

SUGARCANE

1. Conservation biocontrol strategy for the management of sugarcane woolly aphid

Drastic reduction in sugarcane woolly aphid infestation due to the conservation and release of predators and parasitoid in all sugarcane growing states of the country from 2010 to 2015 - completely eliminated the usage of chemical pesticides, leading to savings of several crores of rupees. The crop was regularly monitored for early detection of the pest and release of biocontrol agents from the areas of abundance to woolly aphid infested areas. *Micromus igorotus*, a neuropteran predator, and *Dipha aphidivora*, a lepidopteran predator, were found to rapidly colonise the woolly aphid-infested sugarcane fields and reduce the pest population. The syrphid, *Eupeodes confrater*, and a few species of ladybird beetles were also observed. A parasitoid, *Encarsia flavoscutellum*, was brought from Assam in 2014 and released in aphid-infested areas. It has established well in all places of its release and brought down the pest population drastically.

Impact of adoption of biocontrol technology in sugarcane woolly aphid

During 2003–04, the woolly aphid was observed in 3.13 lakh ha of sugarcane growing areas in Maharashtra and Karnataka. It was brought down to 0.82 lakh ha, only through the natural enemies, viz. *Dipha aphidivora*, *M. igorotus* and *E. flavoscutellum*. An estimated benefit of approximately Rs. 398.23 crores was realised through this biocontrol intervention.

2. BIPM technology for sugarcane borer pests in Punjab (PAU Ludhiana)

- *Trichogramma chilonis* @ 50,000/ha (8 releases) from mid-April to end-June at 10 days interval against early shoot borer, *Chilo infuscatellus* (included in Package of Practices of Crops of Punjab- Kharif 2010).
- *Trichogramma japonicum* @ 50,000/ha (8 releases) from mid-April to end-June at 10 days interval against top borer, *Scirpophaga excerptalis* (included in Package of Practices of Crops of Punjab- Kharif 2010).
- Eleven releases of *T. chilonis* @ 50,000/ha at 10 days intervals from June to November reduced the damage on the cane caused by sugarcane plassey borer, *Chilo tumidicostalis* from 29.45 to 7.50 % with cane yield of 74.8 t/ha, however it was on par with the farmers practice (70.2t/ha), where endosulfan 35 EC @ 3ml/l was applied five times from June to September in Assam.

Impact of adoption of biocontrol technology in sugarcane borers

The technology on BIPM of sugarcane borers through the use of *Trichogramma*, was transferred to two co-operative sugar mills of the state situated at Nawanshahar and Morinda in Punjab has gained maximum acceptance among sugarcane farmers of Punjab. These sugar mills along with

three private sugar mills situated at Amloh (Fatehgarh Sahib), Gurdaspur and Butter Seviyan (Amritsar) are engaged in the mass production of Trichogrammatids under the technical guidance of the university scientists. In collaboration with these sugar mills the large-scale demonstrations of BIPM of sugarcane borers over an area of 12,969 ha have been done.

a) The regular releases of Tricho-cards by the IPM farmers have reduced the incidence of sugarcane borers by 53.5 to 58.1 per cent. During 2013-14 to 2017-18, the adoption of BIPM technology for the management of early shoot borer and top borer in sugarcane has resulted in saving of Rs. 6095/- and 6870/- per ha over chemical control. This has resulted in reduction of pesticide usage to the tune of 9.04 MT (Technical grade) worth Rs. 240.80 lacs. It is worth mentioning here that under Punjab conditions, there is no recommendation of chemical pesticide for the management of Stalk borer. Therefore, the use of BIPM technology comprising release of *Trichogramma* is the only option available with the farmers and dissemination of BIPM technologies recommended by PAU is playing a significant role in this regard.

b) The lesser use of pesticides has improved the sugar recovery, thereby considerably enhancing the profit of the mills and savings of the IPM farmers.

c) It can be concluded *T. chilonis* release resulted in control of early shoot borer with greater cost: benefit ratio (1: 24.41) in biocontrol than the chemical control (1: 16.31).

In Andhra Pradesh, average cane yield of 69.94 t/ha was recorded in the *Trichogramma chilonis* released plots. Increased cane yield of 92.82 t/ha and net return of Rs. 1,72,987/- per ha by adopting the technology. Field release of *T. chilonis* proved as an effective technology for the control of sugarcane shoot borers and improved the sugarcane yield to an extent of 18.27%. The natural enemy *Trichogramma chilonis* is being released by all the sugarcane growers.

COTTON

1. Biological suppression of sap sucking pests of *Bt* cotton

NBAIR strain *Lecanicillium lecanii* (1×10^8 conidia /g) @ 5g/litre of water recorded significantly lowest population of sucking insects viz., aphids, jassids, thrips and white flies with seed cotton yield of 17.85 q/ha which is at par with dimethoate 0.05 per cent (18.56 q/ha).

2. Biological suppression of Pink bollworm

The package with erection of pheromone traps (Funnel type) @ 10 per acre followed by application of Azadirachtin 1500 ppm @ 5ml/l at ETL in *Bt* cotton against pink bollworm fared better than insecticidal usage in Hyderabad. In cotton need based release of *T. chilonis* @1.5 lakh, 8-10 weekly releases starting from 70 DAS based on moths trapped 5 numbers / pheromone baited trap and need based application of HaNPV @450 LE/ha (7 second instar larvae /20 plants) and release of *Chrysoperla* against sucking pests recorded higher yield of 651 kg of kapas over farmer practice (577 kg kapas). The average larval population, boll damage and locule damage due to Pink Bollworm of cotton were lower in the egg parasitoid release (*Trichogrammatoidea*

bactrae) (14.3 and 8.6% boll and locule damage) + BIPM coupled with higher yield. It was vice versa in the untreated check (25.7 and 19.9%). Farmers practice recorded higher larval population, boll damage and locule damage as compared to Parasitoid release + BIPM.

3. Biointensive pest management in Cotton

Demonstration of BIPM of *Bt* cotton was conducted in 46 ha. The mean population of cotton jassids and whitefly in BIPM area and farmers' plots were comparable. The mean predator population in BIPM was higher than farmers' practice.

Impact of adoption of BIPM module in cotton

Adoption of biointensive pest management strategies in cotton resulted in a highest net profit (Rs. 51144/ha) in IPM plot compared to non IPM plot (Rs. 42548/ha) during 2013-2015 in Karnataka. The mean seed cotton yield in BIPM area and farmers' practice was 27.1 and 27.6 q/ha, respectively.

4. Evaluation of multiple pesticide tolerant strain of *Trichogramma chilonis* against bollworm

At AICRP-BC headquarter, NBAIR (PDBC-NBAII), a strain of egg parasitoid, *Trichogramma chilonis* was developed for its tolerance to endosulfan (named endogram) and from 2000 to 2003, this strain was extensively used in cotton, rice and several vegetable crops all over India, covering an area of 12000 ha.

Multiple pesticide tolerant strain of *T. chilonis*, when released 11-12 times at weekly interval @ 150,000 per ha, along with 6-9 insecticidal sprays proved better (7.98% incidence) as compared to control (50.87% incidence) and increased the parasitism of eggs of bollworm, *Helicoverpa armigera* (10.93% parasitization) and the seed cotton yield (15.80 q/ha) during pre *Bt* cotton period.