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EFFICACY OF IPM MODULES AGAINST MAJOR INSECT PESTS OF COMMON BEAN *PHASEOLUS VULGARIS*

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ABSTRACT

This experiment evaluated some IPM modules against pests of common bean *Phaseolus vulgaris*, and observed that the module with soil application of carbofuran 3G @ 32.5 kg/ ha+ 1st of spray with dimethoate 30EC @ 0.03% (45 days after sowing- DAS) and 2nd with dichlorvos 76SC @ 0.076% (70 DAS) was the most effective. This resulted in maximum reduction of pests (76.85, 75.43, 69.97% of aphid, whitefly and weevil, respectively) and resulted in maximum gross returns (₹94,068), net returns (₹64,017) and benefit cost ratio (2.13). Besides, these effect of intercropping of beans with maize revealed a reduced population density of all the major pests, as compared to sole bean crop.

Key words: IPM modules, *Phaseolus vulgaris, Aphis fabae*, *Bemisia tabaci*, *Conapium* sp., intercropping, sole crop, gross returns, pest intensity

Common bean (*Phaseolus vulgaris* L.; Fabaceae) is a legume of importance, and it is also known as French bean, kidney bean, snap bean, runner bean and string bean (Onder et al., 2006). Beans are susceptible to both biotic and abiotic stresses, of which the damage caused by insect pests and diseases is the major constraints in their production. The yield losses due to insect pests alone have been estimated to the tune of 35 to 100% (Singh and Schwartz, 2011). Among the major pests, the common ones are the bean seed fly (*Delia platura*), bean flies (*Ophiomyia* spp.), cutworms (*Agrotis* spp.), aphids (*Aphis craccivora* and *A. fabae*), leaf miners (*Liriomyza* spp.), spider mites (*Tetranychus* spp.), whiteflies (*Bemisia tabaci*), thrips, bugs and the African bollworm (*Helicoverpa armigera*) (Allen et al., 1996). More than 37 arthropods have been found associated with French bean in some locations in Jammu region (Mondal et al., 2017). There had been a complete failure of the crop in some places, while in other places losses it is 90-95% (Abrol et al., 2006). This study evaluated some IPM modules against pests of *P. vulgaris*.

MATERIALS AND METHODS

A field trial was laid out in the experimental field of Division of Entomology, Faculty of Agriculture, Wadura. The validation of IPM modules against major insect pests of beans grown both as sole crop as well as an intercrop with maize was done; the modules include- M-I, M-II, M-III for sole beans whereas, M-V, M-VI and M-VII for beans sown as intercrop with maize, along with an untreated control. Further M-I and M-V, M-II and M-VI, and M-III and M-VII were similar in the details of treatments. The details of treatments are as follows:

Module	Sole beans	Module	Maize + beans (intercrop)
M-I	Seed treatment with deltamethrin 2.8EC @ 3ml/ kg of seed + first spray with chloropyriphos 20EC @ 0.02% (45 DAS) and 2nd spray with quinalphos 25EC @ 0.035% (70 DAS)	M-V	Seed treatment with deltamethrin 2.8EC @ 3ml/ kg of seed + first spray with chloropyriphos 20EC @ 0.02% (45 DAS) and 2nd spray with quinalphos 25EC @ 0.035% (70 DAS)
M-II	Seed treatment with imidacloprid 17.8 SL @ 2ml/ kg of seed + first spray with neem oil @ 0.5% (45 DAS) and 2nd spray with azadirachtin @ 1g/ l (70 DAS).	M-VI	Seed treatment with imidacloprid 17.8 SL @ 2ml/ kg of seed + first spray with neem oil @ 0.5% (45 DAS) and 2nd spray with azadirachtin @ 1g/ l (70 DAS).
M-III	Soil application with carbofuran 3G @ 32.5kg/ ha + first spray with dimethoate 30 EC @ 0.03% (45 DAS) and 2nd spray with dichlorvos 76 SC @ 0.076% (70 DAS)	M-VII	Soil application with carbofuran 3G @ 32.5kg/ ha + first spray with dimethoate 30 EC @ 0.03% (45 DAS) and 2nd spray with dichlorvos 76SC @ 0.076% (70 DAS)
M-IV	Control-I (Untreated)	M-VIII	Control-II (Untreated)

Table 1. Effect of IPM modules on pests of common bean

Treatments	% reduction in incidence										
	Pre-treatment count	1st spray 45DAS 1DAT	3DAT	7DAT	Pooled mean	Pre-treatment count	2nd spray 70 DAS 1DAT	3DAT	7DAT	Pooled mean	Overall mean
					Aphid *A. fabae*						
M-I	12.85	46.35 (41.79)	57.89 (50.86)	70.73 (60.09)	58.32	17.32	55.13 (43.98)	74.39 (54.93)	77.88 (59.67)	69.13	63.73
M-II	12.05	44.45 (41.79)	60.19 (50.86)	75.18 (60.09)	59.94	17.07	48.23 (43.98)	66.98 (54.93)	74.49 (59.67)	63.23	61.59
M-III	14.39	56.63 (48.79)	75.40 (60.27)	85.39 (67.55)	72.47	18.28	64.33 (53.33)	81.94 (64.88)	85.09 (67.36)	77.12	74.80
M-IV	16.59	6.46 (14.68)	6.58 (14.84)	6.55 (14.79)	6.53	18.39	9.53 (17.96)	8.48 (16.89)	10.27 (18.64)	9.43	7.98
M-V	10.53	49.26 (44.56)	64.97 (53.69)	72.17 (58.77)	62.13	16.31	62.73 (52.39)	75.36 (60.27)	80.95 (64.26)	73.01	67.57
M-VI	10.44	47.52 (43.55)	68.50 (55.84)	71.51 (57.83)	62.51	16.53	52.60 (46.49)	71.99 (58.11)	82.93 (65.72)	69.17	65.84
M-VII	9.43	56.60 (48.78)	80.46 (63.82)	89.12 (71.24)	75.39	16.97	67.08 (54.99)	84.76 (67.05)	83.07 (65.83)	78.30	76.85
M-VIII	8.44	15.03 (22.78)	14.32 (22.22)	13.38 (21.43)	14.24	15.60	14.32 (22.21)	13.51 (21.55)	10.82 (19.13)	12.88	13.56
C.D ($p \leq 0.05$)	-	1.94	2.24	4.22	-	-	2.37	3.33	4.13	-	-
					Whitefly *B. tabaci*						
M-I	10.48	51.41 (45.81)	66.69 (54.77)	71.08 (57.48)	63.06	14.40	59.06 (50.20)	65.48 (54.00)	82.00 (64.89)	68.85	65.96
M-II	10.54	51.97 (46.12)	60.40 (51.00)	74.65 (59.79)	62.34	15.64	50.10 (45.03)	60.27 (50.91)	77.41 (61.65)	62.59	62.47
M-III	9.55	58.03 (49.63)	74.28 (59.55)	76.64 (61.10)	69.65	15.22	67.30 (55.12)	79.67 (63.22)	89.84 (71.41)	78.94	74.30
M-IV	9.27	7.13 (15.35)	6.70 (14.92)	9.43 (17.88)	7.75	15.81	25.30 (26.94)	10.60 (18.98)	12.74 (20.87)	16.21	11.98
M-V	6.10	52.36 (46.33)	63.41 (52.78)	81.47 (64.72)	65.75	10.28	66.01 (54.32)	75.57 (60.35)	78.59 (62.41)	73.39	69.57
M-VI	7.66	53.42 (46.94)	62.94 (52.50)	78.65 (62.54)	65.00	10.88	62.08 (51.97)	67.19 (55.03)	77.47 (61.64)	68.91	66.96
M-VII	6.99	60.15 (50.83)	72.86 (58.62)	82.22 (65.18)	71.74	10.33	74.98 (59.98)	81.86 (64.81)	80.49 (63.77)	79.11	75.43
M-VIII	7.22	10.66 (19.04)	8.53 (16.95)	14.10 (21.99)	11.10	11.44	16.75 (24.13)	18.14 (25.16)	14.49 (22.28)	16.46	13.78
C.D ($p \leq 0.05$)	-	3.02	2.84	3.65	-	-	4.28	2.53	2.84	-	-
					Bean weevil *Conapion* sp.						
M-I	8.66	48.00 (43.83)	57.98 (49.57)	68.42 (55.78)	58.13	8.88	50.76 (45.41)	66.51 (54.73)	72.37 (58.29)	63.21	60.67
M-II	9.11	41.50 (40.08)	53.55 (47.01)	61.30 (51.52)	52.11	9.51	44.73 (41.96)	56.38 (48.65)	69.21 (56.28)	56.77	54.44
M-III	8.47	53.47 (46.97)	66.59 (54.67)	73.38 (58.93)	64.48	9.61	55.12 (47.92)	75.78 (60.51)	84.39 (66.74)	71.76	68.12
M-IV	8.73	5.81 (13.91)	7.65 (16.01)	10.34 (18.74)	7.93	10.78	5.62 (13.64)	10.01 (18.39)	10.68 (19.02)	8.77	8.35
M-V	5.96	56.28 (48.59)	68.50 (55.91)	76.21 (60.80)	66.99	6.27	55.54 (48.16)	71.89 (57.98)	78.02 (62.07)	68.48	67.73
M-VI	6.10	48.86 (44.33)	62.71 (52.36)	70.83 (57.34)	60.80	8.42	56.52 (48.73)	69.18 (56.26)	74.54 (59.68)	66.74	63.77
M-VII	6.14	57.94 (49.55)	62.60 (52.28)	80.86 (64.06)	67.13	5.73	61.59 (51.68)	75.16 (60.11)	81.68 (64.63)	72.81	69.97
M-VIII	6.48	11.56 (19.87)	10.80 (19.15)	11.01 (19.36)	11.12	6.99	11.22 (19.53)	14.07 (21.93)	16.68 (24.02)	13.99	12.55
C.D ($p \leq 0.05$)	-	2.11	3.46	3.22	-	-	3.11	4.72	3.00	-	-

Table 2. Economics of IPM modules evaluated in common bean

Modules	Cost of cultivation (₹)	Gross returns (₹)			Net returns (₹)	B:C ratio
		Grain	Straw	Total		
M-I	26,851	72,000	2,610	74,610	47,267	1.77
M-II	30,111	71,100	2,580	73,680	43,579	1.44
M-III	31,931	77,400	2,760	80,160	48,229	1.51
M-IV	26,651	49,500	2,250	51,750	25,099	0.94
M-V	25,463	72,600	6,256	78,856	58,593	2.09
M-VI	28,221	77,350	6,224	83,574	55,353	1.96
M-VII	30,051	87,700	6,368	94,068	64,017	2.13
M-VIII	24,771	56,100	6,016	62,116	37,445	1.50

The variety Shalimar Rajmash-2 and Maize Composite-4 were used, with the experiment laid out in randomized block design (RBD) and replicated thrice. The insecticides were applied to beans only, with two sprays, first on 45 days after sowing (DAS) and the second on 75 DAS. Pretreatment observation on incidence of major pests was carried out just before each spray and post-count observations at 1, 3 and 7 days after treatment (DAT). The data were used to compute % reduction. All the agronomic cultural practices were followed as per package of practices, 2017 of SKUAST-K.

RESULTS AND DISCUSSION

The results reveal that reduction in incidence of pests in beans sole crop was less in comparison to the one intercropped with maize. All the modules led to significant reduction in aphids (72.47% at 45 DAS and 77.12% at 70 DAS) in M-III among the sole bean crop; while in intercropped ones, module M-VII led to 75.39% and 78.30% reduction at 45 and 70 DAS, respectively (Table 1). These results agree with those of Ogenga et al. (1993), Mondal et al (2017). Sithanantham et al. (1990) and Ogenga et al. (1992) observed that intercropping cowpea with maize reduced the incidence of *Aphis fabae* on cowpea. In case of whitefly, maximum reduction (69.65%- 45 DAS; 78.94%- 70 DAS) was observed with module M-III in sole bean crop, while in intercropped bean, with module M-VII (71.74% and 79.11% at 45 DAS and 70 DAS, respectively). Against bean weevil, all the modules irrespective of sole and intercrop caused significant reduction- maximum (64.48%- 45 DAS, 71.76%- 70 DAS) being with module M-III (sole bean crop), and in M-VII (intercropped) it was 67.13% and 72.81% at 45 DAS and 70 DAS, respectively (Table 1). This may be due to that companion and neighbouring plants can reduce pest pressure by providing habitat for the pest's enemies, confuse pests and camouflage crops, trap pests and repel pests (Wallace, 2013). While assessing the economics, the Module V-II gave maximum gross returns (₹94,068), net returns (₹64,017) and benefit cost ratio (2.13) (Table 2). These results agree with those of Sharmah and Rahman (2017).

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