

Cereals

Rice:

- The large scale validation of BIPM technologies in rice was carried out in an area of 1500 hectares per year for last 10 continuous years in different panchayats of Thrissur district of Kerala. The IPM practices involved seed treatment with *Pseudomonas fluorescens* followed by five releases of *Trichogramma japonicum* starting from 20 days after transplanting or 40 days after sowing in case of direct sown rice. Need based foliar sprays of *P. fluorescens* @ 2 % against foliar diseases and neem oil emulsion (0.5%) against sucking pests also recommended. The mean grain yield of 7595 kg/ha was obtained in BIPM plots compared to 7430 kg/ha in fields where insecticides were used. The cost-benefit analysis of the pest management measures revealed that there was a saving of Rs. 2750 per ha in case of BIPM plots. Computed along with the increased yields of 165 kg/ha, the net benefits accrued to farmers following BIPM practices was Rs. 4584 per ha.
- In Assam, Maximum mean yield was registered by BIPM package with 4126 kg/ha and it was on par with farmers' practice (3984.4 kg/ha).
- PAU, Ludhiana, Punjab has recommended the use of *Trichogramma chilonis* and *T. japonicum* @ 100,000/ ha each against leaf folder, *Cnaphalocrosis medinalis* and stem borer, *Scirpophaga incertulas* in organic rice. The regular demonstration of this biocontrol technology was done at farmer's fields for its adoption among organic farmers of rice and *Basmati* rice and till date more than 400 hectares have been covered with considerable success in reducing the pesticides load. In case of *Basmati* rice, six–seven releases of egg parasitoids have reduced the application of cartap hydrochloride from three to one resulting in considerable saving to the farmer (approx.Rs. 7,626 to 9,100/- per ha).
- Large scale demonstrations of the BIPM technology for the bio-suppression of key pests of rice viz. yellow stem borer, *Scirpophaga incertulas*, leaf folder, *Cnaphalocrocis medinalis* and diseases like blast, sheath blight and bacterial blight were conducted over an area of 532 acres in Uttarakhand. The trial conducted has significantly brought down the rice diseases and insect pests, namely, stem borer and leaf folder damage in the BIPM plot compared to the farmers practice. BIPM technology resulted as increased yield,

reduction in the cost of cultivation and an increase in profit by Rs. 46,210/ha. The cost benefit ratio worked out to be 2.24 for BIPM plots, while it was 1.90 for non BIPM fields/farmers practice.

Maize

- In Punjab, Adoption of BIPM in maize comprising single release of *Trichogramma chilonis* @ 1, 00,000/ha on 10-15 days old crop against maize borer *Chilo partellus* has resulted in 50-70% reduction of insecticide usage giving a net return of approximately Rs 10360/- per hectare to the farmers. Many farmers are practicing bio-suppression of maize pests as per PAU recommendation particularly for organic farming.
- The Adhoc field trial against the management of invasive pest, *Spodoptera frugiperda*, fall armyworm, conducted in the states of Andhra Pradesh, Maharashtra, Odisha, Tamil Nadu and Karnataka during 2019-20 revealed that the plots treated with *Trichogramma pretiosum* + *Metarhizium anisopliae* NBAIR -Ma 35 recorded significantly lesser number of dead larvae (23.0) followed by *Trichogramma pretiosum* + NBAIR *Bt* 2% treatment (22.0) and chemical control (48.33). Among the tested bio-modules, trichocard + *Bt* sprays registered the highest yield (16.05t/ha) at Odisha.
- Field evaluation of bioagents, *B. bassiana* (ICAR-NBAIR Bb-45) and *M. anisopliae* (ICAR NBAIR Ma-35) against *S. frugiperda* infesting maize in Karnataka recorded 56-80% pest reduction.

Sorghum

- Field trials conducted against FAW in Telangana indicated that the plots treated with *Trichogramma pretiosum* + *Metarhizium anisopliae* NBAIR -Ma 35 were superior in terms of reduction in number of egg patches, larval population, plant damage and increase in yield of 46.45% over the control.

Pulses

- Farmers of middle Gujarat growing chickpea are advised to follow Bio Intensive Pest Management module for effective and economic management of pod borer and wilt disease in chickpea. The BIPM module produced 928-956 kg/ha grain yield as against 846-884 kg/ha in farmers' practice plots and 621-660 kg/ha in untreated control. Economics of different modules worked out based on the grain yield, its prevailing market price and cost involved in each module revealed that maximum (Rs. 8540/ha)

net realization with higher ICBR (1: 2.59) was found in BIPM module than the module of farmers' practices (Rs. 4300 net realization with ICBR as 1: 0.92).

- In Pune Maharashtra, *Bt* strain NBAII-BTG4 @ 2% was found effective in reducing the pod damage (9.8%) and improving yield (15 q/ha) and was on par with insecticidal treatment.
- Three years of experimentation on efficacy of *Bt* formulations in Raichur Karnataka showed that NBAII BTG 4 *Bt* @2g/lit was effective in reducing pod borer population with higher grain yield in pigeon pea ecosystem. Large scale demonstration of NBAII BTG 4 *Bt* in Raichur district indicated minimum per cent pod damage of (13.46%) and higher yield (12.14 q/ha) and was on par with chemical treatment.
- NBAIR *Bt* G4 was found effective against pigeon pea pod borers, *Helicoverpa armigera* and *Maruca testucalis* in Maharashtra, Karnataka, Punjab and Tamil Nadu. The *Bt* sprayed plots recorded 9.74% pod damage with a grain yield of 6.25q/ha which was on par with farmers practice (Chlorantraniliprole treated), where a pod borer damage of 6.98% with a grain yield of 7.10q/ha was recorded.
- Field trials conducted against *Helicoverpa armigera* in chickpea in Karnataka indicated the efficacy of HearNPV NBAIR, which was on par with chemical insecticide treatment.