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***ALL INDIA COORDINATED RESEARCH  
PROJECT ON WHEAT AND BARLEY***

**CROP PROTECTION**

**Work Plan 2021-22**



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## **PROGRAMME OF WORK CROP PROTECTION 2021-22**

The tentative work plan for the crop year 2021-22 which will be finalized in the 60<sup>th</sup> All India Wheat and Barley Research Workers Meet to be held in August 23-24, 2021 through virtual platform. The various activities to be executed at respective Centres are given below:

### **PROGRAMME 1: Host resistance - IPPSN and PPSN**

#### **Adult Plant Resistance for rusts & other diseases**

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

###### **Objectives**

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

###### **(a) Rusts:**

###### **North:**

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

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

###### **South:**

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

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

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

###### **Objectives**

Evaluation of breeding material for promotion of entries from one stage to the other in the coordinated trials and identification of varieties for release after AVT level on the basis of their level of disease resistance.

###### **(a) Rusts:**

###### **North:**

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

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

###### **South:**

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

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

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

<b>Rust</b>	<b>Rust pathogen</b>	<b>Pathotypes</b>
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

- Stripe, leaf and stem rusts (under controlled conditions):** Flowerdale, Shimla
- Stripe rust** – Ludhiana and New Delhi
- Leaf rust** – Powarkheda, New Delhi and Ludhiana
- 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

- 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.
- Leaf and stem rust:** Mahabaleshwar for SRT on AVT entries of CZ, PZ and NIVT (durum entries).

## PROGRAMME 3: Leaf Blight

### Leaf Blight Screening Nursery (LBSN):

This nursery will consist of AVT's entries as well as other resistant entries identified. It will have all the released varieties and material found resistant in preceding years.

#### Centres:

**NWPZ:** Ludhiana, Karnal, Hisar and Pantnagar.

**NEPZ:** Ayodhya, Varanasi, **RPCAU Pusa**, Sabour, Ranchi, Kalyani Coochbehar and Shillongani.

**CZ:** Indore and Powarkheda

**PZ:** Pune and Dharwad

## PROGRAMME 4: Karnal Bunt

### Karnal Bunt Screening Nursery (KBSN):

This nursery will consist of the earlier identified resistant materials, released varieties along with AVT entries under artificially inoculated conditions.

**Centres:** Malan, Jammu, Ludhiana, Karnal, Hisar, New Delhi, and Pantnagar. (7)

## 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. (4)

## **PROGRAMME 6: Powdery Mildew**

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

**Centres:** Malan, Dhaulakuan, Almora, Jammu, Pantnagar and Wellington (6)

## **PROGRAMME 7: Region specific diseases**

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

## **PROGRAMME 8: Crop Health**

### **1. Pre- harvest crop health monitoring**

#### **Crop Health Monitoring: Pre harvest surveys**

- All the centres associated with crop protection programme will supply information fortnightly on crop health from the areas of their jurisdiction to P.I. Crop Protection starting from November 2020 till the harvest of crop.
- Wheat Crop Health Newsletter will be issued on monthly basis by PI (CP) IIWBR, Karnal, during the crop season. Information on off season surveys will be included in first issue.

### **Monitoring of new virulences of yellow rusts in NWPZ by specially constituted teams:**

Specially constituted teams will visit the areas as per the need for effective monitoring of crop health in general and appearance and spread of yellow rust in particular, along the areas near the western border and foothills / sub-mountainous areas in NWPZ. Teams will be constituted as per the need for survey.

**Monitoring of wheat blast:** The teams are constituted to monitor wheat crop in West Bengal, Bihar and Assam along the Indo-Bangladesh borders for the presence of wheat blast. Teams will be constituted as per the need for survey. If any suspected samples of wheat blast like disease found will be analyzed at Kalyani and Coochbehar centre.

**Monitoring the pathotype distribution of rust pathogens:** It will be undertaken by IIWBR, Regional Station, Flowerdale, Shimla (all three rusts from all zones) and Rust Research Station, Mahabaleshwar (brown and black rust from CZ and PZ). All the cooperating Centres are required to send the rust infected samples (natural infection) for pathotype analysis to the concerned centres according to recommended protocol.

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

**Off-season Disease Monitoring Nursery (To be coordinated by IIWBR Reg. Station, Flowerdale):** This nursery will be planted in Dalang Maidan, Kukumseri, Sangla, Sarahan (HP) and Leh (J&K). High altitude varieties and one 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 Plant Pathological Screening Nursery (EPPSN):** The sources of resistance to three or two rusts identified in PPSN will be retested to confirm their resistance to rusts:

**Stripe rust:** Kudwani, Malan, Dhaulakuan, Almora, Jammu, Ludhiana, Karnal, Delhi, Durgapura and Pantnagar.

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

**Leaf rust (S) and Stem rusts:** Vijapur, Indore, Powarkheda, Niphad, Pune, Mahabaleshwar, Dharwad and Wellington.

- 2. Multiple Disease Screening Nursery (MDSN):** It will have sources of resistance to rusts and other diseases found earlier and will revalidate their status to different diseases:

#### DISEASES

**Stripe rust:** Kudwani, Malan, Dhaulakuan, Almora, Jammu, Ludhiana, Karnal, Delhi, Durgapura and Pantnagar.

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

**Leaf rust (S) and Stem rusts:** Vijapur, Indore, Powarkheda, Niphad, Pune, Mahabaleshwar, Dharwad and Wellington.

**Leaf blights:** Ludhiana, Karnal, Pantnagar, Ayodhya, Varanasi, Sabour, Kalyani, Coochbehar, Indore, Powarkheda, Pune and Dharwad.

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

**Loose smut:** Malan, Almora, Ludhiana, Hisar and Durgapura.

**Powdery mildew:** Malan, Dhaulakuan, Almora, Jammu, Pantnagar and Wellington

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

**Head scab:** Dhaulakuan, Gurdaspur, Delhi and Wellington

**Nematodes (CCN):** Hisar and Durgapura.

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

### 3. Management of diseases

- (a) Chemical management of powdery mildew:**

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

The chemicals will be tested are:

S. No.	Treatments	Doses
1	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC,	@ 0.1%
2	Azoxystrobin 18.2% w/w + Difenconazole 11.4% w/w SC,	@ 0.1%
3	Tebuconazole 50% + Trifloxystrobin 25% WG,	@ 0.06%
4	Propiconazole	@ 0.1%
5	Tebuconazole	@ 0.1%
6	Control	-

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

- (b) Chemical management of head scab:**

**Centres:** Gurdaspur, Ludhiana, Karnal and Wellington.

The chemicals will be tested are:

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

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

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

**(c) Chemical management of leaf rust:**

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

The chemicals will be tested are:

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

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

**(d) Chemical management of stem rust:\***

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

The chemicals will be tested are:

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

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

**(e) Chemical management of leaf blight**

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

The chemicals will be tested are:

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

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

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

## PROGRAMME 10. ENTOMOLOGY

**1. Host plant resistance:** Entomological screening nurseries (ESN), Multiple pest screening nurseries (MPSN), National initial varietal trial nurseries (NIVT) and special screening nurseries of promising entries identified during previous season

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

- (i) Shoot fly (Centres: Dharwad, Ludhiana, Kanpur, Niphad)
- (ii) Brown wheat mite (Centres: Durgapura and Ludhiana)
- (iii) Wheat Aphids (Centres: Niphad, Ludhiana, Karnal, Durgapura, Khudwani, Kalyani, RAU Pusa, and Kharibari)
- (iv) Root aphid (Centres: Karnal and Ludhiana)

The NIVT entries will also be screened against foliar aphids at Niphad, Ludhiana and Karnal

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

- (i) Shoot fly (Centres: Dharwad, Ludhiana, Kanpur and Niphad)
- (ii) Brown wheat mite (Centres: Durgapura and Ludhiana)
- (iii) Foliar aphids (Centres: Niphad, Ludhiana, Karnal, Durgapura, Khudwani, Kalyani, RAU Pusa, and Kharibari)
- (iv) Root aphid (Centres: Karnal and Ludhiana)

## 2. Integrated Pest Management

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

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

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

The effect of sowing time on the population build-up of major insect-pests of wheat will be studied at four geographical locations to better understand the insect-pest behaviour under different climatic conditions.

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

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

**(d) Effect of silicon on the incidence of major insect-pests and natural enemies of wheat** (Centres: Karnal and Ludhiana-New trial)

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

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

Soil application of polyacrylamide and alginate loaded insecticide hydrogel formulations will be tested for management of termites in wheat.

**(f) Basic studies for development of IPM strategies** (Centres: Karnal, Niphad, Ludhiana, Kharibari)

The study will be conducted to generate region-wise data on population dynamics of major insect-pests of wheat and barley for developing pest-forecasting models. Weather parameters of a location will be correlated with insect population to determine the effect of climatic variations on the pest population dynamics under changing climate scenario.

**(g) Zone specific IPM modules** (Centres: Karnal, Ludhiana, Niphad, Kanpur)

The integrated pest module consisting of effective cultural, physical, biological and chemical components of integrated pest management will be formulated and tested against major pests of wheat viz., foliar aphids, shootfly and termites.

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

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

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

With increasing incidence of lepidopterous insect-pests in rice-wheat cropping system, an experiment will be conducted on the management of these pests through, chemicals, biopesticides etc.

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

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

### 3. Stored Grain Pest Management

**(a) Evaluation of different packaging bags for storage insect-pest infestation and its effect on wheat seed quality** (Centre: Karnal, Ludhiana, Kharibari, Niphad)

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

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

Effect of seed protectants will be tested against infestation of major storage insect pests; *Sitophilus oryzae* or *Rhizopertha dominica* in wheat.



## PROGRAMME 11. NEMATOLOGY

1. **Monitoring of Nematodes:** *Heterodera avenae*, *Anguina tritici*, *Meloidogyne graminicola* and other plant parasitic nematode: All centres of Nematology
2. **Evaluation of resistance against nematodes parasitizing wheat**
  - (a) *Heterodera avenae*: Hisar and Durgapura. (AVT and MDSN lines)
3. **Evaluation of new chemical against cereal cyst nematode, *Heterodera avenae***

Centres: Hisar and Durgapura.

**Treatments:**

T1 = Fluensulfone 2% GR @0.5 Kg a.i./ha at sowing (25 Kg formulation/ha)  
T2 = Fluensulfone 2% GR @1.0 Kg a.i./ha at sowing (50 Kg formulation/ha)  
T3 = Fluensulfone 2% GR @1.5 Kg a.i./ha at sowing (75 Kg formulation/ha)  
T4 = Fluensulfone 2% GR @2.0 Kg a.i./ha at sowing (100 Kg formulation/ha)  
T5 = Carbofuran @2 kg a.i/ ha at sowing  
T6 = Untreated Check
4. **Differentiation of CCN Pathotype by using International differential**

Centre: Durgapura