

PROGRAMME OF WORK CROP PROTECTION 2020-21

The programme for the crop year 2020-21 discussed in detail in work plan finalization meeting held on 29.7.2020 through virtual platform and finalized in the 59th All India Wheat and Barley Research Workers Meet during August 24-25, 2020. The various activities to be executed at respective centers are given below:

PROGRAMME 1: Host resistance - IPPSN and PPSN

Adult Plant Resistance for rusts & other diseases

1. Initial Plant Pathological Screening Nursery (IPPSN)

Objectives

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

(a) Rusts:

North:

Yellow Rust: Gurdaspur, Dhaulakuan, Malan, Karnal, Durgapura, Ludhiana, Hisar and Jammu (8)

Leaf Rust: Delhi, Karnal, Durgapura, Ludhiana, Faizabad, Kanpur (6)

South:

Stem Rust + Leaf Rust: Dharwad, Mahabaleshwar, Wellington, Powarkheda, Niphad and Indore (6)

(b) Leaf Blight: Faizabad, Pusa (Bihar), Varanasi, Kalyani, Sabour and Coochbehar (6)

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: Dhaulakuan, Gurdaspur, Malan, Bajaura, Karnal, Delhi, Ludhiana, Pantnagar, Durgapura, Jammu, Kudwani and Hisar (12)

Leaf Rust: Delhi, Hisar, Jammu, Kanpur, Karnal, Ludhiana, Pantnagar, Durgapura, Faizabad (9)

South:

Leaf and Stem Rusts: Wellington, Mahabaleshwar, Niphad, Vijapur, Pune, Junagarh, Powarkheda, Dharwad and Indore (9)

(b) Leaf blight (NIVT 1A, 1B, 3A): Kalyani, Coochbehar, Pusa (Bihar), Faizabad, Varanasi, Sabour, Shillongani (7)

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 immediately to the Incharge, IIWBR Regional Station Flowerdale, Shimla for pathotype analysis, with information to P.I. (Crop Protection). The rusts have to be recorded every month.

For screening against rusts the mixture of following races will be used and be provided by RS, IIWBR, 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 for effective monitoring and data recording in PPSN at various locations in different zones. The Plant Pathologists and Breeders of other zones will monitor PPSN during Zonal monitoring tours.

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

Leaf and Stripe rusts – Karnal, Ludhiana

Stem and leaf rusts -Mahabaleshwar

Leaf rust: Faizabad

Stem rust -Indore

PROGRAMME 2: Seedling rust resistance and rust gene postulation

1. Race specific and slow rusting

(a) **Leaf rust:** AVT entries of NWPZ, NHZ and NEPZ, along with the check entries of the respective zones (under glass house conditions).

Centres: New Delhi and Ludhiana under field conditions and Flowerdale, Shimla

(b) **Stem rust:** AVT of CZ and PZ, along with the check varieties of the respective zone.

Centres: Indore, Pune, Powarkheda and Mahabaleshwar

(c) **Stripe rust:** AVT entries of NWPZ and NHZ alongwith the checks of the respective zones.

Centres: Ludhiana and Delhi under field conditions and Flowerdale (under controlled condition),

Race inoculum to be supplied by RS, IIWBR, Flowerdale and races should be the same for all the respective centers 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 and postulation of Rust Resistance Genes

(a) Leaf, Stem and Yellow 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. Besides, this, identification of Rust Resistance genes to be done in selected entries of MDSN, MPSN and EPPSN.

(b) Stem and Leaf rusts: 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 earlier identified resistant materials as well as the AVT's and NIVTs. It will have all the released varieties and material found resistant in preceding years. It will have entries sent to CIMMYT for screening against wheat blast also.

Centers: 18

NWPZ: Pantnagar, Ludhiana, Karnal and Hisar.

NEPZ: Varanasi, Faizabad, IARI Pusa, Coochbehar, Shillongani, Ranchi, Naini, Gorla Karma Jharkhand and Kalyani

PZ: Dharwad, Wellington, Pune

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.

Centers: Ludhiana, New Delhi, Pantnagar, Hisar, Karnal and Jammu (6).

PROGRAMME 5: Loose Smut

Loose Smut Screening Nursery (LSSN): It will contain resistant materials identified in the past released varieties and AVT entries of NHZ, NWPZ and NEPZ

Centres: Ludhiana, Almora, Durgapura and Hisar (4)

PROGRAMME 6: Powdery Mildew

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

Centres: Almora, Pantnagar, Shimla, Malan, Bajaura, Dhaulakuan, Wellington and Jammu (8)

PROGRAMME 7: Region specific diseases

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

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. *If, by the time the situation of COVID19 outbreak will persist the visits will be very limited and will use mobile phone or whatsapp for monitoring.* Teams will be constituted as per the need for survey.

Monitoring of wheat blast: The following teams are constituted to monitor wheat crop in West Bengal and Assam along the Indo-Bangladesh borders for the presence of wheat blast. *If, by the time the situation of COVID19 outbreak will persist the visits will be very limited and will use mobile phone or whatsapp for monitoring.* 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). *If, by the time the situation of COVID19 outbreak will persist the visits will be very limited and will use mobile phone or whatsapp for monitoring.* All the cooperating centers are required to send the rust infected samples (natural infection) for pathotype analysis to the concerned centres according to recommended protocol.

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

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

SAARC- Nursery (To be coordinated by Flowerdale, Shimla): Nursery will be planted at 15 Indian locations, viz., Ludhiana, Delhi, Dhaulakuan, Gurdaspur, Dera-Baba-Nanak, Abohar, Sri Ganganagar, Chattha, Kathua, Rajouri, Almora, Durgapura, Faizabad, 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 cooperating centres by analysing samples from grain *mandies* in each district of their respective states. Centres from C.Z. (Indore, Sagar, Powarkheda, Junagarh, Vijapur) and PZ (Pune, Niphad and Dharwad) may also supply grain samples to PI (CP), IIWBR, Karnal for analysis.

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:

North: Delhi, Malan, Karnal, Ludhiana, Pantnagar, Durgapura, Hisar, Jammu and Almora (9)

South: Wellington, Mahabaleshwar, Dharwad Niphad, Pune and Indore (6).

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

North:

Stripe rust: Karnal, Ludhiana, Hisar, Dhaulakuan, Malan, Pantnagar, Durgapura

Leaf rust: Karnal, Ludhiana, Delhi, Hisar, Durgapura

Karnal Bunt: New Delhi, Karnal, Ludhiana, Dhaulakuan, Pantnagar

Powdery mildew: Dhaulakuan, Almora, Pantnagar, Malan, Chattha

Foliar blights: Faizabad, Varanasi, Coochbehar, Sabour, Hisar, Kalyani,

Loose smut: Hisar, Durgapura, Ludhiana, Almora

Flag smut: Hisar, Durgapura, Ludhiana

Head scab: New Delhi, Dhaulakuan, Gurdaspur

South:

Leaf and Stem rust: Mahabaleshwar, Indore Dharwad, Niphad, Pune and Wellington

Nematodes (CCN) : Durgapura, Hisar, and Ludhiana

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 stripe rust:** New chemicals will be tested at Karnal, Hisar, Ludhiana, Durgapura, Pantnagar and Jammu. The chemicals will be tested are:

Picoxystrobin 7.05% + Propiconazole 11.7% SC, Pyraclostrobin 133g/l + Epoxiconazole 50g/l SE, Tebuconazole 50% + Trifloxystrobin 25% WG, with standard chemicals (Propiconazole and Tebuconazole) and without chemicals.

The chemical will be evaluated under artificial inoculated condition and doses will be @ 0.1% and repeated once after 15 days. Design – RBD, Plot size – 6 rows of 3 meters, replications - 3.

(b) **Chemical management of powdery mildew:**

New chemicals will be tested at Pantnagar, Shimla, Malan, Bajaura, Dhaulakuan, Wellington and Jammu. The chemicals will be tested are:

Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC, Azoxystrobin 18.2% w/w + Difenconazole 11.4% w/w SC, Tebuconazole 50% + Trifloxystrobin 25% WG with standard chemical (Propiconazole and Tebuconazole) and without chemicals.

The chemical will be evaluated under artificial inoculated condition and doses will be @ 0.1% and repeated once after 15 days. Design – RBD, Plot size – 6 rows of 3 meters, replications - 3.

(c) Chemical management of head scab:*

New chemicals will be tested at Gurdaspur, Ludhiana and Karnal

(d) Chemical management of leaf rust:*

New chemicals will be tested at Jammu, Kanpur, Karnal, Ludhiana, Pantnagar, Durgapura, Faizabad, Coochbehar.

(e) Chemical management of stem rust:*

New chemicals will be tested Dharwad, Mahabaleshwar, Wellington, Powarkheda, Niphad and Indore

*the fungicides to be tested against head scab, leaf and stem rust shall be decided later on and send to centers.

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, Shillongani 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, Shillongani 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) Effect of effect of Zinc sulphate application on aphid incidence in wheat (Centres: Karnal, Ludhiana, Niphad)

Effect of zinc sulphate application in soil as well as foliar application will be tested to determine its effect on aphid abundance in wheat. Soil application rate of zinc sulphate will be kept as 25 kg/hand foliar application rate will be 0.5%. Observations will be recorded on population of aphids per plant, natural enemies (adult and grubs) per plot, yield per treatment and nutrient status of soil as well as of plants before the treatment and at the time of harvest.

(d) 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.

(e) 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.

(f) Effect of organic treatments on the incidence of major insect-pests and natural enemies (Centres: Karnal and Ludhiana)

Keeping in view of the interest of farmers about zero budget farming, effect of organic treatments viz., Neemastra, Bramhastra, Agniastra, Deshparni, Fermented butter milk and Cow urine will be evaluated against major insect-pests of wheat and natural enemies.

(g) Management of aphids through foliar application of new chemical molecules (Centres: Karnal, Ludhiana, Niphad and Kharibari)

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

(h) Management of lepidopterous pests (pink stem borer, army worm & cutworms) of wheat:

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

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

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

3. Stored Grain Pest Management

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

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

PROGRAMME 11. NEMATODOLOGY

- 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, Durgapura, Ludhiana and New Delhi (AVT and MDSN lines)
 - (b) *Meloidogyne graminicola*: Ludhiana and Hisar (AVT)
 - (c) *Heterodera filipjevi*: Ludhiana (AVT)
- 3. Evaluation of new chemical against cereal cyst nematode, *Heterodera avenae***

Centers: Durgapura, Ludhiana, Hisar

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