

WORK PLAN OF CROP PROTECTION (2023-24)-WHEAT

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	<i>Puccinia graminis tritici</i>	11, 40A, 117-6, 21A-2, 122
Stripe/Yellow	<i>P. striiformis</i>	238S119, 46S119, 110S119, 110S84, T
Leaf/Brown	<i>P. triticina</i>	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	<i>P. graminis tritici</i>	11, 40A, 117-6	11, 40A
Stripe/Yellow	<i>P. striiformis</i>	238S119, 46S119, 110S119	238S119, 46S119
Leaf/Brown	<i>P. triticina</i>	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

- All the centres associated with crop protection programme will conduct the surveys on regular interval during crop season and will send the information after every survey. 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 hullless 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 (South) + Stem rust: 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% + Difenconazole 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 + Epoxiconazole 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	Difenconazole 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 a such as that maximum number of roots remain intact. Remove soil particles by shaking and then clean under running tap-water. 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

(e) Assessment of yield losses caused by stripe rust in wheat (New Experiment)

Centres: Karnal, Ludhiana, Hisar, Pantnagar, Jammu, Durgapura, Gurdaspur

PROGRAMME 10. ENTOMOLOGY

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

(a) Entomological screening nurseries (ESN)- In these nurseries, AVT entries along with those found resistant during previous years will be screened for

(i) Shoot fly (Centres: Dharwad, Ludhiana, Kanpur, Niphad)

(ii) Brown wheat mite (Centres: Kanpur and Ludhiana)

(iii) Wheat Aphids (Centres: Niphad, Ludhiana, Karnal, Khudwani, RPCAU Pusa, and Kharibari)

(iv) Root aphid (Centres: Karnal and Ludhiana)

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

(i) Shoot fly (Centres: Dharwad, Ludhiana, Kanpur and Niphad)

(ii) Brown wheat mite (Centres: Kanpur and Ludhiana)

(iii) Foliar aphids (Centres: Niphad, Ludhiana, Karnal, Khudwani, RAU Pusa, and Kharibari)

(iv) Root aphid (Centres: Karnal and Ludhiana)

2. Integrated Pest Management

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

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

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

The effect of 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, Nipad, 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	-

(h) Management of lepidopterous 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 chlorpyrifos 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	-

(i) 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, per cent 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).

Tr.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 chlorpyrifos 20EC	2.5 l
T7	Soil application of chlorpyrifos 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
- Evaluation of resistance against nematodes parasitizing wheat**
(a) *Heterodera avenae*: Hisar and Durgapura. (AVT and EMDSN lines)
- Management of cereal cyst nematode, *Heterodera avenae* in wheat through bio-agents and 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

WORK PLAN OF CROP PROTECTION (2023-24)-BARLEY

1. Crop Health Survey: All barley cooperating centres in their area of command will carry out the survey and record the incidence and infestation of disease and insect pest in the farmer's fields. **The infected samples of rust will be sent to IIWBR, RS Flowerdale and leaf blight to IIWBR, Karnal for further analysis.** Any entry showing > 40S rust reaction in the trials has to be informed to IIWBR, Karnal and sample should be sent to RS Flowerdale, Shimla for race analysis.

(A) Plant Pathology

2. Evaluation for status of host resistance in test entries:

i. Initial Barley Disease Screening Nursery (IBDSN):

This nursery will comprise of test entries of station trial of barley breeding centres. The entries will be screened against rusts and leaf blight at hot spot locations.

Yellow rust: Ludhiana, Durgapura, Bajaura, Karnal, Almora and Jammu (6)

Leaf blight: Pantnagar, Kanpur, Faizabad, and Varanasi (4)

ii. National Barley Disease Screening Nursery (NBDSN):

This nursery will comprise of entries from yield trials (IVT and AVT) which will be screened against rusts and leaf blight.

Yellow rust: Ludhiana, Durgapura, Bajaura, Hisar, Almora, Karnal and Jammu (7)

Leaf rust: Ludhiana Jammu and Wellington (3)

Leaf blight: Pantnagar, Kanpur, Faizabad, Varanasi, Dharwad Coochbehar, and Kalyani (7)

iii. Elite Barley Disease Screening Nursery (EBDSN):

This nursery will have resistant entries identified in NBDSN and EBDSN tested at hot spot locations. The confirmed sources of resistance would later be shared with different barley breeders for their utilization.

Yellow rust: Ludhiana, Durgapura, Bajaura, Hisar, Almora, Karnal and Jammu (7)

Leaf rust: Ludhiana Jammu and Wellington (3)

Leaf blight: Pantnagar, Kanpur, Faizabad, and Varanasi (4)

iv. Seedling Resistant Test (SRT) of NBDSN and EBDSN:

The test would be conducted against different pathotypes of three rusts at RS, Flowerdale, Shimla.

3. Chemical control of leaf blight (Centres: Pantnagar, Kanpur, Faizabad, Vijapur and Varanasi)

S. No.	Treatment	Dosages
1	Tebuconazole 50% + Trifloxystrobin 25%,	0.06%
2	Propiconazole 13.9% + Difenconazole 13.9%	0.1%
3	Azoxystrobin 12.5% + Tebuconazole 12.5%	0.1%
4	Picoxystrobin 7.05% + Propiconazole 11.7%	0.1%
5	Kresoxim Methyl 44.3% SC	0.1%
6	Propiconazole 25%	0.1%
7	Tebuconazole 25.9%	0.1%
8	Mancozeb 75%	0.2%
9	Control	-

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

(B)Entomology

1. **Screening of NBDSN and Elite lines against foliar aphids (Centres: Ludhiana, Kanpur, Khudwani, Pantnagar, Durgapura, Hisar and Karnal).**

The national barley aphid screening nursery (NBDSN) will be continued. It will comprise entries from coordinated trials. Besides, 10-20 extra entries found promising for aphid resistance at Karnal will be screened against aphids at four centres; Ludhiana, Kanpur, Durgapura and Karnal.

2. **Survey and surveillance of insect-pests and their natural enemies in barley (All centres)**

Roving surveys will be carried out at fortnightly intervals during the cropping season 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.

3. **Management of aphids through foliar application of new bio-chemical molecules (Centres: Vijapur, Ludhiana, Kanpur, Durgapura and Karnal)**

New chemical molecules will be evaluated against foliar aphids in barley. Insect population counts before and after the treatment will be recorded along with yield to determine efficacy of each treatment.

4. **Storability and damage potential of major storage insect pests of barley; *Sitophilus oryzae* or *Rhizopertha dominica* in barley (Centres: Karnal, Niphad, Ludhiana, Kanpur and Durgapura)**

Each treatment will consist of 0.5 kg seed sample of barley 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.

(C)Nematology

1. **Screening of NBDSN and EBDSN against CCN:**

The entries of NBDSN and EBDSN will be tested against Cereal Cyst nematode (CCN) at Durgapura and Hisar centers in sick plots/field.

2. **Management of cereal cyst nematode, *Heterodera avenae* in barley through bio-agents and 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