

A success story from western Uttar Pradesh where a severe polyphagous pest -whitegrubs infestation was successfully controlled by using a bioagent -entomopathogenic nematode (*H. indica*)

WHITE GRUB INFESTATION SUCCESSFULLY CONTROLLED BY USING ENTOMOPATHOGENIC NEMATODES (*HETERORHABDITISINDICA*) AT WESTERN UTTAR PRADESH

The team of scientists from the Foundation for Agricultural Resources Management and Environmental Remediation (FARMER) – the Voluntary Centre (VC), Ghaziabad, Uttar Pradesh, India – under the project the ICAR-All India Network Project on Soil Arthropod Pests, successfully controlled the dreadful polyphagous pest white grubs *Holotrichia serrata* and *Holotrichia nagpurensis* by using entomopathogenic nematodes in sugarcane crop. The VC team conducted 45 field experiments covering area of 35.4 acre of 13 villages in the 6 districts viz., Amroha, Bulandshahar, Ghaziabad, Meerut, Muzaffarnagar and Saharanpur of western Uttar Pradesh during 2019-2021.

The vexation of sugarcane farmers in the Western Uttar Pradesh of unsatisfactory suppression of these whitegrubs using the recommended chemical pesticides led the VC to take up large scale demonstration and training to these distressed farmers on the scope of alternative through effective

biological control deploying EPN in their crop fields.

The whitegrubs are root feeding immature stages of scarab beetles being highly destructive in nature, are generally known as May-June beetles due to their adult stage emergence during the months of May / June. This is a polyphagous pest both in the grub and adult stage and inflicts heavy damage to the various fruit trees, their nurseries, vegetables, garden lawns and field crops. *Holotrichia serrata* and *Holotrichia nagpurensis* are the predominant species of root grub damaging sugarcane and in endemic areas, the damage to sugarcane ranges up to 100%. The White grubs are fleshy, whitish or white and the body is curved in the form of ‘C’ shape. The grubs favor light soil, fibrous rooted plants and high particulate organic matter content and are not abundant in waterlogged, compacted, stony soils or lands lacking vegetation.

Biological suppression of whitegrubs

Use of entomopathogenic nematodes (EPN), being natural enemies of whitegrubs and other soil pests, are befitting biological control agents. This ideal biological control agent with broad host range, high virulence, and host seeking ability, ease of mass production, non-polluting, environmentally safe and acceptable to farmers in comparison to chemical insecticides. About 250 species of insects belonging to 75 families of 10 orders have been reported to be susceptible to entomopathogenic nematodes. Entomopathogenic nematodes (EPN) *Heterorhabditis indica* belonging to the genera *Heterorhabditis* is obligate pathogens of insects is recorded effective against a wide host range among the insects of the orders, Lepidoptera, Coleoptera, Orthoptera and Dictyoptera. *H. indica* has certain advantages over chemicals as biocontrol agents as it is virulent cause mortality of the host within 48-72 h after infection by find their hosts actively in soil at particular temperature and humidity. Several biotic and abiotic factors affect the potency of EPN, the virulence of entomopathogenic nematodes depend on the species and strain of the nematodes, variation in the species of symbiotic bacteria. The behavioral, morphological and physiological defense strategies of insects

also affect the ability of the nematodes to infest the host. Some mite species such as *Hypoaspis* sp. feed on nematodes (EPNs), some fungi, *Beauveria bassiana* grows on EPNs and some bacteria also affect the potential of EPN in target areas and target pests.

The use of *Heterorhabditis indica*– Entomopathogenic nematode (EPN) Powder

The released EPN-infected *Galleria mellonella* (surrogate host) cadavers @ 2000 numbers per acre at the time of sugarcane planting successfully controlled the white grubs in the highly infested sugarcane fields and resulting in increase of crop yield by up to 25% over the untreated farmers infested sugarcane farms.

This VC organized 8 field day programme on the topic “Application of EPN & other Bio-agents for the management of white grub in sugarcane crop” at 8 locations in Agra, Bulandshahr, Ghaziabad, Muzaffarnagar and Saharanpur districts, 134 rural youth, women, farmers and sugar mills functionaries actively participated in it. Practical suggestions on EPN treatment were acceptable to them.

FARMER VC visualised to enable production of EPN in villages by farm

family members. The VC conducted several training and awareness programmes for capacity building. A total of 188 farmers (11 women farmers) trained in Mass Multiplication of Entomopathogenic Nematodes (EPNs) and best use of it for soil arthropod pest management under one day training organized four times. A total of 54 farmers (18 women farmers) belonging to Gautam Budh Nagar district were benefited by five days training programmes successfully conducted at the VC facility, Ghaziabad, on two occasions on “Mass Multiplication of Entomopathogenic Nematodes (EPN) at village level”. The VC aspired to get few EPN production units established for the mass-production of EPN formulation for use in the white-grub infested crop fields. Approximately 4224 farmers (323 women farmers) visited the FARMER Stalls that exhibited and video-demonstrated “EPN and its Use for Soil Arthropod Pests Management” in several locations viz., “*Akhil Bhartiya Kisan Mela Avam Krishi Udyog Pradarshani*” at Meerut, “*Pusa Krishi Mela 2020, 2021 & 2022*” at New Delhi, “*Namami Gange Yojnaan targat Jaivik Mela Avam Pardarshni*” at Aligarh and “*Farmer Training Program on Safe and Prudent Industry of Pesticides*” at Hapur. In order to

popularize biological control of whitegrubs using EPN, a webinar on “Bio-control of Soil Arthropod Pests by using Entomopathogenic Nematodes” was organized by this VC. A total of 179 members from 7 number of districts participated online.

Significance of the EPN research in Uttar Pradesh

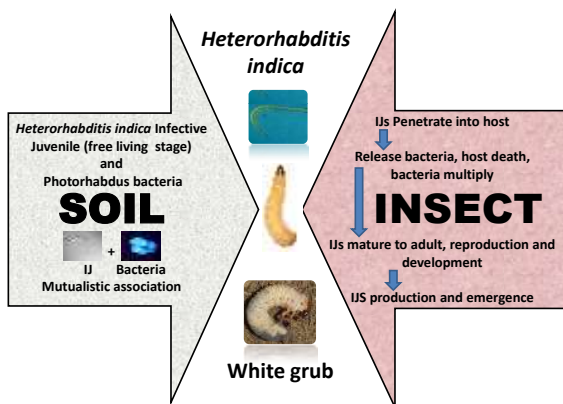
In India, sugar is a Rs. 30,000 crores industry; the second largest in the country in the agro-processing represents the principle livelihood of 35 million farmers. Sugarcane in India is grown in two distinct agro-climatic regions – the Tropical (Maharashtra, Karnataka, Gujarat and Tamil Nadu) and the Sub-tropical (Uttar Pradesh, Punjab, Haryana and Bihar). Among the states, Uttar Pradesh occupies half (2.25 m ha out of them 1.00 m ha in western Uttar Pradesh especially in Meerut, Moradabad and Saharanpur divisions) of the total area followed by Maharashtra (1.04 mha).

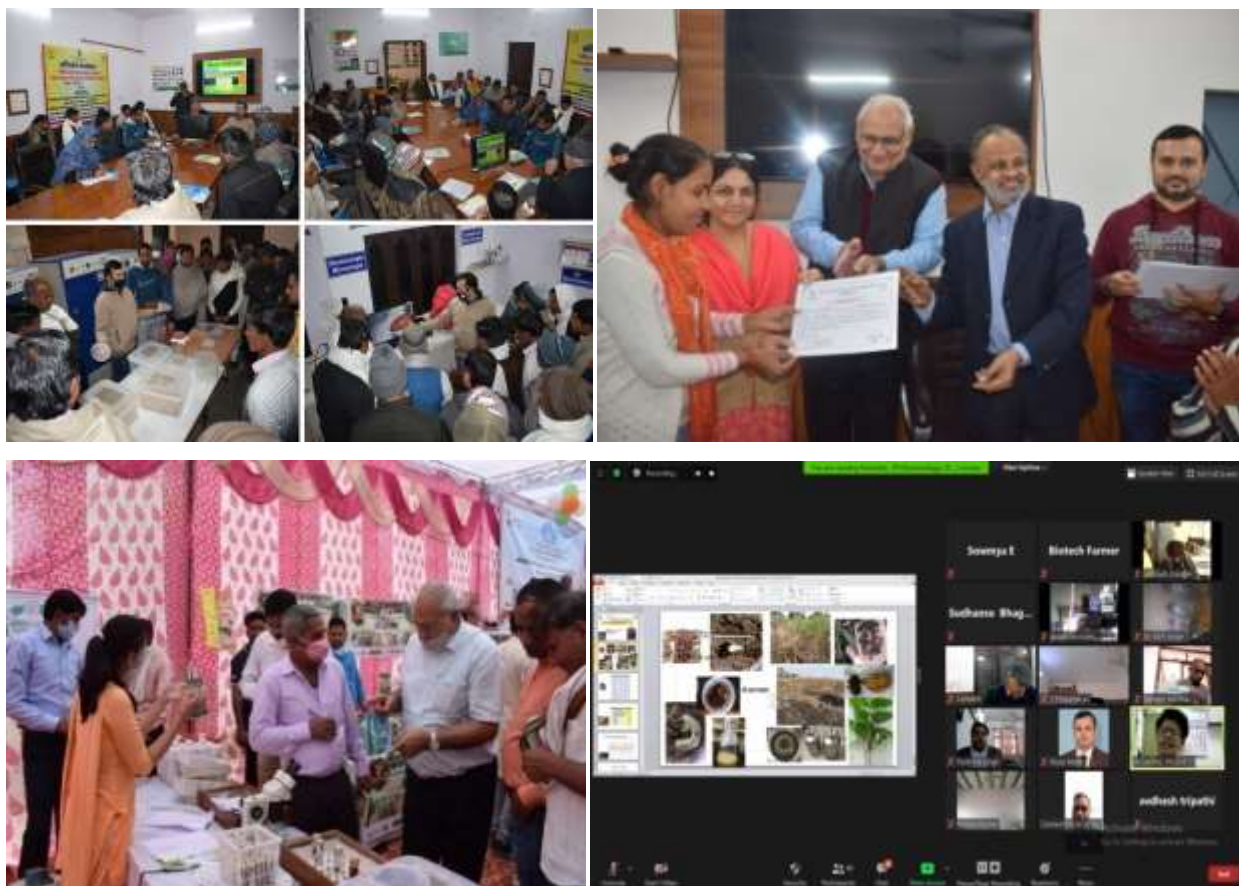
Technology transfer for whitegrubs biological control

The sugarcane farmers adopted whitegrubs management by EPN in sugarcane crop belonged to different districts viz., Bulandshahar, Ghaziabad, Gautam Budh

Nagar, Amroha, Muzaffarnagar, Meerut, Saharanpur in western Uttar Pradesh. A sugarcane grower, Mr. Inderver Singh is a native of *Datiyana* village of district Muzaffarnagar. He applied EPN biopowder @ 8kg/acre in his one acre white grub (*Holotrichia serrata*) infested agricultural land after 30 days of sowing and within 15 days of treatment completely control the target pests. One another farmer Manu Choudhary, cultivate sugarcane at *Dabana* village in Ghaziabad district. He reported that he applied EPN at the time of sowing and no infestation was observed throughout the season. Huge infestation of white grubs in sugarcane crop was reported by Omhari, a farmer belong to Jallopur village in Amroha district. FARMER team visited the target field and applied *Galleria* cadavers as per required quantity. After 21 days of application, a lot of EPN infested white grubs collected from the field and EPNs were isolated from them in FARMER

laboratory. Sunil Kumar from Santali village, Gautam Budh Nagar District recorded white grub infestation in his sugarcane, banana and papaya crop fields. He applied EPN *H. indica* infested -*Galleria* cadaver @ 2000 GC/acre in evening hours, after 25 days of application, FARMER team collected infested white grubs from his field. Dedicated efforts of the VC made whitegrubs infestation below the prescribed economic threshold level (ETL) of – grubs per sq. metre sugarcane crop in western UP. However we are working on understanding of the biology, safety, production, formulation, quality, application strategy and technology, and efficacy of EPNs in different ecosystems of the country against several soil arthropod pests from last 20 years. FARMER VC Ghaziabad developed a unit for in- vivo mass multiplication of EPN and provide EPN-GC and EPN Powder for soil arthropod pest management in various target crops throughout the country.





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