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EFFECT OF FARMERS' PRACTICES FOR THE MANAGEMENT OF INSECT PESTS OF YARD LONG BEAN (*Vigna unguiculata)*

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Abstract

The research activity was conducted in major intensive yard long bean growing areas, such as Jessore, Dhaka, Narsingdi, Comilla, and Chittagong of Bangladesh to know farmers' practices (FPs) for managing major insect pests of yard long bean during March 2009 to October 2009 in the farmers' fields. The study comprised survey of sample farmers through intensive field visit for field data collection and inspection. A total of 5 farmers' practices (FPs) were identified viz., Farmers' Practice 1 (FP_1) comprised chemicals plus mechanical plus cultural plus field sanitation, FP_2 comprised chemicals plus cultural plus field sanitation, FP_3 consisted of combination of chemicals plus field sanitation, FP_4 having combination of mechanical plus cultural plus field sanitation and FP_5 utilized combination of cultural plus field sanitation. Among the sample farmers, 81.33% practiced chemicals plus non-chemical methods, while 18.67% practiced only non-chemical methods. Considering infestation level, pod yield, BCR, and arthropod pests diversity, the performance of FP_1 (chemical + mechanical + cultural + field sanitation methods) was adjudged as the best for managing pod borer and aphid and was revealed as the most suitable option (94.10% infestation reduction) for managing major insect pests of yard long bean in those areas of Bangladesh.

Keywords: Farmers' practices, insect pests management, yard long bean.

Introduction

Yard long bean (*Vigna unguiculata* ssp. *sesquipedalis* (L.) Verdc) belongs to the Leguminosae family. It is one of the three subspecies of cowpea. It is mostly grown in Chittagong, Chittagong Hill Tracts (CHTs), Faridpur, Noakhali, Comilla, and Rangpur districts. At present, it is extensively grown in kharif season in Dhaka, Chittagong, Comilla, Narsingdi, and Jessore districts and also other districts of Bangladesh when there is shortage of vegetable supply in the market. Yard long bean is one of the economically important vegetable crops in Bangladesh. The area under this crop was 5857.49 ha and the production was 21348 t during the year 2008-2009 (Anon., 2010). The tender pods of yard long

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bean and their mature seeds are rich in protein with high amount of lysine; an essential amino acid (Ferry, 1981). A serving of 100 g of yard long bean contains 50 calories, 9.0 g of total carbohydrates, 3.0 g of proteins, 0.2 g total fat, and 0.8 g of minerals (Anon., 2013). Sufficient production and consumption of this vegetable may contribute to solve protein–energy malnutrition in Bangladesh to some extent.

The insect pests have been reported as one of the serious problems to yard long bean cultivation in the country (Rashid, 1993). Insect infestation and management in relation to farmers' practice of yard long bean in major growing regions have not been so far reported. Pod borer (*Euchrysops cnejus and Maruca vitrata*) larvae bore inside the flowers and tender pods. The insects are voracious, widely distributed and have a wide host range and make hole in flowers and tunnel in the pods (Ali, 2006). Aphids (*Aphis craccivora*) suck sap from tender leaves, twigs, inflorescences and pods and make colossal losses in leguminous crops. Published reports on the insect pests of yard long bean and farmers' practices for management aspect in major growing areas of Bangladesh are scanty. The present study was, therefore, undertaken to inspect insect pests and farmers' practices (FPs) for managing major insect pests attacking yard long bean in intensive growing areas of Bangladesh.

Materials and Method

The survey on yard long bean cultivation was conducted in the farmers' fields in five major growing areas of yard long bean, such as Jessore Sadar, Savar (Dhaka), Shibpur (Narsingdi), Chandina (Comilla), and Mirshawrai (Chittagong) upazillas during March 2009 to October 2009. The study comprised survey of sample farmers and intensive field visit for field data collection and inspection. From each upazilla, one union and from each selected union, one yard long bean field (2700 m^2) was randomly selected for the survey and inspection.

For each location, 15 yard long bean farmers were randomly selected for the study by applying the statistical random chart with the help of the sub assistant agriculture officers (SAAOs).

Thus a total of 75 farmers from all the five districts were selected for interviews and their individual plots (180 m^2) were visited for the study.

Description of farmers' practices

Farmers' practice 1 (FP_1): In each location, 3 farmers practiced in combination of chemical, mechanical, cultural, and field sanitation methods for insect pests control. In each plot (180 m^2), malathion (Malaton 57 EC) was sprayed once at the vegetative stage and spinosad (Tracer 45 SC) was sprayed twice during reproductive stage of yard long bean. Hand picking of infested plant parts was

done 5 times during the crop growing season at 7 days intervals for mechanical control measure. Sowing time (1 March) was considered cultural measure and irrigation was applied 7 times to crop field as field sanitation.

Farmers' practices 2 (FP_2): In each location, 3 farmers practiced in combination of chemical, cultural, and field sanitation methods. In each plot, dimethoate (Rogor 40 EC) was sprayed once at the vegetative stage and emamectin benzoate (Proclaim 5 SG) was sprayed 3 times during reproductive stage of yard long bean. Sowing time (16 March) considered as cultural measure and irrigation was applied 7 times to crop field as field sanitation.

Farmers' practices 3 (FP_3): In each location, 3 farmers adopted in combination of chemical and field sanitation methods. In each plot (180 m^2), diazinon (Diazinon 60 EC) was sprayed once at the vegetative stage and cypermethrin (Ripcord 10 EC) was sprayed 3 times during reproductive stage of yard long bean and irrigation was applied 7 times to crop field as field sanitation.

Farmers' practices 4 (FP_4): In each location, 3 farmers practiced in combination of mechanical, cultural, and field sanitation methods. In each plot (180 m^2), hand picking was done 5 times during the crop growing season at 7 days intervals for mechanical control measure. Sowing time (31 March) considered as cultural measure and irrigation was applied 7 times to crop field as field sanitation.

Farmers' practices 5 (FP_5): In each location, 3 farmers practiced in combination of cultural and field sanitation methods. In each plot (180 m^2), sowing time (15 April) considered as cultural measure and irrigation was applied 7 times to crop field as field sanitation.

Data were collected directly from the sample farmers by administering predesigned and pretested questionnaires (Instrument 1). Data were recorded in pre-formatted register (Instrument II) at 15 days interval from the sample farmer's crop fields through field and crop observation. Data were recorded from randomly pre-selected 7 (Seven) yard long bean plants at the morning (8 am - 10 am) by using normal pace of 20 steps interval along the field avoiding boarder lines. Observation was made by visually on infested and healthy plant parts, and ultimately healthy and infested yield at harvest and sales of harvested produces which were assisted by SAAOs of Department of Agricultural Extension (DAE) of respective areas.

For effectiveness and/or impact assessment, one combination of farmers' practice (FP) was considered as treatment and one district was considered as single replication for output of all five districts.

Data were compiled and statistically analyzed by using MSTAT-C software and analysis of variance (ANOVA) was calculated by F-test. Means were separated following the Duncan's Multiple Range Test (DMRT) at 5% level of probability.

Table 1. Farmers' practices for managing major insect pests of yard long bean in five districts of Bangladesh.

Farmers' practice		Practicing farmers (%) in					
Prac. code	Description of components	All 5 districts	Jessore	Dhaka	Narsingdi	Comilla	Chittagong
	Type 1- Chemicals + others						
FP_1	Combination of chemical, mechanical, cultural and field sanitation methods	11.11c	8.89c	8.89c	11.11b	17.78ab	8.89b
FP_2	Combination of chemical, cultural and field sanitation methods	32.44ab	26.67b	31.11b	40.00a	31.11a	33.33ab
FP_3	Combination of chemical and field sanitation methods	37.78a	42.22a	42.22a	31.11ab	33.33a	40.00a
	Total	**81.33**	**77.78**	**82.22**	**82.22**	**82.22**	**82.22**
	Type 2- Non- chemicals						
Fp_4	Combination of mechanical, cultural and field sanitation methods	9.78c	13.33c	8.89c	8.89b	8.89b	8.89b
FP_5	Combination of cultural and field sanitation methods	8.89c	8.89c	8.89c	8.89b	8.89b	8.89b
	Total	**18.67**	**22.22**	**17.78**	**17.78**	**17.78**	**17.78**
	LSD(0.05)	3.43	2.23	7.59	9.16	16.76	9.72

*Means within a column having same letter (s) did not differ significantly ($p>0.05$) by DMRT.

Results and Discussion

Farmers' practices for managing major insect pests

The sample farmers together from five sample districts and those from each sample district practicing the FPs have been shown in Table 1.

Most of the sample farmers (81.33%) practices type-1 while 18.67% of sample farmers practices type-2 in five districts. The farmers practicing FPs of type 1 and type 2 in each of the five districts were identical except Jessore district with some lower rate in case of type-1 (77.78%) while under type-2 with higher rate (22.22%).

The above finding indicates that the use of chemicals still highly dominates in the farmers' practices for managing major insect pests of yard long bean in all the surveyed areas. At the same time, the inclusion of mechanical control, cultural, and field sanitation in the farmers' practices with chemical pesticides is an indication of the farmer's motivation towards reducing sole dependence on chemical pesticides.

Table 2. Effect of farmers' practices (FPs) to control major insect pests of yard long bean.

Farmers' practices		% Pest control achieved by sample farmers.
Prac. code	Description of components	
FP_1	Combination of chemical (spinosad, malathion), mechanical (hand picking), cultural (sowing time) and field sanitation (irrigation) methods.	94.10a
FP_2	Combination of chemical (emamectin benzoate, dimethoate), cultural (sowing time) and field sanitation (irrigation) methods.	85.20b
FP_3	Combination of chemical (cypermethrin, diazinon) and field sanitation (irrigation) methods.	76.70c
Fp_4	Combination of mechanical (hand picking) cultural (sowing time) and field sanitation (irrigation) methods.	65.80d
FP_5	Combination of cultural (sowing time) and field sanitation (irrigation) methods.	54.00e
CV (%)		2.77

*In a column, the numeric data represent the mean value of 5 districts; data of each district were derived from the field of 15 respondents.

*In a column, means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of probability.

Effectiveness of the FPs for managing major insect pests in yard long bean

The effectiveness of FPs in managing major insect pests was measured in terms of some important parameters, such as number of pests, number of healthy and

infested twigs, inflorescences, pods and their percentage, weight of healthy and infested pod and their percentages, total pod yield, and benefit cost ratio (BCR).

From Table 2, it is revealed that farmers' practices (FPs) had significant effects on control of major insect pests of yard long bean in farmers' fields. Significantly the highest rate of effectiveness was observed in FP_1, which was followed by FP_2 and FP_3 and they were statistically different from each other. But it was the lowest in FP_5 followed by that in FP_4 and they were significantly different.

Insect pests of yard long bean

Hairy caterpillar (*Spilosoma obliqua*.), leaf beetle (unidentified), hooded hopper *(Leptocentrus taurus*), thrips (*Megalurothrips* spp.), leaf miners (unidentified), red mite (*Tetranychus* spp.), green sting bug (*N. viridula* L.), semilooper (*Diachrysia* spp.), aphid (*Aphis craccivora),* and pod borer (*Euchrysops cnejus)* were the common insect pests of farmer's field in surveyed areas while the population incidence was much higher in case of aphid and pod borer as shown in Table 3.

The farmers' practices (FPs) had significant effect on the incidence of the insect pests. Significantly the lowest and statistically similar number of aphids per plant was recorded from FP_1 and FP_2, while it was significantly the highest in FP_5, which was followed by FP_4 and FP_3 having significant difference among them. The number of legume pod borers was the lowest in FP_1 and FP_2 having no statistical difference, while it was the highest in FP_5 followed by that in FP_4, which were also statistically similar. Rests of the insect pests' prevalence were very low (Table 3). When considered all pests together, the number of pests was the lowest in FP_1 followed by that in FP_2 and FP_3 having no statistical difference among them. But it was significantly the highest in FP_5 followed by that in FP_4 having no statistical difference between them.

The lowest number of semilooper (0.04/plant) was observed in FP_1, FP_2, and FP_3 and it was the highest in FP_4 (0.81/plant) followed by that in FP_5 having no statistical difference. The lowest number of green sting bugs (0.23/plant) was recorded in FP_3 followed by that in FP_1 and FP_2 and they were statistically identical. But it was significantly the highest in FP_4 (0.93/plant) followed by that in FP_5 with no statistical difference.

Significantly the lowest number of red mite (0.40/plant) was observed in FP_1 and FP_2 followed by that in FP_3, while it was the highest in FP_5 (0.93/plant) followed by that in FP_4 with no statistical difference. Almost similar trends were observed in all FPs in respect of hairy caterpillar, leaf beetle, hooded hopper, and leaf miners. For these pests, statistically higher numbers of insects per plant were observed in FP_4 and FP_5.

Table 3. Mean number of insect pests of yard long bean under different farmers' management practices during March to October, 2009 in major growing areas of Bangladesh.

Code of farmers practice	Number of insect pests/plant										Total no. pests
	Hairy caterpillar	Leaf beetle	Hooded hopper	Thrips	Leaf miner leaf	Red mite	Green sting bug	Semi-looper	Aphid	Pod borer	
FP_1	0.04b	0.45b	0.21b	0.42b	0.70b	0.40b	0.27c	0.04b	4.69d	1.00b	4.00c
FP_2	0.05b	0.57b	0.05b	0.52b	0.62b	0.40b	0.35bc	0.04b	5.72d	1.09b	9.41b
FP_3	0.05b	0.57b	0.04b	0.47b	0.77b	0.44b	0.23c	0.04b	7.05c	1.13b	10.79b
Fp_4	0.94a	1.06a	0.87a	1.11a	1.46a	0.92a	0.93a	0.81a	19.30b	2.62a	30.02a
FP_5	0.90a	1.34a	0.82a	1.25a	1.71a	0.93a	0.85ab	0.80a	26.30a	2.98a	37.88a
Mean	0.40	0.80	0.40	0.75	1.05	0.62	0.53	0.35	12.61	1.76	18.42
CV (%)	27.83	31.61	38.72	9.70	24.17	28.40	33.08	31.90	7.74	32.93	17.21

*In a column the numeric data represent the mean value of 5 districts; data of each district are derived from the field of 15 respondents.

* In a column, means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of probability.

*[FP_1 = Combination of chemical, mechanical, cultural and field sanitation, FP_2 = Combination of chemical, cultural and field sanitation, FP_3 = Combination of chemical and field sanitation, FP_4 = Combination of mechanical, cultural and field sanitation methods, FP_5 = Combination of cultural and field sanitation]

From the above data, it was revealed that all the common pests, major and minor, such as aphid, pod borer, semilooper, green sting bug, red mite, leaf miner, thrips, hooded hopper, leaf beetle, and hairy caterpillar were less abundant in FP_1, FP_2, and FP_3, which included chemical pesticides. But they were most abundant in FP_5 and FP_4, which comprised mechanical, cultural, and field sanitation methods without the application of any chemicals. Thus among all the farmers' practices (FPs), FP_1 was the most effective method in keeping the number of insect pests to a minimum level.

Aphid infestation in yard long bean

Almost similar rates of infestation of aphid were observed in twig, inflorescence, and pod (Table 4). The lowest rate of twig infestation was recorded in FP_1, FP_2, and FP_3, which were statistically similar, while it was the highest in FP_5 followed by that in FP_4, which was statistically different (Table 4).

Table 4. Aphid infestation of twig, inflorescence and pod of yard long bean in different farmers' practices (FPs) at major growing areas of Bangladesh.

Code of farmers' practices	No. of aphids/ twig	No. of aphids/ inflorescence	No. of aphids/ pod	% Aphid infestation		
				Twig	Inflorescence	Pod
FP_1	1.10 d	2.15 d	1.44 c	6.59 c	5.91c	8.50 c
FP_2	1.42 d	2.08 d	2.22 b	7.98 c	7.87 c	8.62 c
FP_3	2.10 c	3.55 c	1.40 c	8.16 c	7.28 c	8.42 c
FP_4	5.20 b	8.19 b	5.91 a	15.44b	15.80 b	14.37 b
FP_5	8.26 a	12.17 a	5.87 a	20.52a	19.58 a	17.97 a
Mean	3.62	5.63	3.37	11.74	11.29	11.58
CV (%)	13.32	11.27	16.56	15.81	18.46	19.45

*In a column the numeric data represent the mean value of 5 districts; data of each district are derived from the field of 15 respondents.

*Means in a column having same letter (s) did not differ significantly ($p>0.05$) by DMRT.

*[FP_1 = Combination of chemical, mechanical, cultural and field sanitation, FP_2 = Combination of chemical, cultural and field sanitation, FP_3 = Combination of chemical and field sanitation, FP_4 = Combination of mechanical, cultural and field sanitation methods, FP_5 = Combination of cultural and field sanitation]

The lowest rate of inflorescence infestation was observed in FP_1, FP_3, and FP_2, which were statistically similar, while it was the highest in FP_5 followed by that in FP_4. At the same time, the lowest rate of pod infestation was observed in FP_3 followed by that in FP_1 and FP_2, which were statistically similar, while it was the highest in FP_5 followed by that in FP_4, which was statistically different.

It indicated that the farmers' practices (FPs) having combination of other control options with chemical were more effective than farmers' practices (FPs) excluding chemical.

Pod borer infestation and yield in yard long bean

The lowest rate of inflorescence infestation (5.27%) by pod borer was observed in FP_1, which was statistically different from all other FPs, followed by that of FP_2 and FP_3, while it was the highest (21.51%) in FP_5 followed by that in FP_4, which were statistically different (Fig. 1).

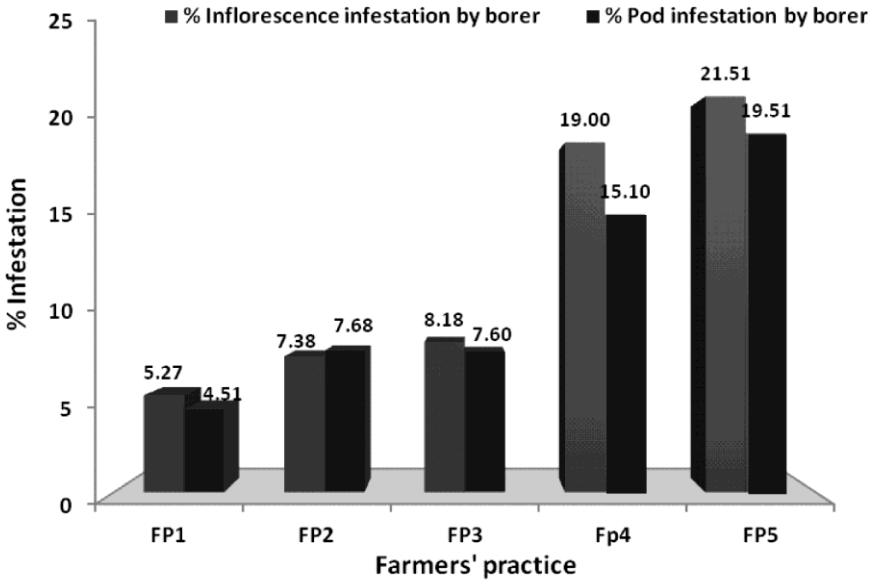

Fig 1. Effects of farmers' practices on pod borer infestation on inflorescence and pod of yard long bean in major growing areas of Bangladesh.

*[FP_1 = Combination of chemical, mechanical, cultural and field sanitation, FP_2 = Combination of chemical, cultural and field sanitation, FP_3 = Combination of chemical and field sanitation, FP_4 = Combination of mechanical, cultural and field sanitation methods, FP_5 = Combination of cultural and field sanitation]

In case of pod infestation by pod borer, significantly the lowest rate of infestation (4.51%) was observed in FP_1 followed by that in FP_3 and FP_2, which were statistically similar, while it was the highest (19.31%) in FP_5 followed by that in FP_4 and they were statistically different.

Infested pod yield, healthy pod yield, and total pod yield significantly varied due to different FPs (Table 5). Significantly the lowest infested pod yield was observed in FP_1 followed by that in FP_3 and FP_2, which were statistically similar,

while it was the highest in FP_5 followed by that in FP_4, which was also statistically identical. On the other hand, the highest healthy pod yield was obtained from FP_1 followed by that in FP_2 and FP_3, FP_4, and FP_5. Treatments FP_2 and FP_3 were statistically similar but FP_4 and FP_5 were different. Again, the lowest pod yield (10.51 t/ha) was recorded from FP_5 followed by that in FP_4, FP_3, and FP_4, later two were statistically similar, while it was statistically the highest (16.93 t/ha) in FP_1, which differed significantly from all other farmers' practices.

Table 5. Effects of farmers' practices for the management of pod borer and aphid on yield of yard long bean in major growing areas of Bangladesh

Code of farmers' practice	Pod yield (t/ha)		
	Infested pod	Healthy pod	Total pod
FP_1	0.85b	15.48a	16.93a
FP_2	1.04b	12.67b	13.69b
FP_3	1.01b	12.65b	13.67b
Fp_4	1.80a	10.39c	12.19c
FP_5	2.04a	8.452d	10.51d
Mean	1.35	11.93	13.40
CV (%)	20.49	5.57	9.35

*In a column the numeric data represent the mean value of 5 districts; data of each district are derived from the field of 15 respondents.

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*[FP_1 = Combination of chemical, mechanical, cultural and field sanitation, FP_2 = Combination of chemical, cultural and field sanitation, FP_3 = Combination of chemical and field sanitation, FP_4 = Combination of mechanical, cultural and field sanitation methods, FP_5= Combination of cultural and field sanitation]

Benefit costs analysis (BCA)

Significantly the highest benefit cost ratio (BCR) was 1.82 calculated in FP_1, while it was the lowest (1.20) in FP_5 followed by that in FP_4, FP_3, and FP_4 (Table 6). In case of net return, the highest amount was received by selling produces from FP_1 followed by that in FP_2 and FP_3. But it was the lowest in FP_5 followed by that of FP_4. The highest gross return was obtained from FP_1, while it was the lowest in FP_5 followed by that in FP_4, FP_3, and FP_2. On the other hand, the lowest production cost was incurred in FP_5 followed by that in FP_4, FP_3, and FP_2 but the highest production cost was incurred in FP_1.

Table 6. Benefit cost analysis of different farmers' practices for managing major insect pests of yard long bean in the surveyed areas during kharif season 2009.

Code of farmers' practice	Gross return (Tk/ha)	Production cost (Tk/ha)	Net return (Tk/ha)	BCR
FP_1	270900.00a	95910.00a	175000.00a	1.82a
FP_2	219000.00b	91290.00b	127700.00b	1.40b
FP_3	218700.00b	90950.00b	127400.00b	1.40b
Fp_4	195100.00c	82850.00c	112200.00c	1.35c
FP_5	168200.00d	76390.00d	91770.00d	1.20d
CV (%)	1.2	0.75	1.9	2.0

*In a column the numeric data represent the mean value of 5 districts; data of each district are derived from the field of 15 respondents.

* In a column, means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of probability.

*[FP_1 = Combination of chemical, mechanical, cultural and field sanitation, FP_2 = Combination of chemical, cultural and field sanitation, FP_3 = Combination of chemical and field sanitation, FP_4 = Combination of mechanical, cultural and field sanitation methods, FP_5 = Combination of cultural and field sanitation].

The above results indicated that among the different FPs, the FP_1 and other FPs that included combination of other control options (Mechanical, cultural, and field sanitation) including chemical method were more effective than the FPs excluding chemical. Thus the effect of chemicals, mechanical, cultural and field sanitation significantly reduced the pod infestation. Similarly, other measures particularly mechanical control through hand destruction of infested twig, inflorescence and pod, and field sanitation rendered non-congenial environment for the pod borer and aphid, which consequently reduced the population. The chemicals (Spinosad, emamectin benzoate, cypermethrin, malathion, dimethoate, and diazinon) used in the FPs most significantly reduced the major insect pests to a minimum and consequently reduced the rate of infestation. All these contributed to higher healthy pod yield and ultimately resulted in the higher BCR. Finding of the present study are comparable with the findings of different components of IPM studied individually by many other researchers (Latif, 2007; Hossen**,** 2008; Anon, 2009)**.**

Conclusion

Farmers' practices for management of insect pests of yard long bean were found in use of chemical and non-chemical methods. The findings of the present study reveal that the use of chemical insecticides profoundly influences farmers' practices for managing insect pests of yard long bean. But they are not solely dependent on chemical insecticides while they are also utilizing other practices like mechanical, cultural, and field sanitation methods. Use of chemical and non-

chemical options maintaining the Integrated Pest Management (IPM) strategy will provide cost effective insect pests management of yard long bean.

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