.86 | 6.56 | - | - | - | - | - | - | - | - | - | - | - | - |
| 51 | 0.00 | 95.00 | 44.14 | 21.31 | 6.23 | - | - | - | - | 4.16 | 3.80 | 3.37 | 3.00 | 8.48 | 6.63 | 5.80 | 3.96 |
| 52 | 0.00 | 92.86 | 77.14 | 15.91 | 9.03 | - | - | - | - | 3.92 | 3.69 | 3.33 | 2.84 | 8.85 | 6.37 | 4.88 | 4.11 |
| 1 | 0.00 | 93.00 | 80.43 | 11.43 | 7.00 | - | - | - | - | 3.15 | 2.89 | 2.68 | 2.33 | 5.11 | 3.79 | 3.14 | 2.73 |
| 2 | 0.00 | 94.86 | 75.71 | 11.69 | 5.59 | 0 | 0 | 0 | 0 | - | - | - | - | - | - | - | - |
| 3 | 0.00 | 94.71 | 73.71 | 13.57 | 5.07 | 0 | 0 | 0 | 0 | - | - | - | - | - | - | - | - |
| 4 | 0.00 | 94.86 | 64.86 | 14.94 | 5.36 | 0 | 0 | 0 | 0 | - | - | - | - | - | - | - | - |
| 5 | 36.40 | 90.71 | 70.29 | 17.63 | 9.51 | 0 | 0 | 0 | 0 | - | - | - | - | - | - | - | - |
| 6 | 0.00 | 94.43 | 46.57 | 19.73 | 5.96 | 1.4 | 1.2 | 0 | 0 | - | - | - | - | - | - | - | - |
| 7 | 0.00 | 93.57 | 43.43 | 23.29 | 7.74 | 5.28 | 4.18 | 3.36 | 3.02 | - | - | - | - | - | - | - | - |
| 8 | 0.00 | 83.14 | 35.29 | 22.71 | 10.00 | 7.38 | 6.34 | 5.64 | 3.88 | 2.46 | 2.33 | 2.03 | 1.86 | - | - | - | - |
| 9 | 40.80 | 81.86 | 44.00 | 22.54 | 10.77 | 15.05 | 14.13 | 13.56 | 12.80 | - | - | - | - | - | - | - | - |
| 10 | 0.00 | 84.57 | 38.29 | 23.11 | 12.07 | 13.95 | 15.89 | 14.50 | 12.97 | - | - | - | - | - | - | - | - |
| 11 | 0.00 | 86.14 | 39.57 | 26.51 | 11.33 | 10.48 | 11.93 | 13.37 | 13.05 | - | - | - | - | - | - | - | - |
| 12 | 0.00 | 76.43 | 42.43 | 29.34 | 16.03 | 0.8 | 1.5 | 2.9 | 3.6 | - | - | - | - | - | - | - | - |
| 13 | 21.30 | 80.29 | 42.57 | 30.23 | 17.07 | 0 | 0 | 0 | 0.6 | - | - | - | - | - | - | - | - |
| 14 | 0.00 | 79.00 | 26.14 | 32.00 | 15.27 | 0 | 0 | 0 | 0 | - | - | - | - | - | - | - | - |

**Table: B2-10.2b. Effect of sowing dates on population build of major insect-pests in wheat 2023-24 (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 | 22.5 | 06.4 | 71.3 | - | - | - | - | - | - | - | - | - | - | - | - |
| 51 | 00.0 | 21.5 | 06.1 | 73.8 | 0.89* | 0.52* | 0.21* | 0.25* | 4.60 | 4.28 | 3.79 | 3.50 | 2.73 | 0.56 | 0.87 | 1.09 |
| 52 | 00.0 | 18.1 | 08.6 | 91.1 | 1.78* | 1.25* | 1.21* | 1.85* | 4.38 | 4.13 | 3.84 | 3.34 | 1.51 | 1.05 | 0.57 | 0.7 |
| 1 | 00.0 | 11.5 | 07.5 | 95.3 | - | - | - | - | 4.02 | 3.66 | 3.51 | 3.25 | 2.54 | 2.09 | 0.74 | 0.54 |
| 2 | 00.0 | 11.5 | 05.9 | 90.6 | 0 | 0 | 0 | 0 | - | - | - | - | 2.43 | 0.56 | 0.87 | 1.09 |
| 3 | 00.0 | 14.9 | 05.0 | 90.1 | 0 | 0 | 0 | 0 | - | - | - | - | - | - | - | - |
| 4 | 00.0 | 14.2 | 04.9 | 87.6 | 0 | 0 | 0 | 0 | - | - | - | - | - | - | - | - |
| 5 | 22.6 | 17.5 | 08.8 | 84.15 | 1.67 | 2.17 | 0.67 | 0.67 | - | - | - | - | - | - | - | - |
| 6 | 00.0 | 20.0 | 06.4 | 74.05 | 5.27 | 4.51 | 3.45 | 3.08 | - | - | - | - | - | - | - | - |
| 7 | 00.0 | 23.5 | 06.9 | 71.95 | 12.9 | 11.46 | 9.31 | 7.27 | 2.78 | 2.57 | 2.54 | 2.40 | - | - | - | - |
| 8 | 03.2 | 23.4 | 09.1 | 69.0 | 13.72 | 11.78 | 10.33 | 8.24 | 3.51 | 3.07 | 2.77 | 2.78 | - | - | - | - |
| 9 | 43.4 | 22.9 | 09.9 | 69.0 | 16.53 | 16.10 | 14.59 | 12.75 | - | - | - | - | - | - | - | - |
| 10 | 00.0 | 23.2 | 07.9 | 64.0 | 12.84 | 14.47 | 15.43 | 13.32 | - | - | - | - | - | - | - | - |
| 11 | 00.0 | 27.4 | 10.5 | 63.6 | 9.34 | 10.38 | 12.09 | 12.73 | - | - | - | - | - | - | - | - |
| 12 | 00.0 | 29.2 | 14.0 | 65.3 | 0.97 | 2.17 | 2.37 | 3.17 | - | - | - | - | - | - | - | - |
| 13 | 00.0 | 33.4 | 17.1 | 60.55 | 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 2023-24 (Centre-Kharibari)**

| Standard Weeks | | Relative humidity | | Temperature $^0$C | | Aphid incidence (Aphids/tiller) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rainfall in mm | Max RH | Min RH | Max Temp | Min Temp | Date of sowing 01.12.23 | Yield qt/ha | Date of sowing 16.12.23 | Yield qt/ha | Date of sowing 01.01.24 | Yield qt/ha |
| 48 | 5.57 | 90.29 | 88.00 | 25.46 | 5.57 | 0.00 | | 0.00 | | 0.00 | |
| 49 | 0.57 | 89.14 | 80.43 | 24.24 | 0.57 | 0.00 | | 0.00 | | 0.00 | |
| 50 | 0.00 | 87.14 | 71.00 | 20.69 | 0.00 | 4.75 | | 0.00 | | 0.00 | |
| 51 | 0.00 | 83.43 | 63.71 | 19.30 | 0.00 | 7.55 | | 0.00 | | 0.00 | 19.35 |
| 52 | 0.00 | 84.14 | 67.14 | 19.91 | 0.00 | 14.65 | | 12.55 | | 0.00 | |
| 53 | 0.00 | 85.86 | 69.86 | 18.29 | 0.00 | 25.65 | | 22.15 | | 0.00 | |
| 1 | 0.00 | 79.57 | 60.57 | 17.79 | 0.00 | 45.35 | | 35.80 | 25.65 | 0.00 | |
| 2 | 0.00 | 84.57 | 76.29 | 17.80 | 0.00 | 85.75 | 30.75. | 72.15 | | 45.70 | |
| 3 | 0.00 | 85.43 | 70.43 | 17.77 | 0.00 | 108.32 | | 95.25 | | 68.75 | |
| 4 | 0.00 | 92.29 | 66.00 | 16.40 | 0.00 | 137.15 | | 145.85 | | 115.95 | |
| 5 | 0.00 | 87.29 | 73.29 | 13.24 | 0.00 | 155.85 | | 173.15 | | 185.50 | |
| 6 | 0.00 | 83.00 | 63.00 | 13.20 | 0.00 | 172.25 | | 215.35 | | 235.50 | |
| 7 | 0.00 | 84.57 | 62.00 | 15.37 | 0.00 | 215.70 | | 245.50 | | 270.32 | |
| 8 | 0.00 | 83.14 | 76.71 | 12.64 | 0.00 | 165.65 | | 185.20 | | 210.25 | |
| 9 | 0.00 | 81.71 | 42.57 | 27.76 | 13.50 | 103.85 | | 152.15 | | 183.45 | |
| 10 | 0.00 | 83.29 | 42.86 | 28.79 | 13.90 | 69.85 | | 132.35 | | 162.83 | |
| 11 | 0.00 | 78.57 | 35.57 | 31.46 | 14.66 | 31.15 | | 121.25 | | 143.20 | |
| 12 | 11.71 | 87.29 | 52.71 | 28.09 | 14.71 | 15.25 | | 98.75 | | 124.20 | |
| 13 | 4.37 | 86.57 | 49.71 | 28.90 | 17.41 | 7.10 | | 75.35 | | 110.30 | |
| 14 | 1.31 | 81.71 | 51.29 | 32.64 | 19.39 | 2.50 | | 55.45 | | 85.10 | |

**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, Smart Seeder and Surface seeder in wheat were 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 methods after harvesting paddy by keeping residue@ 5 tonnes/ha. The incidence of pink stem borer was recorded 3-7 weeks after sowing in each tillage condition 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 tiller. Similarly, foliar aphid incidence was also recorded at the peak period of their activity at earing stage of the crop.

**Centre: Ludhiana:** The data revealed that pink stem borer incidence was significantly higher in super seeder (2.34-4.39%) sown wheat as compared to all other tillage conditions. However, there was no difference in root aphid, foliar aphid incidence and their coccinellid predators among different 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 2.36, 2.80, 2.96, 2.63 and 2.36 % incidence after 3, 4, 5,6 & 7 weeks after sowing, respectively. However, it was the lowest in conventionally sown wheat crop with 1.81,2.06, 2.05, 2.06 and 1.81% 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 with 5.16, 5.38 and 4.17 after 3, 4 & 5, respectively 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 19.86, 22.30 and 18.81aphids/tiller during different observation time. Coccinellid population at peak period of their activity was significantly highest in Super Seeder conditions (5.10/sq m) and lowest 1.54/sq m) in conventionally sown wheat. Overall, all residue managed wheat fields harbour the greater coccinellid population as compared to conventionally sown wheat crop (Table B3-10.2b).

**Table: B3-10.2a. Population dynamics of insect-pests and natural enemies under different residue management scenarios in rice-wheatcropping system during 2023-24 (Centre: Ludhiana)**

| | | | | |
|---|---|---|---|---|
| **Pink stem borer damage (%)** | | | | |
| | **27 Nov 2024** | **4 Dec 2024** | **11 Dec 2024** | **18 Dec 2024** |
| Smart Seeder | 3.84 (11.28)* | 2.89 (9.78) | 2.55 (9.18) | 2.16 (8.45) |
| Surface Seeder | 3.64 (10.99) | 2.49 (9.07) | 2.28 (8.69) | 2.01 (8.15) |
| Super Seeder | 4.39 (12.09) | 3.61 (10.95) | 2.94 (9.86) | 2.34 (8.80) |
| Happy Seeder | 3.55 (10.86) | 2.30 (8.71) | 2.23 (8.56) | 2.04 (8.22) |
| CD (p=0.05) | (0.67) | (0.58) | (0.70) | (0.22) |
| **Root aphid/tiller** | **27 Nov 2024** | **4 Dec 2024** | **11 Dec 2024** | |
| Smart Seeder | 3.20 | 4.00 | 4.40 (2.31)* | |
| Surface Seeder | 3.20 | 4.40 | 5.50 (2.53) | |
| Super Seeder | 3.10 | 3.60 | 4.60 (2.35) | |
| Happy Seeder | 3.10 | 3.80 | 4.00 (2.21) | |
| CD (p=0.05) | NS | NS | (0.21) | |
| **Foliar aphid/tiller** | **16 Feb 2024** | **23 Feb 2024** | **01 Mar 2024** | |
| Smart Seeder | 8.60 | 12.00 | 12.00 | |
| Surface Seeder | 7.80 | 11.60 | 12.20 | |
| Super Seeder | 9.30 | 12.10 | 12.00 | |
| Happy Seeder | 8.40 | 11.30 | 12.50 | |
| CD (p=0.05) | NS | NS | NS | |
| **Coccinellids/sq m** | **24 Mar 2024** | | | |
| Smart Seeder | 3.20 | | | |
| Surface Seeder | 2.80 | | | |
| Super Seeder | 3.00 | | | |
| Happy Seeder | 2.20 | | | |
| CD (p=0.05) | NS | - | | |
| **Yield (q/ha)** | | | | |
| Smart Seeder | 55.50 | | | |
| Surface Seeder | 55.36 | | | |
| Super Seeder | 54.53 | | | |
| Happy Seeder | 54.93 | | | |

* 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 croppingsystem during 2023-24 (Centre: Karnal)**

| | | | | | |
|---|---|---|---|---|---|
| **Pink stem borer damage (%)** | | | | | |
| | **3 WAS** | **4 WAS** | **5 WAS** | **6 WAS** | **7 WAS** |
| Happy Seeder | 2.08 | 2.4 | 2.47 | 2.25 | 2.08 |
| Super Seeder | 2.21 | 2.64 | 2.89 | 2.55 | 2.21 |
| Rotavator | 2.36 | 2.80 | 2.96 | 2.63 | 2.36 |
| Conventional tillage | 1.81 | 2.06 | 2.05 | 2.06 | 1.81 |
| **CD (p=0.05)** | **0.48** | **0.45** | **0.60** | **0.68** | **0.65** |
| **Root aphid/tiller** | **3 WAS** | **4 WAS** | **5 WAS** | | |
| Happy Seeder | 3.36 | 2.96 | 1.86 | | |
| Super Seeder | 3.76 | 3.07 | 1.82 | | |
| Rotavator | 3.66 | 3.28 | 3.26 | | |
| Conventional tillage | 5.16 | 5.38 | 4.17 | | |
| **CD (p=0.05)** | **0.65** | **0.37** | **0.39** | | |
| **Foliar aphid/tiller** | **24-2.2024** | **9-3-2024** | **15-3-2024** | | |
| Happy Seeder | 16.3 | 20.47 | 13.40 | | |
| Super Seeder | 16.1 | 19.53 | 14.40 | | |
| Rotavator | 17.42 | 21.56 | 16.72 | | |
| Conventional tillage | 19.86 | 22.30 | 18.81 | | |
| **CD (p=0.05)** | **0.25** | **0.22** | **0.17** | | |
| **Coccinellids/sq m** | **29-3-2024** | | | | |
| Happy Seeder | 4.41 | | | | |
| Super Seeder | 5.10 | | | | |
| Rotavator | 1.54 | | | | |
| Conventional tillage | 2.12 | | | | |
| **CD (p=0.05)** | **0.19** | | | | |

**** WAS = Weeks after sowing**

**B4: Assessment of grain yield losses caused by aphid complex in wheat**

(Centres: Ludhiana, Karnal, Niphad & Kharibari)

The trial consists of six treatments i.e. spraying the crop at maximum tillering stage, flag leaf stage, earhead emergence stage, milky grain stage, grain maturity stage and unsprayed plots. The crop was sprayed with CIB recommended insecticide i.e. thiamethoxam 25% WG @ 12.5 a. i. g/ha for the control of aphids in wheat. Each treatment was replicated four times. The observation on aphid incidence (number of aphids/tiller) was recorded before insecticide application and 7 days after insecticide application from each plot. During each observation time, five wheat plants from each plot were selected & tagged and the number of aphids per tiller from these selected tillers was recorded. At harvest, the yield from each plot plots was recorded compared to assess the yield losses.

**Centre: Ludhiana:** This trial was conducted in New experimental Area, Department of Plant Breeding and Genetics, PAU, Ludhiana. An aphid susceptible wheat variety PBW 725 was sown in plots measuring 6 x 1.25 =7.5 $m^2$ in randomized complete block design (RCBD) during the second week of November. 2023. The data recorded on number of aphid/tiller reveals that there was no difference in aphid population before and after insecticide application up to ear emergence stage. However, significant differences were observed in aphid population before insecticide application at milky grain stage. The treatments where insecticides were applied at earhead emergence stage recorded significantly lower aphid population. However, 7 days after insecticide application at milky grain stage resulted in significant decrease in aphid population and increase in grain yield. Yield of plots treated with insecticides up to milky grain stage were at par with each other. It clearly indicates that insecticide application should conducted somewhere between earhead emergence and milky grain stage to avoid grain yield losses in wheat (Table B4-10.2a).

**Centre: Karnal -** There was no difference in aphid population before and after insecticide application up to the ear emergence stage for number of aphids per tiller. However, significant differences were noted in aphid populations before insecticide application at the milky grain stage. The treatments where insecticides were applied during the earhead emergence stage recorded a significantly lower aphid population. Moreover, seven days after insecticide application at the milky grain stage, there was a notable decrease in aphid population and an increase in grain yield. The yields of plots treated with insecticides up to the milky grain stage were comparable. (Table B4-10.2b).

**Centre: Niphad-** The data presented revealed 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. The average population of surviving aphids was assessed on the 7th day after the application of thiamethoxam 25 WG at 20 g a.i./ha. Data collected after the third spray revealed significant differences among the treatments. Specifically, treatment T7 demonstrated superior efficacy in controlling aphid populations, which was found comparable to treatment T6 on the 7th day after treatment application. On the 10th and 14th days after the third spray, treatment T7 again showed significantly superior control of aphid populations, while treatments T6, T5, and T3 were found to be equally effective and on par with each other.The data regarding the 1000 grain weight showed that treatment T7 was significantly superior, achieving the highest 1000 grain weight. Treatments T6 and T5 were found to be equally effective and on par with each other. A similar trend was reflected in the grain yield, with the highest yield being 41.81 q/ha for T7, which was at par with 40.39 q/ha for T6 and 37.77 q/ha for T5.It is therefore concluded that the insecticidal spray of thiamethoxam 25 WG @ 20 g a.i./ha at the flag leaf stage, followed by applications at the earhead stage and the milk stage, was found to be effective (T7). The treatment T6, which involved spraying thiamethoxam 25 WG @ 20 g a.i./ha at the earhead stage followed by the milk stage, and T5, which involved spraying thiamethoxam 25 WG @ 20 g a.i./ha at the flag leaf stage followed by the milk stage, were found to be equally effective and on par with T7 (Table B4-10.2c).

**Centre: Kharibari-** The data pertaining to yield loss caused by wheat aphid on DBW-187 are presented in the Table B4-10.2d. The relative data on yield revealed that the aphids are responsible for reducing the yield considerably. In unprotected plot, the average number of aphids/plant/tillers was 23.58, respectively as compared to 2.23 aphid/plant/tillers in protected plots, respectively.The yield was also adversely affected by aphid infestation. The mean yield of DBW-187 obtained was (28.88 q/ha) in protected plots; in comparison to unprotected plots where the mean yield obtained was (24.48 q/ha) during 2023-24, respectively. There was a significant difference in mean yield between protected and unprotected plots. The percent avoidable yield losses were 15.24 percent during 2023-24, respectively

**B5: Management of aphids in wheat through border crops**

(Centres: Ludhiana & Karnal)

The trial consists of five treatments i.e. wheat + one row of border crop of mustard, wheat + two rows of border crop of mustard, wheat + one row of border crop of radish, wheat + two rows of border crop of radish and wheat without any border crop. Each treatment was replicated four times. The observation on the number of aphids/earhead and coccinellids/m$^2$ were recorded at the weekly interval at a peak period of their activity. Observations of aphid incidence were recorded from five randomly selected tiller/plot whereas coccinellid were recorded from five randomly selected spots of one square meter area in each plot. The number of aphids and coccinellid were also recorded from border crop at peak period of their activity. At harvest, the yield from each plot was recorded to assess the yield losses.

**Centre: Ludhiana-** This trial was conducted in New experimental Area, Department of Plant Breeding and Genetics, PAU, Ludhiana. An aphid susceptible wheat variety PBW 725 was sown plots measuring 25 m$^2$ in randomized complete block design (RCBD) during the second week of November. 2023. There was no difference in number of aphids/earhead in wheat where mustard (8.25-8.45 aphids/earhead) or radish (9.20-9.27 aphids/earhead) is grown as border at 8th standard meteorological week (SMW). However, significantly lower aphid/earhead in wheat were observed in plots where mustard (8.25-8.45 aphids/earhead) is grown as border crop as compared to wheat without any border crop (10.05 aphid/earhead). The data recorder at 9th SMW indicated that significantly lower number of aphid/earhead in wheat were observed in plots where both radish (15.34-15.43 aphids earhead) and mustard (13.33-14.10 aphids/earhead) is grown as border crop as compared to untreated control (17.73 aphid/earhead). Similar trends were observed at aphid incidence recorded at 10th and 11th SMW. The number of aphids/10 cm terminal portion of central shoot of radish and mustard crop was statistically at par with each other at 7-10 SMW. Significantly higher number of coccinellids/m2 was observed in wheat when mustard or radish is grown as boarder crop at 12 SMW. However, there was no difference in coccinellids/plants in mustard or radish at 12 SMW. At 13 SMW, 4.38-4.86 coccinellids/m2 were observed in wheat crop where mustard is grown as border crop and it significantly higher that wheat crop grown with single row of radish crop (4.15 coccinellids/m2) and Wheat crop without any border crop (3.29 coccinellid/m2). Similarly higher numbers of coccinellids/plant were recorded in mustard crop (3.77-3.95 coccinellids/plant) as compared to radish (3.05-3.22 coccinellids/plant). The grain yield in wheat crop grown with mustard as border crop ranged from 56.79-56.96 q/ha whereas it was 56.49-56.64 q/ha in radish as border crop. Relatively lower grain yield (55.72 q/ha)was recorder in wheat crop grown without any border crop (Table B5-10.2a).

**Centre: Karnal-** The data showed that significantly fewer aphids per earhead were observed in wheat plots bordered by mustard and recorded 7.96,13.81,10.08 and 5.36 aphids/earhead after 8,9,10 and 10SMW, respectively as compared to wheat crop without any border crop (10.05 aphids/earhead). Significantly more coccinellids per square meter (2.71 & 4.57 after 12 and 13$^{th}$ SMW, respectively) were found in wheat when bordered by mustard. However, there was no difference in the number of coccinellids per plant between mustard and radish. The grain yield in wheat crop grown with mustard as a border crop was 56.67 q/ha as compared to wheat crop grown without any border crop (55.43 q/ha) (Table B5-10.2b).

**B6. Basic studies for development of IPM strategies**

(Centres: Ludhiana & 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 100m2 area while moving in a diagonal path in the field. The population of Coccinella septempunctata was recorded in 1 m2 area around the individual plant. Weekly observations were recorded to study the first incidence and population build up of aphid and Coccinellid beetle.

***Population dynamics of Wheat aphid:*** The aphid first appeared on 23.01.2024 on wheat crop and it started rising and reached its peak on 05.03.2024 (Table B 6a). Thereafter population of wheat aphid started declining and it drastically decreased after 02.04.2024. The population of coccinellid beetle remained low up to 27.02.2024 and thereafter it started rising and reach its peak on 26.03.2024 (three 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 23.01.2024 on barley crop and it started rising and reached its peak on 27.02.2024 (Table B 6b). Thereafter aphid population started declining and became very low after 02.04.2024. The population of coccinellid beetles remained low up to 13.02.2024 and thereafter it stated rising and reached its peak on 12.03.2024 (two weeks after the peak period of activity of barley aphid). Thus, it can be concluded from the data that coccinellid beetle reached it's peak 2-3 weeks 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 29.1.2024 on wheat crop and it started rising and reached its peak (13.9 aphids/plant) on 04.03.2024 (Table B4-10.2c.). Thereafter population of wheat aphid started declining. The population of Coccinellid beetle started from 22-02-2024 and reaches its peak (4.7 beetles/m$^2$) on 25.03.2024.

*Population dynamics of barley aphid:* It first appeared on 22.01.2024 on barley crop and it started rising and reached its first peak 15.5 aphids/plant) on 26.03.2024. The population of coccinellid beetles appeared on 05.02.2024 and reached its peak (4.2 beetles/m$^2$) on 1.03.2022. Thereafter its population started declining. Thus, it can be concluded from the data comparatively higher population of aphid appeared on barley as compared to wheat crop (Table B4-10.2d).

**Table: B4-10.2a. Assessment of grain yield losses caused by aphid complex in wheat during 2023-24 (Centre: Ludhiana)**

| Treatments | Number of aphids/ tiller | | | | | | | | | | Coccinellid/ $m^2$ at grain maturity | Grain yield (q/ha) | Avoidable losses (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Before spray at MS stage | 7 days after spray at MS stage | Before spray at FL stage | 7 days after spray at FL stage | Before spray at EE stage | 7 days after spray at EE stage | Before spray at MG stage | 7 days after spray at MG stage | Before spray at GM stage | 7 days after spray at GM stage | | | |
| Started spraying the crop at maximum tillering (MS) stage | 0.50 | 0.00 | 0.25 | 0.00 | 0.50 | 0.00 (1.00) | 11.00 (3.42) | 0.00 (1.00) | 8.25 (2.95) | 0.00 (1.00) | 1.75 (1.64) | 56.19 | 9.62 |
| Started spraying the crop at flag leaf (FL) stage | 0.50 | 0.25 | 0.25 | 0.00 | 0.50 | 0.00 (1.00) | 12.25 (3.63) | 0.00 (1.00) | 9.00 (3.16) | 0.00 (1.00) | 1.75 (1.61) | 55.53 | 8.32 |
| Started spraying the crop at ear emergence (EE) Stage | 0.00 | 0.50 | 0.50 | 0.50 | 1.75 | 0.00 (1.00) | 13.75 (3.85) | 0.25 (1.10) | 8.50 (3.07) | 0.25 (1.10) | 2.25 (1.74) | 55.44 | 8.16 |
| Started spraying the crop at milky grain (MG) Stage | 0.00 | 0.25 | 0.50 | 0.50 | 1.50 | 2.25 (1.74) | 20.00 (4.57) | 0.50 (1.20) | 7.75 (2.93) | 0.50 (1.20) | 4.00 (2.21) | 55.17 | 7.62 |
| Started spraying the crop at grain maturity stage (GM) stage | 0.25 | 0.50 | 0.50 | 0.50 | 1.75 | 3.00 (1.99) | 21.00 (4.68) | 23.75 (4.96) | 24.75 (5.07) | 28.50 (5.42) | 4.50 (2.33) | 53.35 | 4.08 |
| Untreated control | 0.75 | 0.25 | 0.50 | 0.25 | 2.00 | 3.00 (1.99) | 22.25 (4.81) | 23.50 (4.94) | 26.00 (5.19) | 31.00 (5.65) | 4.75 (2.39) | 51.26 | - |
| **CD (p =0.05)** | NS | NS | NS | NS | NS | (0.38) | (0.50) | (0.33) | (0.60) | (0.33) | (0.57) | 0.74 | - |

| | | | | | |
|---|---|---|---|---|---|
| Date of sowing | : | 15.11.2023 | Plot size | : | 7.5 $m^2$ |
| Dates of spraying | : | 16.01.24, 30.01.24, 13.02.24, 27.02.2024 & 10.03.24 | Variety | : | PBW 725 |
| Date of harvest | : | 26. 04.2024 | Replications | : | Three |

**Table: B4-10.2b. Assessment of grain yield losses caused by aphid complex in wheat during 2023-24 (Centre: Karnal)**

| Treatments | Number of aphids/ tiller | | | | | | | | | | Coccinellid/ $m^2$ at grain maturity | Grain yield (q/ha) | Avoidabl elosses (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Before spray at MS stage | 7 days after spray at MS stage | Before spray at FL stage | 7 days after spray at FL stage | Before spray at EE stage | 7 days after spray at EE stage | Before spray at MG stage | 7 days after spray at MG stage | Before spray at GM stage | 7 days after spray at GM stage | | | |
| Started spraying the crop at maximum tillering (MS) stage | 0.70 | 0.20 | 0.45 | 0.20 | 0.70 | 0.00 (1.00) | 10.50 (3.39) | 0.00 (1.00) | 8.25 (2.83) | 0.00 (1.00) | 1.50 (1.58) | 53.94 | 7.37 |
| Started spraying the crop at flag leaf (FL) stage | 0.70 | 0.45 | 0.45 | 0.20 | 0.70 | 0.50 (1.22) | 11.75 (3.57) | 0.50 (1.22) | 9.00 (2.96) | 0.50 (1.22) | 1.52 (1.59) | 53.28 | 6.07 |
| Started spraying the crop at ear emergence (EE) stage | 0.20 | 0.70 | 0.70 | 0.70 | 0.20 | 0.50 (1.22) | 12.55 (3.68) | 0.25 (1.10) | 8.50 (2.87)) | 0.25 (1.10) | 2.10 (1.76) | 53.19 | 5.91 |
| Started spraying the crop at milky grain (MG) stage | 0.20 | 0.45 | 0.70 | 0.70 | 0.20 | 2.00 (1.73) | 15.25 (4.02) | 0.50 (1.22) | 7.75 (2.74) | 0.50 (1.22) | 3.50 (2.12) | 52.92 | 5.37 |
| Started spraying the crop at grain maturity stage (GM) stage | 0.45 | 0.70 | 0.70 | 0.70 | 0.45 | 2.25 (1.80) | 18.00 (4.36) | 22.50 (4.85) | 24.75 (4.95) | 27.75 (5.32) | 4.32 (2.31) | 51.1 | 2.83 |
| Untreated control | 0.95 | 0.45 | 0.70 | 0.45 | 0.95 | 3.00 (1.99) | 20.35 (4.62) | 20.50 (4.64) | 26.00 (5.07) | 29.75 (5.55) | 4.52 (2.35) | 49.01 | - |
| **CD (p =0.05)** | NS | NS | NS | NS | NS | (0.38) | (0.35) | (0.25) | (0.60) | (0.33) | (0.57) | 0.65 | - |

| | | | | | |
|---|---|---|---|---|---|
| Date of sowing | : | 12.11.2023 | Plot size | : | 7.5 $m^2$ |
| Dates of spraying | : | 17.01.24, 26.01.24, 15.02.24, 26.02.2024 & 12.03.24 | Variety | : | HD2967 |
| Date of harvest | : | 19. 04.2024 | Replications | : | Three |

**Table: B4-10.2c. Assessment of grain yield losses caused by aphid complex in wheat during 2023-24 (Centre: Niphad)**

| T.N | Treatment | Formal Dose g or ml ai/ha | Av population of aphids/shoot(1st Spray) | | | | Av population of aphids/shoot (2nd Spray) | | | Av population of aphids/shoot (3rd Spray) | | | 1000 Grain wt. (g) | Yield q/ha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre count | 7 DAS | 10 DAS | 14 DAS | 7 DAS | 10 DAS | 14 DAS | 7 DAS | 10 DAS | 14 DAS | | |
| 1 | Thiamethoxam 25 WG at flag leaf stage | 50 g | 15.47 (4.04) | 10.53 (3.38) | 7.33 (2.88) | 6.40 (2.71) | 8.80 (3.12) | 12.20 (3.59) | 19.27 (4.45) | 24.67 (5.01) | 31.73 (5.65) | 40.53 (6.36) | 39.05 | 33.70 |
| 2 | Thiamethoxam 25 WG at Ear head stage | 50 g | 13.80 (3.83) | 19.20 (4.48) | 30.27 (5.57) | 35.73 (6.04) | 22.67 (4.85) | 15.13 (4.00) | 10.00 (3.31) | 15.60 (4.07) | 19.87 (4.56) | 25.53 (5.15) | 39.14 | 34.71 |
| 3 | Thiamethoxam 25 WG at Milking Stage | 50 g | 14.93 (3.98) | 20.80 (4.66) | 32.67 (5.78) | 38.53 (6.27) | 46.00 (6.84) | 49.40 (7.08) | 50.27 (7.16) | 19.07 (4.48) | 6.93 (2.82) | 5.73 (2.59) | 39.18 | 34.90 |
| 4 | Thiamethoxam 25 WG at Flag leaf & at Earhead stage | 50 g | 15.53 (4.06) | 10.60 (3.40) | 7.33 (2.88) | 6.47 (2.73) | 5.07 (2.46) | 3.73 (2.17) | 3.67 (2.16) | 9.60 (3.25) | 15.40 (4.05) | 24.40 (5.04) | 39.22 | 35.67 |
| 5 | Thiamethoxam 25 WG at Flag leaf & at Milking Stage | 50 g | 15.00 (3.99) | 10.20 (3.34) | 7.07 (2.83) | 6.53 (2.74) | 8.87 (3.13) | 14.47 (3.92) | 23.53 (4.94) | 7.80 (2.97) | 5.40 (2.53) | 4.00 (2.22) | 40.23 | 37.77 |
| 6 | Thiamethoxam 25 WG at Ear head & milking stage | 50 g | 14.87 (3.98) | 20.67 (4.65) | 32.60 (5.79) | 38.47 (6.28) | 24.33 (5.03) | 16.33 (4.16) | 10.73 (3.42) | 6.47 (2.73) | 4.33 (2.30) | 3.33 (2.08) | 41.32 | 40.39 |
| 7 | Thiamethoxam 25 WG at Flag leaf, Earhead & Milking Stage | 50 g | 13.73 (3.83) | 9.33 (3.21) | 6.40 (2.71) | 5.87 (2.61) | 4.60 (2.36) | 3.60 (2.14) | 3.53 (2.12) | 3.40 (2.07) | 3.80 (2.19) | 3.20 (2.05) | 41.79 | 41.81 |
| 8 | Untreated Control | - | 16.80 (4.21) | 23.27 (4.92) | 36.67 (6.12) | 43.20 (6.63) | 51.07 (7.20) | 52.40 (7.29) | 52.467 (7.29) | 53.40 (7.37) | 54.47 (7.45) | 56.27 (7.57) | 37.25 | 32.24 |
| **SE+** | | | **0.213** | **0.213** | **0.239** | **0.253** | **0.233** | **0.247** | **0.238** | **0.234** | **0.220** | **0.280** | **0.845** | **1.987** |
| **CD 0.5%** | | | **0.646** | **0.643** | **0.725** | **0.764** | **0.705** | **0.748** | **0.720** | **0.707** | **0.667** | **0.848** | **2.558** | **6.013** |
| **CV%** | | | **9.264** | **9.196** | **9.594** | **9.720** | **9.220** | **9.963** | **9.458** | **10.138** | **9.679** | **11.741** | **3.692** | **9.454** |

**Table: B4-10.2d. Assessment of grain yield losses caused by aphid complex in wheat during 2023-24(Centre: Kharibari)**

| Treatment | Average No. of Aphids/plant/ tillers | Yield (q/ha) | Avoidable loss (%) |
|---|---|---|---|
| **Protected (Thiamethoxam 25% WG 12.5 a.i g/ha)** | 2.23 | 28.88 | 15.24 |
| **Unprotected** | 23.58 | 24.48 | |
| **T "Calculated"** | 84.09** | 5.77 | |

**Table: B5-10.2a. Management of aphids in wheat through border crops during 2023-24 (Centre: Ludhiana)**

| S. No | Treatment and dosages | Number of aphids/ earhead | | | | Coccinellid/$m^2$ | | Grain yield (q/ha) |
|---|---|---|---|---|---|---|---|---|
| **Wheat** | | **8 SMW** | **9 SMW** | **10 SMW** | **11 SMW** | **12 SMW** | **13 SMW** | |
| 1. | Wheat+ 1 row of border crop of mustard | 8.45 | 13.33 | 10.47 | 5.75 | 2.85 | 4.35 | 56.79 |
| 2 | Wheat+ 2 rows of border crop of mustard | 8.25 | 14.10 | 10.37 | 5.65 | 3.00 | 4.86 | 56.96 |
| 3. | Wheat+ 1 row of border crop of radish | 9.20 | 15.43 | 12.33 | 6.75 | 2.67 | 4.15 | 56.49 |
| 4. | Wheat+ 2 rows of border crop of radish | 9.27 | 15.34 | 12.17 | 6.57 | 2.73 | 4.41 | 56.64 |
| 5. | Wheat crop without any border crop | 10.05 | 17.73 | 13.71 | 8.87 | 2.21 | 3.29 | 55.72 |
| | CD (p=0.05) | 1.02 | 0.88 | 0.96 | 0.87 | 0.49 | 0.54 | NS |
| **Mustard/Radish** | | **Number of aphids/10 cm terminal portionof central shoot** | | | | **Coccinellid/$m^2$** | | |
| **S.no.** | | **7 SMW** | **8 SMW** | **9 SMW** | **10 SMW** | **12 SMW** | **13 SMW** | |
| 1. | Wheat+ 1 row of border crop of mustard | 15.30 | 21.38 | 17.61 | 11.82 | 5.30 | 3.77 | |
| 2 | Wheat+ 2 rows of border crop of mustard | 15.17 | 21.88 | 16.86 | 10.83 | 5.73 | 3.95 | |
| 3. | Wheat+ 1 row of border crop of radish | 15.24 | 22.19 | 16.78 | 10.76 | 5.00 | 3.05 | |
| 4. | Wheat+ 2 rows of border crop of radish | 15.31 | 21.80 | 16.97 | 11.49 | 5.30 | 3.22 | |
| | CD (p=0.05) | NS | NS | NS | NS | NS | 0.52 | |

* SMW = Standard meteorological weeks

| | | | | | |
|---|---|---|---|---|---|
| Date of sowing | : | 15-11-2023 | Plot size | : | 20 $m^2$ |
| Variety | : | PBW 725 | Date of harvest | : | 21-04-2024 |
| Replications | : | Three | | | |

**Table: B5-10.2b. Management of aphids in wheat through border crops during 2023-24 (Centre: Karnal)**

| S. No | Treatment and dosages | Number of aphids/ earhead | | | | Coccinellid/m$^2$ | | Grain yield (q/ha) |
|---|---|---|---|---|---|---|---|---|
| Wheat | | 8 SMW | 9 SMW | 10 SMW | 11 SMW | 12 SMW | 13 SMW | |
| 1. | Wheat+ 1 row of border crop of mustard | 8.16 | 13.04 | 10.18 | 5.46 | 2.56 | 4.06 | 56.50 |
| 2 | Wheat+ 2 rows of border crop of mustard | 7.96 | 13.81 | 10.08 | 5.36 | 2.71 | 4.57 | 56.67 |
| 3. | Wheat+ 1 row of border crop of radish | 8.91 | 15.14 | 12.04 | 6.46 | 2.38 | 3.86 | 56.20 |
| 4. | Wheat+ 2 rows of border crop of radish | 8.98 | 15.05 | 11.88 | 6.28 | 2.44 | 4.12 | 56.35 |
| 5. | Wheat crop without any border crop | 9.76 | 17.44 | 13.42 | 8.58 | 1.92 | 3.00 | 55.43 |
| | CD (p=0.05) | 0.73 | 0.59 | 0.67 | 0.58 | 0.20 | 0.25 | NS |
| Mustard/Radish | | Number of aphids/10 cm terminal portion ofcentral shoot | | | | Coccinellid/m$^2$ | | |
| S.no. | | 7 SMW | 8 SMW | 9 SMW | 10 SMW | 12 SMW | 13 SMW | |
| 1. | Wheat+ 1 row of border crop of mustard | 15.01 | 21.09 | 17.32 | 11.53 | 5.01 | 3.48 | |
| 2 | Wheat+ 2 rows of border crop of mustard | 14.88 | 21.59 | 16.57 | 10.54 | 5.44 | 3.66 | |
| 3. | Wheat+ 1 row of border crop of radish | 14.95 | 21.90 | 16.49 | 10.47 | 4.71 | 2.76 | |
| 4. | Wheat+ 2 rows of border crop of radish | 15.02 | 21.51 | 16.68 | 11.20 | 5.01 | 2.93 | |
| | CD (p=0.05) | NS | NS | NS | NS | NS | 0.46 | |

* SMW = Standard meteorological weeks

| | | | | | |
|---|---|---|---|---|---|
| Date of sowing | : | 13-11-2023 | Plot size | : | 20 m$^2$ |
| Variety | : | HD2967 | Date of harvest | : | 15-04-2024 |
| Replications | : | Three | | | |

**Table: B6-10.2a. Pest modeling for foliage aphids and their natural enemies during 2023-24 (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. |
| 16.01.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 23.01.2024 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0.0 |
| 30.01.2024 | 0 | 1 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 2 | 0.7 |
| 06.02.2024 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0.4 | 0 | 0 | 2 | 0.7 |
| 13.02.2024 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0.4 | 10 | 4 | 9 | 7.7 |
| 20.02.2024 | 2 | 3 | 0 | 4 | 1 | 4 | 4 | 2 | 3 | 1 | 2.4 | 12 | 9 | 12 | 11.0 |
| 27.02.2024 | 8 | 4 | 5 | 4 | 4 | 5 | 2 | 4 | 8 | 5 | 4.9 | 22 | 24 | 19 | 21.7 |
| 05.03.2024 | 14 | 16 | 17 | 10 | 9 | 15 | 14 | 10 | 9 | 14 | 12.8 | 10 | 14 | 16 | 13.3 |
| 12.03.2024 | 10 | 11 | 10 | 9 | 14 | 8 | 15 | 10 | 8 | 6 | 10.1 | 8 | 4 | 6 | 6.0 |
| 19.03.2024 | 3 | 4 | 1 | 5 | 6 | 0 | 0 | 1 | 2 | 5 | 2.7 | 0 | 0 | 1 | 0.3 |
| 26.03.2024 | 4 | 0 | 2 | 4 | 0 | 0 | 3 | 1 | 0 | 2 | 1.6 | 2 | 4 | 0 | 2.0 |
| 02.04.2024 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 2 | 0.7 | 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. |
| 16.01.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 23.01.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 30.01.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 06.02.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 13.02.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 20.02.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.3 |
| 27.02.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0.1 | 2 | 4 | 0 | 2.0 |
| 05.03.2024 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0.2 | 1 | 0 | 0 | 0.3 |
| 12.03.2024 | 0 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 0 | 0 | 0.5 | 8 | 9 | 4 | 7.0 |
| 19.03.2024 | 2 | 4 | 5 | 0 | 0 | 6 | 7 | 0 | 5 | 8 | 3.7 | 0 | 2 | 5 | 2.3 |
| 26.03.2024 | 7 | 4 | 5 | 0 | 5 | 4 | 8 | 3 | 6 | 9 | 5.1 | 0 | 0 | 0 | 0.0 |
| 02.04.2024 | 2 | 4 | 1 | 0 | 0 | 0 | 2 | 5 | 2 | 3 | 1.9 | 0 | 0 | 0 | 0.0 |
| | | | | | | | | | | | | | | | |

**Table: B6-10.2b. Pest modeling for foliage aphids and their natural enemies during 2023-24 (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. |
| 16.01.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 23.01.2024 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 2 | 0 | 0.5 | 0 | 1 | 0 | 0.3 |
| 30.01.2024 | 0 | 0 | 2 | 0 | 0 | 3 | 4 | 2 | 5 | 6 | 2.2 | 0 | 1 | 2 | 1.0 |
| 06.02.2024 | 0 | 0 | 2 | 1 | 6 | 4 | 5 | 6 | 8 | 5 | 3.7 | 0 | 1 | 1 | 0.7 |
| 13.02.2024 | 10 | 4 | 9 | 17 | 16 | 8 | 11 | 10 | 21 | 9 | 11.5 | 1 | 0 | 0 | 0.3 |
| 20.02.2024 | 12 | 9 | 12 | 23 | 14 | 15 | 15 | 16 | 18 | 20 | 15.4 | 2 | 3 | 0 | 1.7 |
| 27.02.2024 | 22 | 24 | 19 | 23 | 20 | 19 | 18 | 22 | 14 | 14 | 19.5 | 8 | 4 | 5 | 5.7 |
| 05.03.2024 | 10 | 14 | 16 | 18 | 10 | 12 | 19 | 10 | 9 | 8 | 12.6 | 14 | 16 | 17 | 15.7 |
| 12.03.2024 | 8 | 4 | 6 | 8 | 9 | 5 | 4 | 6 | 2 | 2 | 5.4 | 10 | 11 | 10 | 10.3 |
| 19.03.2024 | 0 | 0 | 1 | 2 | 1 | 2 | 4 | 0 | 0 | 5 | 1.5 | 3 | 4 | 1 | 2.7 |
| 26.03.2024 | 2 | 4 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 1.1 | 4 | 0 | 2 | 2.0 |
| 02.04.2024 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.2 | 1 | 0 | 0 | 0.3 |
| | | | | | | | | | | | | | | | |
| Date | Plant No.(Coccinellid beetle/sq m area) | | | | | | | | | | | Collateral host (wheat) | | | |
| | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | Avg. | P1 | P2 | P3 | Avg. |
| 16.01.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 23.01.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 30.01.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0.0 |
| 06.02.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0.2 | 0 | 0 | 0 | 0.0 |
| 13.02.2024 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0.0 |
| 20.02.2024 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 4 | 0.8 | 0 | 0 | 0 | 0.0 |
| 27.02.2024 | 2 | 4 | 0 | 2 | 0 | 0 | 5 | 0 | 4 | 0 | 1.7 | 0 | 0 | 0 | 0.0 |
| 05.03.2024 | 1 | 0 | 0 | 2 | 5 | 5 | 7 | 8 | 4 | 6 | 3.8 | 0 | 0 | 0 | 0.0 |
| 12.03.2024 | 8 | 9 | 4 | 6 | 10 | 5 | 6 | 4 | 8 | 9 | 6.9 | 0 | 0 | 0 | 0.0 |
| 19.03.2024 | 0 | 2 | 5 | 4 | 2 | 0 | 0 | 3 | 6 | 9 | 3.1 | 2 | 4 | 5 | 3.7 |
| 26.03.2024 | 0 | 0 | 0 | 1 | 4 | 2 | 0 | 0 | 0 | 0 | 0.7 | 7 | 4 | 5 | 5.3 |
| 02.04.2024 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.1 | 2 | 4 | 1 | 2.3 |

**Table: B6-10.2c. Population dynamics of wheat aphid and Coccinellid beetle during 2023-24(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.** |
| **15.01.2024** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0.0** | 0 | 0 | 0 | **0.0** |
| **22.01.2024** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0.0** | 0 | 0 | 0 | **0.0** |
| **29.01.2024** | 2 | 2 | 0 | 0 | 1 | 1 | 1 | 2 | 0 | 0 | **0.9** | 3 | 1 | 2 | **2.0** |
| **05.02.2024** | 4 | 1 | 3 | 4 | 4 | 3 | 4 | 0 | 0 | 0 | **2.3** | 2 | 6 | 1 | **3.0** |
| **12.02.2024** | 4 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | **0.9** | 3 | 5 | 9 | **5.7** |
| **19.02.2024** | 0 | 5 | 5 | 5 | 4 | 4 | 0 | 1 | 3 | 2 | **2.9** | 11 | 15 | 14 | **13.3** |
| **26.02.2024** | 4 | 6 | 7 | 6 | 3 | 7 | 8 | 9 | 7 | 8 | **6.5** | 11 | 14 | 17 | **14.0** |
| **04.03.2024** | 10 | 12 | 10 | 15 | 16 | 19 | 15 | 16 | 14 | 12 | **13.9** | 14 | 16 | 15 | **15.0** |
| **11.03.2024** | 5 | 6 | 7 | 8 | 6 | 12 | 9 | 7 | 10 | 13 | **8.3** | 14 | 9 | 11 | **11.3** |
| **18.03.2024** | 6 | 7 | 5 | 7 | 6 | 11 | 7 | 8 | 8 | 9 | **7.4** | 4 | 7 | 5 | **5.3** |
| **25.03.2024** | 4 | 3 | 1 | 1 | 4 | 5 | 7 | 5 | 1 | 0 | **3.1** | 0 | 0 | 3 | **1.0** |
| **01.04.2024** | 4 | 8 | 6 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | **2.2** | 0 | 0 | 1 | **0.3** |
| **08.04.2024** | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 1 | 0 | 4 | **1.0** | 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.** |
| **15.01.2024** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | **0.0** |
| **22.01.2024** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | **0.0** |
| **29.01.2024** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | **0.0** |
| **05.02.2024** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 1 | 2 | 1 | **1.3** |
| **12.02.2024** | 0 | 0 | 2 | 2 | 1 | 2 | 2 | 2 | 0 | 0 | **1.1** | 1 | 3 | 0 | **1.3** |
| **19.02.2024** | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0.3** | 1 | 0 | 1 | **0.7** |
| **26.02.2024** | 0 | 0 | 0 | 3 | 4 | 0 | 2 | 0 | 0 | 0 | **0.9** | 2 | 3 | 2 | **2.3** |
| **04.03.2024** | 0 | 3 | 2 | 1 | 4 | 0 | 1 | 1 | 1 | 0 | **1.3** | 0 | 0 | 0 | **0.0** |
| **11.03.2024** | 2 | 2 | 0 | 3 | 2 | 0 | 2 | 5 | 4 | 3 | **2.3** | 1 | 2 | 3 | **2.0** |
| **18.03.2024** | 5 | 3 | 4 | 1 | 0 | 6 | 6 | 0 | 0 | 5 | **3** | 5 | 6 | 6 | **5.7** |
| **25.03.2024** | 8 | 4 | 6 | 0 | 3 | 7 | 6 | 8 | 0 | 5 | **4.7** | 4 | 6 | 5 | **5.0** |
| **01.04.2024** | 3 | 4 | 1 | 5 | 4 | 0 | 0 | 0 | 5 | 5 | **2.7** | 1 | 5 | 3 | **3.0** |
| **08.04.2024** | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | **0.4** | 0 | 1 | 0 | **0.3** |

**Table: B6-10.2d. Population dynamics of barley aphid and Coccinellid beetle during 2023-24 (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.** |
| **15.01.2024** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | **0.0** |
| **22.01.2024** | 0 | 0 | 0 | 3 | 1 | 1 | 1 | 1 | 3 | 0 | **1.0** | 0 | 0 | 0 | **0.0** |
| **29.01.2024** | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | **0.7** | 0 | 0 | 0 | **0.0** |
| **05.02.2024** | 3 | 5 | 1 | 1 | 4 | 6 | 1 | 1 | 5 | 5 | **3.2** | 2 | 1 | 0 | **1.0** |
| **12.02.2024** | 6 | 7 | 8 | 9 | 10 | 11 | 7 | 8 | 9 | 8 | **8.3** | 1 | 3 | 2 | **2.0** |
| **19.02.2024** | 5 | 15 | 14 | 11 | 9 | 12 | 10 | 16 | 11 | 9 | **11.2** | 2 | 1 | 2 | **1.7** |
| **26.02.2024** | 13 | 17 | 18 | 20 | 11 | 11 | 15 | 19 | 15 | 12 | **15.1** | 3 | 4 | 5 | **4.0** |
| **04.03.2024** | 15 | 14 | 13 | 11 | 12 | 11 | 14 | 11 | 12 | 19 | **13.2** | 10 | 12 | 10 | **10.7** |
| **11.03.2024** | 11 | 10 | 11 | 12 | 9 | 11 | 12 | 13 | 6 | 7 | **10.2** | 6 | 6 | 7 | **6.3** |
| **18.03.2024** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **1** | 5 | 5 | 7 | **5.7** |
| **25.03.2024** | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | **1.8** | 1 | 2 | 1 | **1.3** |
| **01.04.2024** | 4 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | **1.9** | 0 | 2 | 1 | **1.0** |
| **08.04.2024** | 3 | 5 | 0 | 0 | 4 | 3 | 0 | 0 | 5 | 5 | **2.5** | 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.** |
| **15.01.2024** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | **0.0** |
| **22.01.2024** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | **0.0** |
| **29.01.2024** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | **0.0** |
| **05.02.2024** | 0 | 0 | 4 | 4 | 0 | 4 | 0 | 3 | 0 | 0 | **1.5** | 0 | 0 | 0 | **0.0** |
| **12.02.2024** | 1 | 0 | 1 | 2 | 0 | 2 | 3 | 2 | 2 | 0 | **1.3** | 0 | 0 | 0 | **0.0** |
| **19.02.2024** | 1 | 5 | 4 | 5 | 4 | 3 | 2 | 2 | 2 | 5 | **3.3** | 1 | 1 | 2 | **1.3** |
| **26.02.2024** | 5 | 5 | 2 | 6 | 3 | 3 | 2 | 3 | 5 | 2 | **3.6** | 5 | 0 | 0 | **1.7** |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **04.03.2024** | 2 | 4 | 3 | 2 | 4 | 4 | 2 | 5 | 5 | 0 | **3.1** | 1 | 3 | 1 | **1.7** |
| **11.03.2024** | 2 | 5 | 5 | 6 | 5 | 5 | 2 | 5 | 5 | 2 | **4.2** | 2 | 0 | 0 | **0.7** |
| **18.03.2024** | 2 | 2 | 4 | 2 | 4 | 4 | 3 | 3 | 2 | 8 | **3.4** | 2 | 3 | 3 | **2.7** |
| **25.03.2024** | 0 | 3 | 3 | 0 | 2 | 4 | 5 | 3 | 2 | 0 | **2.2** | 4 | 5 | 5 | **4.7** |
| **01.04.2024** | 3 | 2 | 0 | 0 | 1 | 2 | 3 | 4 | 1 | 0 | **1.6** | 1 | 2 | 0 | **1.0** |
| **08.04.2024** | 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, Pusa and Niphad)

**Centre: Ludhiana**
The wheat variety PBW 725 was grown on 4th Nov.2023 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 crossed the economic threshold level wheat. Untreated plots where no insecticide was applied served as check 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, thiamethoxam 25 WG @ 50 g/ha sprayed plots recorded minimum aphid population (1.76 aphids/earhead) and it was at par all other treatments and significantly better than untreated control. However 3 days after treatment, Pymetrozine 50% WG @ 120 g/ha treated plots recorded minimum aphid population (1.47 aphid/earhead). A similar trend was observed seven days after treatment. Maximum grain yield (q/ha) was observed in plots treated with acetamiprid 20 SP @ 100 g/ha (60.13q/ha). However, all the insecticidal treatments recorded higher than grain yield than untreated check (53.91 q/ha) (Table B7-10.2a).

**Centre: Karnal**
Aphid population did not differ significantly among all treatments one before spray. After one day of spraying, Pymetrozine 50% WG @ 120 g/ha treated plots recorded minimum aphid population (2.38 aphid/earhead) followed by treatment of acetamiprid 20 SP @ 100 g/ha which recorded 2.39 aphids/tiller. A similar trend was observed after 3, 7 and 15 days of spraying.
Though, the maximum grain yield recorded under treatment of Thiamethoxam 25% WG (46.87 q/ha) treated plots followed by the treatment of Imidacloprid 17.8 SL (46.76 q/ha). However, all the insecticidal treatments recorded higher than grain yield than untreated check (41.31 q/ha) (Table B7-10.2b).

**Centre: Niphad**
The yield data indicated that the treatment with pymetrozine 50% EC at 120 g a.i./ha significantly outperformed other treatments, achieving the highest grain yield of 51.59 q/ha. But was found at par with the treatments pymetrozine 50% EC at 100 g a.i./ha (50.50 q/ha), thiamethoxam 25% WG at 12.5 g a.i./ha (48.16 q/ha), pymetrozine 50% EC at 80 g a.i./ha (46.94 q/ha), and imidacloprid 17.8 SL at 20 g a.i./ha (45.80 q/ha). The untreated control recorded the lowest yield of 38.01 q/ha (Table B7-10.2c).

**Table: B7-10.2a. Management of aphids through foliar application of new chemical molecules in wheat during 2023-24 (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 | 18.21 | 2.19 (1.78) | 1.87 (1.69) | 1.75 (1.65) | 1.87 (1.69) | 58.97 |
| 2 | Pymetrozine 50% WG | 100 g | 18.30 | 1.95 (1.71) | 1.63 (1.62) | 1.51 (1.58) | 1.73 (1.65) | 59.91 |
| 3 | Pymetrozine 50% WG | 120 g | 18.62 | 1.85 (1.68) | 1.47 (1.57) | 1.43 (1.55) | 1.63 (1.62) | 60.00 |
| 4 | Thiamethoxam 25% WG | 12.5 g | 18.45 | 1.76 (1.66) | 1.58 (1.60) | 1.50 (1.58) | 1.78 (1.66) | 59.77 |
| 5 | Imidacloprid 17.8 SL | 100 ml | 18.37 | 1.91 (1.70) | 1.70 (1.64) | 1.58 (1.60) | 1.86 (1.69) | 58.88 |
| 6 | Acetamiprid 20SP | 100 g | 18.66 | 1.97 (1.72) | 1.60 (1.61) | 1.57 (1.60) | 1.74 (1.66) | 60.13 |
| 7 | Untreated control | - | 18.52 | 20.04 (4.58) | 19.46 (4.52) | 20.30 (4.61) | 23.34 (4.93) | 53.91 |
| CD (p=0.05) | | | NS | (0.10) | (0.11) | (0.10) | (0.11) | 1.42 |

*Figures in parentheses indicate $\sqrt{n+1}$ transformed value.

| | | | |
|---|---|---|---|
| Date of sowing : | 04.11.2023 | Plot size : | 7.5 $m^2$ |
| Date of insecticidal application : | 27.02.2024 | Variety : | PBW 725 |
| Date of harvest : | 19. 04.2024 | Replications : | Three |

**Table: B7-10.2b. Management of aphids through foliar application of new chemical molecules in wheat during 2023-24 (Centre: Karnal)**

| S. No. | Treatments | Dose ml or g / ha | Aphid population per earhead | | | | | Average | Grain Yield (q/ha) |
|---|---|---|---|---|---|---|---|---|---|
| | | | Before spray | After spray | | | | | |
| | | | 1 day | 1 day | 3 days | 7 days | 15 days | | |
| 1 | Pymetrozine 50% WG | 80 g | 9.02 | 2.49 | 2.26 | 2.11 | 2.66 | 2.38 | 46.49 |
| | | | | (1.87) | (1.81) | (1.76) | (1.91) | (1.84) | |
| 2 | Pymetrozine 50% WG | 100 g | 9.76 | 2.43 | 2.20 | 2.05 | 2.58 | 2.32 | 46.23 |
| | | | | (1.85) | (1.79) | (1.75) | (1.89) | (1.82) | |
| 3 | Pymetrozine 50% WG | 120 g | 9.44 | 2.38 | 2.15 | 1.99 | 2.50 | 2.26 | 46.54 |
| | | | | (1.84) | (1.77) | (1.73) | (1.87) | (1.81) | |
| 4 | Thiamethoxam 25% WG | 12.5 g | 9.55 | 2.41 | 2.21 | 2.09 | 2.56 | 2.32 | 46.87 |
| | | | | (1.85) | (1.79) | (1.76) | (1.89) | (1.82) | |
| 5 | Imidacloprid 17.8 SL | 100 ml | 9.77 | 2.44 | 2.16 | 2.07 | 2.52 | 2.30 | 46.76 |
| | | | | (1.85) | (1.78) | (1.75) | (1.88) | (1.82) | |
| 6 | Acetamiprid 20SP | 100 g | 9.98 | 2.39 | 2.20 | 2.02 | 2.47 | 2.27 | 46.3 |
| | | | | (1.84) | (1.79) | (1.74) | (1.86) | (1.81) | |
| 7 | Untreated control | - | 10.01 | 16.89 | 16.13 | 17.10 | 18.22 | 17.09 | 41.41 |
| | | | | (4.23) | (4.14) | (4.25) | (4.38 | (4.25) | |
| **CD (p=0.05)** | | | **NS** | **(0.52)** | **(0.53)** | **(0.52)** | **(0.50)** | **(0.45)** | **1.32** |

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

| | | | | | |
|---|---|---|---|---|---|
| Date of sowing | : | 15.11.2023 | Plot size | : | 7.5 $m^2$ |
| Date of insecticidal application | : | 22.02.2024 | Variety | : | HD2967 |
| Date of harvest | : | 15. 04.2024 | Replications | : | Three |

**Table: B7-10.2c. Management of aphids through foliar application of new chemical molecules in wheat during 2023-24 (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 | 19.93 (4.56) | 15.00 (3.99) | 14.40 (3.92) | 12.27 (3.62) | 12.27 (3.64) | 10.33 (3.35) | 8.87 (3.13) | 8.53 (3.06) | 8.47 (3.08) | 46.94 |
| 2 | Pymetrozine 50 % EC | 100 g | 25.87 (5.12) | 13.93 (3.81) | 13.67 (3.81) | 11.27 (3.50) | 10.80 (3.43) | 9.67 (3.26) | 8.33 (3.05) | 8.13 (2.99) | 8.07 (3.01) | 50.50 |
| 3 | Pymetrozine 50 % EC | 120 g | 15.87 (4.09) | 11.87 (3.58) | 10.80 (3.43) | 9.73 (3.28) | 9.40 (3.21) | 8.73 (3.11) | 7.13 (2.85) | 7.07 (2.84) | 7.00 (2.80) | 51.59 |
| 4 | Thiamethoxam 25% WG | 12.5 g | 22.67 (4.86) | 19.67 (4.55) | 16.40 (4.15) | 11.60 (3.55) | 12.87 (3.70) | 10.00 (3.31) | 9.13 (3.18) | 8.27 (3.04) | 8.20 (3.03) | 48.16 |
| 5 | Imidacloprid 17.8 SL | 20 ml | 27.53 (5.28) | 19.47 (4.52) | 18.40 (4.40) | 14.60 (3.94) | 14.13 (3.89) | 13.00 (3.74) | 12.33 )3.65) | 10.87 (3.42) | 10.73 (3.42) | 45.80 |
| 6 | Acetamiprid 20SP | 20 g | 29.00 (5.40) | 21.27 (4.69) | 21.00 (4.67) | 15.13 (4.00) | 14.47 (3.90) | 13.60 (3.79) | 12.47 (3.65) | 11.20 (3.49) | 11.07 (3.44) | 42.68 |
| 7 | Untreated Check | - | 27.47 (5.31) | 29.47 (5.52) | 30.00 (5.53) | 30.33 (5.59) | 30.67 (5.62) | 30.87 (5.65) | 32.00 (5.72) | 32.07 (5.74) | 32.13 (5.75) | 38.01 |
| **SE+** | | | **NS** | **0.249** | **0.241** | **0.206** | **0.216** | **0.198** | **0.209** | **0.186** | **0.198** | **0.365** |
| **CD 0.5%** | | | **NS** | **0.767** | **0.743** | **0.634** | **0.666** | **0.611** | **0.644** | **0.573** | **0.611** | **1.124** |
| **CV%** | | | **16.103** | **9.837** | **9.766** | **9.079** | **9.572** | **9.175** | **10.039** | **9.168** | **9.793** | **9.477** |

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

**Table: B7-10.2d. Effect of foliar application of new chemical molecules on ladybird beetle population in wheat during 2023-24 (Centre: Niphad)**

| T.N | Treatments | Formal Dose g ai/ha | Av population of LBB /m$^2$(1st Spray) | | | | | Av population of LBB /m$^2$(2nd Spray) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre count | 1 DAS | 2DAS | 7 DAS | 15 DAS | 1 DAS | 2DAS | 7 DAS | 15 DAS |
| 1 | Pymetrozine 50 % EC | 80 g | 0.93 (1.39) | 1.33 (1.53) | 1.20 (1.47) | 1.13 (1.46) | 1.40 (1.54) | 1.33 (1.53) | 1.67 (1.62) | 1.87 (1.69) | 1.93 (1.69) |
| 2 | Pymetrozine 50 % EC | 100 g | 1.00 (1.40) | 1.40 (1.55) | 1.40 (1.55) | 1.20 (1.47) | 1.40 (1.55) | 1.33 (1.53) | 1.80 (1.67) | 1.87 (1.68) | 2.20 (1.78) |
| 3 | Pymetrozine 50 % EC | 120 g | 0.80 (1.34) | 1.33 (1.52) | 1.40 (1.54) | 1.07 (1.43) | 1.20 (1.47) | 1.20 (1.48) | 1.93 (1.69) | 1.93 (1.71) | 1.87 (1.67) |
| 4 | Thiamethoxam 25% WG | 12.5 g | 1.40 (1.55) | 0.80 (1.33) | 0.67 (1.28) | 0.67 (1.28) | 0.73 (1.30) | 0.73 (1.31) | 0.87 (1.34) | 1.13 (1.46) | 1.20 (1.47) |
| 5 | Imidacloprid 17.8 SL | 20 ml | 1.07 (1.44) | 0.67 (1.29) | 0.33 (1.15) | 0.40 (1.18) | 0.67 (1.28) | 0.60 (1.26) | 0.67 (1.28) | 0.73 (1.31) | 1.20 (1.46) |
| 6 | Acetamiprid 20SP | 20 g | 0.73 (1.32) | 0.73 (1.31) | 0.67 (1.29) | 0.60 (1.26) | 0.93 (1.37) | 0.60 (1.26) | 0.73 (1.31) | 1.00 (1.41) | 1.40 (1.54) |
| 7 | Untreated Check | - | 1.20 (1.47) | 1.67 (1.63) | 1.73 (1.65) | 1.80 (1.67) | 2.00 (1.73) | 2.40 (1.84) | 2.47 (1.85) | 2.67 (1.91) | 3.07 (2.02) |
| **SE+** | | | **NS** | **0.070** | **0.071** | **0.070** | **NS** | **0.065** | **0.089** | **0.087** | **NS** |
| **CD 0.5%** | | | **NS** | **0.216** | **0.219** | **0.217** | **NS** | **0.201** | **0.273** | **0.267** | **NS** |
| **CV%** | | | **9.242** | **8.361** | **8.692** | **8.729** | **12.423** | **7.749** | **9.972** | **9.412** | **13.896** |

**Table: B7-10.2e. Effect of foliar application of new chemical molecules on ladybird beetle population in wheat during 2023-24 (Centre: Pusa)**

| S. No. | Treatments | Dose ml or g / ha | Aphid population per earhead | | | | Grain Yield(q/ha) |
|---|---|---|---|---|---|---|---|
| | | | Before spray | After spray | | | |
| | | | 1 day | 3 days | 7 days | 14 days | |
| 1 | Pymetrozine 50% WG | 80 g | 14.00 | 3.00 | 2.00 | 2.33 | 40.62 |
| 2 | Pymetrozine 50% WG | 100 g | 13.67 | 2.33 | 1.33 | 2.67 | 42.47 |
| 3 | Pymetrozine 50% WG | 120 g | 14.67 | 1.67 | 0.67 | 1.67 | 44.07 |
| 4 | Thiamethoxam 25% WG | 12.5 g | 14.33 | 2.67 | 1.33 | 2.67 | 40.00 |
| 5 | Imidacloprid 17.8 SL | 100 ml | 14.67 | 2.33 | 1.00 | 2.33 | 41.39 |
| 6 | Acetamiprid 20SP | 100 g | 13.67 | 2.67 | 2.00 | 2.67 | 39.12 |
| 7 | Untreated control | - | 13.67 | 14.33 | 19.00 | 19.67 | 34.45 |

**B8. Management of lepidoterous pests (pink stem borer, army worm & cutworms) of wheat:**
(**Centres:** Ludhiana Karnal & Kharibari)

**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 7th Nov 2023. The treatments included foliar application of chlorantraniliprole 18.5 SC @ 125 ml/ha, soil applications fipronil 0.6% GR @ 7 g/ha, soil application of chlorpyriphos 20EC @ 2.5 and foliar spray of flubendiamide 20%@ 40, 50 and 60 g/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 in Table B8 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 foliar spray of flubendiamide 20% @ 60 g/ha (0.92%) followed by foliar application of chlorantraniliprole 18.5 SC @ 125 ml/ha (0.93%). Seven days after treatment, the lowest PSB damage was recorded in soil application of chlorpyriphos 20EC @ 2.5/ha (0.76%) followed by soil application of fipronil 0.6% GR @ 7 kg/ha (0.83%) and it was at par with all other treatments except lower dosages of foliar spray of flubendiamide @ 40 g/ha (1.41%). However, all insecticidal treatments were significantly better than untreated control (2.93%). Similar trend was recorded 15 days after treatment. The grain yield (q/ha) obtained was maximum in plot treated with foliar spray of flubendiamide 20%@ 60 g/ha (51.10) and it was at par with all treatment except lower dosage of flubendiamide 20%@ 60 g/ha (49.82 q/ha) and the untreated check (48.92 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 (0.54%) followed by fipronil 0.6% GR @7 kg/ha (0.58%) and by chlorantraniliprole 18.5 SC @ 150 ml (0.59%). Similar trends were seen after seven days and fifteen days after treatment. The mean PSB damage was recorded after 15 of treatment was lowest 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 (47.84) followed by chlorantraniliprole 18.5 SC @ 150 (47.41) and fipronil 0.6% GR @7 kg/ha (47.21%). The lowest yield was recorded in the untreated check (43.02 q/ha) (Table B8-10.2b).

**Centre: Kharibari**

Data recorded during Rabi 2023 on damaged shoots before spraying indicated that there was no significant difference among the percent shoot damage in all the treatments (Table- 6a). Data recorded before the spray application ranged from 10.25 to 12.45 percent damaged shoots per plant. After the spray the highest percent control of shoot damage was recorded in Coragen 18.5 SC (chlorantraniliprole) 100ml/ha (70.13%) , Coragen 18.5 SC (chlorantraniliprole) 125 ml/ha (85.93%), Coragen 18.5 SC (chlorantraniliprole) 150 ml/ha (95.85%), Fipronil 0.6% GR @ 6.0 kg/ha (61.95%), Fipronil 0.6% GR @ 7.0 kg/ha (83.59%) and Fipronil 0.6% GR @ 8.0 kg/ha (94.94%) and were significantly superior when compared to the untreated control and comparative treatments, whereas in untreated control the shoot damage increased from 10.35 to 26.95 per plant (Table B8-10.2c & d).

**Table: B8-10.2a. Efficacy of various insecticides against pink stem borer of wheat during 2023-24 (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) | 125 ml | 3.28 | 0.93 | 0.86 | 0.66 | 50.88 |
| 2 | Soil application of fipronil 0.6 GR | 7 kg | 3.23 | 0.97 | 0.83 | 0.68 | 50.93 |
| 3 | Soil application of chlorpyriphos 20 EC | 2.5 l | 3.18 | 0.99 | 0.76 | 0.70 | 50.34 |
| 4 | Takumi 20 WG (flubendiamide 20%) | 40 g | 3.25 | 1.76 | 1.41 | 1.26 | 49.82 |
| 5 | Takumi 20 WG (flubendiamide 20%) | 50 g | 3.01 | 0.93 | 0.98 | 0.63 | 50.42 |
| 6 | Takumi 20 WG (flubendiamide 20%) | 60 g | 3.12 | 0.92 | 0.84 | 0.65 | 51.10 |
| 7 | Untreated Control | - | 3.09 | 3.13 | 2.93 | 2.63 | 48.92 |
| CD (p=0.05) | | - | NS | 0.19 | 0.14 | 0.15 | 1.02 |

* Figures in parentheses arc transformed means

| | | | | | |
|---|---|---|---|---|---|
| Date of sowing | : | 07-11-2023 | Plot size | : | 25 $m^2$ |
| Date of insecticidal application | : | 04-12-2024 | Variety | : | PBW 725 |
| Date of harvest | : | 29-04-2024 | Replications | : | Three |

**Table: B8-10.2b. Efficacy of various insecticides against lepidopterous pests pink stem borer, army worm & cutworms of wheat during 2023-24 (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 | 1.44 | 1.46 | 1.16 | 1.26 | 1.29 | 44.70 |
| 2 | Coragen 18.5 SC (chlorantraniliprole) | 125 ml | 1.39 | 0.66 | 0.36 | 0.33 | 0.45 | 47.02 |
| 3 | Coragen 18.5 SC (chlorantraniliprole) | 150 ml | 1.41 | 0.59 | 0.29 | 0.25 | 0.38 | 47.41 |
| 4 | Soil application of fipronil 0.6 GR | 6 kg | 1.4 | 1.35 | 1.06 | 1.01 | 1.14 | 47.11 |
| 5 | Soil application of fipronil 0.6 GR | 7 kg | 1.51 | 0.58 | 0.30 | 0.20 | 0.36 | 47.21 |
| 6 | Soil application of fipronil 0.6 GR | 8 kg | 1.48 | 0.54 | 0.26 | 0.13 | 0.31 | 47.84 |
| 7 | Soil application of chlorpyriphos 20EC | 2 litre | 1.58 | 1.42 | 1.17 | 1.06 | 1.22 | 45.64 |
| 8 | Soil application of chlorpyriphos 20EC | 2.5 llitre | 1.55 | 0.69 | 0.52 | 0.29 | 0.50 | 45.78 |
| 9 | Soil application of chlorpyriphos 20EC | 3.0 litre | 1.55 | 0.68 | 0.6 | 0.23 | 0.50 | 44.71 |
| 10 | Untreated Control | - | 1.57 | 2.44 | 2.22 | 2.33 | 2.33 | 43.02 |
| CD (p=0.05) | | - | NS | 0.40 | 0.41 | 0.43 | 0.58 | 0.42 |

* Figures in parentheses are transformed means

| | | | | | |
|---|---|---|---|---|---|
| Date of sowing | : | 11-11-2023 | Plot size | : | 25 $m^2$ |
| Date of insecticidal application | : | 10-12-2023 | Variety | : | HD2967 |
| Date of harvest | : | 15-04-2024 | Replications | : | Three |

**Table: B8-10.2c. Efficacy of various insecticides against pink stem borer of wheat during 2023-24 (Centre: Kharibari)**

| Tr. No. | Treatments | Dosage/ ha | Before treatment population / damaged tillers | % damaged panicle or tillers /Plot | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5 DAT | 10 DAT | 15 DAT | 20 DAT | 30 DAT | 60 DAT | Av. Pink stem borer population / plot after spray | % reduction over control |
| T1 | Coragen 18.5 SC (chlorantraniliprole) | 100 ml | 12.15 (3.56) | 0.00 (0.71) | 0.00 (0.71) | 1.45 (1.40) | 2.35 (1.69) | 6.55 (2.66) | 9.45** (3.15)* | **19.80** | **70.13** |
| T2 | Coragen 18.5 SC (chlorantraniliprole) | 125 ml | 12.45 (3.60) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 1.35 (1.36) | 4.56 (2.25) | **5.91** | **85.93** |
| T3 | Coragen 18.5 SC (chlorantraniliprole) | 150 ml | 10.65 (3.34) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.55 (1.02) | 1.15 (1.28) | **1.70** | **95.85** |
| T4 | Fipronil 0.6% GR | 6.0 kg | 10.85 (3.37) | 0.00 (0.71) | 0.00 (0.71) | 1.25 (1.32) | 2.75 (1.80) | 6.95 (2.73) | 10.75 (3.35) | **21.70** | **61.95** |
| T5 | Fipronil 0.6% GR | 7.0 kg | 11.35 (3.44) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.75 (1.12) | 1.85 (1.53) | 4.85 (2.31) | **7.45** | **83.59** |
| T6 | Fipronil 0.6% GR | 8.0 kg | 10.25 (3.28) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.85 (1.16) | 1.35 (1.36) | **2.20** | **94.94** |
| T7 | Chlorpyriphos 20 EC | 2.0 lt. | 10.55 (3.32) | 0.00 (0.71) | 0.00 (0.71) | 1.15 (1.28) | 6.25 (2.60) | 9.35 (3.14) | 14.75 (3.91) | **31.50** | **46.31** |
| T8 | Chlorpyriphos 20 EC | 2.5 lt. | 10.75 (3.35) | 0.00 (0.71) | 0.00 (0.71) | 3.25 (1.94) | 6.45 (2.64) | 9.75 (3.20) | 13.95 (3.80) | **33.40** | **50.16** |
| T9 | Chlorpyriphos 20 EC | 3.0 lt. | 11.15 (3.41) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 3.45 (1.99) | 7.95 (2.91) | 12.15 (3.56) | **23.55** | **58.15** |
| T10 | Untreated Check | - | 10.35 (3.29) | 11.75 (3.50) | 13.35 (3.72) | 16.75 (4.15) | 19.85 (4.51) | 23.55 (4.90) | 26.95 (5.24) | **112.20** | |
| **S.Em±** | | | **0.187** | **0.060** | **0.052** | **0.072** | **0.096** | **0.131** | **0.151** | | |
| **CD @0.05%** | | | **0.627** | **0.356** | **0.331** | **0.388** | **0.448** | **0.524** | **0.562** | | |

**Table: B8-10.2d. Efficacy of various insecticides against army worm of wheat during 2023-24 (Centre: Kharibari)**

| Tr.No. | Treatments | Dosage/ha | Before treatment population / damaged tillers | Mean nos. of population /Plot | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5 DAT | 10 DAT | 15 DAT | 20 DAT | 30 DAT | 60 DAT | Av. Armyworm population/plot after spray | % reduction over control |
| T1 | Coragen 18.5 SC (chlorantraniliprole) | 100 ml | 3.65 (2.04) | 0.00 (0.71) | 0.00 (0.71) | 0.50 (1.00) | 1.35 (1.36) | 2.15 (1.63) | 2.85** (1.83)* | 1.14 | **60.24** |
| T2 | Coragen 18.5 SC (chlorantraniliprole) | 125 ml | 4.20 (2.17) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.55 (1.02) | 1.15 (1.28) | 0.28 | **86.06** |
| T3 | Coragen 18.5 SC (chlorantraniliprole) | 150 ml | 3.75 (2.06) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.75 (1.12) | 0.13 | **89.82** |
| T4 | Fipronil 0.6% GR | 6.0 kg | 3.95 (2.11) | 0.00 (0.71) | 0.00 (0.71) | 1.15 (1.28) | 1.85 (1.53) | 2.75 (1.80) | 3.85 (2.09) | 1.60 | **50.37** |
| T5 | Fipronil 0.6% GR | 7.0 kg | 3.85 (2.09) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.85 (1.16) | 1.45 (1.40) | 1.95 (1.57) | 0.71 | **74.21** |
| T6 | Fipronil 0.6% GR | 8.0 kg | 4.25 (2.18) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 1.35 (1.36) | 0.23 | **83.83** |
| T7 | Chlorpyriphos 20 EC | 2.0 lt. | 3.65 (2.04) | 0.00 (0.71) | 0.00 (0.71) | 1.35 (1.36) | 2.15 (1.63) | 3.10 (1.90) | 4.15 (2.16) | 1.79 | **42.10** |
| T8 | Chlorpyriphos 20 EC | 2.5 lt. | 4.35 (2.20) | 0.00 (0.71) | 0.00 (0.71) | 1.10 (1.26) | 1.95 (1.57) | 2.45 (1.72) | 3.10 (1.90) | 1.43 | **63.71** |
| T9 | Chlorpyriphos 20 EC | 3.0 lt. | 4.95 (2.33) | 0.00 (0.71) | 0.00 (0.71) | 0.00 (0.71) | 0.75 (1.12) | 1.20 (1.30) | 2.35 (1.69) | 0.72 | **75.83** |
| T10 | Untreated Check | - | 4.15 (2.16) | 4.75 (2.29) | 5.65 (2.48) | 6.45 (2.64) | 7.15 (2.77) | 7.45 (2.82) | 8.15 (2.94) | 6.60 | |
| **S.Em±** | | | **0.118** | **0.043** | **0.037** | **0.045** | **0.056** | **0.074** | **0.097** | | |
| **CD @0.05%** | | | **0.499** | **0.302** | **0.277** | **0.309** | **0.344** | **0.393** | **0.450** | | |

**B9. Management of termites wheat through seed treatment and soil application of chemical molecules combinations**

(Centres: Ludhiana and Kanpur)

**Centre: Ludhiana**

The trial was conducted in the rainfed fields at New experimental area, Dept. of Plant Breeding and Genetics, PAU Ludhiana. The wheat variety PBW 660 was sown on 4th Nov 2023. Before sowing, the seeds were treated with Neonix @ 2 ml/kg of seeds and Cruiser @1.5 & 2 ml/kg of seeds by spraying on the spreaded layer of equal quantity of seed on polyethene sheet. The treated seed was dried overnight before sowing. The other treatments included were soil application three 2 different dosages of fipronil 0.3 GR ( 17.5 and 20 kg/ha) and chlorpyriphos 20 EC (2.5 and 3 l/ha) along with untreated check. Each treatment was replicated thrice. For recording observations on the plant population and damage plants, five spots of 2 m row lengths each, were ear -marked in each plot. The data revealed that differences in plant population/m row recorded after 3 weeks of germination among different treatments were non-significant. Hence, none of treatments 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 as compared to 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 minimum in the plot treated Cruiser 70 WS @1.5 ml/kg of seed (1.06 %) and it was on par with all the other treatments untreated check. The numbers of damaged effective tillers/ha were also lowest in plots treated with Cruiser 70 WS @1.5 ml/kg of seed (9000). All these insecticide treated plots recorded significantly lower number of damaged tillers/ha as compared to untreated check. The grain yield (q/ha) obtained was maximum in plot treated with soil application of chlorpyriphos @ 3 l/ha (47.21 q/ha) and it was at par with all treatments except untreated check (43.96 q/ha) (Table B10a-10.2a).

**Centre: Kanpur**

The data showed that the differences in plant population per meter row, recorded three weeks after germination, were not significant among the different treatments. This indicates that none of the treatments affected seed germination. The percentage of damaged effective tillers per meter row after 3, 4, and 5 weeks of germination revealed that all treatments resulted in significantly lower damage compared to the untreated control. However, the lowest level of termite damage was observed in the treatment with Cruiser 70 WS at 1.5 ml/kg of seed. The per cent damaged effective tillers/m row at crop maturity was also lowest (1.60) in Cruiser 70 WS at 1.5 ml/kg of seed treatment followed by treatment of Cruiser 70 WS at 1.0 ml/kg of seed. The grain yield (q/ha) obtained was maximum in plot treated with Cruiser 70 WS at 1.5 ml/kg followed by Cruiser 70 WS at 1.0 ml/kg of seed (28.05 q/ha) and untreated check recorded the lowest yield of 14.66 q/ha (Table B10a-10.2b).

**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) | 2 ml | 47.22 | 1.13 (7.33) | 1.08 (7.23) | 0.90 (6.80) | 1.21 (7.51) | 10083 (100.38) | 46.41 |
| 2 | Cruiser 70 WS (thiamethoxam) | 1.0 ml | 47.75 | 1.17 (7.42) | 1.07 (7.20) | 0.93 (6.87) | 1.19 (7.44) | 9416 (96.96) | 46.51 |
| 3 | Cruiser 70 WS (thiamethoxam) | 1.5 ml | 47.20 | 1.06 (7.17) | 0.99 (7.01) | 0.87 (6.72) | 1.17 (7.41) | 9000 (94.70) | 47.08 |
| 4 | Soil application of fipronil 0.3 GR | 17.5 kg 15 Kg | 47.70 | 1.26 (7.61) | 1.06 (7.18) | 0.97 (6.95) | 1.27 (7.64) | 9500 (97.14) | 46.80 |
| 5 | Soil application of fipronil 0.3 GR | 20 kg 15 Kg | 47.73 | 1.20 (7.49) | 1.02 (7.08) | 0.92 (6.85) | 1.19 (7.47) | 9166 (95.69) | 46.71 |
| 6 | Soil application of chlorpyriphos 20EC | 2.5 l | 47.95 | 1.28 (7.66) | 1.14 (7.35) | 1.04 (7.12) | 1.31 (7.71) | 9250 (96.15) | 46.33 |
| 7 | Soil application of chlorpyriphos 20EC | 3.0 l | 47.90 | 1.18 (7.45) | 1.01 (7.06) | 0.87 (6.73) | 1.29 (7.68) | 9083 (95.25) | 47.21 |
| 8 | Untreated control | - | 47.80 | 4.04 (12.30) | 3.92 (12.13) | 3.63 (11.72) | 3.19 (11.06) | 16333 (127.76) | 43.96 |
| CD (p=0.05) | | | NS | (0.54) | (0.46) | (0.47) | (0.80) | (9.63) | 0.97 |

* Figures in parentheses are transformed means

| | | | | | |
|---|---|---|---|---|---|
| Date of sowing | : | 04-11-2023 | Plot size | : | 20m$^2$ |
| Date of insecticidal application | : | 03-11-2023 & 23-11-23 | Variety | : | PBW 660 |
| Date of harvest | : | 22-04-2024 | Replications | : | Three |

**Table: B9-10.2c. Management of termites through seed treatment of chemical molecules combinations during 2023-24 (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 atcrop maturity | No. of damaged effective tillers/haat harvest | Grain yield | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 3 weeks | 4 weeks | 5 weeks | | | g/ m row | q/ha |
| 1. | Seed treatment with neonix | 1.5ml | 30.67 | 00 | 0.86(5.32) | 1.80(7.71) | 1.82(7.71) | 11296.29(106.28) | 66.39 | 19.77 |
| 2. | Seed treatment with neonix | 2.0ml | 28.63 | 00 | 0.84(5.26) | 1.78(7.49) | 1.80(7.71) | 1111.10(105.40) | 66.42 | 21.01 |
| 3. | Cruiser 70WS Thiamethoxam | 1.0ml | 28.80 | 00 | 0.55(4.25) | 1.62(7.27) | 1.63(7.27) | 4444.44(66.66) | 76.34 | 28.05 |
| 4. | Cruiser 70WS Thiamethoxam | 1.5ml | 29.20 | 00 | 0.51(4.09) | 1.56(7.04) | 1.60(7.27) | 3518.51(59.31) | 79.04 | 28.60 |
| 5. | Soil application of Fipronil 0.3GR | 15kg./ha | 28.80 | 00 | 0.82(5.20) | 1.75(1.49) | 1.77(7.49) | 10370.37(101.83) | 68.78 | 23.75 |
| 6. | Soil application of Fipronil 0.3GR | 17.5kg./ha | 30.60 | 00 | 0.77(5.03) | 1.70(7.49) | 1.73(7.49) | 7777.77(88.19) | 70.58 | 25.59 |
| 7. | Soil application of Fipronil 0.3GR | 20kg./ha | 30.33 | 00 | 0.60(4.44) | 1.65(7.27) | 1.67(7.27) | 4999.99(70.71) | 75.70 | 27.31 |
| 8. | Soil application of Chlorpyriphos 20EC | 2.0lit./ha | 29.63 | 00 | 0.84(5.26) | 1.76(7.49) | 1.78(7.49) | 10925.92(104.52) | 67.27 | 22.58 |
| 9. | Soil application of Chlorpyriphos 20EC | 2.5lit./ha | 26.60 | 00 | 0.81(5.16) | 1.72(7.49) | 1.75(7.49) | 9814.81(99.06) | 69.73 | 24.86 |
| 10. | Soil application of Chlorpyriphos 20EC | 3.0lit./ha | 31.16 | 00 | 0.66(4.66) | 1.67(9.28) | 1.70(9.46) | 7222.22(84.98) | 72.35 | 26.75 |
| 11. | Control | -- | 28.70 | 2.58 | 2.92(9.81) | 3.66(10.94) | 5.34(13.31) | 24999.89(158.11) | 50.22 | 14.66 |
| | SEm± | | -- | -- | 0.152 | 0.600 | 0.382 | 4.152 | 0.914 | 0.279 |
| | CD at 5% | | -- | -- | 0.450 | 1.782 | 1.136 | 12.334 | 2.714 | 0.829 |

* Arcsin transformed values and in parentheses are actual mean values

Date of sowing : 18/12/2023 — Date of insecticide application : 17/12/2023

Date of harvesting : 17/04/2024 — 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: K1317 Condition : Irrigated

## C. STORED GRAIN PEST MANAGEMENT

### C1. Storability and damage potential of major storage insect pests in wheat and barley

Each treatment consisted of 0.5 kg seed sample of wheat in a cloth bag. Freshly emerged adults of *Sitophilus oryzae* were released into each bag as per treatment details then bags were closed and kept undisturbed. The experiment was laid in CRD design with six replications. The 1st census count was taken 30 days after inoculation of insects and continued at 60, 90, 120, 150 and 180 days. At each census the dead insects were removed. During each census, data on weight of seed grains, adult survival population, percent grain damage and percent seed germination were taken.

**Wheat:** The average survival population of *S. oryzae* from 30 to 180 days after inoculation was significantly higher in damaging the wheat seed. At 30 days after inoculation, the population in T3 (inoculated with 10 pairs of *S. oryzae*) was found to be significantly higher than the untreated control but was on par with the populations in T2 (inoculated with 7 pairs of *S. oryzae*) and T1 (inoculated with 5 pairs of *S. oryzae*). Similar results were recorded at 60, 90, 120, 150, and 180 days after inoculation with *S. oryzae*.The percent weight loss due to *S. oryzae* inoculation shows that T3 again exhibited significantly higher weight loss, with the highest wheat grain weight loss ranging from 1.50 to 9.47 percent at 30 to 180 days after inoculation. However, the treatments T2 and T1 were found to be on par with T3, showing wheat grain weight losses of 1.20 to 7.03 percent and 1.17 to 6.63 percent, respectively. The percent grain damage showed that the treatment T3 was significantly superior in damaging the wheat grains. However, treatments T2 and T1 were found to be on par with T3. A similar trend of results was recorded for the percentage of seed germination of wheat grains.The seedling vigour index showed that treatment T3 had the lowest seedling vigour index of 851.59, but it was found to be on par with T2, which had a seedling vigour index of 974.42.It is concluded that considerable losses in grain weight were observed with the increasing population of *S. oryzae*. Additionally, lower germination rates and the lowest seedling vigour index were recorded with increasing storage days, from 30 to 180 days

**Barley:** The average survival population of *S. oryzae* from 30 to 180 days after inoculation was significantly superior in damaging the barley seed. At 30 days after inoculation, the population in T3 (inoculated with 10 pairs of *S. oryzae*) was found to be significantly higher than the untreated control but was on par with the populations in T2 (inoculated with 7 pairs of *S. oryzae*) and T1 (inoculated with 5 pairs of *S. oryzae*). Similar results were recorded at 60, 90, 120, 150, and 180 days after inoculation with *S. oryzae*. Percent weight loss due to *S. oryzae* inoculation shows that T3 again exhibited significantly higher weight loss, with the highest wheat grain weight loss ranging from 5.14 to 11.94 percent at 30 to 180 days after inoculation. However, the treatments T2 and T1 were found to be on par with T3, showing barley grain weight losses of 5.07 to 11.74 percent and 4.41 to 11.42 percent, respectively. The percent grain damage showed that the treatment T3 was significantly superior in damaging the barley grains. However, treatments T2 and T1 were found to be on par with T3. A similar trend of results was recorded for the percentage of seed germination of barley grains.The treatment T3 had the lowest seedling vigour index of 1034.36, but it was found to be on par with T2 and T1, which had a seedling vigour index of 1057.85 and 1196.48 respectively. Considerable losses in grain weight were observed with the increasing population of *S. oryzae*. Additionally, lower germination rates and the lowest seedling vigour index were recorded with increasing storage days, from 30 to 180 days. Observations are still being recorded in Karnal experiment as it started late in the season (Table C1-10.3a).

**Table: C1-10.3a. Storability and damage potential of major storage insect pests *Sitophilus oryzae* of wheat & barley during 2023-24 (Location:Niphad)**

| Tr. No. | Wheat<br>Treatments | Average survival population of *S. oryzae* Days after inoculation (DAI) | | | | | | Per cent loss of grain weight Days after inoculation of *S. oryzae* | | | | | | Per cent Grain Damage | Per cent Germin ation | Seedl-ing Vigour Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 30 DAI | 60 DAI | 90 DAI | 120 DAI | 150 DAI | 180 DAI | 30 DAI | 60 DAI | 90 DAI | 120 DAI | 150 DAI | 180 DAI | | | |
| 1 | Inoculation of 5 pair of *Sitophilus oryzae* | 14.33 (3.90) | 17.17 (4.23) | 19.17 (4.47) | 20.17 (4.59) | 20.67 (4.62) | 22.00 (4.77) | 1.17 (6.17) | 1.83 (7.78) | 2.03 (8.16) | 4.80 (12.22) | 5.70 (13.79) | 6.63 (14.91) | 3.88 (11.33) | 80.00 (63.69) | 1086.68 |
| 2 | Inoculation of 7 pair of *Sitophilus oryzae* | 17.00 (4.24) | 17.67 (4.30) | 19.83 (4.54) | 20.83 (4.66) | 21.17 (4.69) | 23.00 (4.89) | 1.20 (6.21) | 2.27 (8.63) | 2.47 (8.96) | 5.13 (13.04) | 6.40 (14.60) | 7.03 (14.85) | 3.99 (11.51) | 75.33 (60.71) | 974.42 |
| 3 | Inoculation of 10 pair of *Sitophilus oryzae* | 18.50 (4.39) | 19.17 (4.48) | 20.83 (4.67) | 21.67 (4.69) | 21.67 (4.74) | 23.83 (4.97) | 1.50 (7.01) | 2.33 (8.69) | 2.50 (9.06) | 5.90 (14.05) | 6.80 (14.93) | 9.47 (17.91) | 4.40 (12.06) | 71.33 (57.89) | 851.59 |
| 8 | Untreated control | 3.00 (1.98) | 4.50 (2.34) | 7.33 (2.88) | 9.50 (3.22) | 10.00 (3.29) | 13.50 (3.79) | 0.70 (4.67) | 1.37 (6.70) | 1.73 (7.54) | 2.77 (9.51) | 3.77 (11.15) | 4.70 (12.44) | 2.35 (8.81) | 91.33 (73.37) | 1266.21 |
| | **SE±** | **0.155** | **0.177** | **0.168** | **0.220** | **0.217** | **0.182** | **0.384** | **0.365** | **0.401** | **0.865** | **0.690** | **1.021** | **0.357** | **2.365** | **44.121** |
| | **CD @5%** | **0.461** | **0.526** | **0.498** | **0.654** | **0.645** | **0.540** | **1.141** | **1.084** | **1.190** | **2.571** | **2.051** | **3.032** | **1.061** | **7.027** | **131.074** |
| | **C.V.** | **10.47** | **11.31** | **9.929** | **12.56** | **12.26** | **9.67** | **15.64** | **11.25** | **11.64** | **17.37** | **12.42** | **16.64** | **8.003** | **9.069** | **10.345** |

| Tr. No. | Barley<br>Treatments | Average survival population of *S. oryzae* Days after inoculation (DAI) | | | | | | Per cent loss of grain weight Days after inoculation of *S. oryzae* | | | | | | Per cent Grain Damage | Per cent Germin ation | Seedl-ing Vigour Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 30 DAI | 60 DAI | 90 DAI | 120 DAI | 150 DAI | 180 DAI | 30 DAI | 60 DAI | 90 DAI | 120 DAI | 150 DAI | 180 DAI | | | |
| 1 | Inoculation of 5 pair of *Sitophilus oryzae* | 13.09 (3.74) | 17.00 (4.23) | 25.00 (5.08) | 26.50 (5.22) | 32.50 (5.77) | 16.33 (4.14) | 4.41 (12.03) | 5.52 (13.54) | 6.77 (15.08) | 8.40 (16.82) | 10.24 (18.64) | 11.42 (19.74) | 4.01 11.54 | 82.00 (64.93) | 1196.48 |
| 2 | Inoculation of 7 pair of *Sitophilus oryzae* | 15.27 (4.03) | 19.83 (4.56) | 29.17 (5.48) | 32.33 (5.76) | 41.83 (6.52) | 17.50 (4.29) | 5.07 (12.96) | 5.87 (13.99) | 6.81 (15.12) | 8.72 (17.16) | 10.28 (18.69) | 11.77 (20.06) | 4.41 12.09 | 80.67 (64.12) | 1057.85 |
| 3 | Inoculation of 10 pair of *Sitophilus oryzae* | 16.41 (4.14) | 21.31 (4.69) | 31.33 (5.65) | 46.00 (6.85) | 53.33 (7.36) | 18.83 (4.44) | 5.14 (13.08) | 5.90 (14.03) | 6.84 (15.13) | 8.75 (17.20) | 10.35 (18.74) | 11.94 (20.20) | 5.05 12.87 | 74.67 (60.10) | 1034.36 |
| 8 | Untreated control | 1.61 (1.60) | 2.09 (1.74) | 3.17 (2.02) | 5.17 (2.46) | 8.67 (3.10) | 12.67 (3.69) | 1.01 (5.48) | 1.77 (7.52) | 2.78 (9.54) | 3.78 (11.20) | 4.51 (12.25) | 5.66 (13.75) | 1.82 7.74 | 88.67 (70.55) | 1290.32 |
| | **SE±** | **0.140** | **0.162** | **0.196** | **0.156** | **0.199** | **0.155** | **0.627** | **0.510** | **0.374** | **0.339** | **0.387** | **0.320** | **0.497** | **1.769** | **66.179** |
| | **CD @5%** | **0.417** | **0.482** | **0.584** | **0.464** | **0.591** | **0.462** | **1.863** | **1.516** | **1.112** | **1.007** | **1.149** | **0.950** | **1.476** | **5.256** | **196.604** |
| | **C.V.** | **10.173** | **10.447** | **10.553** | **7.538** | **8.568** | **9.199** | **14.114** | **10.184** | **6.689** | **5.323** | **5.547** | **4.247** | **11.007** | **6.676** | **14.161** |

## CO-OPERATORS

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# PROGRAMME 11. WHEAT NEMATOLOGY

## Crop Health Survey

### Rajasthan

Survey was conducted in the different cultivator's 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 ofstunting, yellowing, patchy and poor growth were recorded during survey of each field. Roots samples were collected from the rhizospere of wheat and barley crops looking above ground symptoms along with 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 six 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. ECN was not found in collected grain sample of wheat.

### Haryana

Crop health monitoring survey of wheat and barley was done in the month of March, 2024 in Hisar, Karnal and Rewari districts of Haryana. Roots of wheat and barley plants were checked on the spot for the detection of white female of cyst nematode and further a total of 21 soil and root samples from Karnal district, around 09 samples from the experimental plots of DDUCEOF, CCSHAU, Hisar and 15 samples from Rewari district were collected for lab analysis to identify the other important plant parasitic nematodes (PPNs) associated with both the crops. The collected soil & root samples were processed with the help of Cobb's sieving and decanting. Out of 45 samples, cereal cyst nematode (CCN, *Heteroderaavenae*) wasreported from 10 samples of Rewari district only (Table 11.1). Other plant parasitic nematodes present in 200 cc soil samples were *Tylenchorhynchus* sp., *Hoplolaimus* sp., *Helicotylenchus* sp., *Pratylenchus* sp., Criconematids and Dorylaimids. 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**

| Nematode species | No. of infested samples | Frequency of occurrence (%) | No. of cysts/200ccsoil | No. of nematodes/200cc soil |
|---|---|---|---|---|
| *Heterodera avenae* | 10/45 | 22.22 | 12-43 | - |
| *Tylenchorhynchus* sp. | 13/45 | 28.88 | - | 02-41 |
| *Pratylenchus* sp. | 04/45 | 08.88 | - | 03-14 |
| *Helicotylenchus* sp. | 03/45 | 06.66 | - | 01-06 |
| *Hoplolaimus* sp. | 07/45 | 15.55 | - | 02-16 |
| *Criconematids* sp. | 08/45 | 17.77 | - | 01-11 |
| *Dorylaimids* sp. | 32/45 | 71.11 | - | 01-58 |

**Studies of pathotypes of *Heterodera avenae:***

The Pathotypes studies of cereal cyst nematode were carried out during the crop season 20023-24 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). It is pertinent to mention here that only RARI center is maintaining International Test Assortment (ITA).

**Table:11.2. Reaction of *Heterodera avenae* of Jaipur population on International differentials.**

| S.No. | International Differentials | Reactions | S.N. | 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 | P-313221 | R | 20 | Loros | S |
| 8 | Martin | R | 24 | Ortalan | S |
| 9 | KVL-191 | R | 25 | Nidar-2 | S |
| 10 | Harlan | R | 26 | Siri | R |
| 11 | IK2 Light | S | 21 | La-estanzuella | R |
| 12 | Psathia | R | 22 | L-62 | S |
| 13 | Capa | S | 23 | Varda | S |
| Pathotype Ha 21, Rating scale : 0-5% = resistant, 6-100% = susceptible | | | | | |

**Host Resistance**

**Resistance against Cereal cyst nematode (*Heterodera avenae*)**

One hundred forty six wheat germplasm (AVT) were received from ICAR-IIWBR, Karnal. Nursery was planted in naturally sick field against cereal cyst nematode, *Heterodera avenae* (Pathotypes Ha 21) of RARI, Durgapura, Jaipur. The inoculums level was 7.2 L/gm of soil. Out of 146 germplasm, none was found resistant and moderately resistant. All germplasm were found susceptible (64) or highly susceptible (82) (Table 11.3).

**Table: 11.3. Screening of AVT lines of wheat against cereal cyst nematode during 2023-2024 at different locations**

| S. No. | Entry | Durgapura | Hisar | Highest reaction |
|---|---|---|---|---|
| 1. | HD3086 (C) | HS | S | HS |
| 2. | HI1668* | HS | S | HS |
| 3. | HD3494 | HS | HS | HS |
| 4. | DBW417 | HS | S | HS |
| 5. | DBW88 (C) | HS | S | HS |
| 6. | PBW957 | HS | HS | HS |
| 7. | DBW222(C)* | HS | S | HS |
| 8. | DBW477 | S | NG | S |
| 9. | HD3471 | S | S | S |
| 10. | PBW916 | S | S | S |
| 11. | DBW386* | S | S | S |
| 12. | PBW826 (C) | S | S | S |
| 13. | DBW476 | S | S | S |
| 14. | HD2967 | S | S | S |
| 15. | PBW725 | S | S | S |
| 16. | HD3386 (I)(C) | S | S | S |
| 17. | PBW958 | S | S | S |
| 18. | HD3455 | S | HS | HS |
| 19. | HD3059 (C) | S | S | S |
| 20. | JKW261 (C) | S | S | S |
| 21. | NW8071 | S | HS | HS |
| 22. | DBW173 (C) | S | S | S |
| 23. | WH1324 | S | NG | S |
| 24. | DBW422 | S | S | S |
| 25. | RAJ4581 | S | S | S |
| 26. | HD3428 | S | S | S |
| 27. | HD3495 | S | S | S |
| 28. | PBW771 (C) | S | S | S |
| 29. | PBW921 | S | S | S |
| 30. | PBW644 (C) | S | S | S |
| 31. | HI1653 (C) | S | S | S |
| 32. | PBW927 | HS | S | HS |
| 33. | HD3369 | HS | HS | HS |
| 34. | HD3468 | S | S | S |
| 35. | NIAW3170 (C) | S | S | S |
| 36. | WH1326 | HS | HS | HS |
| 37. | DBW296 | HS | S | HS |
| 38. | JKW304 | S | NG | S |
| 39. | WH1402 (I)(C) | S | S | S |
| 40. | PBW908 | HS | S | HS |
| 41. | HP1978 | S | S | S |

| | | | | |
|---|---|---|---|---|
| 42. | HD3447 | HS | S | HS |
| 43. | PBW915 | HS | S | HS |
| 44. | HD3388(I) (C) | HS | S | HS |
| 45. | UP3124 | HS | S | HS |
| 46. | KRL2106 | HS | S | HS |
| 47. | HD3249 (C) | HS | S | HS |
| 48. | PBW913 | S | S | S |
| 49. | HD3467 | S | HS | HS |
| 50. | BCW29 | S | S | S |
| 51. | UP3123 | S | S | S |
| 52. | HI1563 (C) | S | S | S |
| 53. | DBW107 (C)* | S | S | S |
| 54. | PBW833 (C) | S | S | S |
| 55. | WH1323 | S | S | S |
| 56. | HD3118 (C) | S | HS | HS |
| 57. | HI1621 (C) | S | HS | HS |
| 58. | HD3171 (C) | S | HS | HS |
| 59. | HD3460 | HS | S | HS |
| 60. | HD3293 (C) | S | S | S |
| 61. | HI1612 (C) | S | S | S |
| 62. | K1317(C)* | HS | S | HS |
| 63. | VL2041 (C) | S | HS | HS |
| 64. | HPW349 (C) | HS | S | HS |
| 65. | VL2059 | HS | S | HS |
| 66. | HS562 (C) | S | S | S |
| 67. | VL907 (C) | HS | HS | HS |
| 68. | MACS6837 | HS | HS | HS |
| 69. | MACS4125 (d) | S | HS | HS |
| 70. | MACS4135 (d) | HS | S | HS |
| 71. | HI1669 | HS | HS | HS |
| 72. | HI1683 | S | HS | HS |
| 73. | HI1684 | S | S | S |
| 74. | HI8848 (d) | S | S | S |
| 75. | HI8849 (d) | HS | S | HS |
| 76. | HI8850 (d) | HS | S | HS |
| 77. | GW554 | S | S | S |
| 78. | GW555 | S | S | S |
| 79. | MP3570 | S | S | S |
| 80. | MPO1395 | S | S | S |
| 81. | GW322 | S | S | S |
| 82. | MACS6768 | HS | S | HS |
| 83. | HI1650 | HS | S | HS |
| 84. | GW547 (I) | S | S | S |
| 85. | HI8737 (d) | HS | S | HS |

| | | | | |
|---|---|---|---|---|
| 86. | HI8713 (d) | HS | S | HS |
| 87. | HI1674 | S | S | S |
| 88. | HI1687 | S | HS | HS |
| 89. | WSM138 | S | S | S |
| 90. | MACS6830 | HS | HS | HS |
| 91. | DBW425 | HS | HS | HS |
| 92. | GW556 | HS | S | HS |
| 93. | HD2932* | HS | S | HS |
| 94. | MP4010* | HS | S | HS |
| 95. | HI1634 | HS | S | HS |
| 96. | CG1029 | S | NG | S |
| 97. | DBW441M | S | HS | HS |
| 98. | DBW428 | S | S | S |
| 99. | DBW432 | HS | S | HS |
| 100. | UAS3029 | S | NG | S |
| 101. | UAS484 (d) | S | S | S |
| 102. | NIAW4267 | HS | S | HS |
| 103. | HI8851 (d) | HS | S | HS |
| 104. | HI8852 (d) | HS | S | HS |
| 105. | MACS4131(d) | HS | S | HS |
| 106. | MPO1398 (d) | HS | HS | HS |
| 107. | DBW110 | HS | S | HS |
| 108. | CG1036 | HS | HS | HS |
| 109. | HI1655* | S | HS | HS |
| 110. | HI8627 (d) | HS | S | HS |
| 111. | HI8823 (d) | HS | S | HS |
| 112. | DBW359 (I)* | HS | S | HS |
| 113. | CG1040 (I) | HS | S | HS |
| 114. | MACS6842 | HS | S | HS |
| 115. | MACS6844 | S | HS | HS |
| 116. | NIAW4364 | S | HS | HS |
| 117. | PBW891 | HS | S | HS |
| 118. | DBW443* | HS | S | HS |
| 119. | DDW62(d) | S | S | S |
| 120. | AKAW5100* | S | S | S |
| 121. | WH1306 | S | HS | HS |
| 122. | NWS2222 | S | S | S |
| 123. | UAS3026 | HS | HS | HS |
| 124. | CG1045 | S | HS | HS |
| 125. | MPO1395 (d) | S | HS | HS |
| 126. | MACS6222 | S | S | S |
| 127. | MP1378 (I) | S | HS | HS |
| 128. | MACS3949 (d) | HS | S | HS |
| 129. | DBW426 | S | HS | HS |

| | | | | |
|---|---|---|---|---|
| 130. | MACS6829 | HS | S | HS |
| 131. | NIAW4114* | HS | NG | HS |
| 132. | NIAW4120 | S | S | S |
| 133. | NIAW4432 | HS | HS | HS |
| 134. | UAS3027 | HS | S | HS |
| 135. | LOK79 | S | NG | S |
| 136. | RAJ4083 (C) | HS | HS | HS |
| 137. | HD3090 (C) | HS | S | HS |
| 138. | HI1633 (C) | S | S | S |
| 139. | CG1047 | S | HS | HS |
| 140. | GW1368(d) | S | S | S |
| 141. | HI1605 | HS | HS | HS |
| 142. | NIAW3170 | HS | HS | HS |
| 143. | UAS446(d) | S | S | S |
| 144. | NIDW1149 (d) | S | S | S |
| 145. | HI1665 (I) | S | S | S |
| 146. | UAS478 (d)(I) | S | S | S |

**Multiple Disease/Pest Screening Nursery (MDSN)**

Forty-eight entries were screened against cereal cyst nematode *Heterodera avenae* 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 (20) or highly susceptible (28)category.

**Organic management of Cereal Cyst Nematode (CCN), *Heterodera avenae* in Wheat**

**Durgapura:**

An experiment was conducted to test efficacy of different type of Bio pesticide at Rajasthan Agricultural Research Institute, Durgapura, Jaipur in sick field of Molya disease. Inoculum level of CCN was 6.2 larvae/g soil. The experiment consisted of ten treatments *viz* (T1) *Purpureocillium lilacinum* @ 2.5 Kg /ha.,(T2) *Purpureocillium lilacinum* @ 3.5 Kg /ha.,(T3) *Pseudomonas fluorescens* @ 2.5 Kg /ha.,(T4) *Pseudomonas fluorescens* @ 3.5 Kg /ha.,(T5) *Trichoderma harzianum*@ 2.5 Kg /ha.,(T6) *Trichoderma harzianum*@ 3.5 Kg /ha.,(T7) T1+500 kg Vermicompost / ha,(T8) T4+500 kg Vermicompost / ha,(T9) T6+500 kg Vermicompost / ha, (T10) Untreated check. Completely randomized block design was used with three replications. The crop was examined for count of white no. of cyst/plant in each treatment after 90 days after sowing. The yield was taken at the time of harvesting of the cropin each treatment block wise. The results revealed that treatment (T9) T6+500 kg Vermicompost/ha, gave 56.66 q/ha by reducing number of cyst/plant followed by (T6) *Trichoderma harzianum*@ 3.5 Kg /ha. (Table11.4). It can be concluded that *Trichodermaharzianum*@ 3.5 Kg /ha. With 500 kg vermicom post is effective control for cereal cyst Nematode, *Heterodera avenae* in wheat.

**Table: 11.4. Organic management of Cereal cyst nematode, *Heterodera avenae* in wheat at Durgapura**

| Treatment | Description | Dose (Kg a.i. per ha) | Mean no of cyst per plant |
|---|---|---|---|
| T1 | *Purpureocillium lilacinum* | 2.5 Kg /ha. at sowing | 6.00 |
| T2 | *Purpureocillium lilacinum* | 3.5 Kg /ha. at sowing | 5.00 |
| T3 | *Pseudomonas fluorescens* | 2.5 Kg /ha. at sowing | 7.66 |
| T4 | *Pseudomonas fluorescens* | 3.5 Kg /ha. at sowing | 7.33 |
| T5 | *Trichoderma harzianum* | 2.5 Kg /ha. at sowing | 2.66 |
| T6 | *Trichoderma harzianum* | 3.5 Kg /ha. at sowing | 2.33 |
| T7 | *Purpureocillium lilacinum*+ vermicompost | 2.5 Kg /ha. +500 kg/ha atsowing | 4.33 |
| T8 | *Pseudomonas fluorescens*+Vermicompost | 3.5 Kg /ha +500 kg/ha atsowing | 7.00 |
| T9 | *Trichoderma harzianum*+ Vermicompost | 3.5 Kg /ha. +500 kg/ha atsowing | 1.33 |
| T10 | Untreated check | | 34.66 |
| CD at 5% | | | 1.15 |

Phtyto-toxicity: Nil

**Hisar :**

The experiment on "Management of cereal cyst nematode, *Heterodera avenae* in wheat through bio-agents and organic manure" was done in screen house in earthen pots of 1 kg capacity (15 cm size) using the bioagents alone and in combination with vermicomposting (T1- *Purpureocillium lilacinum* @ 2.5 kg/ha, T2- *Purpureocillium lilacinum* @ 3.5 kg/ha, T3-*Pseudomonas fluorescens* @ 2.5 kg/ha T4- *Pseudomonas fluorescens* @ 3.5 kg/ha, T5- *Trichoderma harzianum* @ 2.5 kg /haT6- *Trichoderma harzianum* @ 3.5 kg /haT7- T2+500 kg Vermicompost/haT8- T4+500 kg Vermicompost/haT9- T6+500 kg Vermicompost/ha and T10- Untreated Check) in a completely randomized design (CRD) with three replications of each using susceptible wheat variety (WH-1105). Bioagents were mixed in soil just before thesowing (17 Nov 2023) in their respective treatments while vermicompost enriched with bioagents were added one week before sowing in the soil. An observation on number of cyst/plants was recorded after 110 days of sowing. The minimum population of cysts (07 cysts/plant) was observed in T9 treatment (*Trichoderma harzianum* @ 3.5 kg /ha + 500 kg Vermicompost/ha) followed by the other two combined treatments (Table 11.5). All the treatments increased the growth parameters of wheat crop and reduced the nematode population whereas maximum number of nematodes (43 cyst/plant) and minimum plantgrowth parameters were recorded in untreated check. It can be concluded that *Trichoderma harzianum*@ 3.5 Kg /ha with 500 kg vermicompost is effective control for cereal cyst Nematode, *Heterodera avenae* in wheat.

**Table:11.5. Organic management of Cereal cyst nematode, *Heterodera avenae* in wheat at Hisar**

| Treatment | Description | Dose | No of cyst/plant |
|---|---|---|---|
| T1 | *Purpureocillium lilacinum* | 2.5 kg/ha | 14 |
| T2 | *Purpureocillium lilacinum* | 3.5kg/ha | 12 |
| T3 | *Pseudomonas fluorescens* | 2.5 kg/ha | 16 |
| T4 | *Pseudomonas fluorescens* | 3.5kg/ha | 13 |
| T5 | *Trichoderma harzianum* | 2.5 kg/ha | 18 |
| T6 | *Trichoderma harzianum* | 3.5kg/ha | 14 |
| T7 | T2+Vermicompost | 500kg/ha | 10 |
| T8 | T4+Vermicompost | 500kg/ha | 10 |
| T9 | T6+Vermicompost | 500kg/ha | 7/plant |
| T10 | Untreated check | No chemical- | 43 |
| CD @ 5% | | | |

Phtyto-toxicity: Nil

## COOPERATORS

| NAME | CENTER |
|---|---|
| PRIYANKA DUGGAL | HISAR |
| S. P. BISNOI | DURGAPURA |
| PRADEEP SHARMA, PREM LAL KASHYAP, & RAVINDRA KUMAR | KARNAL (COORDINATING UNIT) |

**Annexure: 1. Seedling response of AVT lines against the pathotypes of *Puccinia graminis* f. sp. *tritici* (wheat black rust) during 2023-24 atICAR-IIWBR, RS, Shimla**

| S. No. | Variety/line | Pathotype | | | | | | | | | | | | | | | | | | | | | | | *Sr*-genes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 11 | 11A | 15-1 | 21 | 21-1 | 21A-2 | 24A | 34-1 | 40-A | 40-1 | 40-2 | 40-3 | 42B | 117A | 117A-1 | 117-1 | 117-2 | 117-3 | 117-4 | 117-6 | 122 | 184 | 295 | |
| **1** | HD3086(C) | S | S | S | R | R | R | R | R | MS | R | S | MS | R | R | R | R | R | MR | R | R | S | R | S | *Sr7b+2+* |
| **2** | HI1668 | R | R | R | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | MR | R | *#Sr30+2+* |
| **3** | HD3494 | R | R | R | R | R | R | R | R | R | R | R | S | R | R | R | R | R | MR | R | R | R | MR | R | *Sr13+11+* |
| **4** | DBW417 | MS | S | MR | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | *Sr9b+13+* |
| **5** | DBW88 (C) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | *Sr11+2+* |
| **6** | PBW957 | R | R | R | R | MS | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | MR | R | R | *Sr9b+13+11+* |
| **7** | DBW222(C) | S | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | *#* |
| **8** | DBW477 | S | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - |
| **9** | HD3471 | MS | R | R | MR | R | R | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | R | R | R | *Sr13+7b+* |
| **10** | PBW916 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **11** | DBW386 | MS | R | S | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | S | R | R | *#Sr9b+13+11+* |
| **12** | PBW826(C) | R | R | S | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | S | R | R | *Sr30+8a+2+* |
| **13** | DBW476 | MR | R | R | R | MR | R | R | R | R | R | MR | R | R | R | R | R | R | MR | R | R | R | MR | R | *Sr13+7b+* |
| **14** | HD2967 | R | R | MS | R | R | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | R | R | MR | R | *Sr8a+11+2+* |
| **15** | PBW725 | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | S | R | R | *Sr11+7b+* |
| **16** | HD3386(I)(C) | MR | R | MR | R | S | R | R | R | R | R | MR | S | R | R | R | R | R | R | R | R | R | R | R | *Sr30+5+2+* |
| **17** | PBW958 | R | R | R | R | MR | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | R | MR | R | R | *Sr13+7b+* |
| **18** | HD3455 | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | *Sr13+7b+* |
| **19** | HD3059(C) | S | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | MR | R | R | R | R | R | *Sr11+2+* |
| **20** | JKW261(C) | S | S | S | R | MS | R | R | R | R | R | S | S | R | R | R | R | R | MR | R | R | S | R | R | *Sr11+* |
| **21** | NW8071 | MR | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - |
| **22** | DBW173(C) | S | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | NG | R | R | R | R | *Sr31+5+2+* |
| **23** | WH1324 | MR | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | MS | R | *Sr13+11+* |
| **24** | DBW422 | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | *Sr9b+13+11+* |
| **25** | RAJ4581 | S | R | R | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | MR | R | *Sr13+11+* |
| **26** | HD3428 | S | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - |
| **27** | HD3495 | R | R | S | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | MR | R | R | R | R | R | *Sr9e+13+* |
| **28** | PBW771(C) | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr31+2+* |
| **29** | PBW921 | MR | R | R | R | R | R | R | R | R | R | R | S | R | R | R | R | R | MR | MR | R | R | MR | R | *Sr9e+11+* |
| **30** | PBW644(C) | R | R | R | R | MS | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | R | R | R | R | *Sr11+2+* |
| **31** | HI1653(C) | MS | R | R | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | R | R | *Sr7b+* |
| **32** | PBW927 | MR | R | R | R | R | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | R | MR | R | R | *Sr13+7b+* |
| **33** | HD3369 | R | R | R | R | R | R | MR | R | R | R | R | MS | MS | MR | R | MS | S | R | MR | R | S | R | MS | *Sr13+* |
| **34** | HD3468 | S | R | R | R | R | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | MR | MS | R | S | *Sr11+7b+* |
| **35** | NIAW3170(C) | R | R | MR | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | R | R | *Sr8a+2+* |
| **36** | WH1326 | MS | R | R | R | R | R | R | R | R | R | R | R | R | R | NG | R | NG | R | R | R | R | R | R | - |
| **37** | DBW296 | R | R | MR | R | R | R | R | R | R | R | R | R | MS | MR | R | R | MS | MR | MR | R | MS | R | R | *Sr13+7b+* |
| **38** | JKW304 | S | R | S | R | R | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | *Sr13+7b+* |
| **39** | WH1402(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* |
| **40** | PBW908 | S | R | R | R | MS | R | R | R | R | MR | R | S | R | R | R | R | R | R | R | MR | MS | S | R | *Sr13+11+7b+* |

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **41** | HP1978 | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **42** | HD3447 | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | MR | R | *R* |
| **43** | PBW915 | MR | R | R | R | MR | R | R | R | S | R | R | S | R | R | R | R | R | MR | R | R | R | R | R | *Sr13+11+* |
| **44** | HD3388(I)(C) | R | MR | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | *Sr13+7b+* |
| **45** | UP3124 | MR | R | R | R | MS | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | R | R | R | R | *Sr30+5+* |
| **46** | KRL2106 | MR | MR | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | MR | R | R | *Sr9b+13+7b+* |
| **47** | HD3249 (C) | MS | R | R | R | S | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | R | R | *Sr11+2+* |
| **48** | PBW913 | MS | R | R | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | R | R | *Sr13+11+* |
| **49** | HD3467 | S | R | R | R | MR | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | MR | MS | R | R | *Sr11+7b+* |
| **50** | BCW29 | R | R | MS | R | R | R | R | R | R | R | R | MS | R | R | R | R | MR | R | R | MS | R | R | R | *Sr13+7b+* |
| **51** | UP3123 | S | S | R | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | MS | R | R | R | *Sr9b+13+* |
| **52** | HI1563 (C) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **53** | DBW107(C) | S | S | MR | S | MR | S | MR | R | R | MS | S | MS | R | R | R | MR | MR | MR | R | R | R | R | R | *#* |
| **54** | PBW833(C) | S | R | R | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | R | R | *Sr7b+2+* |
| **55** | WH1323 | MR | R | R | R | R | R | R | R | R | R | NG | MS | R | R | R | R | R | R | R | R | R | NG | R | *Sr30+5+* |
| **56** | HD3118(C) | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | *Sr9b+11+* |
| **57** | HI1621(C) | MR | R | S | R | R | R | R | R | R | R | MR | S | R | R | R | R | R | R | R | R | R | R | R | *Sr28+* |
| **58** | HD3171 (C) | MS | R | R | R | R | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | R | R | R | R | *Sr11+7b+2+* |
| **59** | HD3460 | MR | R | MS | R | R | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | MR | *Sr13+* |
| **60** | HD3293 (C) | S | S | MR | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | MR | S | *Sr13+2+* |
| **61** | HI1612 (C) | S | S | MS | R | R | R | R | R | R | R | MS | S | R | R | R | R | R | R | R | MS | MR | R | MS | *Sr7b+2+* |
| **62** | K1317(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* |
| **63** | VL2041 (C) | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | *Sr30+5+11+* |
| **64** | HPW349 (C) | MS | R | S | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | S | R | R | *Sr7b+2+* |
| **65** | VL2059 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **66** | HS562 (C) | MS | R | MS | R | R | R | R | R | R | R | S | S | R | R | R | R | R | R | R | R | MS | MR | R | *Sr8a+9b+11+* |
| **67** | VL907 (C) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr31+2+* |
| **68** | MACS6837 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **69** | MACS4125(d) | R | R | R | R | R | R | S | R | R | R | R | R | R | S | MR | S | R | S | S | R | R | S | R | *Sr11+* |
| **70** | MACS4135(d) | R | R | R | R | R | R | S | R | R | R | R | R | R | S | MS | S | R | S | S | MR | R | S | R | *Sr11+* |
| **71** | HI1669 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **72** | HI1683 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **73** | HI1684 | R | R | R | R | R | R | R | R | R | NG | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **74** | HI8848(d) | R | R | MR | R | R | R | S | R | R | R | R | R | R | MR | R | MS | S | MR | R | R | R | S | R | *Sr7b+2+* |
| **75** | HI8849(d) | R | R | MR | R | R | R | S | R | R | R | R | R | R | S | S | S | S | S | S | S | R | S | R | *Sr7b+* |
| **76** | HI8850(d) | R | R | R | R | R | R | S | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | MS | R | *Sr7b+* |
| **77** | GW554 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **78** | GW555 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **79** | MP3570 | R | R | S | R | R | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | R | MS | R | R | *Sr9b+13+2+* |
| **80** | MPO1395 | R | R | R | R | R | R | S | R | R | R | R | R | R | S | MS | S | S | S | MS | R | MR | S | R | *Sr9e+2+* |
| **81** | GW322 | S | R | R | R | S | R | R | R | R | R | R | MR | R | MR | R | MR | R | MR | MR | R | MS | R | MS | *Sr11+2+* |
| **82** | MACS6768 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr31+2+* |
| **83** | HI1650 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr31+* |
| **84** | GW547(I) | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+2+R* |
| **85** | HI8737(d) | R | R | R | R | R | R | S | R | R | R | R | MR | S | S | R | S | R | MS | MR | R | MR | S | R | *Sr9e+2+* |
| **86** | HI8713(d) | R | R | R | R | R | R | R | R | R | R | R | R | R | MS | R | MS | MR | MR | MR | R | R | S | R | *Sr9e+2+* |
| **87** | HI1674 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **88** | HI1687 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **89** | WSM138 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |

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| **90** | MACS6830 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **91** | DBW425 | MR | S | MR | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | R | R | *Sr5+9b+13+* |
| **92** | GW556 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **93** | HD2932 | R | R | R | R | MR | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | *Sr11+* |
| **94** | MP4010 | MR | R | R | R | S | R | R | R | R | MR | R | MS | R | R | R | R | R | R | R | R | MS | R | MER | - |
| **95** | HI1634 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr31+* |
| **96** | CG1029 | R | R | R | NG | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+2+R* |
| **97** | DBW441M | R | R | R | R | R | R | R | R | R | MR | MR | R | R | R | R | R | R | R | R | R | R | R | R | *Sr8b+7b+2+* |
| **98** | DBW428 | MR | R | R | R | R | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | R | MR | R | R | *Sr9b+13+11+* |
| **99** | DBW432 | S | S | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | *Sr9b+13+11+* |
| **100** | UAS3029 | R | R | S | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | *Sr9b+13+11+* |
| **101** | UAS484(d) | R | R | MS | R | R | R | S | R | R | R | R | MS | R | MR | R | S | MS | MR | S | MR | R | MS | R | *Sr7b+2+* |
| **102** | NIAW4267 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **103** | HI8851(d) | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | MR | R | *Sr13+7b+* |
| **104** | HI8852(d) | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | MS | MR | R | MS | R | MS | R | *Sr13+7b+2+* |
| **105** | MACS4131(d) | R | R | R | R | R | MR | S | R | R | R | R | R | S | S | R | S | MS | S | S | S | R | S | R | *Sr7b+* |
| **106** | MPO1398(d) | R | R | S | R | R | R | S | MR | R | R | R | S | R | S | R | S | MR | MS | MR | R | R | S | R | *Sr7b+2+* |
| **107** | DBW110 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **108** | CG1036 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr7b+2+* |
| **109** | HI1655 | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | *Sr2+R* |
| **110** | HI8627(d) | R | R | R | R | R | R | MR | R | R | R | R | R | R | MR | R | MS | R | MR | R | MR | R | S | R | *Sr13+11+7b+* |
| **111** | HI8823(d) | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr11+2+* |
| **112** | DBW359(I) | MS | R | R | R | R | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | MS | R | MR | R | *Sr9b+7b+2+* |
| **113** | CG1040(I) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **114** | MACS6842 | MS | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - |
| **115** | MACS6844 | 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** | NIAW4364 | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - |
| **117** | PBW891 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **118** | DBW443 | 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** | DDW62(d) | R | R | MS | R | R | R | S | R | R | R | R | S | R | S | MR | S | MR | S | MR | MR | R | MS | R | *Sr9e+2+* |
| **120** | AKAW5100 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr31+2+* |
| **121** | WH1306 | R | R | NG | R | R | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | R | R | R | R | *Sr30+5+2+* |
| **122** | NWS2222 | R | R | R | R | R | R | R | R | R | R | R | MS | R | R | R | R | R | R | R | R | R | R | R | *Sr30+5+* |
| **123** | UAS3026 | S | R | R | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | MR | R | MR | R | *Sr13+11+7b+* |
| **124** | CG1045 | MS | R | R | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | R | R | *Sr30+2+* |
| **125** | MPO1395(d) | R | R | R | R | R | R | S | MR | R | R | R | R | R | R | MS | S | S | S | MS | S | R | S | R | *Sr9e+2+* |
| **126** | MACS6222 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+2+R* |
| **127** | MP1378(I) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr31+* |
| **128** | MACS3949(d) | R | R | S | MR | R | R | S | R | MR | R | R | R | R | S | R | S | S | MR | S | R | R | MS | R | *Sr7b+2+* |
| **129** | DBW426 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **130** | MACS6829 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **131** | NIAW4114 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **132** | NIAW4120 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **133** | NIAW4432 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **134** | UAS3027 | R | R | R | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | R | R | *Sr30+5+2+* |
| **135** | LOK79 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr24+R* |
| **136** | RAJ4083 (C) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr11+2+* |
| **137** | HD3090 (C) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr31+* |
| **138** | HI1633 (C) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr31+2+* |

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| **139** | CG1047 | S | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - |
| **140** | GW1368(d) | S | S | S | R | MR | MS | R | R | S | S | S | MS | MS | R | R | S | MR | S | S | R | S | MS | S | - |
| **141** | HI1605 | MS | R | R | R | MR | R | R | R | S | R | R | R | R | R | R | R | R | R | R | R | MS | R | MR | *Sr5+11+* |
| **142** | NIAW3170 | R | R | S | R | R | R | R | R | R | R | R | MR | MR | R | R | R | R | R | R | R | R | R | R | *Sr8a+2+* |
| **143** | UAS446(d) | R | R | MR | R | R | R | S | R | MR | R | R | MR | R | S | MR | S | MS | MS | MS | MR | R | S | MR | *Sr11+2+* |
| **144** | NIDW1149(d) | R | R | R | R | R | R | MR | R | MS | R | R | R | MS | MS | R | MR | MR | MR | R | R | MR | S | R | *Sr11+2+* |
| **145** | HI1665(I) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *Sr2+R* |
| **146** | UAS478(d)(I) | R | R | S | R | R | R | S | R | R | R | S | MR | R | S | MR | S | MS | MR | S | S | R | S | R | *Sr7b+2+* |

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

**Annexure: 2. Seedling response of AVT lines against the pathotypes of *Puccinia triticina* (wheat brown rust) during 2023-24 at ICAR-IIWBR, RS, Shimla**

| S. No. | Variety/ line | Pathotype | | | | | | | | | | | | | | | | | | | | | | | *Lr*-gene |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 11 | 12--2 | 12--3 | 12--5 | 12--7 | 16--1 | 20--1 | 77 | 77-1 | 77-2 | 77-5 | 77-7 | 77-8 | 77-9 | 77-10 | 77A-1 | 104-1 | 104-2 | 106 | 107-1 | 108-1 | 162-1 | 162A | |
| **1** | HD3086 (C) | R | S | R | R | S | R | R | R | S | S | S | S | S | S | S | R | S | M | R | R | R | S | R | *Lr23+10+3+* |
| **2** | HI1668 | R | R | MR | S | S | R | S | R | S | S | S | MR | MS | S | S | R | R | R | R | R | MR | MIX | R | *#Lr13+* |
| **3** | HD3494 | R | MR | MR | Mix | S | R | S | R | R | R | S | R | R | S | S | S | R | R | R | R | R | R | R | *Lr13+* |
| **4** | DBW417 | R | R | R | MR | MS | R | R | MS | MS | MS | S | MR | MS | S | S | R | R | R | R | R | R | R | R | *Lr13+* |
| **5** | DBW88 (C) | R | R | R | R | S | R | R | R | S | S | S | S | S | S | S | R | R | R | R | R | R | S | R | *Lr13+10+3+* |
| **6** | PBW957 | R | R | R | R | S | R | S | R | S | S | S | S | S | S | S | R | R | MS | R | R | R | S | MR | *Lr13+10+* |
| **7** | DBW222(C) | R | Mix | MS | MR | MS | R | R | R | R | R | MS | R | R | S | S | R | R | S | R | R | MS | R | R | *#Lr13+* |
| **8** | DBW477 | R | R | R | R | S | R | S | R | S | S | S | MR | S | S | S | S | R | MR | R | R | R | R | R | *Lr13+10+* |
| **9** | HD3471 | R | R | R | R | MS | R | R | R | MR | MS | MS | S | R | S | S | R | R | R | R | R | R | MS | R | *Lr13+10+* |
| **10** | PBW916 | R | R | R | R | S | R | S | R | S | S | S | S | MR | S | S | R | R | S | R | R | R | M | R | *Lr13+10+* |
| **11** | DBW386 | R | R | R | R | R | R | S | R | S | MS | S | R | R | S | S | R | R | MS | R | R | R | R | R | *#Lr13+10+1+* |
| **12** | PBW826 (C) | R | R | R | R | R | R | R | R | R | S | MS | MS | R | S | S | R | R | MS | R | R | R | R | R | *Lr23+1+* |
| **13** | DBW476 | R | R | R | R | MS | R | S | R | S | MS | S | MS | MS | S | S | R | R | R | R | R | R | S | R | *Lr13+10+* |
| **14** | HD2967 | R | R | R | MS | MS | R | MS | R | R | S | S | S | R | S | MS | R | R | R | R | R | R | R | R | *Lr23+* |
| **15** | PBW725 | R | R | R | R | S | R | S | R | S | S | S | S | MR | S | S | R | R | R | R | NG | R | S | R | *Lr13+10+* |
| **16** | HD3386 (I) (C) | R | MR | R | R | R | R | S | Mix | S | S | S | MR | R | S | S | R | R | R | R | R | MR | R | R | *Lr13+10+* |
| **17** | PBW958 | R | MR | R | R | S | R | S | R | S | S | S | S | S | S | S | R | R | R | R | R | R | MS | R | *Lr13+10+* |
| **18** | HD3455 | R | S | S | S | S | MS | R | S | S | S | S | S | R | S | S | S | S | S | R | S | S | S | S | - |
| **19** | HD3059 (C) | R | R | MS | R | S | R | R | R | S | S | S | S | MS | S | S | S | MR | R | R | R | R | S | R | *Lr13+3+* |
| **20** | JKW261 (C) | R | MS | MS | S | S | R | R | R | R | R | S | R | R | S | MR | R | MS | S | R | R | R | R | R | *Lr23+13+* |
| **21** | NW8071 | R | R | R | R | R | R | R | R | S | R | S | S | R | S | R | MR | R | R | R | R | R | R | R | *Lr13+1+* |
| **22** | DBW173 (C) | R | R | R | R | R | R | R | R | S | R | S | S | R | S | S | R | R | R | R | R | R | R | R | *Lr26+10+3+* |
| **23** | WH1324 | NG | NG | R | R | R | NG | R | R | S | MS | S | R | NG | NG | NG | R | R | R | R | R | R | NG | R | *Lr13+1+* |
| **24** | DBW422 | R | R | R | R | R | R | S | S | S | R | S | R | R | S | S | R | R | R | R | R | R | R | R | *Lr13+1+* |
| **25** | RAJ4581 | R | R | R | R | R | R | S | M | S | S | S | R | R | S | S | S | R | R | R | R | R | R | R | *Lr13+* |
| **26** | HD3428 | R | R | R | R | R | R | S | S | S | S | S | R | MS | S | S | S | R | R | R | R | R | R | R | *Lr13+1+* |
| **27** | HD3495 | R | R | R | R | MR | R | S | R | S | MR | S | S | S | S | S | R | M | R | R | R | R | R | R | *Lr13+10+* |
| **28** | PBW771 (C) | R | R | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | R | R | R | *Lr26+23+1+* |
| **29** | PBW921 | R | R | R | R | S | R | S | R | S | S | S | S | S | S | S | R | R | R | R | R | R | S | R | *Lr13+10+* |
| **30** | PBW644 (C) | R | R | R | R | R | R | MS | MR | S | S | S | R | R | S | NG | R | S | S | R | R | R | NG | R | *Lr13+1+* |
| **31** | HI1653 (C) | R | R | R | MR | S | R | R | R | S | S | S | R | S | S | S | Mix | R | R | R | R | R | S | R | *Lr13+10+3+* |
| **32** | PBW927 | R | R | R | R | R | R | S | R | R | R | S | R | MR | S | S | R | R | R | R | R | R | S | R | *Lr13+10+* |
| **33** | HD3369 | R | S | S | S | S | R | MS | S | S | S | S | R | MS | S | R | R | S | S | R | R | R | R | R | *Lr13+* |
| **34** | HD3468 | R | R | R | R | S | R | S | R | S | S | S | MS | R | S | S | R | R | MR | R | R | R | MS | R | *Lr13+10+* |
| **35** | NIAW3170 (C) | R | R | R | R | S | R | MS | R | S | S | S | R | R | S | S | R | R | R | R | R | R | R | R | *Lr13+10+1+* |
| **36** | WH1326 | R | R | R | MR | MS | NG | MR | R | S | MS | S | R | MS | S | S | MIX | R | R | R | NG | NG | S | R | *Lr13+* |
| **37** | DBW296 | R | S | R | S | S | R | R | S | R | S | S | R | R | S | S | R | S | S | R | R | R | R | R | *Lr23+13+10+* |
| **38** | JKW304 | R | MR | MR | S | S | R | S | S | S | S | S | MS | S | S | S | S | R | S | R | R | MS | R | R | *Lr13+* |
| **39** | WH1402 (I) (C) | R | R | R | R | R | NG | S | S | S | S | S | R | R | R | R | NG | S | MIX | R | R | R | NG | R | *Lr13+1+* |
| **40** | PBW908 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **41** | HP1978 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |

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| **42** | HD3447 | R | S | R | R | R | R | R | S | R | MS | S | R | R | R | R | R | M | R | R | R | R | R | R | *Lr13+* |
| **43** | PBW915 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | *Lr28+* |
| **44** | HD3388 (I) (C) | R | S | R | MIX | R | R | R | R | MIX | R | S | MR | R | MIX | S | R | S | R | R | R | R | MIX | R | *Lr13+3+* |
| **45** | UP3124 | R | R | R | R | S | R | MS | R | R | R | S | R | R | S | M | R | R | R | R | R | R | R | R | *Lr23+10+* |
| **46** | KRL2106 | R | R | MS | S | S | R | R | R | R | R | S | R | R | S | M | R | R | R | R | R | R | S | R | *Lr13+* |
| **47** | HD3249 (C) | R | R | R | R | S | R | S | R | S | S | S | MS | R | S | S | R | R | R | R | R | R | S | R | *Lr13+* |
| **48** | PBW913 | R | R | R | R | S | R | S | R | S | S | S | S | MS | S | S | R | R | R | R | R | R | S | R | *Lr13+10+* |
| **49** | HD3467 | R | R | R | R | R | R | S | R | R | S | S | R | R | S | S | R | R | R | R | R | R | R | R | *Lr23+1+* |
| **50** | BCW29 | R | R | S | S | S | R | S | S | S | S | S | R | S | S | S | S | MS | MIX | R | R | S | S | S | *Lr13+* |
| **51** | UP3123 | R | R | R | R | R | R | R | MS | S | R | S | R | R | S | M | S | R | R | R | R | R | R | R | *Lr13+1+* |
| **52** | HI1563 (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+Lr24+* |
| **53** | DBW107 (C) | R | S | R | S | S | R | R | R | R | MIX | S | S | MR | S | NG | R | S | S | R | R | NG | R | R | *#Lr23+* |
| **54** | PBW833 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - | R | R | R | R | R | *R* |
| **55** | WH1323 | R | NG | NG | NG | NG | R | S | R | MS | S | S | S | R | S | NG | NG | R | R | R | R | R | MIX | R | - |
| **56** | HD3118 (C) | R | S | S | S | S | R | S | S | S | S | S | S | S | S | S | S | S | S | R | R | S | M | S | - |
| **57** | HI1621 (C) | R | S | R | MR | S | R | S | S | S | S | S | S | S | S | S | S | MR | MR | R | R | MS | R | R | *Lr13+* |
| **58** | HD3171 (C) | R | R | MR | R | S | NG | MS | R | S | S | S | MS | MS | S | NG | R | MIX | S | R | R | R | MS | Mix | *Lr23+13+10+* |
| **59** | HD3460 | R | S | M | S | S | R | R | R | MR | S | S | S | R | S | S | R | S | MS | R | R | MIX | R | MR | *Lr23+* |
| **60** | HD3293 (C) | R | R | R | S | MS | R | S | R | R | R | S | R | R | S | S | R | R | S | R | R | R | R | R | *Lr13+10+* |
| **61** | HI1612 (C) | R | S | R | S | S | R | M | R | R | R | S | R | R | R | R | R | S | S | R | R | R | R | R | *Lr23+* |
| **62** | K1317 (C) | R | S | R | R | R | R | S | S | S | S | S | MS | MS | S | S | S | R | MR | R | R | R | R | R | *#Lr13+* |
| **63** | VL2041 (C) | R | R | S | S | S | R | S | S | S | S | S | MS | S | S | S | S | R | MS | R | R | MS | R | MS | *Lr13+* |
| **64** | HPW349 (C) | R | MS | MS | R | S | R | R | S | S | S | S | S | R | S | S | R | S | S | R | R | R | MS | R | *Lr13+10+* |
| **65** | VL2059 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **66** | HS562 (C) | R | S | R | R | S | R | R | R | S | S | S | S | S | S | S | R | S | S | R | R | R | MR | R | *Lr23+10+3+* |
| **67** | VL907 (C) | R | R | R | R | MS | R | S | R | R | R | S | MS | R | S | R | R | R | MR | R | R | R | S | R | *Lr26+10+* |
| **68** | MACS6837 | R | R | R | R | R | R | S | R | MR | R | M | R | R | S | M | R | R | R | R | R | R | R | R | *Lr23+1+* |
| **69** | MACS4125 (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* |
| **70** | MACS4135 (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* |
| **71** | HI1669* | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **72** | HI1683 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **73** | HI1684 | R | NG | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **74** | HI8848 (d) | S | R | MR | S | S | S | S | R | R | R | R | R | R | MS | R | R | R | S | S | R | R | R | MS | - |
| **75** | HI8849 (d) | MR | R | MS | S | S | S | R | R | R | R | R | R | R | MR | R | R | MR | MR | R | R | R | MS | S | - |
| **76** | HI8850 (d) | R | R | R | S | MIX | S | R | R | R | R | R | R | R | MS | R | R | R | S | R | R | R | R | MR | - |
| **77** | GW554 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **78** | GW555 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **79** | MP3570 | R | NG | R | R | S | R | R | R | S | S | S | R | MS | S | NG | R | MIX | MIX | R | R | R | R | R | *Lr13+10+* |
| **80** | MPO1395 | S | M | R | R | R | R | MS | R | R | R | R | R | R | R | MS | R | R | MS | S | R | R | R | R | - |
| **81** | GW322 | R | R | R | MR | MS | R | S | S | S | S | S | S | M | S | S | MS | M | R | R | R | R | R | R | *Lr13+1+* |
| **82** | MACS6768 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr26+* |
| **83** | HI1650 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr26+* |
| **84** | GW547 (I) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **85** | HI8737 (d) | R | R | R | S | S | S | R | R | R | R | R | R | R | R | R | R | R | MS | R | R | R | R | R | - |
| **86** | HI8713 (d) | S | MS | MS | S | S | S | R | R | R | R | R | R | R | R | R | R | MS | S | S | R | R | S | MS | - |
| **87** | HI1674* | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *#R+Lr24+* |
| **88** | HI1687 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **89** | WSM138 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **90** | MACS6830 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |

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| **91** | DBW425 | R | R | R | R | R | R | R | S | S | S | S | R | S | S | S | S | S | S | R | R | R | S | S | *Lr3+* |
| **92** | GW556 | R | R | R | R | R | NG | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **93** | HD2932 | R | S | S | S | S | MS | S | S | S | S | S | S | S | S | S | S | S | S | R | S | S | S | S | - |
| **94** | MP4010 | R | R | R | R | R | R | R | S | S | MIX | MIX | S | R | S | S | S | MIX | MIX | R | R | R | R | S | *#Lr13+1+* |
| **95** | HI1634 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr26+* |
| **96** | CG1029 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **97** | DBW441M* | R | S | MIX | MIX | MIX | R | S | S | S | S | S | S | M | S | S | R | S | MIX | R | S | S | R | S | *Lr13+* |
| **98** | DBW428 | R | MS | S | S | S | R | R | R | R | R | MR | R | R | R | R | R | MR | MS | R | R | R | S | MS | *Lr13+* |
| **99** | DBW432 | R | R | R | R | R | R | M | R | S | MS | S | R | S | S | MS | MS | R | R | R | R | R | R | R | *Lr13+1+* |
| **100** | UAS3029 | R | S | R | R | S | R | MIX | R | R | S | S | R | R | S | MS | R | S | R | R | R | R | R | R | *Lr23+10+* |
| **101** | UAS484 (d) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | *R* |
| **102** | NIAW4267 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **103** | HI8851 (d) | R | NG | R | S | S | S | S | R | R | R | R | R | R | R | R | R | R | S | MS | R | R | MR | R | *Lr23+* |
| **104** | HI8852 (d) | R | R | R | MS | MR | S | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | *Lr23+* |
| **105** | MACS4131(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* |
| **106** | MPO1398 (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* |
| **107** | DBW110 | R | MS | MR | MR | MR | R | S | S | S | S | S | S | R | S | S | MIX | S | R | R | R | MS | R | MR | *Lr23+10+1+* |
| **108** | CG1036 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *#R* |
| **109** | HI1655 | R | R | R | R | MS | R | R | R | R | R | R | R | R | S | R | R | R | R | R | R | R | R | R | *#* |
| **110** | HI8627 (d) | MS | S | MS | S | S | MS | R | R | R | R | R | R | R | MS | MR | R | S | S | MS | R | R | S | S | - |
| **111** | HI8823 (d) | S | S | S | S | S | S | R | R | R | R | R | R | R | S | MS | R | S | S | S | R | R | S | S | - |
| **112** | DBW359 (I) | R | MS | S | S | S | R | R | S | S | S | S | R | MS | S | S | S | R | S | R | R | R | S | S | *#Lr3+* |
| **113** | CG1040 (I) | R | S | S | S | S | R | S | S | S | S | S | S | S | S | S | S | S | S | R | R | S | R | S | *Lr13+* |
| **114** | MACS6842 | R | R | R | R | R | R | MR | R | S | R | S | R | R | S | S | MS | R | R | R | R | R | R | R | *Lr13+1+* |
| **115** | MACS6844 | R | R | R | R | MS | R | MS | MS | S | MR | S | R | S | S | S | S | R | R | R | R | R | R | R | *Lr13+* |
| **116** | NIAW4364 | R | S | R | R | S | R | MR | S | S | S | S | S | S | S | S | S | MS | S | R | R | R | R | MS | *Lr13+* |
| **117** | PBW891* | R | MR | MIX | R | MS | R | MIX | R | R | MS | MS | R | R | S | MS | R | R | R | R | R | R | MIX | R | *Lr13+10+* |
| **118** | DBW443* | R | R | R | R | R | R | S | S | S | M | S | S | MR | S | S | S | R | R | R | R | R | R | R | *#Lr13+1+* |
| **119** | DDW62(d) | R | R | R | S | MS | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | R | - |
| **120** | AKAW5100* | R | R | S | S | S | R | R | R | S | R | S | S | R | S | MS | R | R | S | R | R | R | S | R | *#Lr26+* |
| **121** | WH1306* | R | MS | S | NG | S | NG | NG | S | S | S | S | S | S | S | S | NG | R | S | R | R | R | NG | S | - |
| **122** | NWS2222* | R | R | R | R | MR | R | S | S | S | S | S | S | S | S | S | S | R | R | R | R | S | R | R | *Lr13+* |
| **123** | UAS3026 | R | MS | R | R | S | R | MS | R | R | R | S | R | R | S | NG | R | R | R | R | R | R | R | R | *Lr23+10+* |
| **124** | CG1045 | R | R | R | R | R | R | MS | S | S | R | S | R | MS | S | M | S | R | R | R | NG | R | R | R | *Lr13+1+* |
| **125** | MPO1395 (d) | S | MS | R | R | R | R | S | R | R | R | R | R | R | R | MR | R | R | MR | S | R | R | R | R | - |
| **126** | MACS6222 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | NG | R | R | *R+Lr24+* |
| **127** | MP1378 (I) | R | R | R | S | S | R | S | R | R | R | R | R | R | R | R | R | R | MS | R | R | R | R | R | *Lr26+* |
| **128** | MACS3949 (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* |
| **129** | DBW426 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **130** | MACS6829 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | MR | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **131** | NIAW4114* | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *#R+Lr24+* |
| **132** | 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+Lr24+* |
| **133** | NIAW4432 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr24+* |
| **134** | UAS3027 | R | R | R | R | R | R | R | R | S | R | S | R | R | S | R | R | R | R | R | R | R | R | R | *Lr13+1+* |
| **135** | 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+Lr24+* |
| **136** | RAJ4083 (C) | R | MIX | R | R | S | MS | S | S | S | S | S | S | R | S | S | R | S | S | R | R | R | R | R | *Lr13+* |
| **137** | HD3090 (C) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr26+* |
| **138** | HI1633 (C) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R+Lr26+* |
| **139** | CG1047 | NG | MS | R | S | S | R | S | S | S | S | S | S | R | S | S | R | M | R | R | R | R | R | R | *Lr13+* |

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| **140** | GW1368(d) | R | MS | S | S | S | S | MR | R | R | S | S | R | R | S | S | R | S | S | MS | R | R | MS | S | - |
| **141** | HI1605 | R | MS | S | S | S | R | S | S | S | R | MS | R | MS | S | S | MS | MS | S | R | MR | R | S | S | *Lr13+* |
| **142** | NIAW3170 | R | R | R | R | R | R | S | R | S | S | S | S | R | S | S | R | R | R | R | R | R | R | R | *Lr13+10+1+* |
| **143** | UAS446(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* |
| **144** | NIDW1149 (d) | R | MIX | MIX | S | S | S | R | R | S | R | R | R | R | M | R | R | MIX | MIX | MIX | R | R | R | R | *Lr23+* |
| **145** | HI1665 (I) | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **146** | UAS478 (d)(I) | R | R | R | S | S | MIX | R | R | R | R | R | R | R | R | R | R | S | MIX | R | R | R | R | R | *Lr23+* |

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

**Annexure: 3. Seedling response of AVT lines against the pathotypes of *Puccinia striiformis*f. sp. *tritici* (wheat yellow rust) during 2023-24 at ICAR-IIWBR, RS, Shimla**

| S. No. | Variety/line | Pathotype | | | | | | | | | | | | | | | *Yr*-gene |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 46S119 | 110S119 | 238S119 | 78S84 | 110S84 | P | T | 79S4 | 79S68 | 111S68 | K | N | 6S0 | 7S0 | 14S64 | |
| **1** | HD3086 (C) | R | S | S | R | S | S | S | R | MR | R | S | S | R | R | R | *Yr2+* |
| **2** | HI1668 | S | MS | S | R | S | S | S | R | R | R | S | S | R | R | R | *#Yr2+* |
| **3** | HD3494 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **4** | DBW417 | MS | S | S | R | MS | S | S | R | R | R | S | S | MS | MR | R | - |
| **5** | DBW88 (C) | S | S | S | R | MS | R | R | R | R | R | R | - | R | R | R | - |
| **6** | PBW957 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **7** | DBW222(C) | S | S | S | MS | MS | R | R | R | R | R | R | R | R | R | R | *#Yr2+* |
| **8** | DBW477 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **9** | HD3471 | R | S | S | MS | R | S | S | R | R | R | S | S | R | R | R | *Yr2+* |
| **10** | PBW916 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **11** | DBW386 | S | S | S | R | S | S | S | R | R | R | S | MS | R | R | R | *#Yr2+* |
| **12** | PBW826 (C) | S | S | S | R | R | S | S | R | R | R | MIX | MS | R | R | R | *Yr2+* |
| **13** | DBW476 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **14** | HD2967 | S | S | S | R | R | S | S | R | R | R | S | S | R | R | R | *Yr2+* |
| **15** | PBW725 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **16** | HD3386(I)(C) | S | S | S | R | R | S | S | MR | R | R | MS | MS | R | R | R | *Yr2+* |
| **17** | PBW958 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **18** | HD3455 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **19** | HD3059 (C) | S | S | S | R | MS | R | S | S | MR | R | R | MR | R | R | R | *Yr2+* |
| **20** | JKW261 (C) | S | S | S | R | S | MS | R | R | R | R | MS | MS | R | MR | R | - |
| **21** | NW8071 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **22** | DBW173 (C) | S | S | S | R | MR | R | R | R | R | MR | R | R | R | R | R | *Yr9+* |
| **23** | WH1324 | R | R | R | R | - | S | S | R | R | R | MR | S | - | R | R | - |

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| **24** | DBW422 | R | S | S | R | MS | S | S | R | R | R | S | R | R | R | R | *Yr2+* |
| **25** | RAJ4581 | S | S | S | MS | R | S | S | R | R | R | S | S | R | R | R | *Yr2+* |
| **26** | HD3428 | S | S | S | R | MR | S | S | R | R | R | S | S | R | R | R | *Yr2+* |
| **27** | HD3495 | R | R | S | R | R | R | R | R | R | R | R | R | R | R | R | - |
| **28** | PBW771 (C) | R | R | S | R | R | R | R | R | R | R | R | R | R | R | R | *Yr9+* |
| **29** | PBW921 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **30** | PBW644 (C) | S | S | S | R | S | MR | R | R | R | R | MR | R | R | R | R | *Yr2+* |
| **31** | HI1653 (C) | S | S | S | R | S | S | S | R | R | MR | S | S | R | R | R | *Yr2+* |
| **32** | PBW927 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **33** | HD3369 | S | S | S | MS | S | S | S | R | R | MR | S | S | MR | MS | R | - |
| **34** | HD3468 | S | S | S | MS | S | S | S | R | R | R | S | S | R | R | R | *Yr2+* |
| **35** | NIAW3170 (C) | S | S | S | S | S | S | S | R | MS | R | S | S | R | MR | MS | *Yr2+* |
| **36** | WH1326 | R | S | S | R | MS | S | S | R | R | R | S | S | R | R | R | *Yr2+* |
| **37** | DBW296 | R | S | S | S | S | S | S | MR | R | MR | S | S | R | MR | R | *Yr2+* |
| **38** | JKW304 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **39** | WH1402(I)(C) | R | R | - | R | - | R | R | R | R | R | - | R | R | R | R | *R* |
| **40** | PBW908 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **41** | HP1978 | S | S | S | R | R | S | S | R | R | R | S | S | R | R | R | *YrA+* |
| **42** | HD3447 | R | R | R | R | R | S | S | R | R | R | MS | S | R | R | R | *Yr2+* |
| **43** | PBW915 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **44** | HD3388(I)(C) | S | MS | S | R | S | R | MS | R | R | R | R | R | R | R | R | *Yr2+* |
| **45** | UP3124 | MS | R | MS | R | R | R | R | R | R | R | R | R | R | R | R | - |
| **46** | KRL2106 | R | S | S | R | R | S | S | R | R | R | S | S | R | R | R | *YrA+* |
| **47** | HD3249 (C) | S | S | S | MS | R | S | S | R | R | R | S | S | R | R | R | *Yr2+* |
| **48** | PBW913 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **49** | HD3467 | R | R | S | R | R | R | R | R | R | R | R | R | R | R | R | - |
| **50** | BCW29 | R | MR | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |

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| **51** | UP3123 | S | S | S | R | R | S | S | R | R | R | S | S | R | R | R | *YrA+* |
| **52** | HI1563 (C) | S | S | S | R | MR | R | S | R | R | R | MS | MS | R | R | R | *Yr2+* |
| **53** | DBW107 (C) | - | S | S | R | R | S | S | - | R | R | R | R | R | R | R | *#Yr2+* |
| **54** | PBW833 (C) | R | S | S | R | R | R | R | R | R | R | MR | R | R | R | R | - |
| **55** | WH1323 | R | R | MS | R | MS | S | S | R | R | - | R | S | R | R | R | - |
| **56** | HD3118 (C) | S | S | S | MS | S | S | S | R | R | R | S | S | R | R | R | *Yr2+* |
| **57** | HI1621 (C) | MS | S | S | S | S | S | S | MS | MS | S | S | S | R | R | R | *Yr2+* |
| **58** | HD3171 (C) | R | MR | R | R | MR | MS | R | R | R | R | R | R | R | R | R | - |
| **59** | HD3460 | S | S | S | MS | MS | S | S | R | R | R | S | S | R | R | R | *Yr2+* |
| **60** | HD3293 (C) | S | S | S | R | R | MS | R | R | R | R | R | MS | R | R | R | *Yr2+* |
| **61** | HI1612 (C) | MR | MR | MS | R | S | S | MS | R | MR | R | MS | S | R | R | R | *Yr2+* |
| **62** | K1317(C) | R | S | S | R | R | R | S | R | R | R | R | R | R | R | R | #- |
| **63** | VL2041 (C) | R | R | MS | R | R | R | R | R | R | R | R | R | R | R | R | - |
| **64** | HPW349 (C) | S | MS | S | S | R | S | S | R | R | R | S | S | R | R | R | *Yr2+* |
| **65** | VL2059 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | *R* |
| **66** | HS562 (C) | S | S | S | R | R | S | S | R | R | R | S | S | R | R | R | *YrA+* |
| **67** | VL907 (C) | R | S | R | R | R | R | R | R | R | R | R | R | R | R | R | *Yr9+* |
| **68** | MACS6837 | R | S | S | R | S | S | S | R | R | MS | S | S | R | R | R | *Yr2+* |
| **69** | MACS4125(d) | S | S | S | MS | MS | R | R | R | R | R | R | MS | R | R | MR | - |
| **70** | MACS4135(d) | MS | S | S | R | R | MR | R | R | R | R | R | R | R | R | R | - |
| **71** | HI1669* | S | S | S | S | S | MS | MS | MR | S | S | S | S | MR | MS | S | - |
| **72** | HI1683 | S | S | S | MS | S | S | S | MS | S | MS | MR | MS | MS | MS | S | - |
| **73** | HI1684 | S | S | S | S | S | S | S | S | S | S | MR | MR | MR | MR | S | - |
| **74** | HI8848 (d) | S | R | S | S | S | S | R | R | S | MS | R | MR | S | S | S | - |
| **75** | HI8849 (d) | S | S | S | MR | S | MS | S | R | R | S | MR | MS | R | MS | MS | - |
| **76** | HI8850 (d) | S | S | S | MS | S | S | MS | R | R | MS | R | MS | R | R | MR | - |
| **77** | GW554 | S | S | S | S | S | S | S | R | R | MS | S | S | R | R | R | *Yr2+* |
| **78** | GW555 | S | S | S | S | S | R | MS | R | MR | R | R | MR | R | R | R | *Yr2+* |

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| **79** | MP3570 | S | - | S | S | S | MS | S | R | R | MS | S | MS | R | R | R | *Yr2+* |
| **80** | MPO1395 | S | S | S | R | MR | MS | MR | R | R | S | R | MR | R | R | R | *Yr2+* |
| **81** | GW322 | S | S | S | MS | S | S | S | R | MS | MS | S | S | MS | MS | MS | - |
| **82** | MACS6768 | S | S | S | R | S | R | R | R | R | R | R | R | R | R | R | *Yr9+* |
| **83** | HI1650 | S | S | S | R | S | R | R | R | R | R | R | R | R | R | R | *Yr9+* |
| **84** | GW547 (I) | MS | S | S | R | S | S | S | MS | S | MS | S | S | R | MR | R | *Yr2+* |
| **85** | HI8737 (d) | S | S | S | MS | S | S | MR | R | S | R | MR | MS | MS | S | S | - |
| **86** | HI8713 (d) | S | S | S | MS | MS | MS | MS | R | R | S | R | MS | R | S | S | - |
| **87** | HI1674* | S | S | S | R | S | S | S | R | S | R | S | S | R | R | R | *Yr2+* |
| **88** | HI1687 | MS | R | S | S | S | S | S | R | MS | R | S | S | MS | MS | R | - |
| **89** | WSM138 | S | S | S | MS | S | S | S | MS | MR | R | S | S | R | R | R | *Yr2+* |
| **90** | MACS6830 | S | S | S | S | S | S | S | MS | S | S | S | S | R | R | R | *Yr2+* |
| **91** | DBW425 | S | S | S | R | R | MS | S | R | R | R | S | S | R | R | R | *YrA+* |
| **92** | GW556 | S | S | S | S | S | S | S | R | S | R | S | S | R | MS | R | - |
| **93** | HD2932 | MS | S | S | S | S | S | S | R | MR | S | S | S | R | MS | R | - |
| **94** | MP4010 | S | S | S | S | S | S | S | MS | S | S | S | S | R | R | R | *Yr2+* |
| **95** | HI1634 | S | S | S | R | S | R | R | R | R | R | R | R | R | R | R | *Yr9+* |
| **96** | CG1029 | S | - | S | S | S | S | S | MS | MS | S | S | S | R | R | R | *Yr2+* |
| **97** | DBW441M* | S | S | S | MS | S | S | S | R | R | MS | S | S | R | R | R | *Yr2+* |
| **98** | DBW428 | S | MS | R | R | R | R | R | R | R | R | R | R | R | R | R | - |
| **99** | DBW432 | S | MS | S | R | R | MS | S | R | R | R | MS | S | R | R | R | *YrA+* |
| **100** | UAS3029 | S | S | S | R | R | S | S | R | R | R | S | S | R | R | R | *YrA+* |
| **101** | UAS484 (d) | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | - |
| **102** | NIAW4267 | S | S | S | S | S | S | S | S | S | S | S | S | MS | S | S | - |
| **103** | HI8851 (d) | MS | R | S | R | R | S | R | R | R | R | R | R | R | R | R | *Yr2+* |
| **104** | HI8852 (d) | S | S | S | R | MS | MR | R | R | R | R | MR | R | R | R | MS | *Yr2+* |
| **105** | MACS4131(d) | S | R | S | R | MS | MS | MS | R | MS | R | R | R | R | R | R | *Yr2+* |
| **106** | MPO1398 (d) | MS | MS | S | S | S | R | R | R | MS | MS | R | R | R | MS | MS | - |
| **107** | DBW110 | S | S | S | R | S | S | S | R | MS | R | S | S | R | R | R | *Yr2+* |

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| **108** | CG1036 | S | S | S | MS | S | S | S | R | MS | R | S | S | MS | MS | R | - |
| **109** | HI1655 | S | S | S | S | S | S | S | S | S | S | S | S | MS | S | R | - |
| **110** | HI8627 (d) | MS | S | S | R | R | R | R | R | R | R | R | R | R | R | R | - |
| **111** | HI8823 (d) | MS | S | S | MS | MS | MS | R | R | MR | S | S | MS | R | MR | S | - |
| **112** | DBW359 (I) | R | S | S | R | R | S | S | R | R | R | MS | MS | R | R | R | *Yr2+* |
| **113** | CG1040 (I) | MS | S | S | MS | S | S | S | R | S | MS | S | S | R | R | R | *Yr2+* |
| **114** | MACS6842 | S | S | S | MS | R | MS | S | R | R | R | MS | S | R | R | R | *Yr2+* |
| **115** | MACS6844 | S | S | S | R | R | MS | S | R | R | R | MS | S | R | MR | R | - |
| **116** | NIAW4364 | S | S | S | S | S | S | S | R | S | S | MS | S | R | R | R | *Yr2+* |
| **117** | PBW891* | R | S | S | R | R | R | S | R | R | R | MS | S | R | R | R | *Yr2+* |
| **118** | DBW443* | S | R | R | R | MS | R | S | R | R | R | R | MS | R | R | R | *Yr2+* |
| **119** | DDW62(d) | S | MS | S | S | MS | R | R | R | R | R | R | MS | R | MS | MR | - |
| **120** | AKAW5100* | S | S | S | R | S | R | R | R | R | R | R | R | R | R | R | *Yr9+* |
| **121** | WH1306* | - | S | - | R | R | MS | S | - | R | R | R | R | R | R | R | - |
| **122** | NWS2222* | S | S | S | MS | R | R | R | R | MR | R | S | S | R | MS | R | - |
| **123** | UAS3026 | S | S | S | S | S | MS | MS | R | MS | S | S | R | R | MS | R | - |
| **124** | CG1045 | MR | S | S | MS | R | S | S | R | R | R | S | S | R | R | R | *Yr2+* |
| **125** | MPO1395 (d) | MS | S | S | R | R | MS | R | R | R | R | MS | S | R | R | R | *Yr2+* |
| **126** | MACS6222 | S | S | S | R | S | R | MR | R | R | R | S | S | R | MS | R | *Yr2+* |
| **127** | MP1378 (I) | S | S | S | R | S | R | R | R | R | R | R | R | R | R | R | *Yr9+* |
| **128** | MACS3949 (d) | S | S | S | MS | S | R | R | R | MS | R | R | R | R | R | MR | *Yr2+* |
| **129** | DBW426 | S | S | S | R | R | MR | S | R | R | R | MS | MS | R | R | R | *YrA+* |
| **130** | MACS6829 | S | S | S | S | S | S | S | S | S | S | S | S | S | S | MS | - |
| **131** | NIAW4114* | S | S | S | MS | S | S | S | R | R | MR | S | MS | R | R | R | *Yr2+* |
| **132** | NIAW4120* | S | S | S | S | S | S | S | MR | S | S | S | MS | R | R | R | *Yr2+* |
| **133** | NIAW4432 | MS | R | S | S | R | R | S | R | R | R | S | S | R | R | R | *Yr2+* |
| **134** | UAS3027 | S | S | S | R | MS | R | MS | R | R | R | R | R | R | R | R | *Yr2+* |
| **135** | LOK79* | S | S | S | S | S | MS | S | S | S | MS | MS | S | MS | MS | S | - |

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| **136** | RAJ4083 (C) | R | S | S | S | S | MS | MS | R | R | R | S | MR | R | R | R | *Yr2+* |
| **137** | HD3090 (C) | S | S | S | R | S | R | R | R | R | R | MR | R | R | R | R | *Yr9+* |
| **138** | HI1633 (C) | S | S | S | R | S | R | R | R | R | R | R | R | R | R | R | *Yr9+* |
| **139** | CG1047 | S | S | S | S | S | S | S | R | MS | MR | S | S | MS | MR | MS | - |
| **140** | GW1368(d) | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | - |
| **141** | HI1605 | S | S | S | R | MR | R | MR | R | R | R | R | R | R | R | R | *Yr2+* |
| **142** | NIAW3170 | S | S | S | MS | S | S | S | R | MS | MS | S | S | R | MS | R | - |
| **143** | UAS446(d) | S | S | S | MS | MS | S | R | R | S | MS | R | R | R | MS | R | - |
| **144** | NIDW1149(d) | MS | S | S | R | MS | S | S | R | S | MS | MR | S | R | S | MS | - |
| **145** | HI1665 (I) | S | S | S | S | MS | MS | S | S | S | S | S | S | R | R | R | *Yr2+* |
| **146** | UAS478 (d)(I) | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | - |

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

**Annexure: 4. Seedling response of AVT lines against the pathogen of *Puccinia triticii* (black rust) during 2023-24 at Mahabaleshwar**

| Genotype | Pt-11A | Pt-40A | Pt-21A2 | Pt-117-6 | Pt-295 | Pt-40-2 | Pt-117-3 | Pt-11 | Pt-122 |
|---|---|---|---|---|---|---|---|---|---|
| DBW445 | R | R | R | R | S | S | R | S | R |
| HD3461 | R | R | R | S | S | R | R | S | R |
| HD3463 | R | R | R | R | S | R | R | S | R |
| DBW434 | R | R | R | R | R | R | R | R | R |
| CG1044* | R | R | R | S | S | R | R | S | R |
| MP1399 | R | R | R | R | R | R | R | R | R |
| WH1320 | R | R | R | R | R | R | R | R | R |
| GW322 (C) | R | R | R | R | S | R | R | S | R |
| GW543* | R | R | R | R | S | R | R | S | R |
| PBW906 | S | R | R | R | R | R | R | S | R |
| DBW377(I) (C) | R | R | R | R | S | R | R | S | R |
| PBW929 | R | R | R | R | S | R | R | R | R |
| DBW303(C) | R | R | R | R | R | R | R | R | R |
| DBW436 | R | R | S | R | R | R | R | S | S |
| MACS5065(Dic) | R | R | R | R | R | R | R | R | R |
| DDW66 | R | R | R | R | R | R | R | R | R |
| HI8713(C) | R | R | R | R | R | R | R | R | R |
| HI8858 | S | R | S | R | S | S | R | S | S |
| HI8855 | R | R | R | R | R | R | R | R | R |
| HW5306(Dic) | R | R | R | R | R | R | R | R | R |
| HI8854 | S | R | R | R | S | R | R | S | R |
| WHD969 | S | R | S | R | R | R | S | S | S |
| DDW67 | S | R | R | R | S | R | R | S | S |
| PDW366 | S | R | R | R | S | R | R | S | S |
| UAS485 | S | S | S | S | S | R | S | S | R |
| PDW368 | R | R | R | R | R | R | R | R | R |
| DDK1067(Dic) | S | R | S | R | S | S | S | S | S |
| HI8853 | R | R | R | R | R | R | R | R | R |
| PDW367 | R | R | R | R | R | R | R | R | R |
| HW5305(Dic) | R | R | R | R | R | R | R | R | R |
| MPO1403 | R | R | R | R | R | R | R | R | R |
| MPO1404 | S | R | S | R | S | S | S | S | S |
| MACS4147 | S | S | R | R | S | S | R | S | S |

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|---|---|---|---|---|---|---|---|---|---|
| MACS4146 | R | R | R | R | R | R | S | S | R |
| PWU8 | R | R | R | R | R | R | R | R | R |
| HI8737(C) | R | R | R | R | R | R | R | R | R |
| NIDW1557 | R | R | R | R | R | R | R | R | R |
| DDK1066(Dic) | S | S | R | S | S | S | S | S | S |
| GW1371 | S | R | R | R | R | R | R | S | R |
| GW1370 | S | R | S | R | R | R | R | S | R |
| DDW65 | R | R | R | R | R | S | S | S | S |
| PDW314(C) | R | R | R | R | R | R | R | R | R |
| GW1369 | R | R | S | R | R | S | S | S | R |
| MACS3949(C) | R | R | R | R | R | R | R | R | R |
| PBN1841 | S | R | S | S | S | S | S | S | R |
| UAS486 | R | R | R | R | R | R | R | R | R |
| AKDW5520 | R | R | R | R | R | S | S | S | R |
| NIDW1542 | R | R | R | R | R | R | R | R | R |
| MACS5064(Dic) | S | S | R | R | R | S | R | S | R |
| DDK1029(Dic.C) | S | R | S | S | S | R | S | S | R |

**Annexure: 5. Seedling response of AVT lines against the pathogen of *Puccinia graminis* f.sp. *tritici* (brown rust) during at Mahabaleshwar**

| Genotype | Pt 77-8 | Pt 77-1 | Pt 77-5 | Pt 77-9 | Pt 77-2 | Pt 12--2 | Pt 77A | Pt 104-2 | Pt 12--1 | Pt 162A | Pt 77 | Pt 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DBW445 | R | R | R | R | R | R | R | S | R | R | S | R |
| HD3461 | R | R | R | R | R | R | R | S | R | R | R | R |
| HD3463 | R | R | R | R | R | R | R | R | R | R | R | R |
| DBW434 | R | R | S | R | S | R | S | R | R | R | R | R |
| CG1044* | S | S | S | R | R | R | R | S | R | R | R | R |
| MP1399 | R | R | R | R | R | R | R | R | S | R | R | R |
| WH1320 | R | R | R | R | R | R | R | S | S | R | S | R |
| GW322 (C) | R | R | R | R | R | R | R | R | R | R | R | R |
| GW543* | R | R | R | R | R | R | R | R | R | R | S | R |
| PBW906 | R | R | R | R | R | R | R | R | R | R | R | R |
| DBW377(I) (C) | R | R | S | R | R | R | S | R | R | R | R | R |
| PBW929 | R | R | R | R | R | R | R | R | R | R | R | R |
| DBW303(C) | R | R | R | R | R | R | R | R | S | R | S | R |
| DBW436 | S | R | S | R | R | R | R | S | S | S | S | R |
| MACS5065(Dic) | R | R | R | R | R | R | R | R | R | R | R | R |
| DDW66 | R | R | R | R | R | R | R | R | R | R | R | R |
| HI8713(C) | R | R | R | R | R | R | R | R | R | R | R | R |
| HI8858 | R | R | R | R | R | R | R | R | R | R | R | R |
| HI8855 | R | R | R | R | R | R | R | R | R | R | R | R |
| HW5306(Dic) | R | R | R | R | R | R | R | R | R | R | R | R |
| HI8854 | R | R | R | R | R | R | R | R | R | R | R | R |
| WHD969 | R | R | R | R | R | R | R | R | R | R | R | R |
| DDW67 | R | R | S | R | R | R | R | R | R | R | R | R |
| PDW366 | R | R | R | R | R | R | R | R | R | R | R | R |
| UAS485 | R | R | R | R | R | R | R | R | R | R | R | R |
| PDW368 | R | R | S | S | R | R | R | S | S | R | R | S |
| DDK1067(Dic) | R | R | R | S | S | R | R | S | S | R | R | R |
| HI8853 | R | R | R | S | R | R | R | S | S | R | R | S |
| PDW367 | R | R | R | R | R | R | R | R | R | R | R | R |
| HW5305(Dic) | R | S | R | S | S | R | R | R | S | R | R | R |
| MPO1403 | R | R | R | R | R | R | R | R | R | R | R | R |
| MPO1404 | R | R | R | R | R | R | R | R | R | R | R | R |
| MACS4147 | R | R | R | R | R | R | R | R | R | R | R | R |
| MACS4146 | R | R | R | R | R | R | R | R | R | R | R | R |
| PWU8 | R | R | R | R | R | R | R | R | R | R | R | R |
| HI8737(C) | R | R | R | S | R | S | R | R | R | R | R | R |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NIDW1557 | R | R | R | R | R | R | R | R | R | R | R | R |
| DDK1066(Dic) | R | R | R | R | R | R | R | R | R | R | R | R |
| GW1371 | R | R | R | S | R | S | R | S | S | R | R | S |
| GW1370 | R | R | R | R | R | R | R | R | R | R | R | R |
| DDW65 | R | R | R | R | R | R | R | R | R | R | R | R |
| PDW314(C) | R | R | R | R | R | R | R | R | R | R | R | R |
| GW1369 | R | R | R | R | R | R | R | R | R | R | R | R |
| MACS3949(C) | R | R | R | R | R | R | R | R | R | R | R | R |
| PBN1841 | R | R | R | R | R | R | R | R | R | R | R | R |
| UAS486 | R | R | R | R | R | R | R | R | R | R | R | R |
| AKDW5520 | R | R | R | R | R | R | R | R | R | R | R | R |
| NIDW1542 | R | R | R | R | R | R | R | R | R | R | R | R |
| MACS5064(Dic) | R | R | R | R | R | R | R | R | R | R | R | R |
| DDK1029(Dic.C) | R | R | R | R | R | R | R | R | R | R | R | R |

## Annexure: 6. Disease response of IPPSN entries during 2023-24

| | Name | Stem rust | | Leaf rust (S) | | Leaf rust (N) | | Stripe rust(N) | | Leaf blight | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S. No. | | ACI | HS | ACI | HS | ACI | HS | ACI | HS | AVG. | HS |
| | CSSRI, Karnal | | | | | | | | | | |
| 1 | KRL 2304 | 34.4 | 60S | 10.6 | 40S | 0.67 | 5MS | 28.6 | 60S | 35 | 57 |
| 2 | KRL 2305 | 5.3 | 10S | 2.4 | 20MS | 3.23 | 15S | 12.4 | 40S | 36 | 89 |
| 3 | KRL 2306 | 9.5 | 30S | 5.1 | 20MS | 3.97 | 10S | 29.7 | 60S | 46 | 89 |
| 4 | KRL 2307 | 19.8 | 40S | 5.5 | 20MS | 6 | 20MS | 9 | 20S | 46 | 89 |
| 5 | KRL 2308 | 14.3 | 40S | 2.7 | 10MS | 3.67 | 20S | 16.4 | 40S | 45 | 78 |
| 6 | KRL 2309 | 23 | 40S | 5.6 | 30S | 2.33 | 10S | 1.9 | 5S | 46 | 89 |
| 7 | KRL 2310 | 20.9 | 40S | 6.7 | 20S | 12.5 | 40S | 10.6 | 30S | 46 | 78 |
| 8 | KRL 2311 | 13.4 | 60S | 2.7 | 10MS | 1.13 | 10MR | 11.1 | 20S | 46 | 89 |
| | Niphad | | | | | | | | | | |
| 9 | NIAW 4646 | 28.4 | 80S | 6.1 | 20MR | 8.87 | 40S | 43.3 | 60S | 46 | 89 |
| 10 | NIAW 4649 | 5.9 | 20S | 15.6 | 40S | 15 | 30S | 37.2 | 60S | 46 | 89 |
| 11 | NIAW 4652 | 5.3 | 20MS | 0.5 | 5R | 0.8 | 5MS | 37.8 | 60S | 57 | 99 |
| 12 | NIAW 4661 | 20.3 | 40S | 5.3 | 20MS | 3.07 | 10MR | 18.7 | 40S | 46 | 67 |
| 13 | NIAW 4663 | 34 | 80S | 7.5 | 20MS | 16.73 | 40S | 41.6 | 80S | 57 | 99 |
| 14 | NIAW 4665 | 33.3 | 80S | 7.1 | 20MS | 16.03 | 40S | 57.2 | 80S | 57 | 99 |
| 15 | NIAW 4667 | 20.5 | 80S | 4.7 | 20MS | 1.67 | 10S | 58.9 | 80S | 56 | 99 |
| 16 | NIAW 4668 | 13.5 | 40S | 3.5 | 10MS | 0 | 0 | 57.8 | 80S | 56 | 99 |
| 17 | NIAW 4669 | 14.6 | 60S | 3.4 | 10S | 0.83 | 5S | 56.2 | 80S | 46 | 89 |
| 18 | NIAW 4685 | 10.8 | 60S* | 1.2 | 10MS | 6.83 | 40S | 41.6 | 60S | 46 | 99 |
| 19 | NIAW 4716 | 23.3 | 60S | 6.7 | 20MS | 18.33 | 50S | 19.1 | 60S | 46 | 89 |
| 20 | NIAW 4723 | 14.5 | 60S | 10.7 | 30S | 16 | 40S | 37.8 | 60S | 46 | 77 |
| 20A | Infector | 77.5 | 80S | 82.9 | 100S | 83.33 | 100S | 77.8 | 80S | 68 | 79 |
| 21 | NIAW 4728 | 4.3 | 20MS | 2.7 | 10S | 9.17 | 40S | 5.2 | 20S | 46 | 67 |
| 22 | NIAW 4731 | 26.8 | 60S | 3.6 | 20S | 0.9 | 5S | 13.9 | 40S | 46 | 99 |
| 23 | NIAW 4737 | 9.4 | 30S | 0.8 | 10MR | 3.67 | 20S | 28 | 60S | 47 | 99 |
| 24 | NIAW 4741 | 7.3 | 20S | 5.5 | 20MS | 5.83 | 20S | 11.1 | 60S | 46 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | NIAW 4757 | 15.5 | 60S | 4.1 | 20S | 11.67 | 30S | 11.8 | 20S | 46 | 99 |
| 26 | NIAW 4760 | 16.5 | 40S | 4 | 20MS | 3.4 | 15S | 10.3 | 40S | 45 | 99 |
| 27 | NIAW 4761 | 8.4 | 20S | 1.7 | 10MR | 9.5 | 30S | 17.3 | 40S | 46 | 78 |
| 28 | NIAW 4764 | 9.9 | 40S | 1.1 | 5MR | 9 | 30S | 18.1 | 40S | 35 | 68 |
| 29 | NIAW 4765 | 9.8 | 40S | 2 | 10S | 7.5 | 30S | 14.7 | 40S | 46 | 78 |
| 30 | NIAW 4773 | 17.4 | 60S | 2.3 | 10S | 10.67 | 20S | 14.6 | 40S | 46 | 78 |
| 31 | NIAW 4777 | 18 | 40S | 2.1 | 10MR | 5.4 | 20S | 8.5 | 20S | 45 | 78 |
| 32 | NIAW 4790 | 27 | 80S | 3.7 | 10S | 6.33 | 20S | 27.3 | 60S | 46 | 99 |
| 33 | NIAW 4798 | 14 | 40S | 5 | 20S | 11.37 | 40S | 6.3 | 20S | 35 | 78 |
| 34 | NIAW 4802 | 7.7 | 40S | 2.4 | 5MR | 11.73 | 50S | 11.7 | 20S | 46 | 99 |
| 35 | NIDW 1569 | 10.8 | 40S | 4.4 | 20MS | 0.67 | 5MS | 0.4 | 10MR | 45 | 89 |
| 36 | NIDW 1576 | 2 | 10R | 1.5 | 20MR | 0 | 0 | 2.4 | 15S | 45 | 78 |
| 37 | NIDW 1578 | 10.6 | 40S | 9.6 | 40MR | 0.07 | TMR | 4.4 | 20S | 45 | 78 |
| 38 | NIDW 1579 | 20.4 | 60S | 4 | 10S | 0 | 0 | 5.3 | 30S | 46 | 99 |
| | Sabour | | | | | | | | | | |
| 39 | BRW3968 | 22 | 60S | 14.1 | 40S | 27.33 | 60S | 52.3 | 80S | 57 | 99 |
| 40 | BRW3969 | 30.4 | 80S | 6.4 | 20S | 36.67 | 90S | 61.1 | 80S | 36 | 68 |
| 40A | Infector | 77.5 | 80S | 77.1 | 80S | 81.67 | 100S | 78.9 | 100S | 68 | 99 |
| 41 | BRW3970 | 38.5 | 80S | 14.9 | 20S | 35 | 90S | 37.2 | 60S | 46 | 99 |
| 42 | BRW3971 | 8 | 40MR | 15.1 | 40S | 22 | 60S | 41.1 | 60S | 45 | 78 |
| 43 | BRW3972 | 19.9 | 40S | 11.1 | 20S | 24.33 | 60S | 56.7 | 80S | 46 | 99 |
| 44 | BRW3973 | 14.3 | 40S | 7.1 | 20S | 29.67 | 80S | 9.6 | 20S | 56 | 99 |
| 45 | BRW3974 | 14 | 40MS | 3 | 10MS | 18.37 | 70S | 35.4 | 60S | 46 | 99 |
| 46 | BRW3975 | 12.8 | 30S | 5.5 | 20S | 7.33 | 30S | 13.4 | 40S | 46 | 99 |
| 47 | BRW3976 | 5 | 20S | 4.4 | 20MS | 8.83 | 40S | 5.1 | 20S | 46 | 99 |
| 48 | BRW3977 | 2.2 | 10MR | 5.5 | 20MS | 9 | 30S | 40.6 | 80S | 56 | 99 |
| 49 | BRW3978 | 14.6 | 40S | 3.6 | 10MS | 10.87 | 30S | 12.8 | 40S | 46 | 89 |
| 50 | BRW3979 | 2.9 | 10S | 1 | 10R | 3.5 | 10MS | 6.6 | 20MS | 46 | 99 |
| 51 | BRW3980 | 16.3 | 40S | 3.5 | 10MR | 6.83 | 20S | 6.8 | 20S | 46 | 99 |
| 52 | BRW3981 | 31.5 | 60S | 10.3 | 20MS | 6.67 | 20S | 16 | 40MS | 46 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 53 | BRW3982 | 25.3 | 80S | 7.6 | 20MS | 9.17 | 30S | 6.1 | 20MS | 46 | 89 |
| 54 | BRW3983 | 6.9 | 20S | 8.9 | 20MS | 11.83 | 40S | 10.8 | 20S | 46 | 57 |
| 55 | BRW3984 | 17.5 | 80S | 14.5 | 40MS | 23.5 | 60S | 61.1 | 80S | 57 | 99 |
| 56 | BRW3985 | 16.8 | 40S | 11.1 | 20MS | 14.83 | 40S | 38.2 | 60S | 36 | 46 |
| 57 | BRW3986 | 24.8 | 40S | 2.9 | 10MS | 5.73 | 20S | 17.8 | 40S | 35 | 67 |
| 58 | BRW3987 | 14.3 | 40MS | 4.7 | 20MS | 10.5 | 30S | 37.9 | 80S | 46 | 77 |
| | BHU | | | | | | | | | | |
| 59 | HUWL2301 | 14.7 | 40S | 2.6 | 10MR | 8 | 20S | 7.7 | 20S | 57 | 99 |
| 60 | HUWL2302 | 14.6 | 40S | 2.1 | 10S | 6.67 | 30S | 12.7 | 40S | 46 | 99 |
| 60A | Infector | 80 | 80S | 80 | 80S | 75 | 80S | 78.9 | 100S | 68 | 89 |
| 61 | HUWL2303 | 22 | 60S | 9.4 | 20MS | 15.17 | 40S | 10.1 | 40S | 45 | 99 |
| 62 | HUWL2304 | 3 | 10MS | 2.2 | 10S | 6.67 | 20S | 12.8 | 40S | 56 | 89 |
| 63 | HUWL2305 | 1.8 | 5S | 1.8 | 10S | 6.73 | 40S | 9.8 | 20S | 45 | 99 |
| 64 | HUWL2306 | 21.5 | 60S | 1.8 | 20MR | 0.47 | 5MR | 17.1 | 40S | 35 | 45 |
| 65 | HUWL2307 | 20.9 | 60S | 5.2 | 20S | 9.07 | 30S | 16.1 | 40S | 56 | 99 |
| 66 | HUWL2308 | 8.9 | 20S | 9.3 | 20MS | 15 | 30S | 9.8 | 20S | 46 | 78 |
| 67 | HUWL2309 | 31.3 | 60S | 14.6 | 40S | 15 | 40S | 9 | 40S | 45 | 99 |
| 68 | HUWL2310 | 4.2 | 10MS | 2.9 | 10MS | 7.33 | 40S | 9.3 | 40S | 57 | 99 |
| 69 | HUWL2311 | 19.3 | 40S | 3.6 | 20MS | 8.33 | 20S | 6.8 | 20S | 46 | 99 |
| 70 | HUWL2312 | 19.5 | 60S | 2.4 | 20MS | 5.07 | 30S | 13.4 | 40S | 46 | 99 |
| 71 | HUWL2313 | 23.8 | 60S | 6.6 | 20MS | 1.83 | 10S | 10.8 | 40S | 46 | 89 |
| 72 | HUWL2314 | 10.5 | 40S | 4.1 | 20MS | 9.67 | 40S | 11 | 40S | 46 | 99 |
| 73 | HUWL2315 | 12 | 60S | 11.7 | 40MR | 27.67 | 40S | 56.1 | 80S | 46 | 99 |
| 74 | HUWL2316 | 10.5 | 60S | 16.3 | 40S | 26.67 | 40S | 62.2 | 80S | 46 | 99 |
| 75 | HUWL2317 | 19.1 | 60S | 9.1 | 20S | 17.67 | 30S | 19.4 | 40S | 46 | 78 |
| 76 | HUWL2318 | 11.5 | 40S | 8.1 | 20MS | 18.67 | 60S | 52.2 | 80S | 46 | 99 |
| 77 | HUWL2319 | 29.6 | 60S | 6.5 | 20MS | 19.33 | 50S | 35.6 | 60S | 46 | 89 |
| 78 | HUWL2320 | 23.8 | 80S | 3.3 | 20MS | 6.73 | 20S | 28.2 | 60S | 46 | 99 |
| | COOCHBEHAR | | | | | | | | | | |
| 79 | UBKV-23-1 | 29.3 | 80S | 4.9 | 20MS | 9.67 | 40S | 19.4 | 40S | 46 | 89 |
| 80 | UBKV-23-2 | 22.5 | 60S | 3.8 | 10MS | 2.5 | 15S | 18.4 | 40S | 46 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 80A | Infector | 80 | 100S | 80 | 100S | 80 | 100S | 78.9 | 90S | 78 | 89 |
| 81 | UBKV-23-3 | 24.3 | 60S | 2.9 | 20S | 5 | 20S | 17.3 | 40S | 46 | 99 |
| 82 | UBKV-23-4 | 12.5 | 40S | 8.3 | 20S | 8.33 | 20S | 25.2 | 40S | 46 | 99 |
| 83 | UBKV-23-5 | 10.8 | 40S | 6.5 | 20S | 11.67 | 30S | 32.8 | 60S | 46 | 78 |
| 84 | UBKV-23-6 | 17 | 60S | 6.1 | 20MS | 7.5 | 20MS | 28.4 | 40S | 46 | 99 |
| 85 | UBKV-23-7 | 19.3 | 40S | 9.2 | 20MS | 9.33 | 20MR | 5.6 | 15S | 46 | 99 |
| 86 | UBKV-23-8 | 12.3 | 40S | 6.3 | 20MS | 7.33 | 30S | 16.1 | 40S | 46 | 99 |
| 87 | UBKV-23-9 | 9.5 | 40S | 6.3 | 20MS | 12.17 | 30S | 23.1 | 40S | 46 | 99 |
| 88 | UBKV-23-10 | 11 | 30S | 9.7 | 20MS | 14.33 | 40S | 35.6 | 60S | 46 | 99 |
| 89 | UBKV-23-11 | 20.8 | 80S | 18.1 | 40S | 20 | 40S | 27.7 | 40S | 46 | 99 |
| 90 | UBKV-23-12 | 29.3 | 80S | 8.7 | 20S | 14.67 | 40S | 26 | 40S | 46 | 99 |
| 91 | UBKV-23-13 | 23 | 80S | 13.6 | 40MR | 27.33 | 60S | 45.6 | 80S | 46 | 99 |
| 92 | UBKV-23-14 | 19.8 | 80S | 10.6 | 40MR | 28.33 | 40S | 42.7 | 80S | 46 | 99 |
| 93 | UBKV-23-15 | 24 | 80S | 1.9 | 10MS | 5 | 30S | 39 | 60S | 46 | 99 |
| | DURGAPURA | | | | | | | | | | |
| 94 | WR 2190 | 14.3 | 40S | 2.9 | 20MS | 4 | 20S | 9.1 | 40S | 35 | 99 |
| 95 | WR 2191 | 28.8 | 60S | 1.8 | 10MS | 0.2 | TS | 16 | 40MS | 35 | 78 |
| 96 | WR 2192 | 26.4 | 80S | 7.9 | 20S | 16.67 | 20S | 8 | 40S | 46 | 99 |
| 97 | WR 2193 | 13.5 | 60S | 5.7 | 10MS | 2.23 | 10MS | 9.9 | 40S | 45 | 99 |
| 98 | WR 2194 | 10.3 | 60S* | 1.7 | 10MS | 0.83 | 5S | 12.5 | 40S | 46 | 99 |
| 99 | WR 2195 | 12 | 30S | 8.7 | 20S | 20.67 | 40S | 8.7 | 40S | 56 | 99 |
| 100 | WR 2196 | 8.8 | 40S | 2.1 | 10MR | 0.17 | TS | 6.4 | 20S | 56 | 99 |
| 100A | Infector | 80 | 80S | 77.1 | 80S | 78.33 | 100S | 76.7 | 80S | 68 | 89 |
| 101 | WR 2197 | 45 | 80S | 11.6 | 40MS | 33 | 90S | 14 | 60S | 46 | 99 |
| 102 | WR 2198 | 51 | 80S | 13.4 | 40S | 15 | 40S | 7.2 | 40S | 46 | 99 |
| 103 | WR 2199 | 60 | 80S | 5.5 | 20MS | 0.17 | TS | 17.7 | 60S | 35 | 78 |
| 104 | WR 2200 | 57.5 | 80S | 8.9 | 20S | 0.23 | TS | 8 | 40S | 46 | 99 |
| 105 | WR 2201 | 22 | 80S | 15.2 | 40MR | 34.67 | 80S | 11.6 | 40S | 56 | 99 |
| 106 | WR 2202 | 38.5 | 100S | 12.4 | 20S | 30 | 50S | 7.1 | 40S | 56 | 99 |
| 107 | WR 2203 | 29.3 | 80S | 7.9 | 20MS | 18.83 | 40S | 7.2 | 20MS | 46 | 99 |
| 108 | WR 2204 | 9.9 | 30S | 11.6 | 20S | 23.5 | 40S | 5.9 | 20MS | 56 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 109 | WR 2205 | 2.2 | 10MR | 5.4 | 20S | 23.5 | 60S | 10.6 | 20S | 56 | 99 |
| 110 | WR 2206 | 3.5 | 10MS | 6.3 | 20MS | 35 | 80S | 45.6 | 80S | 56 | 99 |
| 111 | WR 2207 | 19.3 | 40S | 7.1 | 20MS | 26 | 90S | 15.1 | 40S | 46 | 99 |
| 112 | WR 2208 | 8.6 | 20MR | 7.7 | 10MS | 22 | 90S | 5.9 | 20S | 46 | 99 |
| 113 | WR 2209 | 20.3 | 40S | 5.3 | 10S | 22.67 | 70S | 6.6 | 10S | 47 | 89 |
| 114 | WR 2210 | 16.8 | 40S | 5.5 | 20MS | 22.67 | 50S | 5.7 | 20S | 56 | 99 |
| 115 | WR 2211 | 15.8 | 60S | 6.3 | 20S | 14.33 | 50S | 17.5 | 40S | 56 | 99 |
| 116 | WR 2212 | 8.6 | 20S | 1.8 | 10MR | 6 | 20MS | 2.3 | 10S | 56 | 99 |
| 117 | WR 2213 | 22.5 | 60S | 8.6 | 20MS | 4.47 | 20MR | 5 | 20MS | 56 | 99 |
| 118 | WR 2214 | 14.6 | 40S | 4.4 | 20MS | 9 | 30S | 15.9 | 40S | 46 | 99 |
| 119 | WR 2215 | 25.5 | 80S | 10.3 | 20S | 21.17 | 60S | 19.9 | 40S | 46 | 99 |
| 120 | WR 2216 | 12.7 | 40MS | 15 | 40S | 54.33 | 100S | 18.9 | 40S | 57 | 99 |
| 120A | Infector | 82.5 | 100S | 80 | 100S | 81.67 | 100S | 78.9 | 100S | 68 | 88 |
| 121 | WR 2217 | 13.4 | 40S | 4.4 | 10MR | 10 | 30S | 12.1 | 20S | 46 | 99 |
| 122 | WR 2218 | 37.5 | 80S | 11.4 | 40S | 5.17 | 30S | 18 | 60S | 56 | 99 |
| 123 | WR 2219 | 30.5 | 80S | 5.8 | 10S | 6.6 | 20S | 5.7 | 20MS | 56 | 99 |
| 124 | WR 2220 | 5.8 | 30S | 11 | 40S | 4.67 | 10MS | 14.8 | 40S | 56 | 99 |
| 125 | WR 2221 | 16 | 60S | 1.6 | 10S | 3.67 | 10S | 8.9 | 40S | 46 | 89 |
| 126 | WR 2222 | 16.5 | 40S | 3.2 | 10MS | 6.5 | 30S | 7.3 | 20S | 46 | 89 |
| 127 | WR 2223 | 13.4 | 60S | 2.9 | 10MS | 3.67 | 20S | 7.7 | 20MS | 56 | 99 |
| 128 | WR 2224 | 15.9 | 60S | 3 | 10MR | 7.6 | 30S | 15 | 40S | 56 | 99 |
| 129 | WR 2225 | 15 | 60S | 9.7 | 20S | 3.67 | 15MR | 15.9 | 60S | 56 | 99 |
| | PARBHANI | | | | | | | | | | |
| 130 | PBN 2023 - 126 | 8.3 | 40MR | 4.7 | 20MS | 10.6 | 40S | 11.2 | 40S | 57 | 99 |
| 131 | PBN 2023 - 128 | 26.5 | 60S | 1.2 | 10MR | 7.37 | 40S | 18.8 | 80S | 56 | 99 |
| 132 | PBN 2023 - 136 | 15.9 | 60S | 5.7 | 20S | 13.7 | 70S | 22.8 | 40S | 46 | 99 |
| 133 | PBN 2023 - 313 | 28 | 80S | 4.6 | 20S | 3.33 | 20S | 10.4 | 20S | 46 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 134 | PBN 2023 - 314 | 21.5 | 40S | 7.9 | 20S | 12.5 | 50S | 22.3 | 40S | 46 | 99 |
| 135 | PBN 2023 - 319 | 18.3 | 40S | 5.2 | 10MS | 8.67 | 40S | 29.6 | 40S | 56 | 99 |
| 136 | PBND 2023 - 13 | 24.8 | 80S | 2.4 | 10MS | 0.83 | 10MR | 2.1 | 20MR | 56 | 99 |
| 137 | PBND 2023 - 15 | 1.4 | 10S | 0.6 | 5MS | 0 | 0 | 10.3 | 40S | 56 | 99 |
| | SAGAR | | | | | | | | | | |
| 138 | JWS 1501 | 4.8 | 20S | 5.9 | 20S | 0.67 | 5MS | 39.6 | 60S | 35 | 57 |
| 139 | JWS 1506 | 7.6 | 40S | 1.7 | 10S | 1.67 | 10MS | 55.6 | 80S | 57 | 99 |
| 140 | JWS 1590 | 12.8 | 60S | 10.3 | 20MS | 18.37 | 40S | 44.4 | 60S | 57 | 99 |
| 140A | Infector | 80 | 80S | 80 | 80S | 78.33 | 100S | 76.7 | 80S | 78 | 89 |
| 141 | JWS 1595 | 5.5 | 20S | 1.7 | 10MR | 0.67 | 5MS | 18 | 40S | 56 | 99 |
| 142 | JWS 1614 | 38.9 | 80S | 2.3 | 10MR | 2.73 | 20MS | 43.3 | 60S | 46 | 89 |
| 143 | JWS 16108 | 36.4 | 80S | 7.1 | 20MR | 10.5 | 20S | 50 | 60S | 46 | 89 |
| 144 | JWS 16134 | 14.4 | 80S | 8.9 | 20MS | 7.33 | 20MS | 47.8 | 60S | 56 | 99 |
| 145 | JWS 16112 | 50 | 100S | 14.9 | 60S | 5.83 | 20S | 29.7 | 60S | 35 | 57 |
| 146 | JWS 16141 | 16.5 | 40S | 6.3 | 20MS | 14 | 30S | 43.3 | 80S | 46 | 99 |
| 147 | JWS 936 | 18.9 | 80S | 6.1 | 20MS | 11.33 | 30S | 25.8 | 60S | 57 | 99 |
| 148 | JWS 1333 | 11.6 | 30S | 9.7 | 20S | 25.33 | 70S | 28.9 | 60S | 46 | 67 |
| | VPKAS | | | | | | | | | | |
| 149 | VW 2301 | 20.5 | 80S | 2.3 | 10S | 2.5 | 10S | 4 | 10S | 45 | 78 |
| 150 | VW 2302 | 30.1 | 80S | 14 | 20S | 21.33 | 40S | 2.6 | 10S | 56 | 99 |
| 151 | VW 2303 | 28.3 | 80S | 6 | 20MS | 3.03 | 20MR | 6.4 | 20S | 46 | 99 |
| 152 | VW 2304 | 26.9 | 80S | 6.3 | 20MS | 10.83 | 40S | 7.3 | 20S | 45 | 99 |
| 153 | VW 2305 | 4.3 | 20S | 1.7 | 10MR | 3.33 | 20MS | 8.1 | 20S | 46 | 99 |
| 154 | VW 2306 | 9.5 | 40S | 1.8 | 10S | 0.67 | 5MS | 5.8 | 20S | 46 | 99 |
| 155 | VW 2307 | 8.5 | 40S | 5 | 20S | 4.67 | 20S | 25.1 | 60S | 57 | 99 |
| 156 | VW 2308 | 24.2 | 60S | 6.4 | 20S | 10 | 40S | 8.4 | 20S | 35 | 78 |
| 157 | VW 2309 | 5.4 | 20MS | 2 | 10MS | 4.17 | 20S | 20.3 | 40S | 46 | 89 |
| 158 | VW 2310 | 17 | 100S * | 4.4 | 20MS | 2.57 | 15S | 6.2 | 20S | 57 | 99 |

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| 159 | VW 2311 | 22.8 | 60S | 17.4 | 40MS | 28 | 60S | 3.9 | 20MS | 46 | 99 |
| 160 | VW 2312 | 16 | 40S | 1.7 | 10S | 7.33 | 20S | 5 | 20S | 46 | 99 |
| 160A | Infector | 80 | 100S | 82.9 | 100S | 76.67 | 90S | 76.7 | 80S | 68 | 89 |
| 161 | VW 2313 | 19.1 | 80S | 7.5 | 20S | 4.17 | 20S | 4.9 | 20MS | 46 | 99 |
| 162 | VW 2314 | 31.3 | 60S | 7.7 | 20MS | 8.17 | 30S | 4.6 | 20MS | 45 | 89 |
| 163 | VW 2315 | 12.8 | 60S* | 8.1 | 20MS | 11.7 | 30S | 6.7 | 20S | 46 | 99 |
| 164 | VW 2316 | 1 | 10MS | 3.2 | 20S | 1.5 | 5S | 1.2 | 10MS | 46 | 78 |
| 165 | VW 2317 | 24.5 | 100S | 8 | 40S | 3.73 | 20S | 4.1 | 15S | 56 | 99 |
| 166 | VW 2318 | 4.4 | 20S | 9.7 | 20S | 21.67 | 50S | 10.4 | 40S | 56 | 99 |
| 167 | VW 2319 | 7.5 | 40S | 6.4 | 20S | 16.7 | 40S | 3.1 | 20MS | 46 | 99 |
| 168 | VW 2320 | 36 | 100S | 10 | 20S | 3.33 | 10S | 8.3 | 20S | 56 | 99 |
| 169 | VW 2321 | 25 | 100S | 6.6 | 20MS | 7.33 | 20S | 4 | 20MS | 46 | 99 |
| 170 | VW 2322 | 10.5 | 60S* | 8.9 | 20MS | 6 | 20MS | 8.3 | 20S | 56 | 99 |
| 171 | VW 2323 | 10.4 | 60S | 3.5 | 20S | 3.5 | 20S | 3.2 | 20MS | 56 | 99 |
| 172 | VW 2324 | 7.8 | 40S | 2.1 | 10MR | 4.83 | 20S | 11 | 40S | 46 | 99 |
| 173 | VW 2325 | 38.5 | 80S | 23.4 | 60S | 39.67 | 90S | 2.6 | 15S | 46 | 99 |
| | JNKV JABALPUR | | | | | | | | | | |
| 174 | 3603 | 11.5 | 40S | 6 | 20MS | 7.37 | 30S | 26.2 | 60S | 46 | 99 |
| 175 | 3604 | 19.8 | 60S | 7.7 | 15MR | 16.67 | 40S | 40 | 60S | 57 | 99 |
| 176 | 3605 | 18 | 60S | 5.8 | 20MS | 11 | 40S | 30 | 60S | 46 | 99 |
| 177 | 3606 | 3.9 | 20S | 2.9 | 10MS | 1 | 5MR | 47.8 | 80S | 56 | 99 |
| 178 | 3607 | 4.3 | 20S | 4.6 | 20MR | 13.33 | 40S | 44.4 | 80S | 56 | 99 |
| 179 | 3608 | 12.5 | 40S | 8.3 | 20MS | 21.67 | 60S | 18.4 | 60S | 45 | 99 |
| 180 | 3609 | 4 | 10MR | 8.1 | 20MS | 16.67 | 60S | 33.6 | 60S | 56 | 99 |
| 180A | Infector | 80 | 80S | 80 | 80S | 78.33 | 100S | 77.8 | 80S | 68 | 89 |
| 181 | 3610 | 10 | 40S | 11.4 | 40MS | 26.67 | 40S | 36.8 | 60S | 46 | 99 |
| 182 | 3611 | 14.5 | 40S | 7.4 | 20MS | 15 | 40S | 7.2 | 20MS | 46 | 99 |
| 183 | 3612 | 8.3 | 20S | 7.1 | 20MS | 15.87 | 40S | 30.2 | 40S | 57 | 78 |
| 184 | 3613 | 34.2 | 80S | 9.9 | 40MS | 11.67 | 50S | 47.8 | 80S | 46 | 99 |
| 185 | 3614 | 13.5 | 80S* | 4 | 10S | 23.33 | 60S | 49.6 | 80S | 57 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 186 | 3615 | 7.1 | 30S | 10.3 | 20S | 20 | 40S | 38.7 | 60S | 56 | 99 |
| 187 | 3616 | 14.5 | 60S | 14.3 | 60S | 33 | 50S | 36.1 | 60S | 45 | 99 |
| 188 | 3617 | 20 | 80S | 16.3 | 40S | 43.33 | 60S | 47.8 | 80S | 67 | 99 |
| 189 | 3618 | 5.5 | 20S | 3.7 | 20MS | 2 | 10MS | 43.9 | 80S | 46 | 99 |
| 190 | 3619 | 7.6 | 40S | 7.4 | 20MS | 13 | 40S | 18.2 | 60S | 46 | 99 |
| 191 | 3620 | 4.9 | 30S | 0.3 | 5MR | 2.73 | 20MS | 37.2 | 80S | 46 | 99 |
| 192 | 3621 | 6.9 | 30S | 3.5 | 10MR | 11.5 | 20S | 16.7 | 60S | 46 | 89 |
| 193 | 3622 | 10.4 | 40S | 11.4 | 20S | 36.67 | 60S | 25.4 | 40S | 56 | 89 |
| | SKAUST-K KHUDW | | | | | | | | | | |
| 194 | SKW 385 | 15 | 60S | 1.5 | 10MS | 3.43 | 20S | 15.9 | 40S | 46 | 78 |
| 195 | SKW386 | 1.7 | 10MS | 1.3 | 10MS | 2.5 | 15S | 9.3 | 40S | 56 | 99 |
| 196 | SKW387 | 9.4 | 20S | 0.3 | 5MR | 12.4 | 50S | 1.9 | 20MS | 56 | 99 |
| 197 | SKW388 | 17.8 | 40S | 2.3 | 10MR | 5.67 | 15S | 1.1 | 10MS | 45 | 89 |
| 198 | SKW389 | 10.9 | 20S | 4.9 | 10MS | 10.87 | 20S | 1.9 | 20MS | 56 | 99 |
| 199 | SKW390 | 12.1 | 30S | 4.4 | 20MS | 11.33 | 30S | 2.1 | 10S | 46 | 99 |
| 200 | SKAU2 | 12.2 | 80S* | 4.1 | 20S | 4.33 | 15MS | 3.1 | 20MS | 46 | 99 |
| 200A | Infector | 82.5 | 100S | 82.9 | 100S | 76.67 | 90S | 80 | 100S | 78 | 99 |
| 201 | SKAU5 | 18 | 60S | 4 | 20MS | 7.53 | 30S | 8.6 | 20S | 46 | 99 |
| 202 | SKAU16 | 18 | 60S | 2.3 | 10MS | 9.33 | 40S | 10.1 | 40MS | 46 | 99 |
| 203 | SKAU70 | 20 | 40S | 2.1 | 10MS | 0.37 | 5MR | 2 | 10MS | 46 | 99 |
| | MALAN | | | | | | | | | | |
| 204 | PW 2301 | 14.3 | 80S | 1.2 | 10MR | 3.33 | 20S | 6.6 | 40S | 56 | 99 |
| 205 | PW 2302 | 8.5 | 30S | 9.7 | 20S | 24.67 | 40S | 11.1 | 60S | 35 | 67 |
| 206 | PW 2303 | 25.9 | 80S | 7.5 | 20MS | 6.67 | 20S | 4 | 20MS | 57 | 99 |
| 207 | PW 2304 | 15 | 40S | 2 | 10S | 1.4 | 10MS | 5.4 | 20MS | 57 | 99 |
| 208 | PW 2305 | 19.8 | 80S | 4.6 | 10S | 10 | 40S | 10.6 | 40S | 46 | 78 |
| 209 | PW 2306 | 14 | 40S | 5.4 | 20MS | 16.33 | 40S | 5.1 | 20MS | 57 | 99 |
| 210 | PW 2307 | 4.3 | 30S | 6.3 | 20S | 5.33 | 15S | 8.4 | 40S | 35 | 67 |
| 211 | PW 2308 | 16.3 | 80S | 21.4 | 40S | 24.33 | 40S | 20.9 | 40S | 56 | 99 |
| 212 | PW 2309 | 13.5 | 80S* | 1.3 | 20MR | 0.83 | 5S | 9.3 | 40S | 46 | 99 |
| 213 | PW 2310 | 23.3 | 60S | 5.5 | 20MS | 2.07 | 15MR | 9.9 | 40S | 46 | 89 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 214 | PW 2311 | 34 | 80S | 13.5 | 40S | 25 | 40S | 2.8 | 10MS | 46 | 99 |
| 215 | PW 2312 | 26.3 | 80S | 7.4 | 20S | 16.5 | 60S | 36.1 | 80S | 46 | 99 |
| 216 | PW 2313 | 31.3 | 100S | 5.3 | 10MS | 6.67 | 10S | 10.9 | 40S | 46 | 99 |
| 217 | BW 290 | 4.8 | 20S | 4.7 | 20S | 6.17 | 20S | 11.7 | 40S | 46 | 89 |
| 218 | BW 291 | 29.3 | 40S | 16.6 | 40S | 41.67 | 60S | 9.6 | 40S | 56 | 99 |
| | BILASPUR | | | | | | | | | | |
| 219 | CG2301 | 12.8 | 30S | 10.9 | 20S | 34 | 60S | 51.1 | 80S | 46 | 99 |
| 220 | CG2302 | 13.3 | 60S | 5.6 | 10S | 13.87 | 50S | 52.2 | 80S | 56 | 99 |
| 220A | Infector | 80 | 80S | 82.9 | 100S | 83.33 | 100S | 71.1 | 80S | 78 | 99 |
| 221 | CG2303 | 21.8 | 80S | 4.7 | 20S | 1.7 | 10S | 65.6 | 80S | 56 | 99 |
| 222 | CG2304 | 25.8 | 100S | 5 | 20MS | 0.9 | 5MS | 36 | 60S | 46 | 99 |
| 223 | CG2305 | 9.7 | 40S | 7.1 | 20MS | 4 | 20S | 39.4 | 80S | 46 | 99 |
| 224 | CG2306 | 13.3 | 40S | 3.5 | 20S | 0.33 | 5MR | 53.3 | 80S | 57 | 99 |
| 225 | CG2307 | 23 | 80S | 9.1 | 20S | 34.67 | 60S | 36.7 | 60S | 46 | 99 |
| 226 | CG2308 | 12.9 | 40S | 4.6 | 20MS | 7.67 | 15S | 19.9 | 40MS | 46 | 99 |
| 227 | CG2309 | 21.8 | 80S | 3.9 | 10MR | 5.17 | 15S | 18.2 | 40S | 56 | 99 |
| 228 | CG2310 | 17.2 | 80S | 8.2 | 20S | 18.03 | 40S | 6.1 | 20MS | 56 | 99 |
| 229 | CG2311 | 20 | 40S | 1.7 | 10MS | 4.33 | 10MS | 5.3 | 20S | 45 | 99 |
| 230 | CG2312 | 14.3 | 40S | 4 | 10MR | 0.83 | 5S | 11.7 | 40S | 45 | 99 |
| 231 | CG2313 | 15.9 | 80S | 7.5 | 20S | 24.33 | 60S | 20.3 | 40S | 46 | 99 |
| 232 | CG2314 | 11.8 | 60S | 3 | 10MS | 8 | 20S | 44.4 | 80S | 56 | 99 |
| 233 | CG2315 | 15.3 | 60S | 7.1 | 20MS | 4.17 | 20S | 64.4 | 100S | 56 | 99 |
| | UDAIPUR | | | | | | | | | | |
| 234 | PWU 1 | 10.6 | 60S* | 2.3 | 10MR | 3.43 | 20S | 56.7 | 80S | 56 | 99 |
| 235 | PWU 3 | 12.2 | 60S | 2.1 | 10S | 0.83 | 5S | 9.9 | 40S | 57 | 99 |
| 236 | PWU 49 | 14.8 | 60S | 4 | 10MS | 0.17 | TMS | 57.8 | 80S | 46 | 99 |
| 237 | PWU 51 | 16 | 60S | 8.7 | 20S | 23.33 | 40S | 36.2 | 60S | 57 | 99 |
| 238 | PWU 53 | 4.9 | 20S | 2.1 | 20MR | 4.33 | 20MS | 30.7 | 60S | 57 | 99 |
| 239 | PWU 54 | 9.9 | 60S* | 1.2 | 10MR | 0.83 | 5S | 55.6 | 80S | 57 | 99 |
| 240 | PWU 55 | 6 | 40S | 0.6 | 5MS | 0.33 | 5MR | 35.9 | 60S | 56 | 99 |
| 240A | Infector | 82.5 | 100S | 82.9 | 100S | 81.67 | 100S | 76.7 | 80S | 68 | 79 |

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| 241 | PWU 110 | 15.1 | 60S | 4 | 20MS | 0.23 | TS | 1.1 | 10MR | 57 | 99 |
| 242 | PWU 113 | 15.1 | 60S | 3.4 | 20MS | 0.9 | 5S | 0.8 | 5MS | 57 | 99 |
| 243 | PWU 115 | 16.6 | 80S | 2.3 | 10MS | 1.67 | 10S | 0.8 | 5S | 56 | 99 |
| | RANCHI | | | | | | | | | | |
| 244 | JKW 321 | 34.3 | 100S | 8.3 | 20S | 11.67 | 40S | 37.8 | 60S | 56 | 78 |
| 245 | JKW 322 | 24.1 | 100S | 5.2 | 10MS | 10.7 | 30S | 29.7 | 60S | 56 | 99 |
| 246 | JKW 323 | 17.3 | 40S | 14 | 20S | 29 | 50S | 37.8 | 60S | 35 | 57 |
| 247 | JKW 324 | 11.4 | 60S | 2.4 | 20MR | 8.33 | 20MS | 6 | 20S | 57 | 99 |
| 248 | JKW 325 | 13.8 | 60S | 1.1 | 5MR | 2.4 | 10S | 17.2 | 40S | 56 | 99 |
| 249 | JKW 326 | 11 | 30S | 1.2 | 10MR | 4.83 | 20S | 34.4 | 60S | 57 | 99 |
| 250 | JKW 327 | 12 | 40S | 1 | 10MR | 2.33 | 10MR | 3.8 | 10S | 57 | 99 |
| 251 | JKW 328 | 16.3 | 60S | 4.9 | 10MS | 2.33 | 10MR | 15.1 | 40S | 46 | 99 |
| 252 | JKW 329 | 23.8 | 40S | 9.1 | 20S | 26.67 | 60S | 8.2 | 20S | 46 | 99 |
| 253 | JKW 330 | 25.4 | 100S | 10.9 | 20S | 28.33 | 80S | 30 | 60S | 46 | 99 |
| | JUNAGADH | | | | | | | | | | |
| 254 | J-2022-02 | 14.8 | 80S | 1.7 | 10S | 5.17 | 20S | 60 | 80S | 56 | 99 |
| 255 | J-2022-08 | 10.6 | 60S* | 3.2 | 10MR | 1.5 | 5S | 64.4 | 80S | 56 | 99 |
| 256 | J-2022-09 | 14.5 | 80S | 8.6 | 20S | 26.33 | 60S | 34.2 | 60S | 46 | 99 |
| 257 | J-2022-11 | 9.7 | 40S | 4.3 | 20S | 3.9 | 10S | 35.9 | 60S | 56 | 99 |
| 258 | J-2022-12 | 6.4 | 40S | 1.2 | 10MR | 0.23 | TS | 34.4 | 60S | 46 | 99 |
| 259 | J-2022-15 | 8.3 | 40S | 3.9 | 20MS | 5.83 | 15S | 57.8 | 80S | 56 | 99 |
| 260 | J-2022-16 | 7 | 30S | 1.5 | 20MR | 1.83 | 10S | 64.4 | 80S | 56 | 99 |
| 260A | Infector | 82.5 | 100S | 82.9 | 100S | 80 | 100S | 78.9 | 90S | 78 | 89 |
| 261 | J-2022-19 | 12 | 60S | 2 | 10S | 0.83 | 5S | 60 | 80S | 56 | 99 |
| 262 | J-2022-20 | 7.3 | 40S | 3.7 | 10MR | 0 | 0 | 53.3 | 80S | 56 | 99 |
| 263 | J-2022-22 | 16.9 | 60S | 3 | 10S | 2.33 | 10S | 23.4 | 60S | 56 | 99 |
| 264 | J-2022-26 | 8.5 | 40S | 2 | 10MR | 0 | 0 | 46.7 | 60S | 57 | 99 |
| 265 | J-2022-28 | 10.3 | 60S* | 1.2 | 10MR | 0 | 0 | 46.7 | 60S | 57 | 99 |
| 266 | J-2022-30 | 11.8 | 60S* | 4.6 | 20S | 0 | 0 | 51.1 | 80S | 56 | 99 |
| 267 | J-2022-31 | 9.5 | 60S* | 1.7 | 10S | 2.33 | 5S | 46.7 | 60S | 57 | 99 |
| 268 | J-2022-34 | 7.5 | 40S | 2.1 | 10MR | 1.53 | 10MR | 41.3 | 60S | 57 | 99 |

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| 269 | J-2022-39 | 7.6 | 40S | 4.6 | 15MR | 1.5 | 10MS | 41.1 | 60S | 57 | 99 |
| 270 | JD 2022-01 | 12.5 | 60S | 4.9 | 20MS | 3.33 | 20S | 4 | 20MS | 46 | 99 |
| 271 | JD 2022-02 | 12 | 40S | 1.8 | 20MR | 4 | 20S | 3.1 | 10S | 46 | 99 |
| 272 | JD 2022-10 | 17.2 | 60S | 2 | 10MS | 0 | 0 | 2.4 | 20MR | 45 | 99 |
| 273 | JD 2022-15 | 11.3 | 60S* | 3.2 | 10S | 0.83 | 5S | 2.4 | 20MR | 45 | 99 |
| | DHARWAD | | | | | | | | | | |
| 274 | UASD2301 | 13.8 | 40S | 4.9 | 20MS | 7.33 | 40S | 20.9 | 40S | 46 | 99 |
| 275 | UASD2302 | 41.5 | 80S | 11.3 | 40S | 0.17 | TS | 26.8 | 40S | 46 | 99 |
| 276 | UASD2303 | 28.3 | 60S | 8.1 | 40S | 4.83 | 20S | 26.5 | 60S | 45 | 99 |
| 277 | UASD2304 | 16.5 | 60S | 6.3 | 20MS | 5.47 | 20S | 27.7 | 60S | 35 | 99 |
| 278 | UASD2305 | 43.5 | 100S | 6.9 | 40S | 3.5 | 20S | 23.8 | 60S | 45 | 99 |
| 279 | UASD2306 | 31.8 | 100S | 8.7 | 40S | 6.33 | 20S | 31.4 | 60S | 56 | 99 |
| 280 | UASD2307 | 34.8 | 100S | 9.7 | 40S | 0.23 | TS | 2.2 | 10S | 45 | 99 |
| 280A | Infector | 82.5 | 100S | 82.9 | 100S | 80 | 100S | 78.9 | 100S | 68 | 79 |
| 281 | UASD2308 | 20.5 | 60S | 3.6 | 20S | 0.17 | TS | 4 | 10MR | 46 | 99 |
| 282 | UASD2309 | 21 | 60S | 3.5 | 20MR | 7.5 | 20S | 55.6 | 80S | 45 | 89 |
| 283 | UASD2310 | 15.3 | 40S | 4.6 | 20S | 0 | 0 | 1.6 | 10MR | 45 | 99 |
| 284 | UASD2311 | 21.3 | 60S | 4.3 | 20S | 0 | 0 | 1.1 | 10MR | 45 | 99 |
| 285 | UASD2312 | 15.3 | 60S | 5.7 | 20MS | 0.83 | 5MS | 2 | 10MR | 46 | 99 |
| 286 | UASD2313 | 41.8 | 100S | 7.7 | 40S | 0 | 0 | 21.6 | 40S | 46 | 99 |
| 287 | UASD2314 | 29 | 80S | 4 | 15MR | 0.83 | 5S | 25.3 | 60S | 45 | 99 |
| 288 | UASD2315 | 24.9 | 80S | 6.4 | 40S | 4.67 | 10S | 27.9 | 60S | 46 | 99 |
| 289 | UASD2316 | 26.1 | 80S | 4.7 | 20S | 5.9 | 20S | 5.1 | 10S | 56 | 99 |
| 290 | UASD2317 | 23.6 | 80S | 2.3 | 10S | 0.83 | 5S | 11 | 40S | 46 | 99 |
| 291 | UASD2318 | 45 | 100S | 7.5 | 40S | 1.5 | 10MS | 25.1 | 60S | 56 | 99 |
| 292 | UASD2319 | 31.6 | 100S | 4.3 | 20S | 1.33 | 10MS | 7.1 | 40S | 45 | 99 |
| 293 | UASD2320 | 17.5 | 60S | 3.6 | 20S | 0.83 | 5S | 7.2 | 40S | 46 | 99 |
| 294 | UASD2321 | 26.5 | 80S | 5.6 | 20MS | 15.33 | 50S | 34.2 | 60S | 46 | 99 |
| 295 | UASD2322 | 3.2 | 40MR | 0.1 | TR | 1.8 | 10S | 20.9 | 60S | 45 | 58 |
| 296 | UASD2323 | 2.1 | 10MR | 2.9 | 20MR | 5 | 20S | 27.3 | 60S | 57 | 89 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 297 | UASD2324 | 4 | 20MS | 2.1 | 20MR | 4 | 20S | 12.7 | 40S | 56 | 89 |
| 298 | UASD2325 | 3.3 | 10S | 2.3 | 10MS | 1.73 | 10S | 42.2 | 60S | 57 | 99 |
| 299 | UASD2326 | 20.8 | 60S | 4.6 | 20MS | 3.2 | 15S | 21.7 | 40S | 45 | 99 |
| 300 | UASD2327 | 12.5 | 40MS | 2.3 | 10MR | 4.07 | 15MS | 32.9 | 60S | 46 | 99 |
| 300A | Infector | 82.5 | 100S | 82.9 | 100S | 85 | 100S | 75.6 | 80S | 68 | 79 |
| 301 | UASD2328 | 21.8 | 40S | 5.1 | 20MS | 20.67 | 50S | 45.1 | 60S | 57 | 99 |
| 302 | UASD2329 | 15.8 | 40S | 4 | 10MS | 2.5 | 10S | 5 | 40MS | 56 | 99 |
| 303 | UASD2330 | 15 | 40S | 4.3 | 20S | 2 | 10S | 28.9 | 60S | 46 | 99 |
| 304 | UASD2331 | 1.7 | 10S | 0.4 | 10MS | 6.5 | 30S | 15.6 | 40S | 46 | 99 |
| 305 | UASD2332 | 24.3 | 80S | 13.1 | 40S | 18.33 | 60S | 22.3 | 60S | 57 | 99 |
| 306 | UASD2333 | 26.9 | 60S | 3.7 | 20S | 7.4 | 20S | 34.8 | 60S | 56 | 99 |
| 307 | UASD2334 | 23.5 | 60S | 2 | 10MR | 1.67 | 10S | 20 | 40S | 45 | 99 |
| 308 | UASD2335 | 12.5 | 60S | 5.1 | 20MS | 5.07 | 20S | 3.8 | 20S | 46 | 99 |
| | SANOSARA | | | | | | | | | | |
| 309 | LOK-2023-1 | 24.8 | 60S | 16.3 | 40S | 20.03 | 40S | 63.3 | 80S | 46 | 99 |
| 310 | LOK-2023-2 | 14.5 | 60S | 3.3 | 20S | 6 | 20S | 55.6 | 80S | 57 | 99 |
| 311 | LOK-2023-3 | 31.5 | 80S | 25.1 | 60S | 26.67 | 60S | 52.9 | 80S | 57 | 99 |
| 312 | LOK-2023-4 | 12.7 | 60S | 2.1 | 10S | 0.83 | 5S | 55.6 | 80S | 57 | 99 |
| 313 | LOK-2023-5 | 11.4 | 60S* | 1.5 | 10MS | 3.33 | 10S | 63.3 | 80S | 57 | 99 |
| | PANTNAGAR | | | | | | | | | | |
| 314 | UPW-1 | 23.6 | 60S | 2 | 10MS | 1.67 | 10S | 7.3 | 20S | 46 | 99 |
| 315 | UPW-2 | 17 | 40MS | 6.6 | 20S | 1.67 | 20MR | 30.9 | 60S | 46 | 89 |
| 316 | UPW-3 | 18.3 | 40MS | 7.7 | 20MS | 6.67 | 40S | 30.2 | 60S | 46 | 99 |
| 317 | UPW-4 | 40.8 | 80S | 17.8 | 40S | 9 | 20S | 38.4 | 60S | 46 | 99 |
| 318 | UPW-5 | 39.5 | 80S | 11.1 | 20S | 25 | 40S | 11 | 20S | 56 | 99 |
| 319 | UPW-6 | 11.9 | 40MR | 3.5 | 20MS | 12.67 | 40S | 34.4 | 60S | 46 | 99 |
| 320 | UPW-7 | 34.8 | 80S | 6.2 | 20MS | 2.83 | 15S | 5.7 | 20S | 56 | 78 |
| 320A | Infector | 80 | 80S | 82.9 | 100S | 76.67 | 90S | 76.7 | 80S | 68 | 79 |
| 321 | UPW-8 | 27 | 60S | 3.8 | 20S | 8 | 40S | 11.1 | 40S | 45 | 99 |
| 322 | UPW-9 | 10.1 | 30S | 0.3 | 5MR | 1.67 | 5S | 10.1 | 40S | 46 | 99 |
| 323 | UPW-10 | 9.3 | 30S | 4.3 | 20MS | 8.5 | 30S | 23.8 | 40S | 46 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 324 | UPW-11 | 12.3 | 40S | 2.6 | 10MS | 9 | 20S | 14.7 | 40S | 46 | 99 |
| 325 | UPW-12 | 14.5 | 60S | 2.9 | 10MR | 7.5 | 20S | 12.8 | 40S | 56 | 99 |
| 326 | UPW-13 | 11 | 30S | 0.7 | 5MS | 2.33 | 15MR | 17.2 | 40S | 47 | 99 |
| 327 | UPW-14 | 12.2 | 20S | 5.7 | 20S | 3.4 | 20S | 29.3 | 40S | 46 | 99 |
| 328 | UPW-15 | 11.3 | 30S | 1.4 | 10MR | 1.33 | 10MS | 14.3 | 10S | 45 | 99 |
| 329 | UPW-16 | 20.3 | 60S | 8.3 | 20MS | 11.33 | 60S | 7.6 | 20S | 46 | 99 |
| 330 | UPW-17 | 29.9 | 60S | 2.9 | 20MS | 6.73 | 20S | 18.1 | 40S | 46 | 99 |
| 331 | UPW-18 | 16.8 | 40S | 3.7 | 20MS | 5.33 | 30S | 18 | 40S | 45 | 99 |
| 332 | UPW-19 | 18.3 | 60S | 4.4 | 20MS | 7.67 | 30S | 4.8 | 20MS | 46 | 99 |
| 333 | UPW-20 | 8.2 | 20S | 4.9 | 10MR | 6.7 | 20S | 2.8 | 10S | 56 | 99 |
| 334 | UPW-21 | 19.8 | 40S | 1 | 5MS | 2.33 | 15MR | 12.1 | 40S | 46 | 89 |
| 335 | UPW-22 | 16 | 30S | 6.1 | 20MR | 7.33 | 20S | 7.3 | 20S | 56 | 99 |
| 336 | UPW-23 | 16.5 | 60S | 5.9 | 20MS | 3.17 | 15S | 18.9 | 40S | 46 | 99 |
| 337 | UPW-24 | 2.8 | 10S | 1.8 | 10S | 4.07 | 20S | 11.5 | 40S | 46 | 99 |
| 338 | UPW-25 | 13.3 | 60S | 4 | 10MR | 7.83 | 15S | 18.9 | 40S | 56 | 99 |
| 339 | UPW-26 | 6.7 | 40S | 2.4 | 15MR | 8.83 | 20S | 13.2 | 40S | 56 | 99 |
| 340 | UPW-27 | 22.6 | 80S | 3.2 | 10MR | 3 | 10MR | 14.7 | 40S | 57 | 99 |
| 340A | Infector | 82.5 | 100S | 82.9 | 100S | 80 | 100S | 76.7 | 80S | 68 | 79 |
| 341 | UPW-28 | 43.8 | 60S | 6 | 20MS | 2.33 | 15MS | 27.2 | 60S | 56 | 99 |
| 342 | UPW-29 | 16.1 | 40S | 2 | 10MS | 3.67 | 20S | 11.2 | 40S | 46 | 99 |
| 343 | UPW-30 | 28.5 | 60S | 2.6 | 15MR | 0 | 0 | 1.4 | 10MS | 45 | 78 |
| 344 | UPW-31 | 21.8 | 40S | 7.6 | 20MS | 8.17 | 20S | 8.8 | 40S | 45 | 78 |
| 345 | UPW-32 | 6.5 | 30S | 0.9 | 10MR | 0.07 | TMR | 4.7 | 10S | 46 | 99 |
| 346 | UPW-33 | 19.1 | 60S | 4.9 | 20S | 10.33 | 40S | 25.3 | 60S | 56 | 99 |
| 347 | UPW-34 | 14 | 40S | 6.9 | 20MS | 19.17 | 40S | 8.7 | 40S | 57 | 99 |
| 348 | UPW-35 | 23.4 | 80S | 0.9 | 10MR | 6.67 | 20S | 8.4 | 40S | 45 | 99 |
| 349 | UPW-36 | 8.5 | 40S | 1.7 | 10S | 6.83 | 20MS | 4.9 | 20MS | 57 | 99 |
| 350 | UPW-37 | 13.8 | 40S | 2 | 10MR | 12 | 40S | 32.3 | 60S | 56 | 99 |
| 351 | UPW-38 | 13.8 | 40S | 1 | 5MR | 4.23 | 15MR | 25.1 | 40S | 45 | 99 |
| 352 | UPW-39 | 16 | 40S | 1.9 | 5MR | 9.07 | 40S | 31.7 | 60S | 46 | 99 |
| 353 | UPW-40 | 14.9 | 40S | 1.1 | 5MR | 2.5 | 10S | 4.6 | 10S | 56 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 354 | UPW-41 | 10 | 30S | 2.7 | 10MR | 9.23 | 40S | 14.7 | 40S | 46 | 99 |
| 355 | UPW-42 | 16.3 | 40S | 6.6 | 20MS | 17.67 | 50S | 6.2 | 20S | 46 | 89 |
| 356 | UPW-43 | 11.1 | 20S | 2.8 | 10S | 14.4 | 30S | 24.4 | 40S | 35 | 99 |
| 357 | UPW-44 | 14.1 | 40S | 1.6 | 10MR | 6.4 | 20S | 5.4 | 20S | 46 | 99 |
| 358 | UPW-45 | 19 | 40S | 2.6 | 20MR | 7.33 | 40S | 16.2 | 40S | 34 | 57 |
| 359 | UPW-46 | 26 | 80S | 2.7 | 10MS | 8 | 30S | 16.2 | 40S | 46 | 89 |
| 360 | UPW-47 | 29.6 | 80S | 15.5 | 60S | 13.33 | 40S | 29.4 | 40S | 46 | 99 |
| 360A | Infector | 85 | 100S | 82.9 | 100S | 81.67 | 100S | 76.7 | 80S | 78 | 99 |
| 361 | UPW-48 | 24.3 | 60S | 8.3 | 20S | 10.67 | 40S | 14.7 | 40S | 45 | 99 |
| 362 | UPW-49 | 15.5 | 40S | 2.8 | 10S | 5.67 | 20S | 1.6 | 10MS | 46 | 89 |
| 363 | UPW-50 | 25.5 | 60S | 2.3 | 10MR | 5.17 | 20S | 4.2 | 20S | 35 | 78 |
| | JAMMU | | | | | | | | | | |
| 364 | JAUW725 | 26.4 | 60S | 2.1 | 10MR | 1.73 | 10S | 16.2 | 40S | 46 | 99 |
| 365 | JAUW726 | 15.6 | 40S | 2.4 | 10MR | 7 | 30S | 27 | 40S | 47 | 99 |
| 366 | JAUW727 | 21.8 | 60S | 5.5 | 20MS | 21.5 | 60S | 15.9 | 40S | 46 | 99 |
| 367 | JAUW728 | 17.5 | 60S | 5.7 | 20MS | 13.33 | 40S | 20.3 | 40S | 56 | 99 |
| 368 | JAUW729 | 13.2 | 40S | 9.7 | 30S | 24 | 60S | 16 | 40S | 46 | 89 |
| 369 | JAUW730 | 18.5 | 60S | 8 | 20MS | 29.33 | 70S | 18.8 | 40S | 57 | 99 |
| 370 | JAUW731 | 2.4 | 10S | 3.5 | 20MS | 3.33 | 20S | 15.2 | 40S | 46 | 99 |
| 371 | JAUW732 | 34.8 | 80S | 10.6 | 20S | 15.67 | 40S | 38.4 | 60S | 46 | 89 |
| 372 | JAUW733 | 8.5 | 40S | 3.3 | 10MR | 2.5 | 15S | 43.9 | 80S | 57 | 99 |
| 373 | JAUW734 | 7.4 | 40S | 4.3 | 10MR | 15.67 | 40S | 47.8 | 60S | 56 | 99 |
| | MODIPURAM | | | | | | | | | | |
| 374 | SVPWL-23-01 | 25.8 | 80S | 2.5 | 10MR | 2.4 | 15MR | 3.2 | 10S | 45 | 99 |
| 375 | SVPWL-23-02 | 13.3 | 40S | 3.2 | 10MR | 0 | 0 | 3 | 10S | 46 | 99 |
| 376 | SVPWL-23-03 | 15.3 | 40S | 1.7 | 10MR | 2.33 | 10MR | 13.4 | 40S | 46 | 99 |
| 377 | SVPWL-23-.04 | 10 | 40S | 2.4 | 10MR | 3.17 | 15S | 8.4 | 40S | 45 | 99 |
| 378 | SVPWL-23-05 | 22 | 40S | 3.7 | 20MR | 4.83 | 15S | 8 | 40S | 46 | 99 |
| 379 | SVPWL-23.06 | 15.8 | 30S | 7.3 | 20MS | 5.67 | 20S | 2.9 | 10MR | 56 | 99 |
| 380 | SVPWL-23-07 | 33.5 | 100S | 16.6 | 60S | 5 | 30S | 1.6 | 5S | 46 | 99 |
| 380A | Infector | 85 | 100S | 82.9 | 100S | 80 | 100S | 78.9 | 100S | 68 | 79 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 381 | SVPWL-23-08 | 13.5 | 40S | 2.6 | 20MR | 0 | 0 | 1 | 5S | 46 | 99 |
| 382 | SVPWL-23-09 | 21.8 | 60S | 7 | 20MS | 0.03 | TR | 2.7 | 10S | 46 | 99 |
| 383 | SVPWL-23-10 | 29 | 60S | 8.3 | 20MS | 0 | 0 | 2.1 | 10MS | 46 | 99 |
| | PRAYAGRAJ | | | | | | | | | | |
| 384 | SHUATS-W64 (G3-MUTANT) | 29.3 | 80S | 2.9 | 10MS | 0 | 0 | 42.2 | 60S | 56 | 99 |
| 385 | SHUATS-W89 (MR-3012/1/3/8) | 41.3 | 100S | 7.7 | 20MS | 3.37 | 20S | 60 | 80S | 46 | 99 |
| 386 | SHUATS-W105 (MR-3151) | 27.5 | 100S | 6.3 | 20MR | 0 | 0 | 40.4 | 60S | 46 | 99 |
| 387 | SHUATS-W98 (MR- 3014/2/4/2) | 52 | 100S | 10.6 | 40S | 0.03 | TR | 61.1 | 80S | 57 | 99 |
| 388 | SHUATS-W100 (MR-3152) | 38.5 | 100S | 18.4 | 40S | 39.33 | 60S | 41.8 | 80S | 57 | 99 |
| 389 | SHUATS-W85 (MR- 3019/12/2) | 41.5 | 80S | 38.9 | 60S | 38.33 | 60S | 43.3 | 60S | 46 | 78 |
| 390 | SHUATS-W109 (MR-3177/8/3/3) | 52.5 | 80S | 11.7 | 40MR | 16 | 60S | 28.1 | 60S | 46 | 78 |
| 391 | SHUATS DURUM -1 | 12.5 | 40S | 3.2 | 10S | 8.33 | 40S | 4.5 | 20S | 56 | 99 |
| 392 | SHUATS DURUM -2 | 13.2 | 40MS | 3.5 | 20S | 0.17 | TS | 4.6 | 20S | 56 | 99 |
| 393 | SHUATS DURUM - 3 | 7.2 | 30S | 2 | 10S | 0 | 0 | 2.9 | 15S | 56 | 99 |
| | RPCAU-PUSA | | | | | | | | | | |
| 394 | RAUW 122 | 25.2 | 60S | 7.8 | 20MS | 16.33 | 50S | 11.2 | 40S | 46 | 99 |
| 395 | RAUW123 | 24.5 | 60S | 7.1 | 20MS | 12.33 | 40S | 7.6 | 20MS | 56 | 99 |
| 396 | RAUW124 | 19.5 | 60S | 5.5 | 20MR | 13 | 40S | 23.6 | 60S | 45 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 397 | RAUW125 | 36.3 | 60S | 6.3 | 20MS | 10.33 | 40S | 34.2 | 60S | 35 | 67 |
| 398 | RAUW 126 | 38.8 | 80S | 3.2 | 10MS | 8.83 | 30S | 46.7 | 80S | 46 | 99 |
| 399 | RAUW 127 | 22.8 | 80S | 18 | 40S | 22.73 | 50S | 7.6 | 20S | 46 | 99 |
| | AYODHYA | | | | | | | | | | |
| 400 | NW-8103 | 17 | 40S | 3.5 | 20MS | 15 | 80S | 12 | 40MS | 56 | 99 |
| 400A | Infector | 82.5 | 100S | 80 | 80S | 80 | 100S | 75.6 | 80S | 68 | 89 |
| 401 | NW-8104 | 13.3 | 60S | 3.2 | 10MS | 3.5 | 15S | 8.1 | 20S | 56 | 99 |
| 402 | NW-8105 | 19.8 | 60S | 4.3 | 20S | 0.67 | 5MS | 7.3 | 40S | 56 | 99 |
| 403 | NW-8106 | 18.8 | 60S | 4.3 | 10MR | 9 | 30S | 10 | 40S | 56 | 99 |
| 404 | NW-8107 | 19.3 | 60S | 3.3 | 10MS | 3.17 | 15S | 34.2 | 60S | 56 | 99 |
| 405 | NW-8108 | 13.5 | 40S | 4.9 | 10MS | 8.33 | 30S | 16.2 | 40S | 46 | 99 |
| 406 | NW-8109 | 27.6 | 60S | 3.3 | 10MS | 6.67 | 20S | 38 | 60S | 46 | 99 |
| 407 | NW-8110 | 26.5 | 60S | 6.3 | 20MS | 11.67 | 20S | 14.2 | 40S | 56 | 99 |
| 408 | NW-8111 | 14 | 60S | 5.1 | 20MR | 18.33 | 40S | 24.7 | 60S | 46 | 99 |
| 409 | NW-8112 | 18.4 | 60S | 5.9 | 20MS | 11.67 | 30S | 12.6 | 40S | 46 | 99 |
| 410 | NW-8113 | 3.8 | 10S | 11.4 | 40S | 28.4 | 50S | 25.9 | 60S | 56 | 99 |
| 411 | NW-8114 | 12 | 60S | 5.7 | 20MS | 4 | 20MS | 3.4 | 10S | 46 | 99 |
| 412 | NW-8115 | 16.8 | 60S | 3.2 | 10MS | 8 | 30S | 14 | 40S | 46 | 99 |
| 413 | NW-8116 | 16.9 | 60S | 5.7 | 20MS | 13 | 40S | 10.2 | 40S | 45 | 99 |
| 414 | NW-8117 | 20.8 | 80S | 3.3 | 10MR | 8.33 | 40S | 32.4 | 60S | 45 | 99 |
| 415 | NW-8118 | 10.3 | 40S | 3.9 | 10MS | 10 | 30S | 13 | 40S | 46 | 99 |
| 416 | NW-8119 | 30.5 | 60S | 4.9 | 10S | 0.87 | 5S | 13.4 | 40S | 46 | 99 |
| 417 | NW-8120 | 25.3 | 60S | 10.3 | 40S | 8.33 | 30S | 22.3 | 60S | 46 | 99 |
| 418 | NW-8121 | 36 | 80S | 3.2 | 10MR | 1.83 | 10S | 20.1 | 60S | 45 | 99 |
| 419 | NW-8122 | 28.3 | 60S | 4.4 | 20S | 0.07 | TMR | 9.2 | 40S | 45 | 99 |
| | BANDA | | | | | | | | | | |
| 420 | BUDW-1 | 21 | 80S | 5.4 | 40MR | 0.07 | TMR | 4 | 20MS | 57 | 99 |
| 420A | Infector | 80 | 80S | 82.9 | 100S | 76.67 | 90S | 76.7 | 80S | 68 | 89 |
| 421 | BUDW-2 | 17.1 | 40S | 3.7 | 10MS | 0.4 | 5MR | 3.4 | 10MS | 46 | 99 |
| 422 | BUDW-3 | 14.3 | 60S | 3.9 | 20S | 0 | 0 | 1.4 | 10MR | 46 | 99 |
| 423 | BUBW-1 | 35 | 80S | 3.1 | 10MR | 5 | 20S | 11.2 | 40S | 46 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 424 | BUBW-2 | 41.8 | 80S | 6.9 | 40S | 4 | 20S | 17 | 60S | 46 | 99 |
| | ARI PUNE | | | | | | | | | | |
| 425 | MACS 4152 | 26 | 60S | 3.1 | 10MR | 0 | 0 | 1.7 | 10MR | 45 | 99 |
| 426 | MACS 4153 | 19.3 | 60S | 2 | 10MS | 0 | 0 | 3.3 | 20MR | 46 | 99 |
| 427 | MACS 4154 | 18.7 | 60S | 2.9 | 10MS | 3.33 | 20S | 2 | 20MR | 56 | 99 |
| 428 | MACS 4155 | 21.8 | 80S | 3.1 | 10MS | 1.73 | 10S | 1.9 | 10S | 46 | 99 |
| 429 | MACS 4156 | 12 | 40S | 3.2 | 10S | 1.67 | 10S | 2.3 | 20MR | 46 | 99 |
| 430 | MACS 4157 | 10.2 | 40S | 2 | 10MR | 1.67 | 10S | 1.4 | 10MR | 56 | 99 |
| 431 | MACS 4158 | 15.5 | 60S | 1.7 | 10S | 0.83 | 5S | 2.8 | 10S | 46 | 99 |
| 432 | MACS 4159 | 19.5 | 60S | 2.3 | 10MS | 1.17 | 5MR | 2.9 | 20MR | 46 | 99 |
| 433 | MACS 4160 | 17.9 | 60S | 3.4 | 10MR | 0 | 0 | 4.2 | 20MS | 56 | 99 |
| 434 | MACS 4161 | 21.3 | 60S | 5.9 | 20MS | 0 | 0 | 3.5 | 20S | 56 | 99 |
| 435 | MACS 5066 | 3.3 | 20MR | 2.9 | 20MS | 0.83 | 5S | 24.2 | 60S | 46 | 78 |
| 436 | MACS 5067 | 1.5 | 10MS | 0.6 | 10MR | 0 | 0 | 24.4 | 60S | 46 | 78 |
| 437 | MACS 6869 | 13.5 | 60S | 1.8 | 10S | 0.17 | TS | 32.1 | 60S | 46 | 99 |
| 438 | MACS 6870 | 13.8 | 60S | 4.6 | 20MS | 0.97 | 5S | 23.6 | 60S | 56 | 99 |
| 439 | MACS 6871 | 29.5 | 80S | 6.3 | 20MR | 14 | 40S | 42.9 | 60S | 57 | 99 |
| 440 | MACS 6872 | 9.1 | 20S | 3.2 | 10MR | 3.33 | 20S | 48.7 | 80S | 57 | 99 |
| 440A | Infector | 82.5 | 100S | 80 | 80S | 81.67 | 100S | 75.6 | 80S | 68 | 89 |
| 441 | MACS 6873 | 14.6 | 40S | 4.6 | 20MS | 3.5 | 20MS | 58.3 | 80S | 57 | 99 |
| 442 | MACS 6874 | 16.8 | 60S | 2.6 | 10MS | 0.83 | 5S | 27.8 | 80S | 46 | 99 |
| 443 | MACS 6875 | 29.8 | 80S | 7.1 | 10S | 1.73 | 10S | 8.2 | 40S | 46 | 99 |
| 444 | MACS 6876 | 12.1 | 60S | 3.2 | 10MS | 1.83 | 10S | 14.4 | 60S | 57 | 99 |
| 445 | MACS 6877 | 13.3 | 60S | 2.8 | 10MR | 3.17 | 10S | 48.3 | 60S | 57 | 99 |
| 446 | MACS 6878 | 11.6 | 40S | 4.1 | 20S | 1.67 | 10S | 40.6 | 60S | 56 | 99 |
| 447 | MACS 6879 | 9.8 | 40S | 4.9 | 30S | 0 | 0 | 15.7 | 60S | 56 | 99 |
| 448 | MACS 6880 | 19.1 | 40S | 7.5 | 20MS | 14.83 | 40S | 5.6 | 20S | 46 | 99 |
| 449 | MACS 6881 | 22 | 80S | 4.6 | 20S | 6.67 | 30S | 21.1 | 60S | 56 | 99 |
| 450 | MACS 6882 | 17 | 40S | 1.7 | 10S | 2.33 | 15MS | 20.1 | 40MS | 56 | 99 |
| 451 | MACS 6883 | 1.5 | 10MR | 2.9 | 10MS | 1.67 | 10S | 22.4 | 60S | 46 | 78 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 452 | MACS 6884 | 4 | 20S | 6 | 30S | 5.83 | 15S | 12.2 | 40S | 56 | 99 |
| 453 | MACS 6885 | 5.3 | 20S | 5.7 | 20MS | 3.33 | 20S | 0.4 | 5MS | 47 | 99 |
| 454 | MACS 6886 | 11.4 | 20S | 1.7 | 10S | 6.5 | 20S | 8.8 | 40S | 46 | 99 |
| 455 | MACS 6887 | 10.1 | 30S | 0.9 | 10MR | 6.73 | 40S | 5.3 | 20S | 46 | 99 |
| 456 | MACS 6888 | 13.6 | 60S | 3.2 | 20S | 0 | 0 | 21.2 | 60S | 57 | 99 |
| 457 | MACS 6889 | 7.9 | 40S | 4.3 | 20MS | 0 | 0 | 42.2 | 60S | 57 | 99 |
| 458 | MACS 6890 | 21.3 | 40S | 4.6 | 20S | 0.33 | 5MR | 18.2 | 40S | 46 | 99 |
| 459 | MACS 6891 | 30 | 60S | 4.9 | 20MS | 3.67 | 20S | 10.5 | 40S | 46 | 99 |
| | VIJAPUR | | | | | | | | | | |
| 460 | VA 2022-12 | 13 | 60S | 1.8 | 10MS | 0 | 0 | 26.2 | 60S | 57 | 99 |
| 460A | Infector | 82.5 | 100S | 82.9 | 100S | 76.67 | 90S | 74.4 | 80S | 78 | 99 |
| 461 | VA 2022-19 | 7.5 | 30S | 2.9 | 10MR | 0.83 | 5S | 60 | 80S | 56 | 99 |
| 462 | VA 2022-34 | 10.1 | 40S | 0.9 | 10MR | 1.4 | 10MS | 54.4 | 60S | 56 | 99 |
| 463 | VA 2022-08 | 6.8 | 40S | 1.2 | 10MS | 0 | 0 | 45.6 | 60S | 46 | 99 |
| 464 | VA 2022-09 | 6.1 | 30S | 2 | 10MR | 2.83 | 20MS | 40 | 60S | 57 | 99 |
| 465 | VA 2022-10 | 29.3 | 80S | 23.6 | 60S | 46.67 | 60S | 41.7 | 60S | 56 | 99 |
| 466 | VA 2022-36 | 8.3 | 40S | 14 | 40MS | 22.33 | 40S | 31.7 | 60S | 57 | 99 |
| 467 | VA 2022-04 | 7.1 | 40S | 6 | 20MS | 7.33 | 20S | 53.3 | 80S | 56 | 99 |
| 468 | VA 2022-05 | 5 | 30S | 0.9 | 10MR | 1.33 | 10MS | 52 | 80S | 57 | 99 |
| 469 | VA 2022-18 | 5.2 | 30S | 1.7 | 10MR | 0 | 0 | 43.9 | 60S | 57 | 99 |
| 470 | VA 2022-21 | 6.6 | 40S | 1 | 10MR | 0.13 | TMS | 50 | 80S | 46 | 99 |
| 471 | VA 2022-15 | 13.5 | 60S | 3.9 | 10MS | 2 | 10S | 51.7 | 80S | 46 | 99 |
| 472 | VA 2022-01 | 9 | 40S | 1.7 | 10S | 0.17 | TS | 55.6 | 80S | 57 | 99 |
| 473 | VA 2022-22 | 6.6 | 30S | 3.1 | 20MR | 0 | 0 | 49.1 | 60S | 46 | 99 |
| 474 | VA 2022-11 | 4.1 | 20S | 2.3 | 10MR | 0 | 0 | 36.9 | 60S | 46 | 99 |
| 475 | VA 2022-07 | 17.5 | 80S | 10.3 | 40S | 23.33 | 40S | 34.2 | 60S | 46 | 99 |
| 476 | VA 2022-14 | 7.8 | 40S | 11.4 | 40MS | 19 | 50S | 39.1 | 60S | 46 | 99 |
| 477 | VA 2022-30 | 7.6 | 40S | 5.7 | 20MS | 6.17 | 20S | 32.9 | 60S | 46 | 99 |
| 478 | VA 2022-24 | 18 | 80S | 3.7 | 10MR | 3.33 | 20MS | 61.1 | 80S | 46 | 99 |
| 479 | VA 2022-23 | 6.5 | 30S | 3.2 | 20MS | 8.33 | 30S | 23.6 | 60S | 46 | 99 |
| 480 | VA 2022-29 | 29.5 | 80S | 30.6 | 80S | 50.03 | 80S | 62.2 | 80S | 56 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 480A | Infector | 85 | 100S | 82.9 | 100S | 81.67 | 100S | 76.7 | 80S | 78 | 99 |
| 481 | VA 2022-28 | 14 | 60S | 2.1 | 10MR | 0.23 | TS | 37.3 | 60S | 56 | 89 |
| 482 | VA 2022-06 | 8.8 | 40S | 1.6 | 10S | 0.67 | 10MR | 61.1 | 80S | 56 | 99 |
| 483 | VD 2022-4 | 10.5 | 60S* | 2.1 | 10MR | 0 | 0 | 2.8 | 10S | 46 | 99 |
| 484 | VD 2022-19 | 6 | 40S | 1.7 | 10S | 0 | 0 | 4.2 | 15S | 56 | 99 |
| 485 | VD 2022-11 | 8.5 | 40S | 0.6 | 10MR | 0 | 0 | 1.4 | 10S | 57 | 99 |
| 486 | VD 2022-20 | 9.1 | 40S | 0.5 | 5MR | 1.73 | 10S | 7.7 | 20S | 57 | 99 |
| 487 | VD 2022-6 | 8.6 | 40S | 2.3 | 10MR | 2.5 | 10S | 7.4 | 20S | 56 | 99 |
| 488 | VD 2022-15 | 10.9 | 40S | 3.4 | 20S | 3.33 | 20S | 3.4 | 20MR | 46 | 99 |
| 489 | VD 2022-3 | 6.4 | 40S | 0.6 | 5MR | 0.17 | TS | 11.6 | 40S | 56 | 99 |
| 490 | VD 2022-2 | 4.1 | 20MS | 0.9 | 10MR | 0 | 0 | 7.3 | 20S | 46 | 99 |
| 491 | VD 2022-14 | 14.6 | 60S | 2.2 | 10R | 0.07 | TMR | 5.6 | 20S | 56 | 99 |
| 492 | VD 2022-17 | 9.3 | 40MS | 4.6 | 20S | 0.83 | 5S | 8.2 | 20S | 46 | 99 |
| 493 | VD 2022-10 | 4.8 | 20S | 3.2 | 10MS | 3.33 | 20S | 3.7 | 20MR | 56 | 99 |
| 494 | VD 2022-7 | 7.5 | 30S | 1.7 | 10MR | 0 | 0 | 6.9 | 20MS | 56 | 99 |
| 495 | DR-21-04 | 36.1 | 100S | 10.3 | 40S | 3.43 | 20S | 17 | 40MS | 57 | 99 |
| 496 | DR-21-05 | 15 | 80S | 4.8 | 10MR | 4.03 | 20S | 53.3 | 60S | 56 | 99 |
| 497 | DR-21-16 | 35.9 | 100S | 10.7 | 40S | 3 | 10S | 67.8 | 100S | 57 | 99 |
| 498 | DR-21-23 | 19.8 | 80S | 4.6 | 20S | 1.67 | 5S | 51.1 | 80S | 57 | 99 |
| 499 | DR-22-03 | 14.1 | 60S | 6 | 10MR | 0.7 | 10MR | 44.7 | 80S | 57 | 99 |
| | KALYANI | | | | | | | | | | |
| 500 | BCW 41 | 14.1 | 40S | 3.5 | 10MS | 7.67 | 20MS | 41.1 | 80S | 46 | 99 |
| 500A | Infector | 80 | 80S | 80 | 80S | 80 | 100S | 77.8 | 80S | 78 | 99 |
| 501 | BCW 42 | 19.3 | 60S | 3.5 | 10MR | 8.4 | 50S | 20.2 | 40S | 56 | 99 |
| 502 | BCW 43 | 10.9 | 30S | 4.3 | 20MS | 4.67 | 20S | 27.2 | 60MS | 56 | 99 |
| 503 | BCW 44 | 9 | 20S | 4.9 | 20MS | 9 | 20MS | 7.6 | 20MS | 46 | 99 |
| 504 | BCW 45 | 3.7 | 10S | 7 | 20MS | 10.13 | 30S | 21 | 40S | 46 | 99 |
| 505 | BCW 46 | 14.9 | 60S | 1.8 | 10MR | 9.17 | 30S | 9.4 | 20MS | 46 | 99 |
| 506 | BCW 47 | 18.8 | 80S | 2 | 10S | 4 | 20MS | 6 | 20MS | 46 | 99 |
| 507 | BCW 48 | 28.5 | 80S | 4.7 | 20MS | 5.83 | 20S | 14.4 | 40S | 56 | 99 |
| 508 | BCW 49 | 4.4 | 20MS | 3.9 | 10MS | 9.33 | 20S | 31.9 | 60S | 46 | 99 |

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| 509 | BCW 50 | 24.3 | 80S | 5.5 | 20S | 7 | 20S | 20.4 | 40S | 46 | 99 |
| | KANPUR | | | | | | | | | | |
| 510 | KA 2301 | 9.8 | 20MS | 0.4 | 5MR | 5.83 | 20S | 28 | 60S | 35 | 57 |
| 511 | KA 2302 | 11.6 | 20S | 2.6 | 20MS | 9.67 | 30S | 27.6 | 40S | 46 | 57 |
| 512 | KA 2303 | 26 | 60S | 5.1 | 20MS | 11.53 | 30S | 43.3 | 60S | 46 | 78 |
| 513 | KA 2304 | 21 | 40S | 3.2 | 10MR | 19.67 | 80S | 13.8 | 40S | 46 | 99 |
| 514 | KA 2305 | 5.7 | 20S | 3.7 | 20S | 7 | 40S | 16.5 | 40S | 46 | 99 |
| 515 | KA 2306 | 10.6 | 30S | 4.9 | 20S | 9 | 40S | 42.2 | 60S | 56 | 99 |
| 516 | KA 2307 | 7.3 | 40S | 3.8 | 20MS | 3.67 | 20S | 45.6 | 60S | 46 | 99 |
| 517 | KA 2308 | 5.4 | 20MS | 3.5 | 20S | 7.33 | 30S | 21.4 | 40S | 46 | 99 |
| 518 | KA 2309 | 2.8 | 10MR | 7 | 20MS | 12.33 | 40S | 38.9 | 60S | 46 | 78 |
| 519 | KA 2310 | 11.6 | 40MR | 2.7 | 10MS | 7 | 30S | 6.3 | 20MS | 46 | 99 |
| 520 | KA 2311 | 9.9 | 40S | 2.1 | 10S | 4.9 | 20S | 10.9 | 20MS | 46 | 99 |
| 520A | Infector | 80 | 80S | 82.9 | 100S | 81.67 | 100S | 75.6 | 80S | 78 | 99 |
| 521 | KA 2312 | 15.1 | 40S | 3.7 | 10MR | 5.67 | 30S | 7.9 | 20MS | 46 | 99 |
| 522 | KA 2313 | 11.8 | 30S | 2 | 10MR | 0.83 | 5S | 35.2 | 60S | 46 | 78 |
| 523 | KA 2314 | 15.5 | 40S | 3.2 | 10MR | 6.67 | 30S | 5.6 | 20MS | 46 | 99 |
| 524 | KA 2315 | 16 | 40S | 4.3 | 10S | 11.67 | 40S | 4.7 | 20MS | 56 | 99 |
| 525 | KA 2316 | 14.8 | 30S | 0.7 | 10MR | 9.73 | 40S | 7.5 | 40S | 46 | 99 |
| 526 | KA 2317 | 12.3 | 40S | 6.3 | 20MS | 1.93 | 5S | 41.1 | 60S | 57 | 99 |
| 527 | KA 2318 | 3.5 | 10MS | 2.9 | 20MR | 5.07 | 10S | 27.9 | 60S | 36 | 59 |
| 528 | KA 2319 | 7.2 | 20S | 4.3 | 20S | 13.83 | 30S | 21.9 | 40S | 46 | 99 |
| 529 | KA 2320 | 33.8 | 80S | 2.6 | 10MS | 6.17 | 20S | 13.4 | 40S | 46 | 68 |
| 530 | KA 2321 | 10.3 | 60S* | 5.4 | 20S | 10.73 | 40S | 24.3 | 60S | 57 | 99 |
| 531 | KA 2322 | 9.6 | 60S* | 3.2 | 20S | 1.73 | 10S | 57.8 | 80S | 46 | 99 |
| 532 | KA 2323 | 23.5 | 60S | 4 | 10MS | 17 | 40S | 25.3 | 60S | 57 | 99 |
| 533 | KA 2324 | 24.3 | 80S | 6.5 | 20MS | 0.4 | 5MR | 17.1 | 60S | 57 | 99 |
| 534 | KA 2325 | 13.5 | 60S | 5.9 | 20MS | 8.83 | 20S | 11.2 | 20S | 46 | 99 |
| 535 | KA 2326 | 5.3 | 20R | 2.9 | 20S | 0.17 | TS | 11.1 | 20S | 56 | 99 |
| 536 | KA 2327 | 14.3 | 60S | 1.5 | 10S | 4.5 | 15MS | 3.7 | 10S | 46 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 537 | KA 2328 | 8 | 30S | 8.2 | 40MS | 20 | 40S | 12.7 | 40S | 56 | 99 |
| 538 | KA 2329 | 16.9 | 60S | 3.2 | 20MS | 5 | 15S | 8.2 | 40S | 46 | 99 |
| 539 | KA 2330 | 4.4 | 20S | 0.3 | 5MR | 0.67 | 5MS | 3 | 10MS | 56 | 99 |
| | KAMADGIRI PVT | | | | | | | | | | |
| 540 | KGW90 | 18.5 | 60S | 2.3 | 10S | 0.43 | 5MR | 3.8 | 10S | 47 | 99 |
| 540A | Infector | 82.5 | 100S | 82.9 | 100S | 78.33 | 100S | 77.8 | 100S | 78 | 99 |
| | NUZIVEEDU SEEDS | | | | | | | | | | |
| 541 | NWS2217 | 33.5 | 80S | 5.5 | 20MS | 0.87 | 5S | 20.8 | 40S | 46 | 99 |
| 542 | NSW2218 | 37.5 | 80S | 5.2 | 20MS | 0 | 0 | 20 | 40S | 46 | 99 |
| 543 | NWS2247 | 17.5 | 40S | 5 | 20MR | 5.57 | 15S | 5 | 20S | 46 | 99 |
| | IARI WEELINGTON | | | | | | | | | | |
| 544 | HW3928-1 | 6.1 | 20MR | 0.9 | 10MR | 0.73 | 10MR | 36.7 | 60S | 46 | 99 |
| | HAU HISAR | | | | | | | | | | |
| 545 | P 14154 | 35 | 80S | 1.7 | 10MR | 7.57 | 20S | 3.3 | 15S | 46 | 99 |
| 546 | P 14197 | 25.3 | 60S | 9.8 | 20MS | 30 | 60S | 8 | 20S | 47 | 99 |
| 547 | P 14283 | 28.3 | 60S | 12.9 | 40S | 13.53 | 20MS | 5.7 | 20MS | 46 | 99 |
| 548 | P 14304 | 23.5 | 60S | 3.8 | 20S | 8.97 | 40S | 21.7 | 40S | 56 | 99 |
| 549 | P 14306 | 10.3 | 40S | 1.5 | 10MS | 1.67 | 10MS | 5.8 | 20S | 46 | 99 |
| 550 | P 14309 | 17.9 | 40S | 19.4 | 40MS | 19 | 40S | 5.5 | 20S | 57 | 99 |
| 551 | P 14316 | 51 | 100S | 14.9 | 40S | 27 | 60S | 7 | 40S | 46 | 99 |
| 552 | P 14328 | 26.5 | 60S | 8 | 20MS | 20 | 50S | 7.2 | 40S | 46 | 99 |
| 553 | P 14335 | 20.5 | 60S | 4.6 | 20S | 11.33 | 50S | 4.9 | 20MS | 46 | 99 |
| 554 | P 14341 | 9.3 | 20S | 1.7 | 10S | 5.37 | 30S | 3.3 | 15MR | 56 | 99 |
| 555 | P 14342 | 30 | 60S | 6.6 | 20MS | 15.67 | 40S | 5.9 | 20MS | 46 | 99 |
| 556 | P 14346 | 32.5 | 60S | 14.9 | 40S | 30 | 60S | 3.8 | 10S | 46 | 89 |
| 557 | P 14350 | 40.3 | 80S | 17.1 | 40MS | 28.33 | 60S | 4.6 | 20S | 57 | 99 |
| 558 | P 14353 | 43 | 80S | 14 | 40MS | 28.33 | 40S | 4.9 | 20S | 46 | 99 |
| 559 | P 14358 | 14.8 | 20S | 1.2 | 10MR | 10.5 | 20S | 4.3 | 10MS | 46 | 99 |

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| 560 | P 14361 | 27.5 | 80S | 4.6 | 20MS | 5.17 | 20S | 19.2 | 40S | 46 | 99 |
| 560A | Infector | 82.5 | 100S | 82.9 | 100S | 80 | 100S | 76.7 | 80S | 78 | 99 |
| 561 | P 14362 | 20.5 | 60S | 4.3 | 20MS | 0.67 | 5MS | 13.9 | 80S | 56 | 99 |
| 562 | P 14364 | 10.5 | 40S | 14.9 | 40S | 20.8 | 40S | 2.2 | 10S | 56 | 99 |
| 563 | P 14369 | 11 | 40S | 2.3 | 10MR | 13.67 | 50S | 14.6 | 40S | 46 | 89 |
| 564 | P 14375 | 19.3 | 40S | 10 | 20MS | 34.33 | 60S | 9.7 | 20S | 56 | 99 |
| 565 | P 14395 | 40.8 | 100S | 19.1 | 80S | 23.33 | 60S | 10.2 | 40S | 57 | 99 |
| 566 | P 14396 | 36.5 | 100S | 14.3 | 20S | 36.67 | 60S | 25.2 | 60S | 56 | 99 |
| 567 | P 14404 | 40 | 80S | 14.3 | 40S | 33.33 | 60S | 6 | 40S | 57 | 99 |
| 568 | P 14407 | 35 | 80S | 10.6 | 20S | 18 | 40S | 7.9 | 40S | 57 | 99 |
| 569 | P 14426 | 6.3 | 20S | 1 | 10MR | 5.7 | 30S | 10.9 | 40S | 45 | 89 |
| 570 | P 14429 | 17.7 | 40S | 4.3 | 20MS | 2.33 | 10MR | 4.8 | 10S | 46 | 99 |
| 571 | P 14430 | 26.9 | 80S | 2.6 | 10MR | 11.17 | 40S | 5 | 20MS | 46 | 99 |
| 572 | P 14444 | 7.6 | 30S | 4.6 | 10MS | 6.67 | 20S | 14.3 | 40S | 56 | 99 |
| 573 | P 14452 | 6.3 | 20S | 3.5 | 20MS | 0.83 | 5S | 10.9 | 40S | 46 | 99 |
| 574 | P 14288 | 23.8 | 40S | 4.6 | 20MR | 9.17 | 20S | 6.5 | 20MR | 46 | 89 |
| 575 | P 20009 | 37 | 80S | 12 | 40MS | 25 | 60S | 4.4 | 20S | 57 | 99 |
| 576 | P 20010 | 42.5 | 80S | 16.6 | 40S | 25.03 | 60S | 5.9 | 40S | 57 | 99 |
| 577 | P 20017 | 24.5 | 40S | 6.9 | 20MS | 9.4 | 20S | 6.3 | 20S | 46 | 99 |
| 578 | P 20025 | 41.3 | 80S | 12.3 | 40MS | 14.83 | 40S | 7 | 40S | 46 | 99 |
| 579 | P 20032 | 18 | 40S | 2 | 10MS | 1.73 | 10S | 20.6 | 40MS | 46 | 99 |
| 580 | P 30033 | 17.4 | 60S | 0.3 | 5MR | 3.67 | 20S | 14.9 | 40S | 46 | 99 |
| 580A | Infector | 85 | 100S | 82.9 | 100S | 80 | 100S | 76.7 | 80S | 68 | 79 |
| 581 | P 20034 | 9.5 | 30S | 1.5 | 10MR | 6.33 | 20S | 11 | 20S | 46 | 99 |
| 582 | P 20037 | 12.4 | 60S | 1.2 | 10MR | 1.73 | 10S | 21.1 | 40S | 46 | 99 |
| 583 | P 20040 | 17.8 | 40S | 2.2 | 10MS | 3.17 | 10S | 17.1 | 40S | 46 | 99 |
| 584 | P 20042 | 13.5 | 40MS | 4.4 | 10MR | 8 | 20S | 22.1 | 60S | 56 | 99 |
| 585 | P 20043 | 33.8 | 80S | 0.7 | 10S | 6 | 20S | 12 | 40S | 57 | 89 |
| 586 | P 20045 | 16.3 | 30S | 2 | 10MR | 6.67 | 20S | 5.8 | 20MR | 45 | 99 |
| 587 | P 20057 | 38.3 | 80S | 7.9 | 30S | 1.33 | 10MS | 20.6 | 40S | 46 | 99 |
| 588 | P 20061 | 12.4 | 40MS | 4.7 | 20MS | 12.03 | 40S | 6.7 | 40MS | 46 | 99 |

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| 589 | P 20063 | 25.8 | 80S | 3.7 | 10MR | 5.37 | 20S | 4.4 | 20S | 56 | 99 |
| 590 | P 20075 | 6.4 | 30S | 2.1 | 10MR | 2 | 10S | 13.6 | 40S | 45 | 99 |
| 591 | P 20078 | 24.3 | 80S | 1.5 | 10MR | 6.5 | 20S | 10.6 | 40S | 56 | 99 |
| 592 | P 20079 | 24.3 | 80S | 1.9 | 10MS | 0.17 | TS | 11.6 | 40S | 56 | 99 |
| 593 | P 20081 | 16.1 | 80S | 5.3 | 20MS | 8.33 | 20S | 11.6 | 40S | 56 | 99 |
| 594 | P 30022 | 13.3 | 80S* | 3 | 10MS | 3.83 | 10MS | 5.6 | 20S | 57 | 99 |
| 595 | P 30024 | 10.5 | 40S | 1.8 | 10S | 0.4 | 5MR | 6.9 | 20S | 45 | 99 |
| 596 | P 30034 | 4.8 | 20MR | 4.9 | 20MS | 13.33 | 40S | 10 | 40S | 46 | 99 |
| 597 | P 30035 | 4.6 | 20S | 1.2 | 10MR | 0.67 | 10MR | 6.2 | 20S | 45 | 99 |
| 598 | P 30041 | 13.5 | 40S | 5.4 | 20MS | 16.67 | 40S | 2.4 | 10S | 56 | 99 |
| 599 | P 30044 | 12.6 | 40S | 5.7 | 20MS | 12.53 | 40S | 5.8 | 20S | 56 | 99 |
| 600 | P 30054 | 14.8 | 40S | 0.6 | 5MS | 4.47 | 20MS | 18.1 | 40S | 56 | 99 |
| 600A | Infector | 85 | 100S | 82.9 | 100S | 81.67 | 100S | 75.6 | 80S | 78 | 99 |
| 601 | P 30055 | 18.3 | 40S | 10.3 | 20S | 20.67 | 40S | 6.4 | 20S | 56 | 99 |
| 602 | P 30060 | 29.3 | 60S | 6.4 | 20MS | 21.67 | 40S | 14.6 | 60S | 57 | 99 |
| 603 | P 40001 | 15.3 | 40S | 13.4 | 20S | 22.33 | 40S | 8.9 | 40S | 57 | 99 |
| 604 | P 40003 | 29 | 80S | 6.3 | 20S | 6.83 | 20MS | 8.9 | 40S | 57 | 99 |
| 605 | P 9041 | 26.5 | 80S | 6.1 | 40S | 1.67 | 10S | 6.9 | 40S | 46 | 99 |
| 606 | P 9058 | 29.8 | 100S | 7.5 | 40S | 0 | 0 | 5.1 | 40S | 56 | 99 |
| 607 | P 9059 | 20 | 80S | 2 | 10MS | 0.83 | 5S | 5.7 | 40S | 56 | 99 |
| 608 | P 9074 | 19.8 | 80S | 2.3 | 10S | 0.83 | 5S | 3.9 | 20S | 57 | 99 |
| 609 | P 9079 | 34.7 | 100S | 13.7 | 60S | 5.33 | 20S | 9.8 | 40S | 56 | 99 |
| | IARI | | | | | | | | | | |
| 610 | IARI-23-01 | 25.5 | 100S | 2.2 | 40S | 1.4 | 10MS | 2.9 | 10MS | 46 | 99 |
| 611 | IARI-23-02 | 3.7 | 20MS | 3.5 | 20S | 4.33 | 20S | 7.7 | 20MS | 46 | 99 |
| 612 | IARI-23-03 | 22.5 | 60S | 4.1 | 20S | 0.17 | TS | 1.1 | 10MS | 46 | 99 |
| 613 | IARI-23-04 | 20.5 | 80S | 10.2 | 40S | 4 | 20S | 2.6 | 10S | 46 | 89 |
| 614 | IARI-23-05 | 37 | 80S | 8.3 | 40S | 1.33 | 10MS | 3.9 | 20S | 45 | 99 |
| 615 | IARI-23-06 | 12.4 | 40S | 2.9 | 10MS | 5.33 | 20S | 3.9 | 20S | 46 | 99 |
| 616 | IARI-23-07 | 15 | 60S | 2.6 | 20MR | 0 | 0 | 0.7 | 5S | 46 | 99 |
| 617 | IARI-23-08 | 25.8 | 80S | 6.3 | 20S | 1.4 | 10MS | 1.8 | 10MS | 45 | 99 |

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| 618 | IARI-23-09 | 14 | 40S | 3.6 | 20S | 6.67 | 30S | 7.4 | 40S | 56 | 99 |
| 619 | IARI-23-10 | 13.1 | 60S | 3.2 | 20S | 3.37 | 15S | 8.7 | 40MS | 56 | 99 |
| 620 | IARI-23-11 | 28.5 | 80S | 2.1 | 10MR | 0.9 | 5S | 21.3 | 60S | 46 | 99 |
| 620A | Infector | 82.5 | 100S | 82.9 | 100S | 80 | 100S | 76.7 | 80S | 78 | 99 |
| 621 | IARI-23-12 | 51 | 100S | 8.9 | 20S | 4 | 20S | 18.4 | 60S | 56 | 99 |
| 622 | IARI-23-13 | 46 | 100S | 6.3 | 40S | 0.67 | 10MR | 10.1 | 40S | 46 | 99 |
| 623 | IARI-23-14 | 27.6 | 80S | 5.9 | 20MS | 6.87 | 20S | 17.9 | 40S | 57 | 99 |
| 624 | IARI-23-15 | 31.3 | 80S | 4.4 | 20MS | 6 | 10S | 16.7 | 40S | 56 | 78 |
| 625 | IARI-23-16 | 27 | 80S | 3.1 | 20MS | 4.2 | 10MS | 19.9 | 60S | 46 | 89 |
| 626 | IARI-23-17 | 43.3 | 80S | 3.5 | 20S | 0.83 | 5S | 16.7 | 60MS | 46 | 99 |
| 627 | IARI-23-18 | 17.5 | 80S | 5.5 | 20S | 8 | 20S | 2.1 | 10S | 46 | 99 |
| 628 | IARI-23-19 | 19.1 | 80S | 1.3 | 10MS | 0 | 0 | 1.2 | 10MR | 46 | 99 |
| 629 | IARI-23-20 | 6.6 | 20S | 7.7 | 20MS | 9.17 | 20S | 7.9 | 20MS | 57 | 99 |
| 630 | IARI-23-21 | 4.3 | 20S | 1.6 | 10S | 4.67 | 20S | 18.7 | 40S | 67 | 99 |
| 631 | IARI-23-22 | 7.8 | 40S | 2.6 | 10MS | 0 | 0 | 52.2 | 80S | 46 | 89 |
| 632 | IARI-23-23 | 27.3 | 80S | 7.5 | 40S | 0 | 0 | 2.8 | 20MS | 46 | 99 |
| 633 | IARI-23-24 | 23.8 | 80S | 6.9 | 40S | 6.47 | 20MS | 4.4 | 20MS | 47 | 99 |
| 634 | IARI-23-25 | 11.9 | 60S | 3.2 | 20MS | 5.73 | 20S | 20.6 | 40S | 46 | 78 |
| 635 | IARI-23-26 | 22.9 | 60S | 1.5 | 10R | 0.33 | 5MR | 7.2 | 40S | 45 | 99 |
| 636 | IARI-23-27 | 12.5 | 40S | 2.3 | 10MS | 1.5 | 10MR | 9.6 | 20MS | 46 | 99 |
| 637 | IARI-23-28 | 24.3 | 100S | 6.3 | 20S | 0.83 | 5S | 1.1 | 10S | 46 | 99 |
| 638 | IARI-23-29 | 9.8 | 60S* | 2 | 10MR | 0.37 | 5MR | 9.3 | 40S | 56 | 99 |
| 639 | IARI-23-30 | 5.1 | 20S | 8.6 | 20MS | 10.8 | 40S | 12.1 | 40S | 56 | 99 |
| 640 | IARI-23-31 | 21.3 | 80S | 10.6 | 40S | 18.33 | 40S | 15.2 | 40S | 56 | 99 |
| 640A | Infector | 82.5 | 100S | 80 | 80S | 78.33 | 100S | 76.7 | 80S | 78 | 99 |
| 641 | IARI-23-32 | 38.2 | 80S | 10.9 | 40S | 16.33 | 40S | 22.4 | 40S | 47 | 78 |
| 642 | IARI-23-33 | 12.6 | 60S | 3.3 | 20MS | 7.33 | 40S | 15.3 | 40S | 57 | 99 |
| 643 | IARI-23-34 | 16 | 80S | 0.9 | 10MR | 2.83 | 15S | 9 | 40S | 57 | 99 |
| 644 | IARI-23-35 | 11.1 | 60S | 3 | 20S | 4.33 | 20MS | 53.3 | 80S | 46 | 99 |
| 645 | IARI-23-36 | 9.8 | 40S | 1.7 | 10MS | 2.33 | 10MR | 56.7 | 80S | 56 | 99 |
| 646 | IARI-23-37 | 11.6 | 60S* | 3.6 | 20MS | 3.33 | 20S | 51.1 | 80S | 67 | 99 |

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| 647 | IARI-23-38 | 11.5 | 60S* | 2.2 | 20MR | 3.47 | 20S | 46.7 | 80S | 46 | 99 |
| 648 | IARI-23-39 | 12.3 | 60S* | 1.3 | 20MR | 1.67 | 10S | 52.2 | 80S | 56 | 99 |
| 649 | IARI-23-40 | 5.5 | 20S | 4.3 | 20S | 1.67 | 10S | 46.2 | 80S | 57 | 99 |
| 650 | No Seed (Infector) | 32.3 | 60S | 16.4 | 40S | 31.67 | 60S | 54.4 | 60S | 57 | 99 |
| 651 | No Seed (Infector) | 32.5 | 60S | 15.3 | 40S | 32.5 | 60S | 50.9 | 80S | 57 | 99 |
| 652 | IARI-23-43 | 8.3 | 20MR | 1.7 | 10S | 1.67 | 5S | 13.3 | 60S | 46 | 89 |
| 653 | IARI-23-44 | 1.5 | 10MR | 0.9 | 10R | 1.7 | 10S | 20.3 | 40S | 46 | 99 |
| 654 | IARI-23-45 | 6.3 | 20MS | 0.2 | 5R | 0.17 | TS | 23.6 | 60S | 46 | 99 |
| 655 | IARI-23-46 | 12.3 | 30S | 4.4 | 20S | 0.07 | TMR | 26.2 | 60S | 36 | 79 |
| 656 | IARI-23-47 | 2.3 | 10MS | 6 | 10MR | 5.83 | 20S | 15.6 | 40S | 46 | 99 |
| 657 | IARI-23-48 | 16.5 | 60S | 4.1 | 20MS | 1.67 | 10S | 14.9 | 40S | 45 | 89 |
| 658 | IARI-23-49 | 25 | 60S | 7 | 20MS | 0 | 0 | 18.2 | 60S | 46 | 99 |
| 659 | IARI-23-50 | 7.8 | 40S | 2.9 | 10R | 0 | 0 | 29.9 | 60S | 56 | 99 |
| 660 | IARI-23-51 | 11.3 | 40S | 3.2 | 20S | 1.67 | 10S | 2.9 | 10S | 56 | 99 |
| 660A | Infector | 80 | 80S | 80 | 80S | 78.33 | 100S | 76.7 | 80S | 78 | 99 |
| 661 | IARI-23-52 | 23 | 80S | 4.8 | 20S | 1.83 | 10S | 0.8 | 5S | 46 | 99 |
| 662 | IARI-23-53 | 16.4 | 40S | 4.1 | 10MS | 3 | 10MS | 6 | 20MS | 57 | 99 |
| 663 | IARI-23-54 | 10.6 | 60S* | 4.7 | 20S | 0 | 0 | 3.6 | 15S | 56 | 99 |
| 664 | IARI-23-55 | 10.3 | 40S | 1.9 | 10MR | 0.83 | 5S | 2 | 10S | 46 | 99 |
| 665 | IARI-23-56 | 14.8 | 80S | 2.9 | 20MR | 4 | 15MR | 15.7 | 60S | 46 | 99 |
| 666 | IARI-23-57 | 24.8 | 80S | 6 | 40S | 0 | 0 | 2.3 | 15S | 46 | 99 |
| 667 | IARI-23-58 | 30 | 80S | 9.9 | 20MS | 8 | 20S | 10.3 | 40S | 46 | 99 |
| 668 | IARI-23-59 | 42.5 | 100S | 8.7 | 40S | 3.33 | 20S | 10.2 | 80S* | 46 | 99 |
| 669 | IARI-23-60 | 21.5 | 60S | 7.4 | 20MS | 12.03 | 40MS | 7.4 | 20S | 46 | 59 |
| 670 | IARI-23-61 | 26.3 | 60S | 8.4 | 20MS | 12.67 | 40S | 10.2 | 40S | 57 | 99 |
| 671 | IARI-23-62 | 13 | 60S | 3.2 | 10MR | 0.73 | 5MS | 6.1 | 20S | 46 | 99 |
| 672 | IARI-23-63 | 23.5 | 60S | 3.4 | 10MS | 8.33 | 20S | 17.3 | 60S | 46 | 99 |
| 673 | IARI-23-64 | 19.1 | 60S | 2 | 10R | 4 | 20S | 11.8 | 40S | 46 | 99 |

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| 674 | IARI-23-65 | 9.6 | 40S | 3.7 | 20MS | 11.17 | 40S | 4.7 | 15S | 47 | 89 |
| 675 | IARI-23-66 | 16.8 | 30S | 4.3 | 10MR | 7 | 20S | 8.4 | 20S | 46 | 99 |
| 676 | IARI-23-67 | 7.6 | 30S | 2.9 | 10MR | 10 | 40S | 7.8 | 20S | 46 | 99 |
| 677 | IARI-23-68 | 5.9 | 20S | 0.8 | S10 | 5.33 | 20S | 19.8 | 80S | 46 | 99 |
| 678 | IARI-23-69 | 5.4 | 20S | 0.7 | 10MR | 0.83 | 5S | 57.8 | 80S | 56 | 99 |
| 679 | IARI-23-70 | 6.8 | 40S | 1.2 | 10R | 1.33 | 10MS | 45.8 | 80S | 57 | 99 |
| 680 | IARI-23-71 | 6.9 | 40S | 1.9 | 20MR | 0.67 | 10MR | 58.3 | 80S | 57 | 99 |
| 680A | Infector | 82.5 | 100S | 82.9 | 100S | 85 | 100S | 73.3 | 80S | 68 | 79 |
| 681 | IARI-23-72 | 8.5 | 40S | 3 | 10MS | 1.4 | 10MS | 58.9 | 80S | 56 | 99 |
| 682 | IARI-23-73 | 1.8 | 10S | 1.2 | 10MS | 0.67 | 5MS | 54.4 | 80S | 56 | 99 |
| 683 | No Seed (Infector) | 37 | 60S | 16.9 | 40MS | 18.33 | 40S | 57.8 | 80S | 46 | 99 |
| 684 | IARI-23-75 | 12.1 | 40S | 4.7 | 20S | 11.33 | 20S | 4.6 | 10S | 46 | 99 |
| 685 | IARI-23-76 | 21 | 60S | 8 | 20S | 3.33 | 20S | 5.2 | 20S | 46 | 99 |
| 686 | IARI-23-77 | 44.5 | 100S | 8.2 | 20S | 3.17 | 10MR | 14 | 40S | 46 | 99 |
| 687 | IARI-23-78 | 28.5 | 80S | 3.2 | 20S | 2 | 10S | 5.1 | 20MS | 56 | 99 |
| 688 | IARI-23-79 | 27.8 | 80S | 6.5 | 40S | 0.83 | 5S | 31.1 | 60S | 46 | 99 |
| 689 | IARI-23-80 | 6.7 | 20MR | 2.4 | 10S | 6.67 | 20S | 10.2 | 20S | 57 | 99 |
| 690 | IARI-23-81 | 28.8 | 60S | 12 | 40S | 21.67 | 40S | 21.7 | 40S | 45 | 99 |
| 691 | IARI-23-82 | 10.8 | 60S* | 2 | 10R | 0 | 0 | 5.4 | 20S | 57 | 99 |
| 692 | IARI-23-83 | 10 | 40S | 2.3 | 10R | 0 | 0 | 6.2 | 20S | 57 | 99 |
| 693 | IARI-23-84 | 8.3 | 40S | 0.8 | 10MR | 0 | 0 | 11.1 | 40S | 57 | 99 |
| 694 | IARI-23-85 | 21.3 | 80S | 1.8 | 10S | 0 | 0 | 1.2 | 10MR | 57 | 99 |
| 695 | IARI-23-86 | 8.9 | 40S | 2.9 | 10R | 3.33 | 20S | 4.7 | 20S | 57 | 99 |
| 696 | IARI-23-87 | 14.8 | 60S | 2.3 | 10MR | 3.33 | 20S | 5.4 | 20S | 46 | 99 |
| 697 | IARI-23-88 | 16 | 60S | 1.9 | 10S | 0 | 0 | 2 | 15S | 46 | 99 |
| 698 | IARI-23-89 | 13.8 | 60S | 4.9 | 20S | 0 | 0 | 4.1 | 20S | 46 | 99 |
| 699 | IARI-23-90 | 17.3 | 60S | 3 | 10MS | 1.67 | 10S | 3.1 | 20S | 46 | 89 |
| 700 | IARI-23-91 | 9.3 | 40S | 1.5 | 10MR | 0 | 0 | 9.2 | 40S | 46 | 99 |
| 700A | Infector | 82.5 | 100S | 80 | 80S | 80 | 100S | 76.7 | 80S | 78 | 99 |
| 701 | IARI-23-92 | 26.5 | 100S | 9.3 | 40S | 0.37 | 5MR | 5.2 | 40S | 56 | 99 |

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| 702 | IARI-23-93 | 11.8 | 40S | 1.5 | S40 | 1.5 | 10MS | 21.8 | 60S | 56 | 99 |
| 703 | IARI-23-94 | 10.8 | 60S | 1.5 | 10MS | 4.33 | 20MS | 39.8 | 80S | 46 | 99 |
| 704 | IARI-23-95 | 7.4 | 20S | 4.7 | 10MS | 14 | 40S | 7.9 | 20S | 46 | 99 |
| 705 | IARI-23-96 | 1.2 | 10MR | 0.7 | 10MR | 2.33 | 5S | 34.4 | 60S | 46 | 99 |
| 706 | IARI-23-97 | 4 | 10MS | 3.5 | 20MS | 2.5 | 10S | 9.3 | 40S | 46 | 99 |
| 707 | IARI-23-98 | 18.8 | 80S | 0.7 | 5S | 0.9 | 5S | 6.8 | 40S | 45 | 99 |
| 708 | IARI-23-99 | 50 | 80S | 2 | 10MS | 1.33 | 10MS | 11.8 | 40S | 45 | 99 |
| 709 | IARI-23-100 | 30.8 | 80S | 8.1 | 40S | 0 | 0 | 1.9 | 10S | 46 | 99 |
| 710 | IARI-23-101 | 20.5 | 60S | 6.1 | 20S | 5.5 | 20S | 8.7 | 40S | 46 | 99 |
| 711 | IARI-23-102 | 21.8 | 80S | 0.7 | 10MR | 5.67 | 20S | 4.2 | 20S | 56 | 99 |
| 712 | IARI-23-103 | 11.1 | 40S | 1.2 | 10MR | 1.67 | 10S | 2.1 | 10S | 46 | 99 |
| 713 | IARI-23-104 | 46.3 | 80S | 7.3 | 20S | 8 | 20MS | 17.3 | 40S | 46 | 99 |
| 714 | IARI-23-105 | 4.6 | 10MR | 0.5 | 5R | 5.07 | 20S | 17.7 | 40S | 57 | 89 |
| 715 | IARI-23-106 | 26.4 | 80S | 6.3 | 20S | 7.03 | 30S | 9.6 | 30S | 46 | 99 |
| 716 | IARI-23-107 | 4.7 | 20MS | 7.7 | 20S | 23.47 | 60S | 25 | 80S | 46 | 99 |
| 717 | IARI-23-108 | 10.8 | 40S | 0.9 | 10MR | 10.83 | 60S | 64.4 | 80S | 46 | 99 |
| 718 | IARI-23-109 | 7.5 | 40S | 2.7 | 10MS | 9.67 | 40S | 58.9 | 80S | 56 | 99 |
| 719 | IARI-23-110 | 7.3 | 40S | 1.9 | 10S | 5.33 | 20S | 46.7 | 80S | 57 | 99 |
| 720 | IARI-23-111 | 7.6 | 30S | 4.1 | 20S | 0 | 0 | 50 | 80S | 67 | 99 |
| 720A | Infector | 80 | 80S | 80 | 80S | 81.67 | 100S | 80 | 100S | 79 | 99 |
| 721 | IARI-23-112 | 13.8 | 40S | 4.6 | 20MS | 0.4 | 5MR | 7.8 | 40S | 56 | 99 |
| 722 | IARI-23-113 | 12 | 40S | 2.7 | 10MS | 1.73 | 10S | 20.6 | 40S | 56 | 99 |
| 723 | IARI-23-114 | 27.3 | 80S | 8.7 | 40S | 0 | 0 | 9.4 | 30S | 46 | 99 |
| 724 | IARI-23-115 | 13.3 | 40S | 2 | 10S | 2.13 | 10S | 4.2 | 20S | 57 | 99 |
| 725 | IARI-23-116 | 4.8 | 10R | 1.5 | 10MR | 2.57 | 10S | 14.8 | 40S | 56 | 99 |
| 726 | IARI-23-117 | 45 | 100S | 12.7 | 60S | 6.33 | 30S | 15.6 | 40S | 46 | 99 |
| 727 | IARI-23-118 | 9.5 | 60S* | 3.9 | 10MS | 2 | 5MR | 5.3 | 15S | 56 | 99 |
| 728 | IARI-23-119 | 7.6 | 30S | 3.6 | 20MS | 3.17 | 10MR | 18.4 | 40S | 46 | 78 |
| 729 | IARI-23-120 | 27.9 | 80S | 7.6 | 40S | 0.2 | TMS | 3.4 | 10S | 45 | 99 |
| 730 | IARI-23-121 | 13.3 | 60S | 1.7 | 10S | 1.73 | 10S | 20.6 | 40S | 46 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 731 | IARI-23-122 | 26.8 | 80S | 9.5 | 60S* | 0 | 0 | 1.7 | 10MS | 46 | 99 |
| 732 | IARI-23-123 | 23 | 60S | 10.6 | 60S* | 3.33 | 20S | 2.3 | 10S | 46 | 99 |
| 733 | IARI-23-124 | 28.3 | 80S | 6.9 | 20MS | 1.23 | 5S | 5.6 | 20MS | 46 | 99 |
| 734 | IARI-23-125 | 13.6 | 60S | 9.3 | 40S | 1.83 | 5S | 4.4 | 20S | 45 | 99 |
| 735 | IARI-23-126 | 10.3 | 40S | 2.1 | S20 | 3.33 | 20S | 2.1 | 15S | 45 | 78 |
| 736 | IARI-23-127 | 10.5 | 40S | 2.6 | 20MR | 1.33 | 10MS | 3.2 | 15S | 56 | 99 |
| 737 | IARI-23-128 | 29.5 | 80S | 21.4 | 60S | 30 | 60S | 7.1 | 30S | 46 | 99 |
| 738 | IARI-23-129 | 51.3 | 80S | 16.3 | 60S | 3 | 10S | 19.7 | 40S | 46 | 99 |
| 739 | IARI-23-130 | 19.5 | 40S | 2.1 | 10MS | 0 | 0 | 16.8 | 40S | 46 | 99 |
| 740 | IARI-23-131 | 24.5 | 60S | 3 | 20S | 0.67 | 5MR | 9 | 20S | 46 | 99 |
| 740A | Infector | 82.5 | 100S | 82.9 | 100S | 81.67 | 100S | 75.6 | 80S | 78 | 99 |
| 741 | IARI-23-132 | 5.3 | 20S | 2.3 | 10MR | 5.83 | 20S | 37.1 | 60S | 57 | 99 |
| 742 | IARI-23-133 | 11.8 | 60S | 3.5 | 10MS | 0 | 0 | 17.6 | 40MS | 57 | 99 |
| 743 | IARI-23-134 | 7.9 | 30S | 1.9 | 10MS | 1.67 | 10S | 40.7 | 60S | 57 | 99 |
| 744 | IARI-23-135 | 2 | 10R | 0.3 | 5MR | 1.33 | 5R | 21.6 | 40S | 57 | 99 |
| 745 | IARI-23-136 | 11 | 30S | 3.8 | 20MS | 3.5 | 20S | 4.8 | 20S | 46 | 99 |
| 746 | IARI-23-137 | 24 | 60S | 9.5 | 20S | 11.67 | 40S | 2.3 | 15S | 35 | 56 |
| 747 | IARI-23-138 | 24.5 | 80S | 7.2 | 20S | 6.83 | 20S | 7.6 | 40S | 46 | 99 |
| 748 | IARI-23-139 | 47.5 | 100S | 12 | 60S | 3.33 | 20MR | 15.2 | 40S | 45 | 99 |
| 749 | IARI-23-140 | 39.8 | 80S | 11.6 | 40S | 10.67 | 20S | 24.2 | 40S | 46 | 99 |
| 750 | IARI-23-141 | 13.8 | 40S | 2.3 | 10MS | 4.67 | 20S | 8.7 | 30S | 46 | 99 |
| 751 | IARI-23-142 | 19.3 | 60S | 4.8 | 20S | 7.63 | 30S | 4.6 | 10S | 56 | 99 |
| 752 | IARI-23-143 | 30 | 80S | 8.8 | 40S | 1.67 | 20MR | 2.4 | 10S | 46 | 78 |
| 753 | IARI-23-144 | 1.2 | 10MS | 0.9 | 10R | 1.67 | 10S | 1 | 5MS | 46 | 77 |
| 754 | IARI-23-145 | 1.9 | 10S | 0.7 | 10MR | 2.5 | 10S | 3.3 | 10S | 35 | 89 |
| 755 | IARI-23-146 | 33 | 80S | 10.3 | 40S | 11.73 | 40S | 1.8 | 10S | 46 | 99 |
| 756 | IARI-23-147 | 27.4 | 80S | 9.3 | 20S | 12.17 | 40S | 0.8 | 5MR | 46 | 99 |
| 757 | IARI-23-148 | 16.8 | 40S | 2 | 10MR | 10.33 | 40S | 2.1 | 10S | 56 | 99 |
| 758 | IARI-23-149 | 17.8 | 40S | 4.7 | 20S | 2.5 | 20MR | 3.6 | 10S | 46 | 99 |
| 759 | IARI-23-150 | 24.1 | 100S | 8.3 | 40S | 0.83 | 5S | 2.9 | 15S | 46 | 99 |
| 760 | IARI-23-151 | 34 | 100S | 9.5 | 40S | 3.4 | 20S | 0.8 | 5S | 57 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 760A | Infector | 80 | 80S | 80 | 80S | 80 | 80S | 76.7 | 80S | 68 | 79 |
| 761 | IARI-23-152 | 17 | 40S | 2.1 | 10S | 0.67 | 10MR | 1.9 | 10S | 57 | 99 |
| 762 | IARI-23-153 | 12.5 | 60S | 2.1 | 10MR | 0.83 | 5S | 5 | 20MS | 57 | 99 |
| 763 | IARI-23-154 | 3.9 | 20MS | 0.9 | 10MR | 0.07 | TMR | 1 | 5S | 46 | 99 |
| 764 | IARI-23-155 | 16.3 | 60S | 5 | 20S | 2.03 | 10MR | 7.1 | 40S | 45 | 99 |
| 765 | IARI-23-156 | 6.6 | 20S | 1.1 | 5MR | 0.77 | 10MR | 8.8 | 40S | 46 | 99 |
| 766 | IARI-23-157 | 13.1 | 40S | 5.3 | 20MS | 11 | 30S | 14.8 | 40S | 46 | 99 |
| 767 | IARI-23-158 | 2.8 | 10MS | 1.5 | 10S | 0.07 | TMR | 11 | 40S | 45 | 99 |
| 768 | IARI-23-159 | 3.3 | 20MS | 3.8 | 20MS | 0.17 | TS | 3.9 | 10MS | 46 | 99 |
| 769 | IARI-23-160 | 19.3 | 40S | 5.9 | 20MS | 9.5 | 40S | 6.3 | 20S | 46 | 99 |
| 770 | IARI-23-161 | 26.3 | 80S | 8.9 | 30S | 17.53 | 60S | 4.1 | 15S | 47 | 99 |
| 771 | IARI-23-162 | 38.8 | 80S | 7 | 20S | 0.13 | TMR | 1.9 | 5S | 35 | 67 |
| 772 | IARI-23-163 | 30.8 | 100S | 5 | 20MS | 3.33 | 20S | 4.3 | 20MS | 46 | 99 |
| 773 | IARI-23-164 | 37.3 | 80S | 11.5 | 40S | 10 | 20S | 13.1 | 60S | 56 | 99 |
| 774 | IARI-23-165 | 27.5 | 80S | 9.1 | 40S | 6.73 | 40S | 32.9 | 80S | 46 | 99 |
| 775 | IARI-23-166 | 42.9 | 100MS | 7 | 20MS | 0.07 | TMR | 24.5 | 60S | 56 | 99 |
| 776 | IARI-23-167 | 19.5 | 60S | 2.8 | 10MS | 3.67 | 20S | 14.3 | 40S | 46 | 99 |
| 777 | IARI-23-168 | 23.3 | 80S | 2.7 | 10MR | 8.4 | 20S | 7 | 20S | 46 | 99 |
| 778 | IARI-23-169 | 21.8 | 60S | 9.6 | 20MS | 11.67 | 30S | 10.5 | 40S | 46 | 99 |
| 779 | IARI-23-170 | 9.6 | 40S | 4 | 10MR | 3 | 10MR | 28.3 | 60S | 45 | 99 |
| 780 | IARI-23-171 | 16.1 | 60S | 2.2 | 10S | 2.57 | 15S | 11.4 | 40S | 46 | 99 |
| 780A | Infector | 82.5 | 100S | 82.9 | 100S | 83.33 | 100S | 78.9 | 100S | 78 | 99 |
| | IIWBR STN TRIAL | | | | | | | | | | |
| 781 | RWP2079 | 21.8 | 60S | 1.1 | 5R | 1.2 | 10MR | 12.1 | 40S | 46 | 99 |
| 782 | RWP2080 | 2.7 | 20MS | 4.7 | 10MR | 4 | 15S | 4.8 | 20S | 56 | 99 |
| 783 | RWP2081 | 15 | 60S | 3.3 | 10MR | 2.5 | 10S | 16.8 | 40S | 57 | 99 |
| 784 | RWP2197 | 8 | 30S | 5.7 | 50MR | 8.33 | 30S | 5.3 | 20S | 57 | 99 |
| 785 | RWP1062 | 14.2 | 30S | 3.7 | 20S | 10.67 | 40S | 4 | 20S | 56 | 99 |
| 786 | RWP1199 | 9.3 | 40S | 9.5 | 20S | 18.33 | 40S | 3.4 | 10S | 46 | 99 |
| 787 | LBP2023-1 | 14.5 | 40S | 3.2 | 10MS | 7 | 15MR | 5.8 | 20S | 57 | 99 |

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| 788 | LBP2023-2 | 14.5 | 30S | 3.6 | 10MS | 16.7 | 40S | 5.8 | 20S | 47 | 99 |
| 789 | LBP2023-3 | 25 | 80S | 5.2 | 20MS | 17.17 | 40S | 5.8 | 20MS | 46 | 89 |
| 790 | LBP2023-4 | 12.8 | 60S | 3.5 | 10S | 12.33 | 40S | 2 | 10S | 46 | 89 |
| 791 | LBP2023-5 | 12.4 | 80S* | 4 | 10MS | 10.1 | 40S | 12 | 40MS | 46 | 89 |
| 792 | LBP2023-6 | 26.8 | 60S | 11.2 | 20S | 33 | 90S | 3.7 | 20S | 57 | 99 |
| 793 | WAP2301 | 15.3 | 40S | 9 | 20MS | 11.33 | 20S | 4.4 | 20S | 46 | 99 |
| 794 | WAP2302 | 24 | 60S | 3.5 | 10MS | 7 | 20S | 10.2 | 40S | 56 | 99 |
| 795 | WAP2303 | 21.8 | 80S | 2.2 | 10S | 0 | 0 | 16.8 | 40S | 46 | 99 |
| 796 | WAP2304 | 22.5 | 40S | 2.6 | 10MS | 1.5 | 10MR | 13.1 | 40S | 45 | 99 |
| 797 | WAP2305 | 14.8 | 40S | 4.6 | 20MS | 6 | 30S | 27.4 | 60S | 35 | 78 |
| 798 | WAP2306 | 21 | 60S | 2.7 | 10MS | 2.4 | 10MR | 11.1 | 40S | 35 | 99 |
| 799 | PBS-ST-1-23-01 | 29.5 | 60S | 13 | 60S | 0.83 | 5S | 13.6 | 40S | 36 | 89 |
| 800 | PBS-ST-1-23-02 | 39.8 | 80S | 11.7 | 40S | 18 | 40S | 35.6 | 60S | 46 | 99 |
| 800A | Infector | 82.5 | 100S | 82.9 | 100S | 81.67 | 100S | 80 | 100S | 78 | 99 |
| 801 | PBS-ST-1-23-03 | 12.6 | 30S | 1.6 | 10MS | 6.5 | 30S | 18.4 | 60S | 46 | 99 |
| 802 | PBS-ST-1-23-04 | 33 | 60S | 8.3 | 40S | 0 | 0 | 3.4 | 15S | 45 | 78 |
| 803 | PBS-ST-1-23-05 | 19.1 | 40S | 8.5 | 40MS | 15 | 40S | 10.6 | 40S | 56 | 99 |
| 804 | QYT 2301 | 5.4 | 20S | 5 | 20S | 7.67 | 20S | 14.6 | 40S | 57 | 99 |
| 805 | QYT 2302 | 4 | 20S | 2.7 | 10MS | 6.77 | 30S | 11.7 | 40S | 56 | 99 |
| 806 | QYT 2303 | 1.8 | 10R | 4.7 | 20MS | 13.47 | 40S | 17.1 | 40S | 46 | 99 |
| 807 | QYT 2304 | 12.3 | 60S | 2 | 10S | 1.67 | 20MR | 19.6 | 20S | 46 | 99 |
| 808 | QYT 2305 | 13 | 40S | 2.3 | 10MS | 10.07 | 40S | 18.2 | 40S | 46 | 89 |
| 809 | QYT 2306 | 16.8 | 40S | 1.9 | 10S | 8.67 | 20S | 23 | 40S | 57 | 99 |
| 810 | BSP 2302 | 8 | 30S | 19.7 | 40S | 24.67 | 60S | 30.2 | 40S | 56 | 99 |
| 811 | BSP 2303 | 14 | 40S | 8.3 | 30S | 15.83 | 60S | 22.4 | 40S | 56 | 99 |
| 812 | BSP 2304 | 16.5 | 60S | 7.3 | 30S | 8.83 | 20S | 18.4 | 40S | 46 | 99 |
| 813 | BSP 2305 | 15 | 30S | 5.2 | 20S | 6.7 | 20S | 12.5 | 40MS | 46 | 99 |
| 814 | BSP 2306 | 6.7 | 20S | 2 | 10MR | 5.2 | 15MR | 16 | 40MS | 46 | 99 |

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| 815 | RWP1057 | 22.3 | 60S | 2.7 | 20MR | 6.33 | 15S | 15.4 | 40MS | 46 | 99 |
| 816 | RWP1131 | 19.3 | 60S | 4.6 | 10MR | 9.33 | 20MS | 14.4 | 40MS | 46 | 99 |
| 817 | RWP2146 | 14.5 | 60S | 2.8 | 10MS | 3.4 | 20S | 10.7 | 40MS | 46 | 99 |
| 818 | RWP2189 | 19.9 | 60S | 1.7 | 10S | 3.33 | 20S | 18.4 | 40S | 46 | 99 |
| 819 | LBP2023-7 | 20.6 | 40S | 4.3 | 10MS | 4.5 | 20S | 15 | 40S | 47 | 99 |
| 820 | LBP2023-8 | 16.8 | 40S | 0.4 | 5MR | 2.67 | 15MS | 14.4 | 40S | 46 | 99 |
| 820A | Infector | 80 | 80S | 80 | 100S | 80 | 100S | 77.8 | 80S | 78 | 99 |
| 821 | LBP2023-9 | 24.5 | 50S | 1 | 5MR | 2.67 | 15MR | 16.4 | 40S | 46 | 99 |
| 822 | LBP2023-10 | 22.3 | 60S | 4 | 20MR | 0.4 | 5MR | 6 | 40S | 46 | 99 |
| 823 | WAP2307 | 21.5 | 40S | 4.5 | 10MS | 1.67 | 5S | 31.4 | 60S | 45 | 99 |
| 824 | WAP2308 | 22.3 | 80S | 16.9 | 40MS | 19.17 | 40S | 47.1 | 60S | 46 | 99 |
| 825 | WAP2309 | 19.5 | 60S | 3.3 | 10S | 2.07 | 10MR | 21.2 | 40S | 56 | 99 |
| 826 | WAP2310 | 7.6 | 40S | 5.3 | 20MR | 2.67 | 20MR | 7.6 | 20S | 46 | 99 |
| 827 | PBS-ST-2-23-01 | 13.3 | 40S | 1.5 | 10S | 8 | 30S | 10.7 | 40S | 45 | 99 |
| 828 | PBS-ST-2-23-02 | 18.4 | 60S | 2.6 | 20MR | 2.67 | 10S | 10.6 | 40S | 35 | 89 |
| 829 | PBS-ST-2-23-03 | 8.4 | 30S | 5.1 | 20MS | 5.67 | 20MS | 5.9 | 20S | 45 | 99 |
| 830 | PBS-ST-2-23-04 | 9.8 | 30S | 3.2 | 10MR | 12 | 30S | 40.7 | 80S | 46 | 99 |
| 831 | QYT 2307 | 5.4 | 20MS | 1.4 | 10MR | 7.33 | 30S | 11.8 | 20S | 45 | 99 |
| 832 | QYT 2308 | 22 | 40S | 7.7 | 20MS | 10.03 | 40S | 2.3 | 10S | 46 | 99 |
| 833 | QYT 2309 | 4.2 | 20S | 4 | 10MS | 9 | 40S | 15 | 40S | 45 | 99 |
| 834 | BSP 2307 | 11.8 | 40MS | 6.3 | 20MS | 9.67 | 30S | 8.3 | 20S | 46 | 99 |
| 835 | BSP 2308 | 18.3 | 40S | 7.3 | 20MS | 8.33 | 20S | 41.1 | 60S | 46 | 99 |
| 836 | BSP 2309 | 12 | 40MS | 3.5 | 10MR | 4.83 | 15MR | 8.7 | 30S | 46 | 99 |
| 837 | RWP1556 | 9.6 | 40M R | 2.6 | 10S | 14.83 | 40S | 4.1 | 30S | 46 | 99 |
| 838 | RWP1831 | 14.1 | 40S | 5 | 20S | 13.67 | 40S | 16.7 | 60S | 46 | 99 |
| 839 | RWP1880 | 13.5 | 40S | 0.6 | 10MR | 0.33 | 5MR | 5.8 | 20S | 46 | 99 |
| 840 | RWP2071 | 15 | 40S | 1.7 | 10S | 7 | 20S | 5.5 | 30S | 46 | 99 |
| 840A | Infector | 80 | 80S | 80 | 100S | 80 | 100S | 78.9 | 100S | 78 | 99 |

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| 841 | LBP2023-11 | 2.6 | 10S | 6.3 | 20MS | 11.33 | 40S | 13.1 | 40S | 46 | 99 |
| 842 | LBP2023-12 | 11.4 | 40S | 4 | 10MS | 11.67 | 40S | 20.4 | 40S | 46 | 99 |
| 843 | LBP2023-13 | 10.1 | 40MS | 1.2 | 10MR | 2.07 | 15MR | 5.4 | 20S | 35 | 89 |
| 844 | LBP2023-14 | 16 | 60S | 4 | 10MS | 6.5 | 20S | 1.8 | 10S | 46 | 99 |
| 845 | WAP2311 | 14.4 | 60S | 4.6 | 20S | 4.33 | 15MR | 13.9 | 40S | 46 | 99 |
| 846 | WAP2211 | 9.1 | 30S | 3.2 | 10MR | 1.33 | 10MS | 12.6 | 40S | 46 | 99 |
| 847 | WAP2312 | 11.5 | 30S | 2 | 10S | 2 | 10MS | 11.2 | 40S | 46 | 99 |
| 848 | WAP2313 | 26.9 | 60S | 9.9 | 20MS | 25 | 70S | 6 | 20S | 56 | 99 |
| 849 | PBS-ST-3-23-01 | 11.2 | 40S | 2 | 10S | 16.33 | 50S | 22.8 | 60S | 56 | 99 |
| 850 | PBS-ST-3-23-02 | 22.8 | 40S | 2.6 | 10S | 1.73 | 10S | 8.6 | 20S | 35 | 99 |
| 851 | PBS-ST-3-23-03 | 18 | 60S | 10.3 | 30S | 8.83 | 40S | 5.5 | 20S | 46 | 99 |
| 852 | PBS-ST-3-23-04 | 22.5 | 60S | 10.6 | 20MS | 12.17 | 40S | 12.3 | 20S | 35 | 78 |
| 853 | QYT 2310 | 2.4 | 10MS | 2.9 | 10MS | 8.07 | 40S | 4.1 | 20S | 35 | 99 |
| 854 | QYT 2311 | 16 | 80S | 2.3 | 10MR | 6.73 | 20S | 22 | 60S | 56 | 99 |
| 855 | QYT 2312 | 5.5 | 20S | 1.7 | 10R | 0 | 0 | 20.4 | 40S | 46 | 99 |
| 856 | QYT 2313 | 23.8 | 40MS | 3.7 | 10MR | 1 | 5S | 19.9 | 40S | 46 | 99 |
| 857 | BSP 2310 | 3.6 | 10R | 3.4 | 10MR | 6.2 | 30S | 6.2 | 20S | 46 | 99 |
| 858 | BSP 2311 | 14.8 | 40S | 8.3 | 20MR | 10.4 | 30S | 10 | 40S | 46 | 99 |
| 859 | RWP1549 | 17.8 | 40S | 1.8 | 10R | 6.73 | 30S | 1.4 | 10MS | 46 | 99 |
| 860 | RWP1844 | 3.5 | 10S | 3.1 | 20S | 4.17 | 20S | 1.4 | 10MR | 45 | 99 |
| 860A | Infector | 80 | 80S | 82.9 | 100S | 80 | 100S | 77.8 | 80S | 78 | 99 |
| 861 | RWP1899 | 2.2 | 10S | 2.5 | 20MS | 7.33 | 20MS | 5.7 | 20S | 46 | 99 |
| 862 | RWP2060 | 47.5 | 80S | 11.6 | 60S | 0.83 | 5S | 1.8 | 10MS | 45 | 99 |
| 863 | LBP2023-15 | 14.3 | 40MS | 3.7 | 10MR | 1 | 10MR | 1.8 | 10S | 45 | 99 |
| 864 | LBP2023-16 | 21 | 80S | 2 | 10S | 5 | 15S | 14.2 | 40S | 46 | 99 |
| 865 | LBP2023-17 | 24.3 | 80S | 2.7 | 10MS | 4.17 | 20S | 7.2 | 20MS | 46 | 99 |
| 866 | LBP2023-18 | 24.5 | 80S | 14.9 | 40S | 5 | 20S | 8 | 20S | 46 | 99 |
| 867 | WAP2314 | 33.7 | 80S | 2.6 | 10MR | 2.73 | 10S | 10.9 | 40S | 46 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 868 | WAP2315 | 19.8 | 40S | 6 | 20MS | 5.83 | 10S | 7.8 | 20S | 46 | 99 |
| 869 | WAP2316 | 12.6 | 30S | 3.6 | 10MS | 2.5 | 20MR | 6.2 | 20S | 45 | 99 |
| 870 | WAP2317 | 26 | 60S | 14.1 | 40S | 25 | 60S | 2.3 | 10S | 45 | 99 |
| 871 | PBS-ST-4-23-01 | 15 | 60S | 4.4 | 10MR | 13.37 | 40S | 12.8 | 40S | 46 | 99 |
| 872 | PBS-ST-4-23-02 | 19.3 | 40S | 2.6 | 10MR | 16.67 | 40S | 30 | 60S | 46 | 99 |
| 873 | PBS-ST-4-23-03 | 21.7 | 60S | 8.1 | 20MS | 7.7 | 20S | 9.6 | 20MS | 46 | 99 |
| 874 | QYT 2314 | 8.3 | 30S | 4.9 | 10MS | 9.67 | 30S | 31.8 | 60S | 46 | 99 |
| 875 | QYT 2315 | 27.5 | 60S | 7.7 | 20MS | 16.67 | 40S | 27.1 | 40S | 46 | 99 |
| 876 | QYT 2316 | 4.9 | 40MR | 1.2 | 10MR | 0.07 | TMR | 1.1 | 5S | 45 | 99 |
| 877 | QYT 2317 | 11.4 | 40MS | 5.8 | 20S | 8.17 | 15S | 15.7 | 40S | 35 | 78 |
| 878 | BSP 2312 | 13 | 30S | 2.4 | 10MR | 10.37 | 30S | 8.8 | 20S | 46 | 99 |
| 879 | BSP 2313 | 21.5 | 60S | 4 | 10MS | 4.67 | 20S | 5 | 20MS | 46 | 99 |
| 880 | BSP 2314 | 15.3 | 40MS | 4.3 | 20MS | 15 | 40S | 40 | 60S | 46 | 99 |
| 880A | Infector | 80 | 80S | 80 | 80S | 78.33 | 90S | 76.7 | 80S | 78 | 99 |
| 881 | RWP2137 | 1.8 | 10MR | 1.6 | 10S | 0.33 | 5MR | 14.5 | 40S | 46 | 99 |
| 882 | RWP2185 | 5 | 30S | 1.5 | 10MR | 1 | 10MR | 8.8 | 20S | 45 | 99 |
| 883 | RWP2190 | 20.3 | 60S | 7.5 | 20MS | 7.37 | 30S | 19.5 | 60S | 46 | 99 |
| 884 | RWP2191 | 11.9 | 30S | 2.9 | 10R | 3.8 | 20S | 13.2 | 40S | 45 | 99 |
| 885 | LBP2023-19 | 9.3 | 40MS | 3 | 20MS | 4.63 | 20S | 21 | 40S | 35 | 99 |
| 886 | LBP2023-20 | 5.6 | 20MS | 2.9 | 10MS | 2.5 | 10MS | 19.6 | 40S | 35 | 78 |
| 887 | LBP2023-21 | 21.6 | 60S | 3.6 | 20MS | 3.4 | 20S | 16.1 | 40S | 35 | 89 |
| 888 | LBP2023-22 | 13.8 | 30S | 4.5 | 10S | 11.07 | 40S | 7.9 | 40S | 46 | 99 |
| 889 | WAP2301 | 14.5 | 40MS | 6.7 | 20S | 12 | 30S | 5.8 | 20S | 46 | 99 |
| 890 | WAP2316 | 12.3 | 20S | 3.5 | 15MS | 8.67 | 30S | 6.8 | 20S | 46 | 99 |
| 891 | WAP2303 | 20.8 | 80S | 1.9 | 10MR | 0.83 | 5S | 12.4 | 40S | 46 | 99 |
| 892 | WAP2318 | 10.4 | 40S | 2.4 | 10MR | 0.23 | TS | 13.8 | 40S | 45 | 99 |
| 893 | PBS-ST-5-23-01 | 23.3 | 80S | 4.3 | 10MR | 4.87 | 15S | 5.1 | 20S | 35 | 89 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 894 | PBS-ST-5-23-02 | 37.5 | 80S | 7.7 | 20MS | 2.5 | 5S | 8.6 | 20S | 46 | 99 |
| 895 | PBS-ST-5-23-03 | 15.5 | 40MS | 6 | 20MS | 14 | 40S | 9.7 | 40MS | 46 | 99 |
| 896 | QYT 2318 | 24.5 | 60S | 7.1 | 20MS | 2 | 10S | 14.6 | 40S | 36 | 78 |
| 897 | QYT 2319 | 14.1 | 60S | 2.1 | 10MR | 2 | 10S | 4.4 | 20S | 45 | 99 |
| 898 | QYT 2320 | 1.3 | 10MR | 4.2 | 20S | 11.5 | 40S | 15.9 | 40S | 46 | 99 |
| 899 | QYT 2321 | 5.2 | 20S | 3.2 | 10R | 8.33 | 20S | 12.2 | 40S | 46 | 99 |
| 900 | BSP 2315 | 4.3 | 40MR | 3.9 | 20MS | 9 | 20S | 10.8 | 20S | 46 | 99 |
| 900A | Infector | 82.5 | 100S | 82.9 | 100S | 81.67 | 100S | 76.7 | 80S | 78 | 99 |
| 901 | BSP 2316 | 3.8 | 10MS | 4.6 | 20MS | 5.83 | 30S | 16 | 40S | 46 | 99 |
| 902 | BSP 2317 | 15.3 | 30S | 10.9 | 20S | 18.33 | 40S | 8.2 | 20S | 46 | 99 |
| | PAU, LUDHIANA | | | | | | | | | | |
| 903 | WBL 0026 | 2.2 | 10MR | 2.3 | 10MR | 0 | 0 | 4.2 | 10MS | 46 | 99 |
| 904 | WBL 0028 | 4.8 | 20MR | 1.2 | 10MS | 0 | 0 | 1.7 | 10S | 46 | 99 |
| 905 | WBL 0064 | 23.8 | 60S | 1.2 | 10MS | 3.33 | 20S | 0.3 | 5MR | 46 | 89 |
| 906 | WBL 1564 | 21 | 40S | 4.4 | 10MR | 12.33 | 40S | 0.1 | TS | 46 | 78 |
| 907 | WBL 1567 | 27.8 | 60S | 5 | 10MS | 5.67 | 20S | 1.1 | 5S | 46 | 78 |
| 908 | WBL 1569 | 6.3 | 20MS | 2.9 | 10S | 17.07 | 60S | 1.6 | 5S | 36 | 56 |
| 909 | WBL 1570 | 4.9 | 20MS | 3.3 | 10MR | 12.83 | 50S | 1.1 | 5S | 35 | 56 |
| 910 | WBL 1573 | 3.2 | 20S | 3 | 20S | 0.83 | 5S | 0.9 | 5MR | 46 | 99 |
| 911 | WBL 1574 | 22 | 60S | 9.1 | 20S | 5 | 20S | 0.1 | TS | 35 | 89 |
| 912 | WBL 1575 | 21 | 60S | 0.1 | TR | 1.67 | 10S | 0.9 | 5S | 35 | 55 |
| 913 | WBL 1578 | 17.4 | 60S | 0 | 0 | 0 | 0 | 2.1 | 10MR | 36 | 57 |
| 914 | WBL 1585 | 27 | 60S | 4.1 | 20MS | 0.03 | TR | 2.6 | 10MS | 35 | 99 |
| 915 | WBL 1586 | 27.8 | 60S | 4 | 10MS | 0 | 0 | 3.5 | 10S | 35 | 99 |
| 916 | WBL 1591 | 23.5 | 60S | 3.7 | 10MS | 1.13 | 10MR | 0.6 | 5MS | 35 | 78 |
| 917 | WBL 1747 | 13.5 | 60S | 3.5 | 10MR | 4.67 | 15MS | 0 | 0 | 56 | 99 |

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| 918 | WBL 1827 | 25 | 60S | 1.2 | 5R | 0.17 | TS | 4.4 | 20S | 45 | 89 |
| 919 | WBL 1942 | 23.3 | 40S | 0.6 | 5MS | 0 | 0 | 0.9 | 10MR | 35 | 57 |
| 920 | WBL 1994 | 23.8 | 60S | 10 | 40S | 10.83 | 20S | 14.5 | 40S | 46 | 99 |
| 920A | Infector | 77.5 | 80S | 77.1 | 100S | 76.67 | 80S | 76.7 | 80S | 68 | 89 |
| 921 | WBL 2040 | 26.3 | 80S | 45.7 | 80S | 50 | 80S | 4 | 20MS | 45 | 99 |
| 922 | WBL 2113 | 15.5 | 60S | 4.1 | 20MR | 9 | 30S | 1 | 10MS | 46 | 99 |
| 923 | WBL 2114 | 22.8 | 60S | 1.9 | 10MS | 2.67 | 10S | 2 | 10MS | 45 | 99 |
| 924 | WBL 2117 | 27 | 80S | 0.2 | 5R | 1.67 | 10S | 4.2 | 10S | 35 | 89 |
| 925 | WBL 2240 | 14.5 | 80S | 2.9 | 10MS | 0 | 0 | 1 | 5MS | 46 | 99 |
| 926 | WBL 2241 | 16.6 | 80S | 2.7 | 10MS | 1.67 | 10MS | 1.9 | 10S | 35 | 99 |
| 927 | WBL 2252 | 19.3 | 40S | 1.7 | 10MR | 7.17 | 30S | 1.3 | 5MR | 46 | 89 |
| 928 | WBL 2254 | 35 | 80S | 5.1 | 20MS | 0 | 0 | 0.6 | 10MR | 45 | 99 |
| 929 | WBL 2255 | 15.3 | 40S | 0.7 | 10MR | 4 | 10MR | 0.6 | 5MS | 46 | 99 |
| 930 | WBL 2256 | 16.1 | 40S | 1.7 | 10MS | 6.33 | 10MR | 0.6 | 5S | 35 | 99 |
| 931 | WBL 2266 | 14.1 | 60S | 5.7 | 30S | 0 | 0 | 1 | 5S | 46 | 99 |
| 932 | WBL 2316 | 18.8 | 60S | 3.5 | 10MR | 16.7 | 80S | 1 | 5MS | 46 | 99 |
| 933 | WBL 2317 | 21.5 | 60S | 5.1 | 20S | 21.83 | 90S | 1 | 10MS | 56 | 99 |
| 934 | WBL 2332 | 16.3 | 60S | 3.5 | 20S | 20.33 | 70S | 1.4 | 10MR | 45 | 99 |
| 935 | WBL 2337 | 31.3 | 80S | 3.2 | 20S | 0.2 | TMS | 3.8 | 10MR | 45 | 99 |
| 936 | WBL 2338 | 18 | 80S | 3 | 10MS | 0.83 | 5S | 6.3 | 20S | 46 | 99 |
| 937 | WBL 2339 | 13.6 | 80S | 2.7 | 10MS | 0 | 0 | 0.3 | 5MR | 56 | 99 |
| 938 | WBL 2340 | 20.5 | 80S | 3.2 | 10MS | 1.73 | 10S | 5.9 | 40S | 46 | 99 |
| 939 | WBL 2341 | 18.5 | 60S | 3.5 | 20S | 0.73 | 5MS | 4.8 | 20MS | 56 | 99 |
| 940 | WBL 2342 | 17 | 80S | 1.5 | 10S | 0 | 0 | 2.3 | 10MS | 46 | 99 |
| 940A | Infector | 82.5 | 100S | 80 | 80S | 81.67 | 100S | 76.7 | 80S | 78 | 99 |
| 941 | WBL 2343 | 19.8 | 60S | 5.7 | 20MS | 13.33 | 50S | 0.1 | TS | 45 | 99 |
| 942 | WBL 2344 | 42.5 | 80S | 8.9 | 40S | 0.1 | TMR | 1.9 | 10S | 46 | 99 |
| 943 | WBL 2345 | 23 | 60S | 3.4 | 10MS | 15.13 | 40S | 1.2 | 5MR | 46 | 99 |
| 944 | WBL 2346 | 30.6 | 60S | 1.5 | 10R | 3.33 | 20S | 2.6 | 10MS | 35 | 54 |
| 945 | WBL 2347 | 38.8 | 80S | 5.7 | 20R | 1.4 | 20MR | 1.4 | 10S | 46 | 99 |
| 946 | WBL 2348 | 16.3 | 80S | 1.7 | 10S | 3.33 | 10S | 2 | 10MS | 46 | 99 |

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| 947 | WBL 2349 | 12.8 | 60S | 1.5 | 10MR | 1.67 | 10S | 0.6 | 5MS | 46 | 99 |
| 948 | WBL 2350 | 15.9 | 60S | 4.1 | 10MS | 15.67 | 40S | 12.9 | 40S | 46 | 99 |
| 949 | WBL 2351 | 9.8 | 40MR | 1.7 | 10S | 17.5 | 50S | 0.4 | 5MR | 46 | 89 |
| 950 | WBL 2352 | 11.3 | 40S | 2.7 | 10MS | 0 | 0 | 1.3 | 5S | 35 | 67 |
| 951 | WBL 2353 | 22 | 60S | 5.8 | 20S | 15 | 60S | 0.3 | TS | 46 | 99 |
| 952 | WBL 2354 | 26.3 | 80S | 4.4 | 20S | 7.33 | 40S | 0.6 | 5S | 46 | 99 |
| 953 | WBL 2355 | 28.5 | 80S | 3.2 | 10MS | 3.17 | 10S | 2.9 | 10S | 46 | 99 |
| 954 | WBL 2356 | 8 | 20S | 2.3 | 10MR | 4 | 20S | 8.6 | 20S | 46 | 99 |
| 955 | WBL 2357 | 14.8 | 80S | 2.7 | 10MS | 4.17 | 20S | 4.5 | 20S | 56 | 99 |
| 956 | WBL 2358 | 13.6 | 40S | 2.6 | 10MR | 14.03 | 40S | 13 | 40S | 56 | 99 |
| 957 | WBL 2359 | 17.3 | 60S | 1.8 | S20 | 1.77 | 10S | 9.6 | 40S | 46 | 99 |
| 958 | WBL 2360 | 14.3 | 60S | 4.5 | 20S | 0.33 | 5MR | 10.4 | 40S | 46 | 99 |
| 959 | WBL 2361 | 37.8 | 80S | 8.7 | S40 | 16.83 | 40S | 1.2 | 10S | 57 | 99 |
| 960 | WBL 2362 | 16.8 | 60S | 4.3 | 20S | 0.87 | 10MR | 7.9 | 40S | 46 | 99 |
| 960A | Infector | 80 | 80S | 83.3 | 100S | 81.67 | 100S | 80 | 100S | 78 | 99 |
| 961 | WBL 2363 | 16.5 | 40S | 6 | 20MS | 16.67 | 60S | 1.9 | 10S | 56 | 99 |
| 962 | WBL 2364 | 23.8 | 60S | 1.9 | 10MR | 6.5 | 30S | 1.3 | 5S | 36 | 57 |
| 963 | WBL 2365 | 5.3 | 20MS | 2.8 | 10MR | 8.17 | 40S | 1 | 5S | 35 | 57 |
| 964 | WBL 2539 | 4.5 | 20S | 3 | 20S | 0 | 0 | 3.5 | 20MS | 56 | 99 |
| 965 | WBL 2540 | 12 | 60S | 2.3 | 10R | 0.67 | 5MS | 13.9 | 40MS | 57 | 99 |
| 966 | WBL 2544 | 13.5 | 40S | 8.7 | 20MS | 12.5 | 50S | 2.6 | 10MS | 46 | 99 |
| 967 | WBL 2549 | 11.4 | 40S | 5.3 | 20S | 8.37 | 40S | 10.1 | 40S | 46 | 99 |
| 968 | WBL 2550 | 19.3 | 80S | 3 | 20S | 0.33 | TS | 5.9 | 20S | 46 | 78 |
| 969 | WBL 2552 | 17.3 | 60S | 1.7 | 10S | 5 | 30S | 5.7 | 20S | 46 | 89 |
| 970 | WBL 2553 | 27 | 60S | 2.6 | 10MS | 4.17 | 20S | 4 | 10S | 46 | 99 |
| 971 | WBL 2561 | 14.8 | 30S | 2.6 | 10MS | 8.33 | 40S | 2.7 | 5MS | 46 | 78 |
| 972 | WBL 2578 | 14.4 | 60S | 1.5 | 10S | 0.67 | 5MS | 3.3 | 10MS | 46 | 99 |
| 973 | WBL 2584 | 23.9 | 60S | 8.9 | 40S | 7.33 | 30S | 1 | 5S | 46 | 99 |
| 974 | WBL 2587 | 26.3 | 60S | 10.4 | 40S | 9.33 | 20S | 1.6 | 5S | 46 | 99 |
| 975 | WBL 2590 | 22.5 | 60S | 2.7 | 10MS | 3.33 | 20S | 1.7 | 5MS | 46 | 99 |
| 976 | WBL 2602 | 11.6 | 40S | 2.5 | 20MR | 1.7 | 10S | 1 | 10MS | 46 | 89 |

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| 977 | WBL 2604 | 20.8 | 40S | 2 | 10MR | 3 | 10S | 3.7 | 10S | 46 | 99 |
| 978 | WBL 2654 | 30 | 60S | 6.3 | 40S | 0.83 | 5S | 2 | 5S | 45 | 99 |
| 979 | WBL 2655 | 41 | 60S | 1.7 | 10MR | 1.67 | 5S | 3 | 10MS | 46 | 99 |
| 980 | WBL 2684 | 20.4 | 60S | 4.4 | 20MS | 6.67 | 15MR | 0.7 | 5MS | 57 | 99 |
| 980A | Infector | 80 | 80S | 82.9 | 100S | 85 | 100S | 76.7 | 80S | 78 | 99 |
| 981 | WBL 2685 | 24 | 60S | 2.3 | 10MR | 14 | 40MS | 3.8 | 20S | 46 | 99 |
| 982 | WBL 2687 | 16.8 | 60S | 3 | 10MR | 15.17 | 40S | 1.1 | 10MR | 46 | 99 |
| 983 | WBL 2689 | 21.1 | 60S | 2.7 | 10MR | 14.17 | 60S | 1.4 | 10MS | 46 | 99 |
| 984 | WBL 2690 | 21.7 | 40S | 3.5 | 10MR | 15.73 | 50S | 0.1 | TS | 46 | 99 |
| 985 | WBL 2691 | 20.9 | 40S | 3 | 10MS | 8.67 | 50S | 1.2 | 10MS | 46 | 99 |
| 986 | WBL 2701 | 9.8 | 30S | 3.3 | 10MS | 14 | 40S | 0.1 | TS | 46 | 99 |
| 987 | WBL 2714 | 21 | 40S | 1.9 | 10S | 8 | 30S | 0.1 | TS | 46 | 99 |
| 988 | WBL 2721 | 21.4 | 60S | 3.6 | 20S | 2.5 | 10S | 3.7 | 40MS | 45 | 78 |
| 989 | WBL 2734 | 10.5 | 30S | 0.2 | 5R | 0 | 0 | 0.6 | 5MS | 45 | 78 |
| 990 | WBL 2796 | 22 | 60S | 7.8 | 20MS | 6.67 | 20MR | 7.9 | 20S | 46 | 99 |
| 991 | WBL 3051 | 8.8 | 30S | 0.9 | 10MR | 5.33 | 30S | 6.1 | 20S | 46 | 99 |
| 992 | WBL 3052 | 9.3 | 40S | 0.3 | 5MR | 4 | 20S | 13.1 | 40S | 46 | 99 |
| 993 | WBL 3053 | 11.5 | 40S | 4 | 20MS | 6 | 15MR | 11.2 | 40S | 46 | 99 |
| 994 | WBL 3054 | 8.7 | 40S | 1.8 | 10R | 4.4 | 20S | 10.2 | 40S | 57 | 99 |
| 995 | WBL 3055 | 17.2 | 60S | 1.3 | 10MR | 7.33 | 20S | 12 | 40S | 46 | 99 |
| 996 | WBL 3056 | 12.8 | 40MS | 4.9 | 20MS | 5.93 | 30S | 9.6 | 40S | 46 | 99 |
| 997 | WBL 3057 | 14.5 | 20S | 11.1 | 20MS | 8.37 | 20MS | 13.4 | 40S | 46 | 99 |
| 998 | WBL 3058 | 11.8 | 40S | 1.9 | 10MS | 2.4 | 15MS | 7.3 | 20S | 46 | 99 |
| 999 | WBL 3059 | 37 | 80S | 3.7 | 10MR | 4.5 | 15S | 20.5 | 60S | 46 | 99 |
| 1000 | WBL 3060 | 5.5 | 20S | 2.1 | 10MS | 2.67 | 15MS | 7 | 20S | 46 | 99 |
| 1000A | Infector | 80 | 80S | 80 | 80SÂ | 78.33 | 100S | 78.9 | 100S | 68 | 79 |
| 1001 | WBL 3061 | 17.7 | 60S | 4.3 | 20MS | 10 | 30S | 10 | 40S | 46 | 99 |
| 1002 | WBL 3062 | 2.5 | 10S | 1.2 | 10MR | 5.7 | 20S | 11.2 | 40S | 46 | 99 |
| 1003 | WBL 3063 | 16.6 | 60S | 3.1 | 10MS | 3.87 | 15S | 9.5 | 40S | 46 | 99 |
| 1004 | WBL 3064 | 18.3 | 60S | 3 | 10MR | 7.87 | 20S | 8 | 20S | 46 | 99 |
| 1005 | BWL 7742 | 13.1 | 40S | 1.7 | 20MR | 1.67 | 10S | 5 | 10S | 46 | 99 |

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| 1006 | BWL 9965 | 17.1 | 40S | 2.6 | 10MS | 2.33 | 10S | 0 | 0 | 45 | 99 |
| 1007 | BWL 9966 | 14.5 | 40S | 5.8 | 20MS | 9.83 | 30S | 3.8 | 10S | 46 | 99 |
| 1008 | BWL 9985 | 11.1 | 60S | 0.9 | 10R | 0.37 | 5MR | 4.4 | 10S | 45 | 99 |
| 1009 | WG 2714 | 26 | 60S | 2.6 | 10R | 1.17 | 5S | 6.9 | 20S | 35 | 57 |
| 1010 | WG 2905 | 31.6 | 80S | 11.4 | 40MS | 8.4 | 40S | 3.2 | 10MS | 45 | 78 |
| 1011 | WG 2916 | 27.5 | 80S | 2.9 | 10MS | 5.83 | 20S | 14.7 | 40S | 46 | 99 |
| 1012 | WG 2926 | 37.8 | 60S | 1.6 | 10MR | 1.7 | 10S | 1.4 | 10MS | 45 | 99 |
| 1013 | WG 2929 | 16.5 | 40S | 5.1 | 20MS | 5 | 15S | 2.9 | 10MS | 46 | 99 |
| 1014 | WG 2986 | 29.6 | 80S | 5.4 | 20MR | 2 | 10MS | 3.6 | 10MS | 46 | 99 |
| 1015 | WG 2988 | 6.1 | 20S | 2.2 | 10S | 4.07 | 20S | 8.2 | 40S | 46 | 99 |
| 1016 | WG 2995 | 8.3 | 30S | 1.2 | 10MS | 0.1 | TMR | 1.2 | 5MS | 46 | 99 |
| 1017 | WG 3000 | 23.8 | 60S | 1.1 | 10MR | 3.47 | 20S | 2.7 | 10S | 45 | 78 |
| 1018 | WG 3001 | 20 | 40S | 2.7 | 20MS | 10.67 | 40S | 1.1 | 10MS | 46 | 99 |
| 1019 | WG 3018 | 12.5 | 40MR | 4.8 | 20MS | 9.17 | 30S | 3.4 | 10S | 46 | 99 |
| 1020 | WG 3020 | 15.8 | 40S | 5.2 | 20S | 11 | 30S | 2 | 10S | 56 | 99 |
| 1020A | Infector | 82.5 | 100S | 82.9 | 100S | 81.67 | 100S | 78.9 | 100S | 68 | 89 |
| 1021 | WG 3022 | 24.8 | 80S | 4.3 | 20S | 5.67 | 20S | 9.6 | 40S | 56 | 99 |
| 1022 | WG 3029 | 11.9 | 30S | 2.3 | 10MS | 1.83 | 20MR | 1 | 5S | 56 | 99 |
| 1023 | WG 3036 | 17.3 | 40S | 6.3 | 20MS | 9.67 | 30S | 5.3 | 20MS | 46 | 89 |
| 1024 | WG 3082 | 28.8 | 60S | 17.7 | 40S | 22.33 | 50S | 9 | 40S | 56 | 99 |
| 1025 | WG 3120 | 34.8 | 80S | 5.5 | 20MS | 5.07 | 20S | 8.7 | 40S | 45 | 99 |
| 1026 | WG 3124 | 20.8 | 40S | 11.1 | 20MS | 15 | 50S | 6.9 | 40S | 56 | 99 |
| 1027 | WG 3137 | 7.4 | 30S | 5.1 | 20S | 1.57 | 5S | 9.2 | 40S | 45 | 99 |
| 1028 | WG 3195 | 13.6 | 30S | 2.9 | 10MR | 3.4 | 20S | 11.4 | 40S | 45 | 99 |
| 1029 | WG 3255 | 11.5 | 40S | 4.9 | 10S | 8.83 | 20S | 13.3 | 40S | 36 | 78 |
| 1030 | WG 3273 | 7.1 | 20MS | 4.2 | 20S | 0.07 | TMR | 3.6 | 15S | 45 | 78 |
| 1031 | WG 3274 | 16.3 | 40S | 3.3 | 10MS | 2.83 | 15S | 6.5 | 40S | 46 | 99 |
| 1032 | WG 3290 | 26.5 | 40S | 2 | 10MS | 4.5 | 15MS | 0.5 | 5MS | 46 | 78 |
| 1033 | WG 3291 | 6.1 | 20S | 2.4 | 20MR | 10.67 | 40S | 0.9 | 5MS | 35 | 57 |
| 1034 | WG 3292 | 35.5 | 60S | 2.6 | 10MS | 0 | 0 | 5.8 | 40S | 36 | 57 |
| 1035 | WG 3293 | 13.8 | 40S | 3.4 | 10MS | 6.17 | 20S | 2.1 | 10MS | 46 | 99 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 1036 | WG 3294 | 28 | 60S | 1.7 | 10MS | 0.9 | 5S | 5.7 | 20S | 46 | 89 |
| 1037 | WG 3295 | 24.5 | 60S | 10.6 | 20S | 8.33 | 20S | 2.4 | 20MS | 45 | 99 |
| 1038 | WG 3297 | 12.5 | 40S | 5.3 | 20MS | 8.17 | 20S | 6 | 20S | 46 | 99 |
| 1039 | DWG 3087 | 19.3 | 40S | 2 | 10MR | 1.07 | 5MR | 5.6 | 20S | 45 | 89 |
| 1040 | DWG 3116 | 17.6 | 60S | 2.1 | 10MR | 0.83 | 5S | 6.7 | 20S | 45 | 99 |
| 1040A | Infector | 80 | 80S | 82.9 | 100S | 78.33 | 90S | 76.7 | 80S | 78 | 99 |
| 1041 | DWG 3298 | 18.6 | 60S | 6 | 20MS | 0 | 0 | 3.4 | 20S | 56 | 99 |
| 1042 | DWG 3299 | 31.5 | 80S | 0.9 | 10MR | 1.67 | 10S | 3.6 | 20S | 46 | 99 |
| | Dr CN Mishra | | | | | | | | | | |
| 1043 | QYT23-1 | 11 | 60S | 6.6 | 20MS | 7.17 | 15S | 20.1 | 40S | 46 | 99 |
| 1044 | QYT23-2 | 22.3 | 40S | 3.7 | 20MS | 5.07 | 15MR | 13.2 | 40S | 35 | 78 |
| 1045 | QYT23-3 | 4.5 | 20S | 9.3 | 40MS | 5.83 | 20S | 4.8 | 20S | 45 | 99 |
| 1046 | QYT23-4 | 4.9 | 20MS | 4.1 | 20MS | 9.2 | 20S | 9.8 | 40S | 45 | 99 |
| 1047 | QYT23-5 | 11.6 | 40S | 4.6 | 20MS | 6.7 | 20S | 5.8 | 20S | 45 | 99 |
| 1048 | QYT23-6 | 8.8 | 40S | 12.9 | 20S | 23.37 | 40S | 10.9 | 20S | 45 | 99 |
| 1049 | QYT23-7 | 13.8 | 40S | 6.6 | 20MS | 11.67 | 20S | 17.8 | 40S | 56 | 99 |
| 1050 | QYT23-8 | 22.8 | 80S | 5.5 | 20S | 7.83 | 20MS | 9.2 | 30S | 46 | 99 |
| 1051 | QYT23-9 | 13.8 | 80S | 5 | 20S | 7.5 | 20S | 21.7 | 40S | 45 | 99 |
| 1052 | QYT23-10 | 20.5 | 60S | 6.3 | 20MS | 10.83 | 40S | 12.2 | 40S | 46 | 99 |
| | Dr Hanif Khan | | | | | | | | | | |
| 1053 | RWP1526 | 1.2 | 10MR | 1.5 | 10S | 2.67 | 10S | 8.6 | 40S | 46 | 99 |
| 1054 | RWP1555 | 9.8 | 20S | 4 | 20S | 7 | 30S | 3.4 | 20MS | 46 | 99 |
| 1055 | RWP1560 | 16.5 | 40S | 3.7 | 20MR | 9.67 | 40S | 5.6 | 30S | 45 | 99 |
| 1056 | RWP1762 | 17.9 | 80S | 2.3 | 10S | 3.3 | 15MS | 18.2 | 40S | 46 | 99 |
| 1057 | RWP2089 | 10.3 | 60S | 1.6 | 10S | 6.67 | 20S | 15.3 | 40S | 35 | 67 |
| 1058 | RWP2121 | 9.8 | 30S | 2.6 | 10MS | 3 | 10MR | 5 | 20S | 46 | 99 |
| 1059 | RWP2198 | 38.8 | 80S | 3.3 | 10MS | 0.67 | 5MS | 10 | 40S | 46 | 99 |
| 1060 | RWP2091 | 10.6 | 60S | 1.4 | 10MS | 4.4 | 20MS | 16.2 | 40S | 46 | 99 |
| 1060A | Infector | 82.9 | 100S | 83.3 | 100S | 75 | 80S | 76.7 | 80S | 78 | 99 |
| 1061 | RWP2194 | 28.5 | 60S | 1.3 | 10MR | 3.73 | 10S | 16.7 | 40S | 46 | 99 |
| 1062 | RWP2068 | 4 | 20S | 4.6 | 20S | 4.73 | 20MR | 13.3 | 40S | 46 | 99 |

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| | Dr Sindhu Sareen | | | | | | | | | | |
| 1063 | 15003 | 19.5 | 40S | 10.1 | 40MS | 4.2 | 20MS | 13.6 | 40S | 45 | 99 |
| 1064 | 15005 | 14.8 | 40S | 7.4 | 40MR | 12.67 | 40S | 3.9 | 10S | 56 | 99 |
| 1065 | 15007 | 15.8 | 40S | 10.6 | 30S | 18.33 | 40S | 2.9 | 10MR | 46 | 99 |
| 1066 | 15009 | 14.4 | 40S | 4.9 | 10S | 11 | 40S | 2.8 | 10MS | 46 | 99 |
| 1067 | 15010 | 14.8 | 40S | 7.3 | 20MR | 12.67 | 40S | 19.2 | 40S | 35 | 57 |
| 1068 | 15004 | 11 | 40S | 2.2 | 10S | 3.13 | 20MR | 10.2 | 20S | 46 | 99 |
| 1069 | 15006 | 21.3 | 80S | 3.4 | 10MS | 0.73 | 5MS | 1.2 | 10MS | 45 | 99 |
| 1070 | 15008 | 31.3 | 60S | 4 | 10S | 10.33 | 30S | 4.2 | 30S | 46 | 78 |
| | Dr B S Tyagi | | | | | | | | | | |
| 1071 | PBS-IPPSN-23-1 | 40.8 | 100S | 9 | 40S | 0 | 0 | 5.6 | 20S | 46 | 99 |
| 1072 | PBS-IPPSN-23-2 | 22.8 | 60S | 3.5 | 10R | 0 | 0 | 3.7 | 20MS | 46 | 99 |
| 1073 | PBS-IPPSN-23-3 | 41.1 | 100S | 5.1 | 20S | 0 | 0 | 4.4 | 20S | 46 | 99 |
| | Dr Vikas Gupta | | | | | | | | | | |
| 1074 | NEIPPSN-1 | 25.5 | 60S | 1.9 | 10MS | 0.67 | 10MR | 17.7 | 60S | 45 | 78 |
| 1075 | NEIPPSN-2 | 33.8 | 80S | 4.3 | 20S | 2 | 10MS | 20.1 | 60S | 46 | 99 |
| 1076 | NEIPPSN-3 | 21.4 | 80S | 10.1 | 40S | 6.33 | 20S | 2.4 | 10S | 46 | 78 |
| 1077 | NEIPPSN-4 | 20.8 | 60S | 4.9 | 20MS | 8 | 30S | 11.3 | 40S | 46 | 99 |
| 1078 | NEIPPSN-5 | 20.8 | 40S | 5.6 | 10MS | 11 | 20S | 11.1 | 40MS | 46 | 99 |
| 1079 | NEIPPSN-6 | 13 | 40S | 9.4 | 20MS | 14.17 | 40S | 14.9 | 40S | 46 | 99 |
| 1080 | NEIPPSN-7 | 4.4 | 30S | 0.6 | 10MR | 5.17 | 20S | 12.2 | 40MS | 46 | 99 |
| 1080A | Infector | 77.1 | 80S | 80 | 80S | 78.33 | 90S | 77.8 | 80S | 78 | 98 |
| 1081 | NEIPPSN-8 | 10.1 | 20S | 2.4 | 10S | 5.83 | 20MS | 13.4 | 40MS | 46 | 99 |
| 1082 | NEIPPSN-9 | 17 | 40S | 5.6 | 20S | 15 | 40S | 10.1 | 20S | 46 | 99 |
| 1083 | NEIPPSN-10 | 16 | 40S | 2.3 | 10R | 3 | 15MS | 7.7 | 20S | 46 | 99 |
| 1084 | NEIPPSN-11 | 4.3 | 20S | 11.1 | 20MS | 5.83 | 20S | 5.1 | 20MS | 46 | 99 |
| 1085 | NEIPPSN-12 | 3.3 | 20S | 2.3 | 10MS | 4 | 20S | 5.3 | 20S | 45 | 99 |
| 1086 | NEIPPSN-13 | 11.3 | 20S | 2.9 | 10MS | 1.33 | 10MR | 8.7 | 20S | 46 | 99 |

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| 1087 | NEIPPSN-14 | 10.3 | 20S | 6.7 | 20S | 15 | 40S | 7.8 | 20S | 46 | 99 |
| | Dr Satish Kumar | | | | | | | | | | |
| 1088 | BSP 2318 | 22.3 | 80S | 15 | 40S | 20 | 80S | 17.1 | 40S | 57 | 99 |
| 1089 | BSP 2319 | 5.9 | 20S | 4.4 | 20S | 3.83 | 10MS | 1.7 | 10MS | 35 | 89 |
| 1090 | BSP 2320 | 9.5 | 40MS | 7.6 | 20S | 10.07 | 40S | 3.7 | 20S | 45 | 99 |
| 1091 | BSP 2321 | 27.3 | 80S | 11.7 | 20S | 16.33 | 40S | 5.6 | 20S | 46 | 99 |
| 1092 | BSP 2322 | 17 | 60S | 9.7 | 20S | 20 | 40S | 5 | 20S | 56 | 99 |
| 1093 | BSP 2323 | 13.8 | 60S | 3.6 | 20S | 0 | 0 | 7.3 | 20S | 46 | 78 |
| 1094 | BSP 2324 | 19.7 | 100S | 2.6 | 10MS | 2.4 | 15MS | 15.1 | 40S | 46 | 99 |
| 1095 | BSP 2325 | 31.5 | 100S | 14.7 | 60S | 20.5 | 40S | 26.7 | 40S | 46 | 99 |
| 1096 | BSP 2326 | 26.6 | 60S | 23.4 | 60S | 5.97 | 20S | 37.3 | 40S | 45 | 99 |
| 1097 | BSP 2327 | 15 | 40S | 4.3 | 10S | 1.5 | 5MS | 26.1 | 40S | 46 | 89 |
| | Dr Vishnu Goel | | | | | | | | | | |
| 1098 | DWAP2322 | 9.3 | 30S | 2.1 | 10MS | 9.33 | 40S | 7.9 | 40S | 57 | 99 |
| 1099 | DWAP2323 | 9.8 | 20S | 0.9 | 10S | 1.17 | 5MR | 5.4 | 20MS | 46 | 99 |
| 1100 | DWAP2324 | 3.3 | 20S | 5.3 | 20MS | 10 | 20S | 1.2 | 5S | 45 | 99 |
| 1100A | Infector | 82.5 | 100S | 82.9 | 100S | 78.33 | 100S | 78.9 | 100S | 68 | 99 |
| 1101 | DWAP2325 | 4.5 | 30S | 0.7 | 10MR | 2 | 10MS | 3.9 | 10S | 46 | 99 |
| 1102 | DWAP2326 | 10.3 | 40S | 12 | 20S | 25 | 40S | 1.8 | 20MS | 46 | 99 |
| | Dr Charan Singh | | | | | | | | | | |
| 1103 | EMPSN-1 | 16.8 | 40S | 4.7 | 20S | 4.17 | 15S | 12.8 | 40S | 45 | 99 |
| 1104 | EMPSN-2 | 10.4 | 20S | 3.5 | 10MS | 5.5 | 20S | 9.2 | 40S | 46 | 99 |
| 1105 | EMPSN-3 | 18.5 | 80S | 7.5 | 20MS | 10 | 20S | 0.6 | 5S | 46 | 99 |
| 1106 | EMPSN-4 | 15.3 | 40S | 3.9 | 10MS | 14 | 40S | 1.8 | 20MS | 45 | 99 |
| 1107 | EMPSN-5 | 17 | 40S | 5.9 | 20S | 9.17 | 30S | 10 | 40MS | 47 | 99 |
| 1108 | EMPSN-6 | 23.1 | 60S | 5.7 | 20MS | 19.17 | 40S | 10.4 | 40S | 46 | 99 |
| 1109 | EMPSN-7 | 27.5 | 60S | 11.3 | 40MS | 15.83 | 40S | 10.9 | 40S | 57 | 99 |
| 1110 | EMPSN-8 | 17.3 | 40S | 3.9 | 10MS | 13.83 | 40S | 19.8 | 40S | 56 | 99 |
| 1111 | EMPSN-9 | 36.3 | 80S | 3.2 | 10MS | 1.07 | 10MR | 13.8 | 40S | 46 | 99 |

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| 1112 | EMPSN-10 | 18.3 | 60S | 3.3 | 10MS | 5 | 20S | 9.4 | 40S | 46 | 99 |
| | POWARKHE DA | | | | | | | | | | |
| 1113 | PKD IPPSN 2024-01 | 23.3 | 60S | 4.9 | 20S | 0 | 0 | 8.7 | 40S | 56 | 99 |
| 1114 | PKD IPPSN 2024-02 | 17 | 60S | 5.9 | 40S | 5 | 20S | 3.8 | 20S | 46 | 99 |
| 1115 | PKD IPPSN 2024-03 | 16.8 | 60S | 4.9 | 20MR | 1.17 | 5MR | 3.7 | 20MS | 56 | 99 |
| 1116 | PKD IPPSN 2024-04 | 13.5 | 40S | 3.5 | 20S | 0.07 | TMR | 2.8 | 20MR | 56 | 99 |
| 1117 | PKD IPPSN 2024-05 | 41 | 80S | 9.5 | 40S | 2 | 10S | 9.9 | 40MS | 45 | 99 |
| 1118 | PKD IPPSN 2024-06 | 46.5 | 80S | 23.1 | 60S | 21.67 | 50S | 47.3 | 80S | 47 | 99 |
| 1119 | PKD IPPSN 2024-07 | 26.3 | 80S | 10 | 20MS | 19.67 | 60S | 40.7 | 80S | 56 | 99 |
| 1120 | PKD IPPSN 2024-08 | 0 | 0 | 10 | 20S | 8 | 20S | 15.2 | 40S | 47 | 57 |
| 1120A | Infector | 82.5 | 100S | 80 | 80S | 81.67 | 90S | 76.7 | 80S | 78 | 99 |
| 1121 | PKD IPPSN 2024-09 | 21.3 | 60S | 4.3 | 20S | 0.33 | 5MR | 6.4 | 20S | 56 | 99 |
| 1122 | PKD IPPSN 2024-10 | 20.8 | 80S | 12.9 | 40S | 10.83 | 40MS | 27.6 | 60S | 56 | 99 |
| 1123 | PKD IPPSN 2024-11 | 9.7 | 20S | 8.2 | 40S | 2.67 | 15MR | 6.6 | 40S | 57 | 99 |
| 1124 | PKD IPPSN 2024-12 | 21.6 | 80S | 3.6 | 10MS | 11.67 | 40S | 7.7 | 20S | 46 | 99 |
| 1125 | PKD IPPSN 2024-13 | 13 | 40S | 7.5 | 20S | 12.5 | 20S | 13.7 | 40MS | 46 | 99 |
| 1126 | PKD IPPSN 2024-14 | 15.3 | 20S | 7.3 | 20MS | 14.17 | 40S | 9 | 40S | 47 | 99 |
| 1127 | PKD IPPSN 2024-15 | 15 | 40S | 7.3 | 20MS | 20 | 40S | 7 | 20S | 47 | 99 |
| 1128 | PKD IPPSN 2024-16 | 14.8 | 40MS | 6.3 | 20MS | 12.67 | 40S | 10 | 40S | 46 | 89 |

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| 1129 | PKD IPPSN 2024-17 | 23.1 | 80S | 7.6 | 20MR | 16.17 | 40S | 21 | 60S | 56 | 99 |
| 1130 | PKD IPPSN 2024-18 | 16 | 40S | 2.9 | 10MS | 8.17 | 20S | 19.7 | 40S | 56 | 99 |
| 1131 | PKD IPPSN 2024-19 | 23.8 | 40S | 6.1 | 20MR | 10.33 | 20S | 14.7 | 40S | 56 | 99 |
| 1132 | PKD IPPSN 2024-20 | 5.2 | 20S | 9.3 | 20S | 16.17 | 40S | 30.8 | 60S | 46 | 99 |
| 1133 | PKD IPPSN 2024-21 | 8.3 | 30S | 5 | 20MS | 10.5 | 40S | 7.6 | 20S | 46 | 99 |
| 1134 | PKD IPPSN 2024-22 | 3.3 | 20MR | 14.3 | 40S | 10 | 30S | 5.1 | 20S | 46 | 99 |
| 1135 | PKD IPPSN 2024-23 | 13.3 | 40S | 9.6 | 40S | 5.33 | 15S | 13 | 40S | 57 | 99 |
| 1136 | PKD IPPSN 2024-24 | 18 | 60S | 12.3 | 40S | 20 | 40S | 15.4 | 60S | 56 | 99 |
| 1137 | PKD IPPSN 2024-25 | 19.5 | 60S | 6.4 | 20MS | 6.67 | 20S | 33.6 | 60S | 56 | 99 |
| 1138 | PKD IPPSN 2024-26 | 17.3 | 60S | 2.8 | 20S | 6 | 20MS | 15.3 | 40S | 56 | 99 |
| 1139 | PKD IPPSN 2024-27 | 17.1 | 60S | 2.6 | 10MS | 0.67 | 10MR | 30.6 | 60S | 46 | 99 |
| 1140 | PKD IPPSN 2024-28 | 30.1 | 80S | 9.8 | 40S | 19.67 | 40S | 9.4 | 40MS | 46 | 78 |
| 1140A | Infector | 80 | 80S | 80 | 80S | 78.33 | 90S | 76.7 | 80S | 78 | 99 |
| 1141 | PKD IPPSN 2024-29 | 17 | 40S | 4.3 | 10S | 7.83 | 20MS | 25.3 | 60S | 46 | 99 |
| 1142 | PKD IPPSN 2024-30 | 9 | 40S | 1.2 | 10MS | 10.33 | 30S | 39 | 60S | 46 | 67 |
| | AKOLA | | | | | | | | | | |
| 1143 | AKAW-4682 | 30 | 80S | 14.4 | 40MS | 23.33 | 40S | 28 | 60S | 56 | 99 |
| 1144 | AKAW-5347 | 17 | 40S | 11.7 | 40S | 12.33 | 40S | 28.3 | 60S | 46 | 99 |
| 1145 | AKAW-5448 | 18.5 | 80S | 8.4 | 40S | 3.67 | 20MR | 33.2 | 60S | 46 | 89 |
| 1146 | AKAW-5513 | 38.3 | 80S | 13.9 | 40S | 4.5 | 15MS | 41.1 | 60S | 46 | 78 |
| 1147 | AKAW-5521 | 18.3 | 80S | 9.3 | 40S | 13.17 | 40S | 37.8 | 60S | 46 | 99 |

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| 1148 | AKAW-5524 | 22.8 | 80S | 11.1 | 20S | 19.17 | 40S | 46.7 | 60S | 46 | 99 |
| 1149 | AKAW-5555 | 17.3 | 80S | 10.1 | 30S | 4.33 | 15MR | 33.3 | 80S | 46 | 99 |
| 1150 | AKAW-5557 | 26 | 80S | 27.1 | 60S | 31.33 | 60S | 26.8 | 60S | 56 | 99 |
| 1151 | AKAW-5558 | 27.9 | 80S | 11 | 20S | 25 | 60S | 34 | 60S | 56 | 99 |
| 1152 | WSM-180 | 23.8 | 80S | 32 | 60S | 41.67 | 90S | 36.7 | 60S | 57 | 99 |
| | QCWBN | | | | | | | | | | |
| 1153 | QBP 2308 | 30.5 | 60S | 3.7 | 20S | 2.23 | 10S | 22.6 | 40S | 46 | 99 |
| 1154 | QBP 2309 | 23.3 | 80S | 4.3 | 20S | 5.17 | 15MR | 9.3 | 20S | 46 | 99 |
| 1155 | QBP 2310 | 19.9 | 60S | 6.2 | 40S | 5.83 | 15S | 21.3 | 40S | 47 | 89 |
| 1156 | LBP 2023-26 | 2.8 | 10S | 3.2 | 20MR | 7.83 | 20S | 29.4 | 60S | 46 | 99 |
| 1157 | QYT 2322 | 23.3 | 60S | 4.4 | 20MR | 9.67 | 20S | 32 | 60S | 56 | 99 |
| 1158 | RWP 2196 | 8.3 | 40MS | 4 | 20MR | 8 | 30S | 17 | 40S | 46 | 99 |
| 1159 | WBL 1747 | 12.1 | 60S | 1.8 | 10MS | 7.33 | 30S | 7.2 | 20MS | 46 | 99 |
| 1160 | WBL 0028 | 5 | 30S | 1.3 | 10MR | 5.9 | 20S | 5.9 | 30S | 46 | 99 |
| 1160A | Infector | 80 | 80S | 80 | 80S | 81.67 | 100S | 80 | 100S | 68 | 79 |
| 1161 | WBL 9966 | 20 | 60S | 8.1 | 20MS | 12.67 | 40S | 3.9 | 20MS | 46 | 99 |
| 1162 | WHB1 | 15.3 | 40S | 17.7 | 40S | 28.33 | 50S | 8.2 | 20MS | 46 | 99 |
| 1163 | WHB2 | 24.8 | 80S | 8 | 40S | 4.83 | 20S | 10.6 | 20S | 46 | 99 |
| 1164 | UP 3127 | 8.3 | 40S | 5.1 | 10MR | 1.67 | 10MR | 35.1 | 60S | 46 | 99 |
| 1165 | UP3102 | 18.1 | 60S | 2.4 | 10MS | 14 | 40S | 21.7 | 40S | 46 | 99 |
| 1166 | K 2001 | 6.5 | 30S | 1.2 | 10MS | 4 | 20S | 23.1 | 60S | 46 | 67 |
| 1167 | K 21O1 | 3 | 20S | 13.4 | 40S | 15 | 30S | 15.6 | 40S | 45 | 67 |
| 1168 | GW 1028 | 25.8 | 60S | 7 | 30S | 6.33 | 15S | 20.8 | 60S | 57 | 99 |
| 1169 | GW 1029 | 13.3 | 60S | 4.3 | 10MR | 4 | 10S | 2.1 | 10S | 56 | 99 |
| 1170 | GW 1367 | 7.9 | 40S | 2 | 10MR | 3 | 10MR | 7.9 | 20S | 56 | 99 |
| 1171 | NIAW 4114 | 12.3 | 60S | 1.6 | 10S | 3.33 | 20S | 52.2 | 80S | 56 | 99 |
| 1172 | NIAW 4120 | 9.8 | 60S | 1.3 | 10MS | 0 | 0 | 51.1 | 80S | 57 | 99 |
| 1173 | MACS 6892 | 22.8 | 80S | 2.9 | 10R | 4.17 | 10S | 30.9 | 60S | 57 | 99 |
| 1174 | MACS 6893 | 11.6 | 60S | 1.3 | 10MS | 2.67 | 20MS | 40.9 | 60S | 56 | 99 |
| 1175 | IBW 2022-22 | 5.7 | 40S | 0.7 | 5R | 1.83 | 10S | 56.4 | 80S | 46 | 99 |
| 1176 | HDHG-2022-52 (d) | 10.5 | 30S | 6.6 | 20MS | 4.07 | 20MS | 13.2 | 60S | 46 | 99 |

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| 1177 | UASQ 336 (d) | 12.6 | 40S | 5.7 | 20MS | 5.67 | 20S | 12.9 | 80S | 46 | 99 |
| 1178 | UASQ 337 (d) | 16.6 | 60S | 5.7 | 10MS | 8 | 20S | 2.9 | 20MS | 46 | 99 |
| 1179 | CG2213 | 5.8 | 30S | 1.3 | 10MS | 10 | 40S | 46.7 | 80S | 57 | 99 |
| 1180 | QBP2311 | 18.5 | 40S | 9 | 20S | 23.33 | 60S | 11.6 | 40MR | 57 | 99 |
| 1180A | Infector | 82.5 | 100S | 82.9 | 100S | 83.33 | 100S | 77.8 | 80S | 78 | 99 |
| 1181 | BSP2328 | 7.5 | 40MS | 4.6 | 10R | 10.67 | 40S | 16.3 | 40S | 56 | 99 |
| 1182 | QYT2325 | 23.8 | 60S | 9.7 | 20S | 11.33 | 30S | 32.7 | 60S | 56 | 99 |
| 1183 | BST23-1 (d) | 18.3 | 60S | 6.1 | 40S | 0 | 0 | 8.3 | 40MS | 45 | 99 |
| | SATSN | | | | | | | | | | |
| 1184 | KRL 2207 | 40.5 | 100S | 8.3 | 40S | 0 | 0 | 18.4 | 40MS | 46 | 99 |
| 1185 | KRL 2212 | 7.5 | 30S | 2.7 | 10S | 4.4 | 20S | 10.9 | 40MS | 46 | 99 |
| 1186 | KRL 2213 | 11.9 | 30S | 1.1 | 10MR | 6.73 | 40S | 8.6 | 40S | 46 | 78 |
| 1187 | KRL 2214 | 3.3 | 10S | 4.3 | 10R | 7.5 | 20S | 13.2 | 40S | 46 | 99 |
| 1188 | KRL 2215 | 16.3 | 30S | 3 | 10MS | 5.83 | 20S | 11.6 | 40S | 46 | 99 |
| 1189 | KRL 2301 | 15.3 | 40S | 6 | 20S | 13.33 | 40S | 11.9 | 40S | 46 | 99 |
| 1190 | KRL 2302 | 21.3 | 60S | 7.7 | 20S | 4.33 | 15MR | 21.1 | 40S | 46 | 99 |
| 1191 | KRL 2303 | 7.8 | 40S | 2.9 | 10MS | 0.83 | 5S | 11.3 | 40MS | 45 | 89 |
| 1192 | WBL 1547 | 30.3 | 80S | 5.3 | 20MS | 0.83 | 5S | 0.1 | TS | 46 | 78 |
| 1193 | WBL 2300 | 26.4 | 60S | 3.3 | 10MS | 0.07 | TR | 0.5 | 5MS | 36 | 77 |
| 1194 | K 2001 | 8.2 | 20S | 1.2 | 10MR | 0.07 | TMR | 17.6 | 60S | 35 | 57 |
| 1195 | K 2003 | 5.3 | 20S | 0 | 0 | 0.07 | TMR | 18.4 | 60S | 35 | 57 |
| 1196 | NW 8082 | 28.4 | 40S | 4.6 | 10MS | 1.83 | 10MR | 17.1 | 60S | 45 | 99 |
| 1197 | NW8090 | 18 | 40S | 5.7 | 20MS | 7.33 | 30S | 12.8 | 40S | 46 | 99 |
| 1198 | PBS-SAL /ALK-23-01 | 11.1 | 30S | 4.3 | 20MS | 6.8 | 20S | 22.1 | 60S | 46 | 89 |
| 1199 | WAP 2327 | 16.3 | 30S | 7.5 | 20MS | 16.67 | 40S | 11.7 | 40S | 46 | 99 |
| 1200 | SANSR-10 | 11.8 | 30S | 6.1 | 20MS | 17.33 | 40S | 28.2 | 60S | 46 | 99 |
| 1200A | Infector | 80 | 80S | 82.9 | 100S | 81.67 | 100S | 78.9 | 100S | 78 | 99 |
| 1201 | LBP-2023-23 | 17.5 | 40S | 14.3 | 20S | 16.67 | 40S | 9.5 | 40S | 56 | 99 |
| 1202 | RWP 1123 | 16.3 | 60MS | 3.3 | 10MR | 3.33 | 20S | 2.9 | 10S | 46 | 99 |
| 1203 | BSP2301 | 28.3 | 80S | 2.2 | 10S | 2.67 | 15S | 8.6 | 40S | 46 | 99 |
| 1204 | WH1341 | 14.6 | 60S | 4 | 10MR | 0.33 | 5MR | 0.6 | 5MS | 45 | 99 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1205 | WH1342 | 16.1 | 80S | 5.4 | 20S | 2.33 | 10MR | 17.8 | 40S | 46 | 99 |
| 1206 | WH1343 | 14.5 | 40S | 7.4 | 20S | 8.33 | 20S | 11.3 | 40S | 46 | 99 |
| 1207 | WH1344 | 15.3 | 40S | 3.2 | 10MS | 2 | 10S | 2.2 | 10S | 46 | 99 |
| | BIOSEED | | | | | | | | | | |
| 1208 | 3101 | 17.4 | 80S | 1.7 | 10MS | 5.83 | 20S | 54.4 | 80S | 46 | 99 |
| 1209 | 3107 | 22 | 80S | 2.7 | 10MS | 1.67 | 10S | 19.1 | 40S | 46 | 99 |
| 1210 | 3109 | 15.3 | 80S | 3 | 10MS | 2.37 | 20MR | 18.9 | 40S | 46 | 89 |
| | SIGNET PVT LTD | | | | | | | | | | |
| 1211 | SIGNET 104 | 11 | 20MS | 3.7 | 10MR | 20.67 | 60S | 15.7 | 40S | 46 | 99 |
| | SAHIB SEED | | | | | | | | | | |
| 1212 | SAHIB 2607 | 21.7 | 40S | 11 | 40S | 28.67 | 50S | 18.2 | 40S | 46 | 89 |

Abbreviations: ACI = Average Coefficientof Infection, HS = Highest Score, Avg. = Mean, NG = No germination, *Indicates high rust score (more than 40S) at one location only.

Stem rust: Data of Wellington have not been considered due to erratic/ low disease development; Leaf rust (S): Data of Dharwad, and Wellington have not been considered due to erratic/poor disease development; Leaf rust (N): Karnal Centre have not been considered due to erratic data; Strip rust: Data of Kudwani and Malan have not been considered due to wrong recording; erratic/too low incidence of disease

**Annexure: 7. Performance of the entries screened against wheat blast at Jashore, Bangladesh during 2023-24.**

| S. No. | Entries | Av | HS |
|---|---|---|---|
| 1. | HD3474 | 33.7 | 63.7 |
| 2. | HD3475 | 66.4 | 74.4 |
| 3. | HD3476 | 32.9 | 51.9 |
| 4. | HD3477 | 38.3 | 51.6 |
| 5. | HP1981 | 10.0 | 10.0 |
| 6. | DBW446 | 6.7 | 10.0 |
| 7. | DBW447 | 0.0 | 0.0 |
| 8. | DBW448 | 0.0 | 0.0 |
| 9. | DBW449 | 0.0 | 0.0 |
| 10. | DBW450 | 18.1 | 36.2 |
| 11. | PBW936 | 17.7 | 35.4 |
| 12. | PBW937 | 12.6 | 25.3 |
| 13. | PBW938 | 20.9 | 41.8 |
| 14. | PBW939 | 18.4 | 36.8 |
| 15. | PBW940 | 29.0 | 58.0 |
| 16. | UP3140 | 10.2 | 20.4 |
| 17. | UP3141 | 0.8 | 1.5 |
| 18. | UP3142 | 24.6 | 43.5 |
| 19. | RAJ4584 | 61.4 | 63.2 |
| 20. | RAJ4585 | 46.0 | 57.7 |
| 21. | RAJ4586 | 38.3 | 49.5 |
| 22. | WH1328 | 16.9 | 25.9 |
| 23. | WH1329 | 19.8 | 36.4 |
| 24. | NW8094 | 16.0 | 32.0 |
| 25. | K2301 | 6.8 | 10.0 |
| 26. | HUW858 | 61.7 | 75.1 |
| 27. | KRL2202 | 20.6 | 41.2 |
| 28. | JAUW723 | 61.8 | 65.6 |
| 29. | NWS2124 | 73.3 | 77.7 |
| 30. | Supreme-1122 | 7.8 | 15.5 |
| 31. | BCW35 | 19.1 | 38.3 |
| 32. | UBW 22 | 71.9 | 80.3 |
| 33. | SVPWL22-04 | 9.4 | 15.7 |
| 34. | HD3478 | 9.1 | 18.1 |
| 35. | HD3479 | 69.8 | 72.4 |
| 36. | HD3480 | 87.2 | 88.4 |
| 37. | HP1982 | 31.2 | 47.6 |
| 38. | DBW451 | 18.4 | 36.8 |
| 39. | DBW452 | 28.3 | 41.8 |
| 40. | DBW453 | 20.5 | 41.0 |
| 41. | DBW454 | 5.1 | 5.2 |
| 42. | DBW455 | 2.1 | 4.3 |
| 43. | PBW941 | 10.0 | 20.0 |
| 44. | PBW942 | 0.0 | 0.0 |
| 45. | PBW943 | 0.0 | 0.0 |
| 46. | PBW944 | 17.3 | 34.7 |
| 47. | PBW945 | 19.3 | 38.6 |
| 48. | UP3143 | 43.9 | 79.1 |
| 49. | UP3144 | 34.0 | 64.0 |
| 50. | NW8089 | 12.9 | 21.4 |
| 51. | NW8095 | 17.1 | 34.2 |
| 52. | WH1330 | 7.4 | 14.9 |
| 53. | WH1331 | 19.7 | 34.2 |
| 54. | K2303 | 26.0 | 52.0 |
| 55. | K2304 | 15.1 | 30.3 |
| 56. | BRW3964 | 9.2 | 14.7 |
| 57. | BRW3967 | 79.7 | 86.5 |
| 58. | RAJ4587 | 71.4 | 72.8 |
| 59. | JKW317 | 5.0 | 10.0 |
| 60. | HUW859 | 7.9 | 10.0 |
| 61. | NWS2124 DUP | 59.4 | 63.5 |
| 62. | BCW32 | 29.4 | 58.9 |
| 63. | SVPWL22-10 | 32.5 | 60.8 |
| 64. | RAUW107 | 7.8 | 10.0 |
| 65. | KRL2101 | 31.3 | 59.3 |
| 66. | BW20R105 | 19.7 | 39.3 |
| 67. | HD3481 | 21.2 | 42.3 |
| 68. | HI1694 | 75.7 | 84.1 |
| 69. | HI1695 | 35.3 | 67.0 |
| 70. | HW3928-1 | 55.0 | 74.7 |
| 71. | MACS6864 | 32.3 | 44.7 |
| 72. | MACS6858 | 56.6 | 70.4 |
| 73. | MACS6862 | 7.6 | 15.1 |
| 74. | GW559 | 47.7 | 59.3 |
| 75. | GW560 | 60.3 | 66.1 |

| S. No. | Entries | Av | HS |
|---|---|---|---|
| **76.** | GW561 | 73.7 | 77.1 |
| 77. | DBW456 | 8.2 | 16.4 |
| 78. | DBW457 | 26.1 | 52.1 |
| 79. | UAS3030 | 35.3 | 70.7 |
| 80. | UAS3031 | 31.6 | 59.6 |
| 81. | MP3583 | 22.4 | 36.5 |
| 82. | MP3584 | 31.7 | 56.8 |
| 83. | NIAW4516 | 22.1 | 36.9 |
| 84. | NIAW4581 | 58.9 | 68.6 |
| 85. | MP1400 | 21.1 | 42.1 |
| 86. | MP1401 | 39.3 | 78.6 |
| 87. | GW565 | 62.7 | 67.9 |
| 88. | GW566 | 65.6 | 68.2 |
| 89. | PWU13 | 71.3 | 76.7 |
| 90. | PWU52 | 70.9 | 79.0 |
| 91. | PBW946 | 40.7 | 71.4 |
| 92. | RAJ4590 | 66.4 | 74.2 |
| 93. | CG1050 | 43.3 | 78.0 |
| 94. | AKAW4764 | 67.0 | 80.4 |
| 95. | LOK82 | 47.0 | 61.2 |
| 96. | NWS2237 | 31.8 | 53.6 |
| 97. | WH1332 | 42.5 | 53.8 |
| 98. | JWS1528 | 43.8 | 74.2 |
| 99. | HD3482 | 19.9 | 39.9 |
| 100. | HD3483 | 25.0 | 49.9 |
| 101. | HD3484 | 80.3 | 95.8 |
| 102. | HP1983 | 69.4 | 69.9 |
| 103. | DBW458 | 18.2 | 36.3 |
| 104. | DBW459 | 30.7 | 61.4 |
| 105. | DBW460 | 27.2 | 54.3 |
| 106. | DBW461 | 19.9 | 39.9 |
| 107. | DBW462 | 27.9 | 55.8 |
| 108. | PBW947 | 27.2 | 54.5 |
| 109. | PBW948 | 17.6 | 35.2 |
| 110. | PBW949 | 36.3 | 62.5 |
| 111. | PBW950 | 52.4 | 58.4 |
| 112. | PBW951 | 12.5 | 24.9 |
| 113. | WH1335 | 18.3 | 36.6 |
| 114. | WH1336 | 24.2 | 48.4 |
| 115. | WH1337 | 21.2 | 42.5 |

| S. No. | Entries | Av | HS |
|---|---|---|---|
| **116.** | K2306 | | |
| 117. | K2307 | | |
| 118. | RAJ4588 | 20.8 | 41.6 |
| 119. | RAJ4589 | 22.7 | 35.7 |
| 120. | NW8081 | 14.2 | 25.0 |
| 121. | NW8084 | 11.5 | 22.9 |
| 122. | UP3145 | 23.3 | 43.5 |
| 123. | UP3146 | 18.7 | 37.4 |
| 124. | JKW319 | 27.5 | 44.9 |
| 125. | BRW3954 | 19.5 | 30.1 |
| 126. | HUW860 | 19.2 | 38.4 |
| 127. | BCW31 | 27.8 | 55.6 |
| 128. | UBW21 | 12.7 | 15.4 |
| 129. | SVPWL22-02 | 80.5 | 78.9 |
| 130. | RAUW111 | 24.6 | 49.3 |
| 131. | HI1696 | 70.1 | 60.4 |
| 132. | HI1697 | 55.1 | 46.9 |
| 133. | HI1698 | 82.9 | 78.5 |
| 134. | HI1699 | 69.9 | 71.3 |
| 135. | DBW463 | 14.8 | 29.6 |
| 136. | DBW464 | 22.6 | 45.1 |
| 137. | UAS3032 | 50.2 | 53.2 |
| 138. | UAS3033 | 26.1 | 52.3 |
| 139. | MP3598 | 42.3 | 46.6 |
| 140. | MP3599 | 78.2 | 88.6 |
| 141. | NIAW4621 | 4.9 | 9.7 |
| 142. | NIAW4624 | 17.6 | 25.2 |
| 143. | MACS6868 | 41.5 | 78.0 |
| 144. | MACS6854 | 76.4 | 88.3 |
| 145. | GW562 | 67.0 | 67.4 |
| 146. | WSM141 | 61.8 | 66.7 |
| 147. | CG1061 | 70.2 | 88.6 |
| 148. | WH1338 | 25.8 | 51.5 |
| 149. | GW567 | 69.9 | 83.2 |
| 150. | LOK83 | 79.1 | 86.2 |
| 151. | PBW952 | 44.8 | 89.7 |
| 152. | MP1402 | 75.6 | 76.2 |
| 153. | HI8853 | 70.8 | 84.5 |
| 154. | HI8854 | 70.9 | 81.0 |
| 155. | HI8855 | 64.2 | 74.0 |

| S. No. | Entries | Av | HS |
|---|---|---|---|
| 156. | HI8858 | 54.0 | 57.5 |
| 157. | NIDW1542 | 69.8 | 72.7 |
| 158. | NIDW1557 | 61.4 | 76.2 |
| 159. | DDW65 | 64.2 | 67.4 |
| 160. | DDW66 | 45.1 | 70.4 |
| 161. | DDW67 | 76.2 | 78.9 |
| 162. | UAS485 | 73.7 | 90.5 |
| 163. | UAS486 | 64.6 | 71.6 |
| 164. | DDK1066 (Dic) | 37.4 | 74.9 |
| 165. | DDK1067 (Dic) | 43.1 | 86.1 |
| 166. | PDW366 | 41.4 | 82.8 |
| 167. | PDW367 | 70.0 | 78.0 |
| 168. | PDW368 | 76.3 | 77.8 |
| 169. | MPO1403 | 74.1 | 84.8 |
| 170. | MPO1404 | 22.1 | 44.1 |
| 171. | MACS4147 | 72.6 | 84.5 |
| 172. | MACS4146 | 74.5 | 87.9 |
| 173. | MACS5064 (Dic) | 34.6 | 63.1 |
| 174. | MACS5065 (Dic) | 32.6 | 65.3 |
| 175. | GW1369 | 68.6 | 82.7 |
| 176. | GW1370 | 85.5 | 92.4 |
| 177. | WHD969 | 85.6 | 92.7 |
| 178. | PWU8 | 91.0 | 91.6 |
| 179. | GW1371 | 60.2 | 68.2 |
| 180. | PBN1841 | 51.4 | 91.1 |
| 181. | AKDW5520 | 59.6 | 88.1 |
| 182. | HW5305(Dic) | 38.9 | 77.9 |
| 183. | HW5306(Dic) | 47.3 | 94.6 |
| 184. | HD3485 | 42.4 | 59.6 |
| 185. | HD3486 | 33.9 | 67.7 |
| 186. | HD3487 | 19.9 | 39.8 |
| 187. | HD3488 | 30.3 | 51.7 |
| 188. | DBW465 | 15.5 | 31.0 |
| 189. | DBW466 | 26.3 | 52.5 |
| 190. | DBW467 | 16.7 | 33.3 |
| 191. | DBW468 | 39.6 | 69.1 |
| 192. | PBW953 | 39.4 | 78.8 |

| S. No. | Entries | Av | HS |
|---|---|---|---|
| 193. | PBW954 | 39.1 | 64.9 |
| 194. | PBW955 | 38.2 | 76.4 |
| 195. | PBW956 | 42.7 | 62.2 |
| 196. | UP3147 | 27.5 | 55.0 |
| 197. | WH1339 | 25.8 | 51.5 |
| 198. | WH1340 | 51.7 | 62.0 |
| 199. | K2310 | 63.2 | 85.4 |
| 200. | HUW861 | 10.0 | 10.0 |
| 201. | JKW320 | 10.0 | 20.0 |
| 202. | BRW3959 | 10.5 | 20.9 |
| 203. | JAUW719 | 14.8 | 29.6 |
| 204. | KRL2203 | 30.6 | 61.2 |
| 205. | HI1700 | 43.3 | 86.5 |
| 206. | HI1701 | 57.7 | 83.9 |
| 207. | HI1702 | | |
| 208. | HI8856(d) | 50.3 | 73.8 |
| 209. | HI8857(d) | 80.5 | 81.7 |
| 210. | DBW469 | 17.5 | 35.1 |
| 211. | DBW470 | 20.4 | 40.9 |
| 212. | DDW67(d) | 75.6 | 88.1 |
| 213. | UAS487(d) | 16.8 | 23.6 |
| 214. | UAS3034 | 29.8 | 59.6 |
| 215. | NIAW4533 | 49.1 | 64.2 |
| 216. | NIDW1561(d) | 67.9 | 76.9 |
| 217. | GW563 | 61.4 | 83.2 |
| 218. | GW1372(d) | 76.0 | 89.7 |
| 219. | AKAW5441 | 63.5 | 77.2 |
| 220. | CG1052 | 79.1 | 83.1 |
| 221. | MP3601 | 65.3 | 65.6 |
| 222. | MP1405 | 17.9 | 35.7 |
| 223. | MACS6850 | 73.6 | 82.2 |
| 224. | MACS6851 | 56.7 | 74.2 |
| 225. | PBN2115 | 43.1 | 86.1 |
| 226. | HD3489 | 53.1 | 59.0 |
| 227. | WH1333 | 18.1 | 36.2 |
| 228. | MP1406 | 43.6 | 77.3 |
| 229. | HD3490 | 66.2 | 63.4 |
| 230. | HD3491 | 7.4 | 14.9 |
| 231. | HD3492 | 73.7 | 91.3 |
| 232. | PBW931 | 22.5 | 45.1 |

| S. No. | Entries | Av | HS |
|---|---|---|---|
| 233. | PBW932 | 37.3 | 74.5 |
| 234. | PBW933 | 44.1 | 88.1 |
| 235. | PBW934 | 21.9 | 43.7 |
| 236. | PBW935 | 15.4 | 30.8 |
| 237. | DBW471 | 19.8 | 39.6 |
| 238. | DBW472 | 28.7 | 47.4 |
| 239. | DBW473 | 12.7 | 25.4 |
| 240. | DBW474 | 17.7 | 25.5 |
| 241. | DBW475 | 10.0 | 20.0 |
| 242. | WH1334 | 17.5 | 34.9 |
| 243. | RAJ4591 | 71.5 | 77.3 |
| 244. | UP3148 | 41.7 | 83.3 |
| 245. | GW564 | 67.6 | 68.1 |
| 246. | GW568 | 77.6 | 79.1 |
| 247. | UBKV-22-10 | 77.7 | 81.4 |
| 248. | UBKV-23-1 | 42.3 | 67.0 |
| 249. | UBKV-23-2 | 55.7 | 69.3 |
| 250. | UBKV-23-3 | 57.6 | 74.6 |
| 251. | UBKV-23-4 | 45.9 | 50.2 |
| 252. | UBKV-23-5 | 46.5 | 62.1 |
| 253. | UBKV-23-6 | 52.1 | 67.4 |
| 254. | UBKV-23-7 | 83.7 | 92.2 |
| 255. | UBKV-23-14 | 82.5 | 85.7 |
| 256. | UBKV-23-15 | 84.4 | 93.5 |
| 257. | NIDW1520 | 78.2 | 89.8 |
| 258. | INDB2303 | 70.5 | 71.8 |
| 259. | INDB2305 | 78.0 | 78.3 |
| 260. | RWP2080 | 24.2 | 48.3 |
| 261. | LBP2023-2 | 24.8 | 35.1 |
| 262. | LBP2023-3 | 42.6 | 43.8 |
| 263. | LBP2023-4 | 67.0 | 88.4 |
| 264. | WAP2304 | 30.3 | 49.9 |
| 265. | WAP2305 | 40.9 | 50.8 |
| 266. | PBS-ST-1-23-02 | 43.1 | 55.1 |
| 267. | PBS-ST-1-23-03 | 63.5 | 90.8 |
| 268. | QYT2301 | 37.5 | 65.8 |
| 269. | QYT2302 | 49.4 | 63.2 |
| 270. | QYT2303 | 41.6 | 48.8 |
| 271. | QYT2304 | 54.4 | 77.4 |

| S. No. | Entries | Av | HS |
|---|---|---|---|
| 272. | QYT2305 | 43.8 | 54.0 |
| 273. | QYT2306 | 47.6 | 60.0 |
| 274. | BSP2303 | 61.3 | 66.6 |
| 275. | WAP2307 | 68.6 | 78.8 |
| 276. | PBS-ST-2-23-01 | 65.3 | 71.7 |
| 277. | WAP2314 | 69.8 | 78.1 |
| 278. | WAP2315 | 73.7 | 76.7 |
| 279. | WAP2316 | 76.6 | 87.5 |
| 280. | WAP2317 | 62.8 | 79.1 |
| 281. | PBS-ST-4-23-01 | 65.1 | 71.4 |
| 282. | PBS-ST-4-23-02 | 64.2 | 67.9 |
| 283. | PBS-ST-4-23-03 | 65.5 | 71.7 |
| 284. | QYT2315 | 60.3 | 74.7 |
| 285. | QYT2316 | 61.3 | 77.5 |
| 286. | BSP2313 | 60.4 | 87.6 |
| 287. | RWP2190 | 84.1 | 84.9 |
| 288. | RWP2191 | 66.4 | 72.8 |
| 289. | BSP2316 | 65.8 | 89.4 |
| 290. | BSP2317 | 61.7 | 77.0 |
| 291. | RWP2079 | 28.3 | 56.5 |
| 292. | RWP2081 | 53.6 | 66.8 |
| 293. | RWP2197 | 17.7 | 25.5 |
| 294. | RWP1062 | 40.9 | 51.9 |
| 295. | RWP1199 | 41.5 | 52.5 |
| 296. | LBP2023-1 | 56.6 | 67.5 |
| 297. | LBP2023-5 | 44.5 | 73.5 |
| 298. | LBP2023-6 | 45.4 | 58.5 |
| 299. | WAP2301 | 42.7 | 50.7 |
| 300. | WAP2302 | 83.1 | 84.7 |
| 301. | WAP2303 | 34.3 | 36.8 |
| 302. | WAP2306 | 34.0 | 43.2 |
| 303. | PBS-ST-1-23-01 | 70.1 | 67.3 |
| 304. | PBS-ST-1-23-04 | 67.6 | 87.7 |
| 305. | PBS-ST-1-23-05 | 52.8 | 70.9 |

| S. No. | Entries | Av | HS |
|---|---|---|---|
| 306. | BSP2302 | 25.6 | 39.6 |
| 307. | BSP2304 | 31.9 | 52.9 |
| 308. | BSP2305 | 31.9 | 36.0 |
| 309. | BSP2306 | 43.3 | 76.5 |
| 310. | RWP1057 | 31.9 | 59.1 |
| 311. | RWP1131 | 39.7 | 62.6 |
| 312. | RWP2146 | 55.0 | 63.4 |
| 313. | RWP2189 | 34.9 | 55.1 |
| 314. | LBP2023-7 | 39.2 | 52.2 |
| 315. | LBP2023-8 | 53.1 | 64.5 |
| 316. | LBP2023-9 | 52.5 | 80.5 |
| 317. | LBP2023-10 | 66.2 | 81.1 |
| 318. | WAP2308 | 58.9 | 66.5 |
| 319. | WAP2309 | 58.5 | 75.8 |
| 320. | WAP2310 | 40.8 | 65.0 |
| 321. | PBS-ST-2-23-02 | 58.5 | 76.9 |
| 322. | PBS-ST-2-23-03 | 43.1 | 59.2 |
| 323. | PBS-ST-2-23-04 | 44.1 | 71.4 |
| 324. | QYT2307 | 36.2 | 46.1 |
| 325. | QYT2308 | 47.9 | 56.5 |
| 326. | QYT2309 | 49.3 | 72.3 |
| 327. | BSP2307 | 28.1 | 39.6 |
| 328. | BSP2308 | 38.6 | 51.8 |
| 329. | BSP2309 | 40.4 | 65.4 |
| 330. | RWP1556 | 41.0 | 47.8 |
| 331. | RWP1831 | 37.7 | 45.6 |
| 332. | RWP1880 | 51.5 | 72.5 |
| 333. | RWP2071 | 41.0 | 46.2 |
| 334. | LBP2023-11 | 46.2 | 50.3 |
| 335. | LBP2023-12 | 30.5 | 49.3 |
| 336. | LBP2023-13 | 32.1 | 39.2 |
| 337. | LBP2023-14 | 42.5 | 49.9 |
| 338. | WAP2311 | 43.1 | 55.8 |
| 339. | WAP2211 | 38.7 | 51.0 |
| 340. | WAP2312 | 20.6 | 31.3 |
| 341. | WAP2313 | 26.1 | 36.9 |
| 342. | PBS-ST-3-23-01 | 50.1 | 64.9 |
| 343. | PBS-ST-3-23-02 | 56.4 | 66.3 |
| 344. | PBS-ST-3-23-03 | 56.0 | 59.9 |
| 345. | PBS-ST-3-23-04 | 40.4 | 65.1 |
| 346. | QYT2310 | 10.0 | 10.0 |
| 347. | QYT2311 | 38.8 | 62.0 |
| 348. | QYT2312 | 12.3 | 14.6 |
| 349. | QYT2313 | 17.2 | 18.8 |
| 350. | BSP2310 | 30.6 | 41.4 |
| 351. | BSP2311 | 26.1 | 35.7 |
| 352. | RWP1549 | 15.0 | 20.0 |
| 353. | RWP1844 | 25.9 | 35.1 |
| 354. | RWP1899 | 33.9 | 42.3 |
| 355. | RWP2060 | 78.3 | 81.5 |
| 356. | LBP2023-15 | 12.4 | 14.9 |
| 357. | LBP2023-16 | 38.3 | 54.8 |
| 358. | LBP2023-17 | 28.2 | 39.7 |
| 359. | LBP2023-18 | 16.4 | 22.9 |
| 360. | QYT2314 | 58.5 | 68.4 |
| 361. | QYT2317 | 12.4 | 14.9 |
| 362. | BSP2312 | 60.0 | 92.3 |
| 363. | BSP2314 | 48.8 | 66.7 |
| 364. | RWP2137 | 57.9 | 73.5 |
| 365. | RWP3185 | 48.9 | 72.8 |
| 366. | LBP2023-19 | 57.5 | 83.7 |
| 367. | LBP2023-20 | 45.8 | 66.2 |
| 368. | LBP2023-21 | 46.8 | 62.9 |
| 369. | LBP2023-22 | 58.1 | 75.3 |
| 370. | WAP2318 | | |
| 371. | PBS-ST-5-23-01 | 55.8 | 75.9 |
| 372. | PBS-ST-5-23-02 | 70.2 | 78.3 |
| 373. | PBS-ST-5-23-03 | 61.2 | 81.3 |
| 374. | QYT2318 | 77.4 | 79.8 |
| 375. | QYT2319 | 54.8 | 72.8 |
| 376. | QYT2320 | 52.3 | 74.1 |
| 377. | QYT2321 | 35.2 | 49.7 |

| S. No. | Entries | Av | HS |
|---|---|---|---|
| 378. | BSP2315 | 38.5 | 61.3 |
| | BARI Gom 33 | 6.6 | 10.0 |
| | BARI Gom 26 | 81.7 | 85.4 |

Total of 378 entries in 2023 were screened against blast at Jashore, Bangladesh at two differentdates of sowing during 2023-24

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63वीं अखिल भारतीय गेहूँ एवं जौ अनुसंधान कार्यकर्ता गोष्ठी-2024
आचार्य नरेन्द्र देव कृषि एवं प्रौद्योगिकी विश्वविद्यालय, अयोध्या (उत्तर प्रदेश)

**63rd All India Wheat and Barley Workers Meet-2024**
**Acharya Narendra Deva University of Agriculture & Technology, Ayodhya (Uttar Pradesh)**

सितम्बर 11-13, 2024 | September 11-13, 2024