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The first issue of Vol. 19 (2013-14) is being brought out in the month of November. Wheat crop health was monitored during off season in high hills of Himachal Pradesh (Lahaul, Spiti and Kullu). The Crop Protection Technologies for different wheat growing zones finalized in the 52nd All India Wheat Workers' Meet held at Kanpur during September 1-4, 2013 are also being presented in this issue.

Off season survey

During June 4-5, 2013, stripe rust survey was conducted extensively in Kullu (Himachal Prades) by scientists of DWR (Dr Indu Sharma, Project Director, DWR, Karnal) and Dr Rakesh Devlash (Wheat Pathologist, CSKHPKVV Regional Research Centre, Bajoura, HP). Stripe rust was observed in Bajoura. As the crop was at maturity only stripe rust teliospores could be seen. In villages, Bragran and Bhaliyani in Kullu district, stripe rust was observed (60-80S) in wheat sown under apple trees and upto 20S on barley. The disease was also observed in self sown wheats. Stripe rust uredospores were observed in high hills in Himachal Pradesh i.e. 1087-1887 mamsl. Looking at the possibility that this inoculum which is available in June may spread to Lahaul valley in July and may multiply further during July-September on a regular offseason crop season, advisory was issued for disease management on June 7, 2013.

Dr Daman Jeet Kaur, Senior Nematologist (Wheat), Dr Ritu Bala Asstt. Pathologist of PAU, Ludhiana and Dr Mangal Singh, Technical Officer, DWR, Karnal monitored the wheat crop for diseases in the wheat and barley fields enroute Bajaura, Kullu, Manali, Rohtag, Koksar, DWR, Dalang, Tandi, Keylong, Trilokinath , Kukumseri, Udaipur adjoining areas of Kullu and Lahaul valley during 17th to 22nd June, 2013. The survey included the high hills having elevation ranging between 2415m to 4007 m. Stripe rust incidence up to 40S was recorded on barley from Manali-Rohtag road near Manali (Elevation 2415m; 32˚18.812N and 077˚10.883E). The infected barley crop was at grain filling stage. No rust was recorded on wheat from any of the places monitored. Dr Indu Sharma, Project Director, DWR, Karnal surveyed Kullu and Lahaul valley of HP during September 21-22, 2013. Stripe rust was observed in the material planted at Dalang Maidan.

As per report received from Dr. S. C. Bhardwaj, Head, DWR Regional Station, Flowerdale, Shimla, no rust was observed in Wheat Disease Monitoring Nursery planted as staggered sowing at Malan, Dhaulakuan in Kharif season. However, leaf rust was observed at Shimla and pathotype 104-2 was identified in 4 samples analysed. During October 23-24, 2013, Dr. OP Gangwar, Dr. Subodh Kumar and Sh. Bhoop Ram Thakur surveyed Ropar, Nangal, Una, Amb, Kangra, Hamirpur and Bilaspur areas for grasses or any other hosts for rusts in the areas where wheat stripe rust is observed frequently. The team collected leaf rust samples from grasses which will be analyzed further for their role in rust survival in off season. On October 29, 2013, Dr. S. C. Bhardwaj and Dr. M. S. Saharan surveyed

Yamunanagar and Ambala areas for observing grasses and other hosts for rusts. Grasses on which leaf rust symptoms were observed have been collected and samples will be analyzed further for their role in rust survival in off season. Other related grass spp. were also collected and carried to Flowerdale, Shimla which will be inoculated with both leaf and stripe rust to see if they get infected with the prevalent races of leaf and stripe rusts.

Awareness for Stripe Rust Management

Stripe rust awareness among farmers was created by organizing Farmers' Fair in collaboration with State Department of Agriculture, Yamunanagar at Bilaspur (Yamunanagar) on September 25, 2013. Lectures related to stripe rust management were delivered by Dr. Indu Sharma, Project Director and Dr. M. S. Saharan, Principal Scientist-Plant Pathology, DWR, Karnal. Dr. Randhir Singh, Principal Scientist-Extension and Dr. Arun Gupta Principal Scientist-Germplasm Unit and Dr Raj Kumar, Sr. Scientist-Plant Breeding also delivered lectures on different aspects related to wheat crop. Posters were also displayed to make farmers aware of the stripe rust diagnosis and management. More than 2500 farmers attended the fair.

Dr. Indu Sharma, Project Director, DWR, Karnal delivered lecture on wheat stripe rust management in Kisan Mela organized at Kaithal on September 28, 2013. Stripe rust management cards were distributed among the farmers in above Kisan Melas. Farmers Innovator and Seed day was organized at DWR, Karnal on October 15, 2013 in which farmers were apprised of the strategies enhancing wheat production including crop production and protection technologies with emphasis on stripe rust management. Dr. R. S. Paroda, Chairman, Haryana Kisan Ayog was the Chief Guest at the occasion. State Department of Agri., Karnal and ICAR institutes of Karnal also participated in the exhibition.

Strategy Planning Meetings

A meeting on evolving strategies for enhancing wheat production with special reference to management of wheat rusts with special emphasis on stripe rust was organized by DAC on Oct. 5, 2013 in Kisan Bhavan, Panchkula under the Chairmanship of Sh. Asish Bahuguna, Secretary (A&C), Govt. of India. In continuation to this, meetings were organized at Dehradoon on October 21 and at Jammu on Oct. 25, 2013. From DWR, Karnal, Dr. Indu Sharma, Project Director alongwith subject experts participated in the above meetings and presented strategic initiatives to be adopted for enhancing wheat production and managing stripe rust.

CROP PROTECTION TECHNOLOGIES

Crop Protection Technology for wheat in different agro-climatic zones/states is given hereunder:

A. North Western Plain Zone, NWPZ (Punjab, Haryana, Northern Rajasthan, Western U.P., foot hills and plains of J&K, H.P. and Uttra Khand)

(a) Stripe Rust Management Strategy

1. For avoiding the losses due to stripe rust of wheat in NWPZ, avoid planting of PBW 343 and other susceptible varieties like UP 2338, HD 2687, HD 2329, HD 2733, WH 711 and PBW 373 etc. Varieties like WH 1105, HD 2967, DBW 621-50, WH 542, PBW 550, PDW 314 (d) and WHD 943 (d) for timely sown and DBW 16, DBW 71, PBW 590, WH 1021 and HD 3059 for late sown conditions may be preferred. Special attention should be given to the epidemiologically important region, i.e., the foot hills and plains of

Jammu and Kashmir, parts of Punjab, especially along the international border, foot hills of Himachal Pradesh and Yamunanagar area of Haryana.

2. Since most of the varieties recommended for NWPZ do not carry high level of resistance, hence, chemical sprays are needed. Spray the crop with propiconazole (Tilt 25 EC @ 0.1 per cent), or tebuconazole (Folicur 250EC @ 0.1%) or triademefon (Bayleton 25WP @ 0.1%) at stripe rust initiation. Usually, it is required in the first half of February. This spray will also help in the control of powdery mildew and Karnal bunt diseases.
3. Vigilance should be kept for stripe rust in the foot hills through extensive monitoring starting from early December onwards. If disease is spotted, the farmers should be immediately advised by the concerned State Departments of Agriculture for taking up recommended spray schedule, since further disease spread from initial infection foci it will depend upon the first appearance of disease. Farmers should also keep monitoring their crop critically and take essential steps if disease is spotted.
   Usually, it is observed that the early infection of stripe rust starts in wheat fields under the poplar trees wherever these are grown having early sown crop (i.e. October). Hence, strict watch is needed by the farmers in such fields.

(b) Other diseases and pests

1. Loose smut control measures should be undertaken in view of the horizontal distribution of the seed material among the farmers and the use of the carry over seed. Seed treatment with a combination of the reduced dosage of the fungicide and *T. viride* is made. The bioagent fungus, apart from enhancing the efficacy of the fungicide, also leads to better germination, growth and protection against diseases through induced systemic resistance. For this purpose, seed treatment should be done with *T. viride* @ 4 g / Kg seed in combination with carboxin (Vitavax 75 WP) @ 1.25 g / Kg seed or tebuconazole (Raxil 2 DS) @ 1.0 g / Kg seed.
2. Karnal bunt control is required for seed crop and the produce grown for export purposes. For producing KB free wheat, farmers are advised to grow KB resistant varieties recommended for the respective area.
   NWPZ: PBW 502, PDW 233 and WH 896
   - In areas where Karnal bunt incidence is low, by growing durum wheat for 2-3 years, fields can become free from Karnal bunt pathogen, *Tilletia indica*.
   - Zero tillage helps in reducing Karnal bunt incidence.
   - Avoid irrigation at heading time
   - One spray of Propiconazole 25EC (Tilt 25 EC) @ 0.1 per cent or Tebuconazole 250 EC (Folicur 250 EC) @ 0.1 per cent be given in mid February to control the disease.
3. For powdery mildew control, one spray of propiconazole (Tilt 25 EC) @ 0.1 % at ear head emergence or appearance of disease (whichever is earlier) is recommended for the powdery mildew prone areas.
4. Flag smut disease also poses problems in isolated fields in Punjab, Haryana, Rajasthan and some other parts of NWPZ. Disease management measures taken for the control of loose smut disease (as discussed above), prove to be effective against flag smut too. Hence, seed treatment with carboxin or tebuconazole may be followed in fields with flag smut history.
5. In the termite prone areas, seed treatment with chlorpyriphos @ 0.9g a.i /kg seed, be taken up for their management. Seed treatment with thiamethoxam 70WS (Cruiser 70WS) @ 0.7 g a.i./kg seed or Fipronil (Regent 5FS @ 0.3 g a.i./kg seed) is also very effective. In the standing crop, the broadcasting of the insecticide treated soil 15 DAS be practiced. For this, chloropyriphos @ 3 Litre mixed in 50 Kg soil be used for one hectare field. Crop planted under FIRBS is more prone to termite attack in the

termite-prone areas, while zero tillage shows less termite damage. Hence, proper attention should be given in crop planted under FIRBS.

6. The IPM module developed and validated in NWPZ can be adopted in parts of north-west plain zone. This involves the seed treatment with *T.viride* (@4g/kg seed) + carboxin (75WP @1.25g/kg seed) or tebuconazole (@ 1.0g/kg seed) for the control of loose smut, followed by broadcast of insecticide treated soil (with chloropyriphos @ 3L/ha) at 15DAS for termites. For the management of aphids, foliar spray of imidacloprid 200SL @20g a.i./ha on border rows at the start of the aphid colonization be given. This will help in protection of the bioagent insect, the lady bird beetle inside the field which feeds on aphids. In KB prone areas, the seed crop can be given one spray of propiconazole or two sprays of *T.viride* at tillering and ear head emergence. For the control of powdery mildew in disease prone areas, one need-based spray of propiconazole (Tilt 25 EC @ 0.1%) can be given at earhead emergence or appearance of disease on flag leaf, whichever is earlier.
7. In this zone, a blanket-recommendation on seed treatment with a combination of the reduced dosage of the fungicide and *T.viride* is made. This involves the seed treatment with *T.viride* (@4g/kg seed) + carboxin (75WP @1.25g/kg seed) or tebuconazole (Raxil 2DS @ 1.0g/kg seed). Seed treatment with *T. viride* alone also is recommended. The bioagent fungus, leads to better germination, growth and protection against diseases including Stripe rust, induced systemic resistance.

B. Northern Hill Zone, NHZ (Hills of J&K State, H.P., Uttrakhand)

1. For avoiding the losses due to stripe rust of wheat, avoid planting of susceptible varieties. Replace the susceptible varieties with resistant varieties like HPW 349, HS 507, HS 365, HS 375, VL 616, VL 907, VL 829, VL 832, VL 892, HPW 155, SKW 196 etc.
2. Growing susceptible varieties in the higher as well as the mid-hills should be discouraged to minimize the inoculum load and further spread to plains of Punjab and other states of NWPZ. Such varieties, if grown, should be sprayed judiciously.
3. Loose smut and hill bunt are the two important diseases of wheat in the hills. Hence, seed treatment, as recommended for NWPZ for loose smut disease, be adopted. Both these diseases will be checked through the seed treatment.
4. Powdery mildew is also important in the hills, especially the valley areas. One foliar spray of propiconazole as mentioned under NWPZ may be given in the disease prone areas.

C. North Eastern Plain Zone, NEPZ (U.P., Bihar, Jharkhand, West Bengal)

1. Foliar blight and brown rust are the main crop health problems in this zone. For effective management of the diseases, cultivation of recommended varieties, like HD 2985, HI 1563, DBW 39, CBW 38, NW 1014, NW 2036, K 9107, HD 2733 (resistant to LB), DBW 14, HD 2888, K0307, DBW39 and HUW 468 should be encouraged.
2. Loose smut is also important in this zone, hence, seed treatment should be done as mentioned under NWPZ.
3. Ear cockle is an important disease in eastern parts of India, hence proper precautions be taken, especially in eastern U.P., Bihar and Jharkhand. Wider publicity should be given by extension agencies on the use of gall-free seed, well before the sowings. Farmers should adopt floatation technique for the separation of galls from the infested seed lots. The infested seed lot should be floated in 2 percent brine solution for this purpose The galls will float on the surface. These should be separated and destroyed away from the field by burning. The seed should be thoroughly washed to remove the salt solution before sowing.

D. Central Zone, CZ (M.P., Gujarat, Southern Rajasthan, Chhatisgarh)

1. Stem and leaf rusts are the major diseases of wheat in this zone. From rust epidemiology point of view, Central Zone has a great importance in the country. Hence, old and susceptible varieties should be discouraged. For disrupting the *Puccinia* path, following rust resistant varieties are required to be grown in the Zone.
   Timely sowing: HI 1544, GW 322, DL 803-3, MP 3288, HI 8498(durum) and HD 4672 (durum)
   Late sowing: MP 1203, HD 2864, HD 2932 and Raj 4083
2. In parts of northern and eastern M.P., loose smut occurs occasionally. Hence, disease control measures as recommended for NWPZ, be adopted wherever the disease is a problem.
3. Ear cockle nematode occurs in some small pockets in the states of M.P. and Chhatisgarh. Hence, emphasis should be given on the use of gall-free seed in the areas with ECN history.
4. Northern and Central parts of M.P. are prone to KB infection. Congenial environment prevails during ear head emergence. Hence, sprinkler irrigation should be avoided wherever susceptible varieties are grown.

E. **Peninsular Zone (Maharashtra, Karnataka)**

1. Leaf and stem rusts are the main crop health problems in this zone. The old, local and susceptible varieties should be avoided. The rust resistant recommended varieties as given below should be grown.
   Timely sowing: MAACS 6222, Raj 4037, GW 322, HUW 510, HD 2189, MACS 2971 (dicoccum) and HD 8663 (durum).
   Late sowing: AKAW 4627, HD 2932, HD 2833, Raj 4083 and PBW 533.

F. **Southern Hills Zone (Tamil Nadu)**

Rusts resistant varieties of wheat (HW 2044, HW 1085, Co(W)-1) should be grown.

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