

Development of a Vegetable IPM Program in a Rice-Based Cropping System

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ABSTRACT

The study was conducted with the objective of developing a pest management scheme in vegetables that is compatible with the principles of IPM. The first stage of the study was the mapping of the arthropod population profile in the two crops under study (stringbeans and eggplant). Eight insect pests were recorded on stringbeans with five critical windows. In eggplant, leafhopper, thrips, and fruit and shoot borer predominated and five critical windows were also observed. The profile was used as the basis for identifying critical stages when the crops were most susceptible to pest damage and in formulating corrective measures or pest management intervention.

The second stage was a field comparison of farmers' pest management practices with strategically timed insecticide applications.

Field trial results in the two vegetable crops showed that strategic insecticide applications outperformed farmers' practice by producing higher yields, requiring fewer sprays, lowering production cost, and incurring higher profits or ROI. The strategy optimized the effect of insecticides on the pests while minimizing the impact on beneficial arthropods.

Further studies are presently being conducted which include insecticide x parasitoid complementation. Initial trials showed promising results.

Key words : integrated pest management, eggplant, stringbeans, rice-based

INTRODUCTION

In most developing countries like the Philippines, vegetable as a food group constitutes an important component of a common family's food diet. The demand for these commodities is expected to increase in the coming years due to the continuing population growth and rising per capita income.

Vegetable production has the potential to generate high income even for the small farmer. In

Batangas province, farmers grow mixed vegetable to about one ha and 0.1 ha is planted to eggplant (Litsinger and Apostol, 1994). However, crop injury due to pests and technology to effectively control them have often been a major factor in discouraging farmers to venture in a rice-based vegetable production system.

In spite of the government's commitment to advocate Integrated Pest Management (IPM) as the national crop protection policy, the development of

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IPM in vegetables is not considered a priority. In addition, pesticide misuse among farmers is attributed to the absence of IPM strategies for technicians to impart for the control of insect pests (Tjornhom *et al.*, 1997). At present, only limited efforts in research and information dissemination is accorded to vegetable crop protection. An effective IPM program still remains to be realized.

Objectives

General: To develop a practical, economical, environmentally acceptable and technically sound IPM strategy in vegetables.

Specific: Stage I. Monitoring / Profiling of insect pests and beneficial arthropods

- To identify the different insect pests and beneficial arthropods of eggplant and stringbeans planted after rice at different growth stages;
- To identify the critical growth stage(s) of the crops against insect infestation.

Stage II. Strategic insecticide application trial

- To demonstrate the concept of quality and judicious use of insecticides as a component of IPM in vegetables grown in a rice-based cropping system.

MATERIALS AND METHODS

Stage I. Monitoring / Profiling of insect pests and beneficial arthropods

The study was conducted at the Central Luzon State University experiment station, Muñoz, Nueva Ecija, Philippines. Monitoring of arthropods was done during the regular planting seasons (November to March) from 1993 to 1996. Occurrence of insect pests and beneficial arthropods relative to crop stage was determined in protected and unprotected plots. Protected plots received weekly spraying of appropriate insecticides. Monitoring of arthropods was done before and after

treatment applications. On untreated plots, monitoring was done weekly. The treated plots were established in case high pest pressure prematurely destroy the unprotected plots.

Stage II. Strategic insecticide application trial

Results obtained in Stage I were analyzed and served as the basis in formulating treatments for Stage II. This was conducted in two growing seasons from November to March of 1996 to 1998. The following treatments were evaluated:

T-1 Strategic insecticide application: Critical windows identified in stage I for insecticide intervention were followed.

T-2 Farmers' practice: This was based on surveys conducted on farmers' practices, particularly on insect pest control in eggplant and stringbeans.

T-3 Unprotected plot: No insecticide application was employed on these plots.

Necessary cultural practices were done on all treatments. Yield was taken from two inner rows of each plot in all treatments.

RESULTS AND DISCUSSION

Stage I. Insect pests and beneficial arthropods population:

Stringbeans

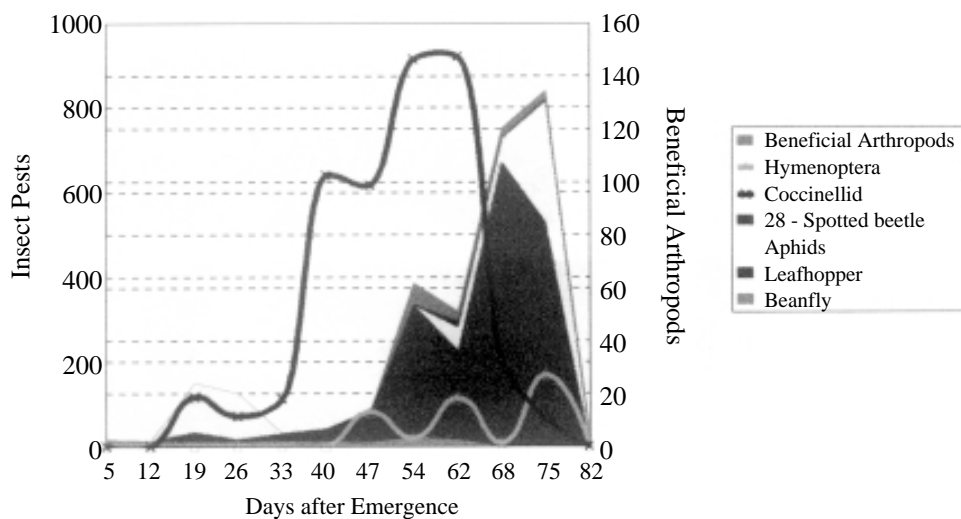
Eight insect pests were monitored in stringbeans, namely beanfly (*Ophiomyia phascoli*), aphid (*Aphis craccivora*), leafhopper (*Empoasca ricei*), leafminer (*Liriomyza* sp.), green soldier bug (*Nezara viridula*), cutworm (*Spodoptera litura*), thrips (*Thrips palmi*), and podborer (*Maruca testulalis*). Sucking insects like leafhoppers, were present throughout the crop growth and followed a characteristic population pattern. Three peaks or critical periods (windows) for sucking pests like leafhopper and aphids were observed. These critical windows started at 19 -20 days after emergence (DAE) followed by 53 -54 and 65 -75 DAE. For

pod borer, the critical windows were 51-53 and 65-75 DAE. The other insect pests occurred at minimal numbers (Fig. 1).

Eggplant

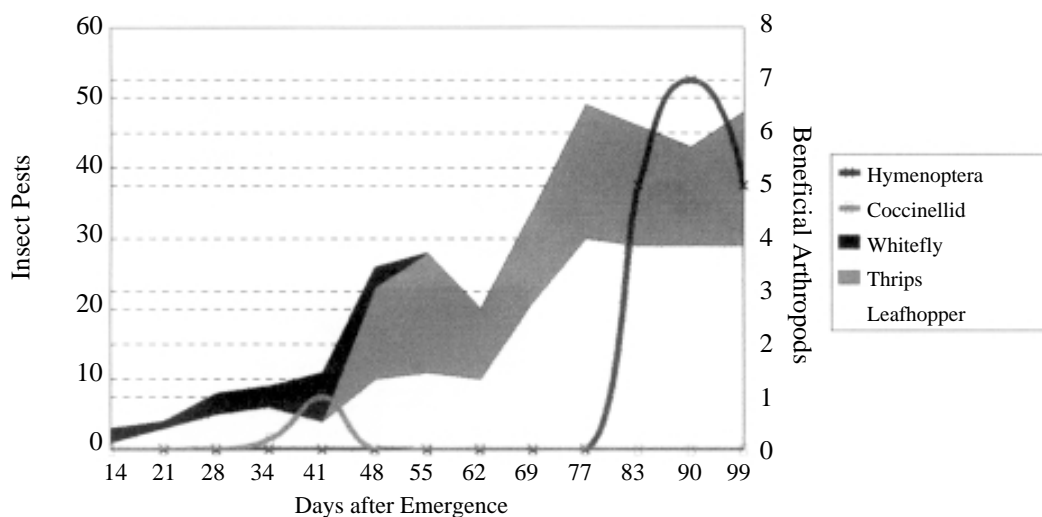
In eggplant, the most common insect pests monitored were leafhopper (*Empoasca biguttula*), thrips (*Thrips paimi*), whitefly (*Bemisia tabaci*),

shoot or fruit borer (*Leucinodes orbonalis*), and beetle (*Epilachna philippinensis*). Leafhopper and thrips predominated throughout the crop growth stages but were observed highest at 20-25, 40-45, 70-77 and 85-90 days after transplanting (DAT) (Fig.2). Shoot borer was observed to be highest at 67 DAT but declined at 74 and 81 DAT (Fig.3).



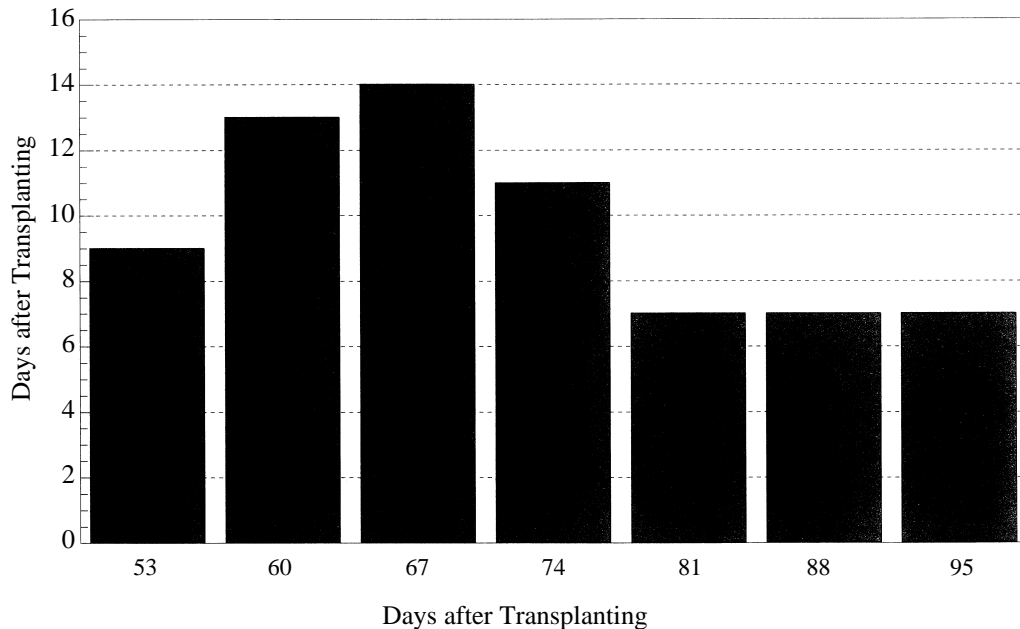
CLSU, Muñoz, Nueva Ecija, Philippines

Figure 1 Arthropod population in stringbeans.



CLSU, Muñoz, Nueva Ecija, Philippines

Figure 2 Arthropod population in eggplant.



CLSU, Muñoz, Nueva Ecija, Philippines

Figure 3 Shoot borer damage in eggplant

Compared to the Los Baños condition, leafhoppers were also throughout the cropping season including aphids. Mealybugs became very serious in the area which started to appear one week after transplanting (Entom. Lab. Annual Report, 1997).

In both crops, coccinellids and some hymenopterans were the most predominant beneficial insects. The presence of some spider species was also observed.

Stage II. Strategic insecticide application trial

The arthropod population profile obtained was used to formulate a strategic insecticide application to optimize the effect of insecticides on insect pests while minimizing the impact on beneficial arthropods. Strategic spray timings required less insecticide applications in both crops compared to farmers' practice - a reduction of three in stringbeans and six in eggplant (Table 1).

Furthermore, strategic application of insecticide produced higher yields, reduced production cost, and correspondingly incurred higher profits and return on investment (ROI). In stringbeans, the computed ROI for strategic application is 0.45 while the farmers' practice is 0.05. Likewise, the ROI in eggplant is 0.82 for strategic application and 0.59 for farmers' practice (Table 1). Similar results were obtained in rice. Gross yield was not significantly different using complete protection by insecticide and the ETL practice. However, the latter gave higher net profits due to savings in the cost of spraying (Rola and Sanchez, 1992).

CONCLUSIONS

The study conducted at the Central Luzon State University, Muñoz, Nueva Ecija, Philippines (1993 - 1998) was aimed at identifying the arthro-

Table 1 Economic analysis of the various treatments in string beans and eggplant (CLSU, 1996-98)

Treatments	Number of sprays	Cost of insecticide and labor	Total prod'n cost	Yield (tonnes/Ha)	Value at US\$ 0.46/kg	Net return	Return on investment
Stringbeans							
T1	10	171.86	1072.09	3.34	1553.49	481.4	0.45
T2	13	278.37	1178.6	2.65	1232.56	53.95	0.05
T3	-	-	900.23	2.53	1059.07	158.84	0.17
Eggplant							
T1	7	175.12	875	6.85	1593	718.02	0.82
T2	13	282.33	982.21	6.70	1558.14	575.93	0.59
T3	-	-	699.98	2.69	625.58	(-74.30)	-

Note : Computed values are in US \$ currency based on exchange rate of US\$ 1 = P43.00

pod population profile in vegetables (stringbeans and eggplant) within the crop growth stages.

The arthropod population profile is important in identifying critical stages when the crops are most susceptible to pest damage and in timing corrective measures or pest management intervention.

Strategically timed insecticide applications were based on the arthropod population profile to optimize the effect of insecticides on the pests while minimizing its impact on beneficial arthropods.

Field trial results of the two crops (stringbeans and eggplant) showed that strategic insecticide applications outperformed farmers' practice producing higher yields, requiring less sprays, lowering production cost, and incurring higher profits or ROI.

Further studies are presently being conducted which includes insecticide x parasitoid

complementation. Initial trials showed very promising results.

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