**Proceeding of research review and work plan meeting (2022-23) of Crop Protection held on 12th August, 2022**

**Date: 12.08.2022 Time: 11.00 – 13.00 hrs Venue: Virtual platform**

**Chairman:** Dr. G. P. Singh, Director, ICAR-IIWBR, Karnal

**Co-Chairman:** Dr. Sudheer Kumar, PI, Crop Protection, ICAR-IIWBR, Karnal

**Rapporteurs:** Dr. P.L. Kashyap and Dr. Ravindra Kumar, Crop Protection, ICAR-IIWBR, Karnal

The research plan meeting of All India Coordinated Research Projects on Wheat and Barley (AICRPW&B) crop protection (2022-23) was held on 12th August, 2022 at VS Mathur Hall, ICAR-IIWBR, Karnal though online zoom platform. The meeting was chaired by Dr. G.P. Singh, Director, ICAR-IIWBR, Karnal and co-chaired by Dr. Sudheer Kumar, Principal Investigator (PI), Crop Protection. PI, Crop Protection welcomed the chairman and other participants attending the meeting. The meeting was started with the welcome address by chairman. He appreciated the efforts of crop protection team for untiring efforts made by them in securing the wheat crop from diseases and pest. Further, he also expressed his satisfaction and appreciated that due to effective survey and surveillance, racial status of rusts ant it use in resistance screening, advisories lead to no major disease and pest outbreak in the country since decades. Besides this, he also showed his concerns to the frequent transfer of AICRP scientists at collaborative centers which adversely affected the programme.

The major achievements and work done by crop protection group during the crop season 2021-22 and work plan for year 2022-23 was made by Dr. Sudheer Kumar. The trial conduction was very good with almost 100%. However, the data of some centers were not included due to very low/ erratic disease development specially leaf rust due to sudden temperature raise in month of Feb. 2022 during the cropping season. Some of the nurseries have not been screened at Kalyani center due to heavy rain and thereon water stagnation in the field. During the discussion, it was decided that screening of LBSN would not be in central zone centers and also in Ranchi because there is only one nursery. It was discussed that the EPPSN and MDSN should be merged and should be form single nursery as EMDSN because of less practicability of keeping two separate nurseries.

It was also discussed that survey and surveillance is an important activity and will be done by all the centers in their jurisdiction area. Further emphasis has been given to collect and send the wheat leaf samples immediately after the appearance of rust disease under natural conditions to IIWBR, Regional Station, Flowerdale, Shimla and samples of other diseases to PI, Crop Protection, IIWBR, Karnal. Similarly, all the centers will collect the seed samples from grain markets, analyzed and submit the report to the PI, Crop Protection. One trial on chemical control of powdery was concluded last season, and remaining trials on chemical management will be continued.

The entomological trials were also discussed and suggested that the new trials initiated during last year will be continued. Data of insect resistance from few centres were not included in the report owing to the low infestation of the insects. Therefore, the centres were advised to build of proper infestation load by artificially releasing the insect population into the border rows of highly susceptible check entries.

In the nematology experiments, survey, screening and management of CCN will be continued at both the centers. While discussion it was noticed that many new scientists have joined the crop protection, therefore, need was felt to organize training course on crop protection trial conductance, uniform diseases/pest recording and reporting to improve the accuracy and efficiency.

The work plan was again discussed during the workshop on 30.8.2022 and further refined and changes proposed have been included in the crop protection work plan 2022-23.

The following recommendations have been emerged in the meeting:

* The plant pathological nursery EPPSN and MDSN has to be merged and should be one nursery as EMDSN to keep elite germplasm and will be screened against multiple diseases.
* It is recommended to grow the highly yellow rust resistant newly released varieties like DBW 296, DBW 327, DBW 332, DBW303, DBW187, JKW 261, WH1270, DBW 222, PBW 771, HD 3226, PBW 752, HD 3237, HI 1620, DBW 173, WB 02, HD 3096, DBW 90, WH 1124, WH 1080, WH 1142 etc. in view of current pathotype prevalence in Haryana, Punjab, Himachal Pradesh and Jammu.
* Strict monitoring for wheat blast in NEPZ specially areas bordering to Bangladesh. Use of preventive measures i.e. quarantine, adoption of alternate crop plan, grow wheat blast resistant varieties identified for the NEPZ with seed treatment etc. in disease prone areas.
* It is recommended to apply Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 0.1% to management of powdery mildew and may be repeated after 15 days as per need.
* Soil application of Fipronil 0.6% GR @ 7.5 kg/ha is recommended for the management of lepidoterous pest pink stem borer in wheat.
* Training to scientists recently associated with crop protection programme for diseases and insect pest scoring, recording and reporting to further improving effectiveness of the programme.

The house approved the crop protection work plan proposed for the rabi 2022-23 (Annexure 1).

The meeting was ended with a vote of thanks to chair.

***Annexure – 1***

**PROGRAMME OF WORK CROP PROTECTION 2022-23**

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

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

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

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

**Objectives**

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

1. **Rusts:**

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

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

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

1. **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.

1. **Rusts:**

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

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

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

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

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

|  |  |  |
| --- | --- | --- |
| **Rust** | **Rust pathogen** | **Pathotypes** |
| Stem/Black | *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 |

1. **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.

1. **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

1. **Stripe, leaf and stem rusts (under controlled conditions):** Flowerdale, Shimla
2. **Stripe rust –** Ludhiana and New Delhi
3. **Leaf rust –** New Delhi and Ludhiana
4. **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 |

1. **Seedling Resistance Tests (SRT) and postulation of rust resistance genes**
2. **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.
3. **Leaf and stem rust**: Mahabaleshwar for SRT on AVT entries of CZ, PZ and NIVT (durum entries).

**PROGRAMME 3: Leaf Blight**

**Leaf Blight Screening Nursery (LBSN):**

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

**Centres:**

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

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

**PZ:** Pune and Dharwad

**PROGRAMME 4: Karnal Bunt**

**Karnal Bunt Screening Nursery (KBSN):**

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

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

**PROGRAMME 5: Loose Smut**

**Loose Smut Screening Nursery (LSSN):** It will contain resistant materials identified in the past released varieties and AVT entries.

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

**PROGRAMME 6: Powdery Mildew**

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

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

**PROGRAMME 7: Region specific diseases**

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

**PROGRAMME 8: Crop Health**

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

**Crop Health Monitoring: Pre harvest surveys**

* All the centres associated with crop protection programme will conduct the surveys on regular interval during crop season and will send the information after every survey. During survey, if found any disease, in case of rusts samples should be sent to Incharge, ICAR-IIWBR, RS, Flowerdale, Shimla and other disease P.I. Crop Protection.
* Wheat Crop Health Newsletter will be issued on monthly basis by PI (CP) IIWBR, Karnal, during the crop season. Information on off season surveys will be included in first issue.

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

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

**Off-season Disease Monitoring Nursery (To be coordinated by IIWBR Reg. Station, Flowerdale)**: This nursery will be planted in 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.

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

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

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

**PROGRAMME 9: Integrated disease management**

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

**Diseases**

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

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

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

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

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

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

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

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

**Head scab:** Dhulakuan, Gurdaspur and Delhi

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

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

1. **Management of diseases**
2. **Chemical management of head scab:**

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

The chemicals will be tested are:

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

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

1. **Chemical management of leaf rust:**

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

The chemicals will be tested are:

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

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

1. **Chemical management of stem rust:**

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

The chemicals will be tested are:

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

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

1. **Chemical management of leaf blight**

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

The chemicals will be tested are:

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Treatments** | **Dosages**  |
| 1 | Tebuconazole 50% + Trifloxystrobin 25%,  | 0.06% |
| 2 | Propiconazole 13.9% + Difenconazole 13.9% | 0.1% |
| 3 | Azoxystrobin 12.5% + Tebuconazole 12.5% | 0.1% |
| 4 | Picoxystrobin 7.05% + Propiconazole 11.7% | 0.1% |
| 5 | Kresoxim Methyl 44.3% SC | 0.1% |
| 6 | Propiconazole 25% | 0.1% |
| 7 | Tebuconazole 25.9% | 0.1% |
| 8 | Mancozeb 75%  | 0.2% |
| 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) and special screening nurseries of promising entries identified during previous season will be evaluated as per following plan.
2. **Entomological screening nurseries (ESN)-** In these nurseries, AVT entries along with those found resistant during previous years will be screened for
3. Shoot fly (Centres: Dharwad, Ludhiana, Kanpur, Niphad)
4. Brown wheat mite (Centres: Durgapura and Ludhiana)
5. Wheat Aphids (Centres: Niphad, Ludhiana, Karnal, Durgapura, Khudwani, RAU Pusa, Vijapur, and Kharibari)
6. Root aphid (Centres: Karnal and Ludhiana)
7. **Multiple pest screening nurseries (MPSN)-** In these nurseries, the germplasm having resistance to multiple diseases and insect-pests will be screened for
8. Shoot fly (Centres: Dharwad, Ludhiana, Kanpur and Niphad)
9. Brown wheat mite (Centres: Durgapura and Ludhiana)
10. Foliar aphids (Centres: Niphad, Ludhiana, Karnal, Durgapura, Khudwani, RAU Pusa, Vijapur and Kharibari)
11. Root aphid (Centres: Karnal and Ludhiana)
12. **Integrated Pest Management**
13. **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.

1. **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.

1. **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.

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

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

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

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

Following treatments will be evaluated against termites in wheat.

|  |  |  |
| --- | --- | --- |
| **Treatment ID** | **Treatment and dosages** | **Method of application**  |
| T1 | Goond Katira (100 g/kg) + Jaggery (250 g/litre)+ Thiamethoxam 70WS @ 1 g/kg of seed)  | Seed treatment  |
| T2 | Goond Katira(100 g/kg) + Jaggery (250 g/litre)+ chlorpyriphos @ 4 ml/kg of seed) | Seed treatment  |
| T3 | Goond Katira (100 g/kg) + Jaggery (250 g/litre)+ Neonix @ 2 ml/kg of seed)  | Seed treatment  |
| T4 | Thiamethoxam 70WS @ 1 g/kg of seed | Seed treatment  |
| T5 | Chlorpyriphos @ 4 ml/kg of seed | Seed treatment  |
| T6 | Neonix @ 2 ml/kg of seed | Seed treatment  |
| T7 | Goond Katira (5kg/ha)+ Fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation | Soil application  |
| T8 | Goond Katira (5kg/ha)+ Chlorpyriphos 20 EC(2.5 litres/ha) before Ist irrigation | Soil application  |
| T9 | Fipronil 0.6% GR (8.75 kg/ha) before Ist irrigation | Soil application |
| T10 | Chlorpyriphos 20 EC(2.5 litres/ha) before Ist irrigation | Soil application  |
| T11 | Untreated seed+ no application of chemical (Control) | - |

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

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

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

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

Following chemicals will be evaluated against lepidopterous insect-pests in wheat

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

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

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

|  |  |  |
| --- | --- | --- |
| **Tr.No.** | **Treatment** | **Dosage** |
| T1 | Seed treatment with Neonix (Imidacloprid 18.5%+ Hexaconazole 1.5% FS) |  1.5 ml/kg of seed |
| T2 | Seed treatment with Neonix (Imidacloprid 18.5%+ Hexaconazole 1.5% FS) |  2 ml/kg of seed |
| T3 | Cruiser 70 WS (thiamethoxam) | 1 ml/kg of seed |
| T4 | Cruiser 70 WS (thiamethoxam) | 1.5 ml/kg of seed |
| T5 | Soil application of fipronil 0.3 GR | 15 Kg |
| T6 | Soil application of fipronil 0.3 GR | 17.5 Kg |
| T7 | Soil application of fipronil 0.6 GR | 20 Kg |
| T8 | Soil application of chlorpyriphos 20EC | 2.0 l |
| T9 | Soil application of chlorpyriphos 20EC | 2.5 l |
| T10 | Soil application of chlorpyriphos 20EC | 3.0 l |
| T11 | Untreated control | - |

1. **Stored Grain Pest Management**
2. **To evaluate seed protectants for management of storage insect pests of wheat** (**Centres**: Karnal, Ludhiana, Kharibari, Niphad)

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

|  |  |  |
| --- | --- | --- |
| **Tr.No.** | **Treatments** | **Doses/****kg seed** |
|
| T1 | Neem oil (*Azadiracta indica)*   | 15 ml |
| T2 | Blue gum oil (*Eucalyptus globulus*)  | 15 ml |
| T3 | Karanj oil (*Pongamia pinnata*)  | 15 ml |
| T4 | Castor oil (*Ricinus cumunis*)  | 15 ml |
| T5 | Sweet flag (Vekhand) powder (*Acorus calamus*)  | 5 g |
| T6 | Turmeric Powder (*Curcuma longa*)  | 5 g |
| T7 | Diatomaceous earth  | 500 ppm |
| T8 | Untreated control  | - |

**PROGRAMME 11. NEMATOLOGY**

1. **Monitoring of Nematodes:** *Heterodera avenae****,*** *Anguina tritici, Meloidogyne graminicola* and other plant parasitic nematod*e*: All centres of Nematology
2. **Evaluation of resistance against nematodes parasitizing wheat**
3. ***Heterodera avenae*:** Hisar and Durgapura. (AVT and EMDSN lines)
4. **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