Pest Management in Horticultural Ecosystems
Vol. 28, No.2 pp 115-118 (2022)

DOI Number: 10.5958/0974-4541.2022.00048.0

Plant Health Clinic (PHC) startups as a viable extension model for transfer of biocontrol products in horticultural crops

ABRAHAM VERGHESE*[1,2] and M. A. RASHMI[1]

[1] Rashvee International Phytosanitary Research and Services, Bengaluru 560024, India

* [2] Formerly with ICAR-National Bureau of Agricultural Insect Resources and ICAR-Indian Institute of Horticultural Research, Hesaraghatta, Bengaluru, Karnataka, India

***E-mail :** abraham.avergis@gmail.com

ABSTRACT: In recent past, public funded institutions are entering into commercialization of their products especially in the field of crop protection like biopesticides and botanical products. This has paved way for emergence of 'startup culture' in agriculture with young entrepreneurs with sound technical background showing keen interest. This article highlights the scope of these startups doubling up as plant health clinics and how they reach out to farmers with a case study of an emerging startup being promoted by entomologists.

Keywords: Agri-startup, farm inputs, biopesticides, plant health clinic

INTRODUCTION

Biocontrol has been in existence in India for over a hundred years. The early phase of biocontrol was dependent on parasitoids and predators supplied by public labs. These bio-agents used to survive in crops which were less sprayed like coconut, papaya, sugarcane, eucalyptus, mulberry etc. But in horticultural crops where insecticide pressure was high like many of the commercial vegetables and fruits, the parasitoids and predators would be killed. Further the commercial availability of these was also low. However in the last 15 years the availability of commercial entomopathogenic fungi/nematodes/viruses/bacteria, many of which are products from ICAR institutes and state agricultural universities, have come to the market.

MATERIALS AND METHODS

To understand the knowledge levels on biocontrol among farmers of south Karnataka (Bangalore Rural, Chikballapur, Kolar districts) a survey was conducted between 2019 and 2022. A simple one page questionnaire was prepared. 240 farmers were interviewed through snowball sampling. As this was the Covid phase, interviews were conducted mostly over the phone. Apart from personal details, answers elicited were crops grown, awareness of biocontrol, biocontrol agents, use of bioagents like *Trichogramma*, *Cryptolaemus*, etc., ecosystem services by birds, reptiles, etc and knowledge/ information contact points. The data obtained were subjected to analysis to know the adoption levels of these commercially available biocontrol products. In 2022 a market survey was conducted among 12 randomly selected input suppliers (both private and public) of the same districts to know the commercial availability of biopesticides. The data were classified and four main responses were tabulated (Table1). Based on these foundational information further extensional strategisations were made.

RESULTS AND DISCUSSION

It was found that majority (94%) of the horticultural farmers were aware of 'biocontrol' and among the biocontrol products, they were mostly aware of Trichoderma (78%) followed by Bt (*Bacillus thuringiensis*) and entomopathogenic nematodes. Trichoderma is familiar as it is available commercially even in public labs of DDPQ, KVK's, ICAR, SAU's and certain NGO's. Some public labs distribute them free of cost. As part of the survey, feedback on Tricho cards and *Cryptolaemus* showed that 36% and 64% respectively, have not even heard of them. Main reason for this was that these were commercially not available. For the extent of ecosystem services through insectivorous birds, reptiles and frogs, farmers were not sure of it. Though (*Trichoderma*) was widely available, only about 16% of the farmers were aware of it and about 4% used it, and when it comes to other products like Bt, EPF, EPN the percentage of use was less than 2 percent. Even when used these were not appropriately used or timed well. Overall, among the horticulture farmers adoption of these commercially available biocontrol products as of 2020-22 was less than 5%.

Our further interactions showed that farmers were not aware what biocontrol products to be used for what pests and the dose and the frequency of application. There was the problem of quality as some products showed low efficacy (hence a distrust). We found that the entomopathogenic nematodes, *Beauveria bassiana,*

Table 1. Interview response of farmers from Karnataka (n=240 farmers)

Sl. No.	Questions	Response	Proportion (%)
1	Are you aware of biocontrol?	Yes	94
2	Which biocontrol agent do you know?	Trichoderma	16
3	Do you use any biocontrol agent?	Trichoderma (Recommended by dealer)	4
4	Whom do you consult in case of farm needs?	input dealers	100

Metarhizium anisopliae, Verticillium lecanii, Trichoderma viride, Pochonia, Paecilomycaes fumosoroeus, Pseudomonas florescence, Bacillus thuringiensis, Nuclear polyhedrosis viruses (NPV for *Spodoptera* and *Helicoverpa*) were the common biocontrol agents commercially available to farmers. Therefore, in our transfer of technology, we decided to concentrate on these, as transfer of technology (TOT) is possible only for biocontrol products on market shelf. Systematic extension activity was carried out using audio visual aids, social media, Facebook, Twitter, WhatsApp, YouTube, field demonstrations, farm melas, one to one contacts and field visits, to apprise the farmers of the benefits of the commercially available biopesticides. In order to facilitate a better adoption, a plant health clinic was started for diagnosis and attached to it an input supply system was created to ensure that farmers have free access to commercially available biopesticides which were tested for quality and efficacy.

The scope for TOT depended on a professional extension team (agriculture degree holders) who could constantly liaise with farmers literally 7 X 365 days. Such a team of seven qualified post graduates were formed. A plant health clinic (PHC) with complete diagnosis and input supply facility was started as a startup in 2021. This was recognized by the Ministry of Commerce and Primary industries (GoI) and DDPQ (GoI). Next to win farmers confidence meant a professional approach involving regular field visits, diagnosis of problems, finding solution, fixing problems with appropriate BC products on the market shelf, convincing the farmers of efficacy through lab bioassays and one window supply of BC products along with other inputs like seeds, fungicides, manures, etc. On an average 82 -112 farmers visited the PHC per day in the year 2022. Of these majority, visited between 8 and 11 am in the morning and between 5 and 8 pm in the evening (Fig.1). The activities of the PHC are summarized in Figs 2 & 3.

Transforming subsistence agriculture into profitable agriculture is a great challenge before the extension functionaries in India. It is a well-known fact that farmers' need for the latest knowledge has risen as the focus has shifted from subsistence to profitable agriculture, whereas, the knowledge of the public extension functionaries of the galloping input and agri-product markets and exports have not matched adequately. A unstructured interaction with more than a dozen serving research plant protectionists, cursory though, showed inadequacy of latest agri-products on the market shelf, though being used by farmers! The knowledge gap between FMCG in agriculture and extension, is mainly of combo and bio products.

Agri-input dealers in the country are a prime source of farm information to the farming community, besides the supply of inputs and credit. In India, there are about 2.82 lakh practicing Agri-input dealers, who are the prime source of farm information to the farming community. The first contact point for majority of farmers is the Agri-input dealer (National Institute of Agricultural Extension Management, MANAGE, Hyderbad). Our results fully corroborates this (Table1). In our agri startup which included laboratory and plant health clinic Rashvee-International Phytosanitary Research and Services Pvt Ltd., (R-IPRS) and input supply, we could do a quick diagnosis, followed by quick bioassay of all the commercially available biocontrol products before we recommend to the farmers because several brands were available in the market. Then, especially for grape, pomegranate and vegetable growers who were not willing to forgo insecticides and go for an organic approach we thought of a residue free approach using biocontrol agents after fruiting begins. Almost all farmers seemed to agree on this, provided we guaranteed quality fruits. We knew for sure that our extension approach should be that the commercial products should be compatible with insecticides and fungicides if not in combination but in time and space. The products we recommend should always be available and commercial products (Table 2) should have quality guarantee from us being experts and agriculture graduates. Further, it should also be cost

effective. Our field trials and demonstrations in farmers' fields at pre-harvest, excluding synthetic insecticides, but including tested biopesticides, gave confidence to farmers to adopt. We also had farmers involving in demonstrations in their own fields. They gave us 0.5 to 1.5 acre of their crop fields for short trials. The repeated demand for recommended biopesticides was taken as successful adoption and hence successful TOT. We introduced biological control at pre-harvest and the farmers' feedback was compiled and studied. From these we formulated and upscaled our recommendations.

Example of recommendations of biopesticides: In grapes one month prior to harvest we began to recommended Bt and NPV for *Spodoptera* and *Helicoverpa.* Immediately after pruning we recommended *Trichoderma* + vermicompost, and IIHR's Arka Microbial Consortia. Same was recommended for pomegranate soon after pruning and after the fruits set, mixtures of *Verticillium lecanii, Beauveria bassiana,* and *Metarhizium anisopliae,* mixed with Rashvee herbal liquid soap kept the thrips and mites away and also resulted in significantly lower volume of diseases. In tomato during fruiting, we demonstrated and recommended *Bt* + EPN + herbal repellants and *Phthorimaea* (=Tuta) traps were effective for controlling thrips, mites and *Tuta.* In mango, during flowering *Beauveria bassiana* + *Metarhizium anisopliae* effectively controlled caterpillars and reduced the hoppers (Table 2). These were compatible with Imidacloprid and L-cyalothrin.

Table 2. Some of biocontrol products and biopesticides available in the local market*

Biocontrol agent	Commercial product
Beauveria bassiana	BABA, Utakarsh, Holly green, Mycota, Green heal, Daman L,
Metarhizium anisopliae	Meta king, Kalichakra
Verticillium lecanii	Verti king, Varunastra, vertifire
Trichoderma viride	All round , Nisarga
Pochonia chlamydosporia	Nematofree
Paecilomycaes fumosoroeus	Niyantran
Pseudomonas florescence	All round, Sprash
Bacillus thuringiensis, B. subtilis	Basi rich, Mahastra
Nuclear polyhedrosis viruses (NPV for *Spodoptera* and *Helicoverpa*)	Biovirus-S

*List not exhaustive

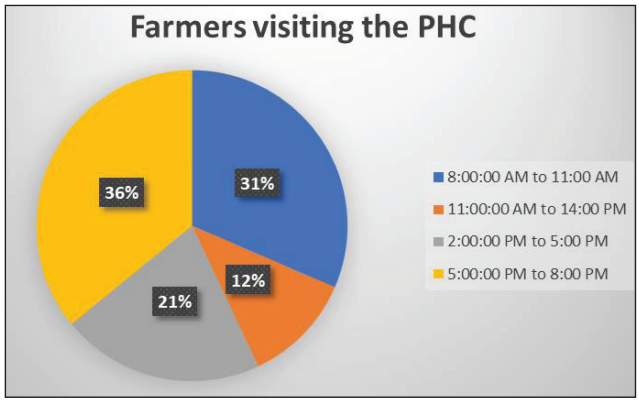

Fig. 1. Daily timeline of the farmers' footfall to the plant health clinic (PHC) for consultation, diagnosis and input purchase

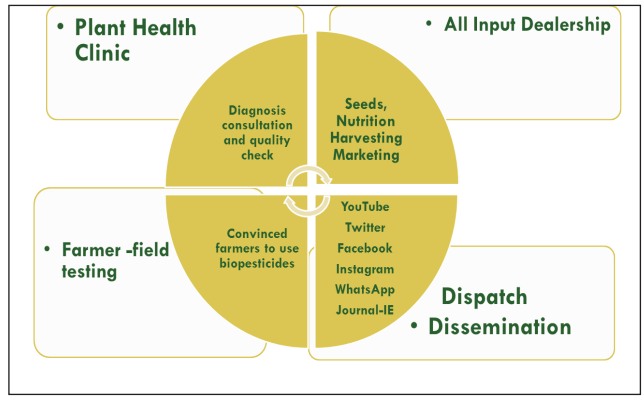

Fig. 2. Integrated approach of plant health clinic for transfer of technology

Our plant health clinic (RIPRS) has all the basic equipment like microscopes, BOD, bioassay facilities, autoclave, etc. and has been recognized by the Ministry of Commerce as a Startup and accredited by DPPQ. We have integrated approach to the farmers with diagnosis, consultation, supply of seeds/ planting material, plant protection requirements and marketing. The inputs supplied undergo quality check in the

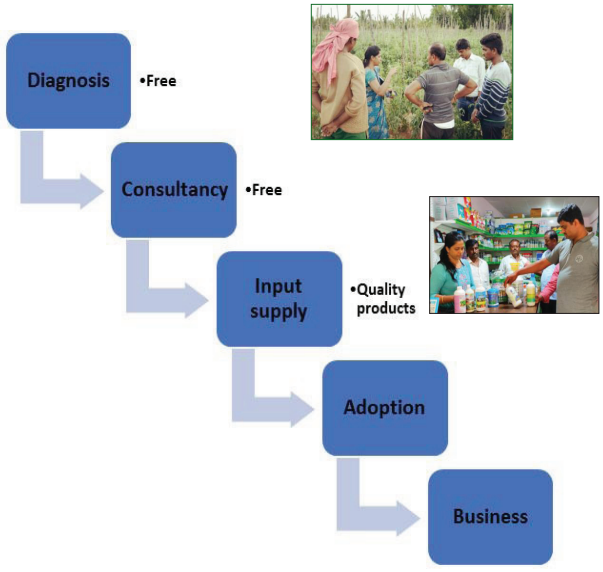

Fig. 3. Step by step activities of Plant health clinic - viable extension model for innovation and adoption

farmers field demonstrations which adds to the increased implementation of the biopesticides. The information is disseminated to large number of farmers with the help of the social media, audio visual aids (Fig. 2). We stressed that for quality fruits for export and table purpose we need residue-free products. So, one or two months prior to harvest depending on the crop the insecticides were tapered off and those EPNs and EPFs, pheromone traps and botanical herbals, all commercially available on the shelf were transferred and supplied to farmers. The steps involved and the activities carried out can be seen in the form of flowchart in Fig. 3 (Verghese and Rashmi, 2022).

CONCLUSION

Therefore as a way forward, it is suggested that industry as a vital loop and professional interfacing by agriculture graduates in the field will assure adoption of biocontrol products on the market shelf by the farmers. Using startups for business and transfer of technology should be the future of extension in the country. Professional interfacing by agriculture graduates in the field instilled confidence in farmers and assured supply of quality biocontrol products on the market shelf boosted biocontrol adoption. This way of using startups for business and transfer of products will be realistic and pragmatic extension for horticulture in the country.

REFERENCES

DPPQS, DAC, Ministry of Agriculture & Farmers Welfare, Government of India

NIAEM, MANAGE, 2023, https://www.manage.gov.in/daesi/daesi.asp

Soumya, B. R., Rashmi, M. A. and Verghese, A. 2021 Bioecology of the mango inflorescence caterpillar, *Perixera illepidaria* Guenée and record of its feeding on mango fruits, *Pest Management in Horticultural Ecosystems,* **27**(1) :22-26.

Verghese, A. and Soumya B. R. 2021. Threat of loopers (*Perixera illepidaria*). *Insect Environment*, 20 March, Blog. *www.insectenvironment.com*

Verghese, A. and Rashmi, M.A. 2022. Agri-startups as a viable extension model for innovation and adoption of biocontrol strategies: case studies in horticultural crops. *Proc. Seventh National Conference on Biological Control 75 Years of Biological Control of Pests and Diseases in Agriculture: Challenges and Way Forward 2022*, pp 176.

MS Received: 02 November 2022
MS Accepted : 14 December 2022