

Farmers' driven improved IPM module brings a better return in bitter gourd

Adaptable and eco-friendly pest management technology for bitter gourd was synthesized, validated, and promoted during 2014-17 at Varanasi, Mirzapur and Deoria districts of eastern Uttar Pradesh in a farmers' led approach. The IPM technology synthesized for bitter gourd crop comprised seed treatment with *Trichoderma viride* @ 5g/kg of seed; need based spraying of Azadirachtin (0.03%) based neem insecticide @ 5 ml/l for Hadda beetle; installation of cue lure traps (MAT) for fruit flies @ 10/acre; raking of soil for exposing fruit fly pupae to sunlight and predatory fauna and removal of associated weeds, need based application of *Bacillus thuringiensis* @ 2 g/l against cucumber moth; Azadirachtin 0.03% @ 5 ml/l of water or NSKE 5% for whitefly; systemic fungicide Cymoxanil 8 WP+Mancozeb 64 WP @ 2.5 g/l against downy mildew were found very effective in reducing the incidence of pests and minimizing the yield losses. The IPM plots had lower number of fruit damage (9.60%), Cucumber moth larvae (9.53/plant) and Hadda beetle (2.76/plant) infestations as compared to non-IPM plots (19.10% fruit damage, 20.38 and 6.44, respectively). The adoption of IPM technology also resulted in reducing the number of chemical sprays to 7-10 from 21-25 in non-IPM fields in a season. Moreover, IPM farmers registered higher fruit yield accompanied with average higher net return and higher C:B ratio as compared to the non-IPM farmers.

BITTER gourd (*Momordica charantia* Linn.) is grown by about 60% of the vegetable growers as the main *Kharif* season crop in the Mahagaon village of Varanasi. However, full yield potential of bitter gourd is not realized by the farmers due to biotic constraints especially fruit fly (*Bactrocera cucurbitae*), cucumber moth (*Diaphania indica*) and Downy mildew (*Pseudoperonospora parasitica*). Indiscriminate and injudicious usage of pesticides to overcome the losses often failed to bring smile to the farmers' faces. ICAR-Indian Institute of Vegetable Research, Varanasi, Uttar Pradesh and ICAR-National Research Centre of Integrated Pest Management, New Delhi jointly realized the genuine problem of growers and formulated an Integrated Pest Management (IPM) Programme for cucurbitaceous vegetable crops particularly for bitter gourd to bring down the losses due to these biotic stresses and thereby increase the production, productivity and overall net returns to the farmers.

The model was initially implemented in the village Mahagaon, district Varanasi and village Adalpur, district Mirzapur and village Malhana (Majhaur), district Deoria. These villages are popular for growing vegetables especially bitter gourd for several years. Due to continuous growing of cucurbits, especially bitter gourd over several years, intensity and severity of several pests

has increased. Before 2014-15, growers on an average used to give 20-25 chemical pesticide sprays alone in a season. Spraying of chemicals was generally undertaken at regular intervals without observing the pest load by most of the cultivators. Despite high load of pesticide sprays, farmers were unable to raise their production and productivity. That is why a joint integrated pest management programme was taken up by ICAR-IIVR, Varanasi in collaboration with ICAR-NCIPM, New Delhi. A panel of experts comprising an entomologist, plant pathologist and nematologist regularly visited the farmers' fields to identify the major biotic stresses of bitter gourd crop and suggest eco-friendly IPM technology and sustainable management.

IPM technology

Low level of awareness of different ecofriendly IPM technologies among the farming community along with non-availability of many IPM components including cue lure traps for fruit flies readily were the major obstacles in the adoption of the environment friendly and effective bio management technologies. It is in this context and to address these issues, above mentioned two ICAR institutes implemented Area Wide Community Adoption (AWCA) IPM Programme in the aforesaid villages during 2014-

17. Though initially reluctant to follow the IPM, several meetings of the progressive farmers/vegetable growers were therefore arranged and organized to convince, persuade and make them aware of the IPM programme, its socio-economic benefits and its implementation.

The technology involved seed treatment with *Trichoderma viride* @ 5 g/kg of seed; need based spraying of neem insecticide (Azadirachtin 0.03%) @ 5 ml/l against *Hadda* beetle and sucking pests; installation of cue lure traps for fruit flies (Male Annihilation Technique) for wider area management @ 10/acre (wooden plywood blocks were dipped in solution of Ethanol : Cuelure : Insecticide @ 8:2:1 for 48 hours); raking of soil for exposing fruit fly to sunlight and predatory fauna, need based application of insecticides like *Bacillus thuringiensis* (Bt) @ 2 g/lit against cucumber moth, *D. indica* in bitter gourd; need based spraying of Azadirachtin 0.03% @ 5 ml/lit of water or NSKE 5% against whitefly; need based application of systemic fungicides Cymoxanil 8 WP + Mancozeb 64 WP @ 2-2.5 g/lit against downy mildew. All the mature fruits were harvested before spraying, after maintaining the waiting periods.



Demonstration of IPM of bitter gourd at farmers' field in Varanasi and Deoria

Outreach

Farmers of IPM adopted fields were visualized that their bitter gourd crop suffered less damage from fruit fly, a dreaded pest of cucurbits, as compared to fields where only farmers' practices were followed. In case of bitter gourd, the fruit damages were only 9.60% in IPM plots which were significantly lower than the non-IPM fields (19.10%). Cucumber moth and *Hadda* beetle infestations were similarly lower on bitter gourd. Only 9.53 *D. indica* larvae per plant were recorded in IPM adopted fields and

the corresponding value for non-IPM fields was 20.38/plant. IPM adopted fields also harboured minimum *Hadda* beetle population (2.76/plant) than the non-IPM fields (6.44/plant). Interestingly, the predatory fauna viz. number of lady bird beetle and spiders populations were much higher (5.10 and 3.43 numbers per plant, respectively) in IPM adopted farmers' fields than the non-IPM farmers' fields (1.68, 0.96 respectively).

Similarly, downy mildew incidence was recorded in IPM and non-IPM plots from the farmers' field. In IPM plots, per cent disease incidence (PDI) was less (9.09–12.40) compared to non-IPM plots (21.5–34.3). Moreover, the occurrence of viral diseases was severe compared to downy mildew disease. IPM fields recorded lower (11.25 – 31.41%) disease incidence compared to growers who did not follow IPM (26.75–63.54%) throughout the crop growth. Crop duration was also more in case of IPM adopted fields because of good growth than those vegetable growers who did not adopt IPM. The adoption of IPM technology, apart from lowering the incidence of major pests, ensued in reducing the number of chemical sprays to 7–10 as against 21–25 in non-IPM fields in a season.

Farmer's acceptability and economic viability

Seed treatment with *Trichoderma viride* in bitter gourd was highly acceptable and easily available to farmers from market for the management of seed/soil borne diseases. Majority of the farmers started spraying biopesticide (Bt)/neem based insecticide which were available in the local market for cucumber moth as well as *Hadda* beetle. These biopesticides were reported to be safe to environment and natural enemies. Periodical raking of soil was followed by the farmers and easily adopted by them. For mitigating the fruit fly menace, food baits and cue lure traps using plastic bottles were installed for trapping adults of fruit fly. Fruit fly damaged fruits were collected in a pit and covered with soil to prevent the emergence of adults from time to time. Clean cultivation, helped in management of diseases very effectively. There was substantial reduction in chemical pesticide consumption in IPM villages. Few local pesticide shops have started selling neem and other biopesticides. Bitter gourd farmers by using ecologically safe methods under IPM programmes, have been immensely benefitted and their dependence on chemical pesticides has reduced and at the same time production and productivity of bitter gourd along with the population of natural enemies has also increased. A few farmers were able to grow bitter gourd with a minimum use of chemical pesticide. After seeing the significant impact of IPM technology, non-IPM farmers of adopted villages and nearby villages were eager to come forward and adopt the above technologies in their crops.

Personal experiences of adopted farmers

Some of the IPM adopted farmers of village Adalpura and Mahagaon narrated their experiences about the benefits of adopting IPM in the bitter gourd. During post-crop season interaction, Mr. Rajvali Yadav, an IPM beneficiary of Mahagaon village said that he was overwhelmed with earnings of about ₹ 50000/- from his



Adult fruit flies trapped in cue lure bottle trap



Farm woman with bitter gourd fruits

half acre of bitter gourd with high Benefit: Cost (B:C) ratio of 3.1:1. He further said that earlier he used to give 20-22 sprays of chemical pesticides in a season. However, he was quite impressed with the adoption of IPM technology and now gives 7-8 sprays along with bio-pesticides like *Bt*, neem and *Trichoderma* etc. Use of cue lure traps gave astounding results.

Similarly, another beneficiary Mr. Virendra Pratap Maurya from Shitalpura village with a broad smile on his face told that with the adoption of IPM technology, there was tremendous increase in the production and productivity of bitter gourd crop in the village. He also earned a net profit of ₹ 25000/- from 0.26 acre of bitter gourd crop. He returned higher B:C ratio (2.58:1) as compared to the non-IPM farmers (1.78:1). He feels proud to be among the progressive farmers now.

Conclusion

An integrated insect-pest and diseases management

module of bitter gourd was synthesized with a view to study the validation, economic viability and feasibility of adaptable and rational IPM technology in a farmers' led approach in three districts of eastern Uttar Pradesh. The IPM adopted farmers had lower insect pests and diseases incidence and higher natural enemies in their field than the non-IPM farmers. Numbers of pesticide sprayings were also lower in IPM farmers than the non-IPM farmers. Furthermore, IPM farmers registered higher fruit yield accompanied with average higher net return and higher B:C ratio as compared to the non-IPM farmers.

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