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EFFECT OF ORGANIC MANURES AND ITS COMBINATION WITH INORGANIC FERTILIZERS ON INSECT PESTS INFESTING COWPEA*

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ABSTRACT

Use of chemical fertilizers alone exhibited maximum population of sucking pests *i.e. Aphis craccivora* Koch, *Empoasca kerri* Pruthi, *Bemisia tabaci* Genn., *Megaleurothrips* sp. and leaf miner, *Acrocercops caerulea* and spotted pod borer, *Maruca vitrata* Fab. in cowpea crop, whereas the plots supplemented with organic manures and its combination with CF registered significantly low incidence of these pests over the untreated check. The application of FYM (10 t ha^{-1}) + 50% RDF was found best in reducing the pest population and increasing the yield of green pods. Organic manures also influenced various growth attributing characters such as pod length, plant height, 50% flowering (days) and number of pods per plant. Maximum Incremental Cost Benefit Ratio (1:5.27) was registered with (5 t ha^{-1}) + 50% RDF followed by FYM applied @ 5 t ha^{-1} (1: 4.07).

Key words : *Aphis craccivora, Empoasca kerri, Bemisia tabaci, Megaleurothrips* sp., *Acrocercops caerulea, Maruca vitrata*

INTRODUCTION

Cowpea, *Vigna unguiculata* (Linn.) Walpers is one of the most versatile pulse crop grown in kharif and summer season. As many as 21 insect pests of different groups have been recorded damaging the crop right from germination to maturity. Chemical pesticides are commonly used to control these pests. Due to development of insecticide resistance, resurgence and residues it becomes inevitable to find out alternatives which are effective in suppressing the pests and also eco-friendly in nature.

Organic amendments improve the soil fertility status and confers the resistance in crops against many insects (Panda *et al.,* 2004; Kavitharaghavan *et al.,* 2005; Adilakshmi *et al.,* 2008). Therefore, the present study was made to evaluate the effect of organic manures and its combination with inorganic fertilizers on insect pests of cowpea.

MATERIALS AND METHODS

In order to assess the effect of various organic manures and its combination with inorganic fertilizers on the incidence of insect pests of cowpea, a field experiment was conducted at Agronomy farm, B.A. College of Agriculture, Anand Agricultural University, Anand during kharif 2007. The experiment was laid out in Randomized Block Design with 12 treatments (Table 1) and three replications. Gross and net plot size was 5.00 × 2.70 and 4.00 × 1.70 m, respectively. The seeds of Pusa phalguni cultivar were dibbled at 45 × 20 cm spacing during second week of July 2007. Five organic manures *viz;* Farm yard manure (FYM), Castor cake (CC), Poultry manure (PM), Neem Cake (NC) and Vermicompost (VC) alone each @ 10, 1, 2, 1 and 2 t ha^{-1} respectively and its half dose along with 50% recommended dose of fertilizer (RDF) from Chemical fertilizer (CF) were evaluated and compared with the CF alone as well as control (without any fertilizer). All the organic amendments were applied 15 days prior to sowing while phosphatic fertilizers were applied at the time of sowing. Nitrogenous fertilizers were applied in two equal splits *i.e.* 50% at the time of sowing and remaining 50% after 30 days of sowing. All the required agronomical practices were followed to raise the healthy crop. Experimental plots were kept free from any pesticidal application throughout the season.

The observations on insect pests were recorded at weekly interval from 15 days after sowing till harvesting from five tagged plants selected randomly from each plots. Aphid, *Aphis craccivora* Koch. population was recorded on three randomly selected twigs (about 10 cm in length) from each tagged plant. Similarly, leafhopper, *Empoasca kerri* Pruthi and whitefly, *Bemisia tabaci* Genn.

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Table 1. Effect of various organic manures and its combinations with inorganic fertilizers on insect pests and yield of cowpea

Treatments		Mean population of insects					Pod borer damage (%)	Yield (kg/ha)
		Aphids/twig	Leaf hopper/leaf	Whitefly/leaf	Thrips/flower	Mines/leaf		
FYM @ 10t/ha	T_1	0.81 a (0.15)	1.00 a (0.50)	0.95 a (0.40)	1.36 ab (1.36)	0.91 a (0.33)	0.41 a (1.89)	147a
Castor cake @ 1 t/ha	T_2	6.58 bc (42.85)	1.99 c (3.45)	1.95 cd (3.32)	2.05 c (3.71)	2.27 c (4.66)	23.77 bc (15.61)	1103bc
Poultry manure @ 2 t/ha	T_3	7.61 cd (57.43)	2.11 cd (3.96)	2.12 e (4.00)	2.06 c (3.74)	1.74 b (2.52)	26.26 c (18.89)	970c
Neem cake @ 1 t/ha	T_4	8.12 cd (65.40)	1.18 ab (0.88)	1.07 a (0.65)	0.94 a (0.38)	1.03 a (0.56)	10.34 a (2.92)	1480a
Vermicompost @ 2 t/ha	T_5	5.67 b (31.63)	2.35 e (5.04)	1.91 c (3.14)	2.36 c (5.07)	2.37 c (5.12)	21.86 b (13.27)	1054c
FYM 5 t/ha + 50% RDF from CF	T_6	1.82 a (2.79)	1.30 b (1.20)	1.02 a (0.55)	2.31 c (4.83)	1.08 a (0.67)	9.60 a (2.50)	1368ab
Castor cake 0.5 t/ha + 50% RDF from CF	T_7	2.61 a (6.32)	2.07 cd (3.80)	1.48 b (1.69)	2.53 c (5.88)	2.41 c (5.30)	21.73 b (13.12)	923c
Poultry manure 1 t/ha + 50% RDF from CF	T_8	6.33 bc (39.53)	2.22 de (4.43)	1.89 c (3.06)	1.95 bc (3.28)	2.49 c (5.72)	23.23 bc (14.93)	923c
Neem cake 0.5 t/ha + 50% RDF from CF	T_9	7.18 bcd (51.07)	2.19 de (4.28)	1.83 c (2.84)	0.97 a (0.43)	2.32 c (4.86)	24.58 bc (16.64)	1007c
Vermicompost 1 t/ha + 50% RDF from CF	T_{10}	6.81 bc (45.81)	2.20 de (4.33)	1.85 c (2.93)	3.20 d (9.75)	2.47 c (5.62)	22.55 bc (14.09)	925c
Chemical fertilizer		9.03 d (80.73)	2.2 de (4.34)	2.09 de (3.87)	2.53 c (5.90)	2.46 c (5.54)	25.71bc (18.15)	872cd
Control		11.51 e (131.98)	2.97 f (8.32)	2.74 f (7.01)	4.43 e (19.12)	3.38 d (10.92)	33.99 d (30.45)	610d
S.Em. ±		0.66	0.07	0.05	0.23	0.08	1.39	90.56
C.V. (%)		14.03	12.85	14.11	13.48	14.12	14.41	14.80

Treatment means with common letter (s) are non-significant by DNMRT at 5% level of significance

populations were recorded from three leaves (each from top, middle and bottom region) of selected plants. Thrips, *Megaleurothrips* sp. population was recorded by randomly selecting five flowers on tagged plants, whereas leaf miner, *Acrocercops caerulea* incidence was assessed by critically observing leaf mines in all the leaves on each selected plant. Total 6, 9, 9, 4 and 8 observations were made at weekly interval (from 3 to 11 weeks after sowing) for aphid, leaf hopper, whitefly, thrips and leaf miner, respectively. Based on these observations, mean values for each pest (Table 1) were worked out. The data thus obtained were analyzed after square root transformation.

The effect of various treatments on plant height, days to 50% flowering, number of pods per plant and length of pods were recorded. The observations like number of pods per plant and pod length were recorded at each picking, whereas plant height was measured at maximum growth stage of plants. The data thus obtained are presented in Table 2.

RESULTS AND DISCUSSION

Data (Table 1) revealed that all the plots supplied with organic manures and chemical fertilizers registered significantly low incidence of insect pests compared to control. Least population of aphid (0.15/twig) was recorded in the plots fertilized with FYM (10 t ha^{-1}) followed by application of FYM (5 t ha^{-1}) + 50% RDF from CF. These treatments registered significantly low population of the pest than rest of the treatments evaluated. Plots having CF alone exhibited maximum number of aphids (80.73/twig). Leaf hopper population was found lowest (1.0 to 1.3/leaf) on plots supplemented with FYM (10 t ha^{-1}), neem cake (1 t ha^{-1}) and FYM (5 t ha^{-1}) + 50% RDF from CF. Almost similar trend of treatment effect was noticed in case of whitefly population. Application of castor cake (0.5 t ha^{-1}) + 50% RDF from CF also proved better in reducing the population of leaf hopper (2.07/leaf) and white fly (1.48/leaf).

Table 2. Effect of various organic fertilizers and its combinations with inorganic fertilizers on growth parameters cowpea

Treatments	Pod length (cm)	Plant height (cm)	50% flowering (days)	No. of pods/plant
FYM @ 10t/ha	13.74 a	70.87 abc	36.00 a	18.00 a
Castor cake @ 1t/ha	10.14 d	67.67 bcd	38.00 ab	13.03 c
Poultry maure @ 2t/ha	11.85 bc	70.67 abcd	36.67 a	14.67 bc
Neem cake @ 1t/ha	11.62 bc	69.67 abcd	37.33 ab	15.37 b
Vermicompost @ 2t/ha	10.75 cd	63.87 cd	37.67 ab	14.47 bc
FYM 5 t/ha + 50% RD from CF	12.15 b	77.13 ab	35.67 a	17.60 ab
Castor cake 0.5 t/ha + 50% RDF from CF	11.51 bc	62.40 d	37.00 ab	14.13 bc
Poulrty manure 0.5 t/ha + 50% RDF from CF	11.92 bc	80.87 a	36.00 a	13.47 bc
Neem cake 0.5t/ha + 50% RDF from CF	10.70 cd	75.13 ab	37.00 ab	12.53 c
Vermicompost 1 t/ha + 50% RDF from CF	11.68 bc	58.93 de	38.33 ab	13.87 bc
Chemical fertilizer (20-40-0)	10.68 cd	67.17 bcd	40.33 bc	9.93 d
Control (No fertilizer)	9.92 e	46.67 e	42.00 c	8.40 d
S.Em. ±	0.43	4.21	1.22	0.75
C.V. (%)	6.56	10.79	5.62	9.47

Treatment means with common letter (s) are non significant by DNMRT at 5% level of significance

Green pods for vegetable purpose were harvested as and when ready. Total 3 pickings were made. Harvested green pods were observed for infestation of pod borer, *Maruca vitrata* Fab. and per cent pod borer damage was worked out. The data obtained were analyzed after arc sine transformation. Treatment-wise yield data were recorded and converted in kg ha^{-1}. Economics (Incremental Cost; Benefit Ratio) for each treatment was worked out and presented in Table 3.

Significantly low population of thrips (0.38 to 0.43 thrips/flower) was observed in the plots amended with neem cake alone (1 t ha^{-1}) and neem cake (0.5 t ha^{-1}) + 50% RDF from CF in comparison to test treatments, except the treatment of FYM. Among the various combinations evaluated, the plots fertilized with vermicompost (1 t ha^{-1}) + 50% RDF from CF registered significantly highest population of thrips (9.75/flower). Viswanathan and Kandiannan (1990) reported that the application of neem

cake with urea (1:5 ratio) significantly reduced the leaf hopper and plant hopper population in rice as compared to control. Kavitharaghavan *et al.* (2005), observed that the application of FYM (12.5 t ha^{-1}) + biofertilizer (2 kg ha^{-1}) followed by neem cake (1 t ha^{-1}) reduced the incidence of sucking pests in brinjal. Varghese and Giradi (2005) revealed that the application of neem cake (0.5 t ha^{-1}) with 50% RDF recorded significantly lower density of chilli thrips comparable to chemical control. These reports are corroborated with the present findings.

Minimum incidence of leaf miner (0.33 mines/leaf) was recorded in plots supplied with FYM alone followed by neem cake (0.5/leaf) and FYM + CF (0.6/leaf). These treatments registered significantly low population of leaf miner over other tested treatments. Plots fertilized with either castor cake, vermicompost and poultry manure alone as well as in combination with chemical fertilizer exhibited more or less same level of leaf miner incidence. This finding is supported by the report of Rao *et al.* (2001), who opined that the application of FYM, neem cake and vermicompost recorded lowest incidence of leaf miner in groundnut crop.

The plots treated with FYM, vermicompost and neem cake registered significantly low (1.89 to 2.92%) incidence of pod borer. Rest of the treatments also reduced the pod borer population but statistically were at par. Adilakshmi *et al.* (2008) recorded lowest incidence of *Earias vittella* when plots fertilized with 75% RDF from neem cake + 25% RDF from CF.

Plots fertilized with neem cake (1 t ha^{-1}) registered highest (1480 kg ha^{-1}) yield of green pods followed by the treatment of FYM (1429 kg ha^{-1}) and FYM (5 t ha^{-1}) + 50% RDF from CF (1368 kg ha^{-1}). These treatments were at par and produced significantly higher yields over rest of the treatments evaluated, except the treatment of castor cake (Table 1). Dademal and Dongale (2004) obtained significantly higher okra fruit yield in the treatment with FYM applied @ 7.5 t ha^{-1} as compared to no manure. These reports supported the above finding.

Studies on influence of various organic and inorganic fertilizers applied individually and its combination on some growth parameters revealed that the plots treated with FYM @ 10 t ha^{-1} registered significantly highest pod length (13.74 cm) over rest of the treatments. Poultry manure applied either alone or in combination with chemical fertilizer also proved better in increasing the pod length (Table 2). Relatively more plant height was measured when poultry manure, FYM and neem cake were applied in combination with chemical fertilizers than these organic manures applied individually. Vermicompost applied either alone or in combination with chemical fertilizer did not influenced much on plant height. Minimum duration to 50% flowering (35.67) days were observed in the plots fertilized with FYM 5 t ha^{-1} + 50% RDF from CF followed by FYM (10 t ha^{-1}) and PM (0.5 t ha^{-1}) + 50% RDF from CF (36.00). Maximum duration to 50% flowering (40.33) days in cowpea crop was recorded when chemical fertilizers applied alone. Almost similar trend of treatment effect was

Table 3. Economics of different treatments of organic and inorganic fertilizers evaluated against pests of cowpea

Treatments	Cost of treatment including labour charge (Rs./ha)	Yield (kg/ha)	Gross realization (Rs./ha)	Net realization (Rs./ha)	Net profit (Rs./ha)	ICBR
FYM @ 10 t/ha	3200	1479	22184	13034.95	98.34.95	1:4.07
Castor cake @ 1 t/ha	6600	1103	16545	7396.00	796.00	1:1.12
Poultry manure @ 1 t/ha	5200	970	14555	5405.95	205.95	1:1.04
Neem cake @ 1 t/ha	6200	1480	22203	13053.55	68.53.55	1:2.11
Vermicompost @ 1 t/ha	6200	1054	15809	6659.65	459.65	1:1.07
FYM 5 t/ha + 50% RDF from CF	2158	1368	20527	11377.90	9219.54	1:5.27
Castor cake 0.5 t/ha + 50% RDF from CF	3858	923	13843	4693.90	835.54	1:1.22
Poultry manure 0.5 t/ha + 50% RDF from CF	3158	923	13847	4697.50	1539.14	1:1.49
Neem cake 0.5 t/ha + 50% RDF from CF	3658	1007	15107	5958.40	2300.04	1:1.63
Vermicompost 1 t/ha + 50% RDF from CF	3658	925	13882	4732.60	1074.24	1:1.29
Chemical fertilizer (20-40-0)	1110	872	13073	3924.40	2814.40	1:3.54
Control (No fertilizer)	-	610	9149	-	-	-

Note: (A) Market price of cowpea green pods Rs. 15/kg

(B) Labour charge @ Rs. 100/day

noticed in case of number of pods per plant. Treatment with chemical fertilizer alone was found to be at par with untreated control and registered significantly less number of pods per plant in comparison to remaining treatments evaluated. These findings are supported by the reports of Dademal and Dongale (2004) and Adilakshmi *et al.* (2008).

Economics of different treatments (Table 3) revealed that maximum net realization (Rs. 13,054 ha^{-1}) was found when neem cake applied @ 1 t ha^{-1} followed by FYM @ 10 t ha^{-1} (Rs. 13035 ha^{-1}) and FYM @ 5 t ha^{-1} + 50% RDF from CF (Rs. 11378 t ha^{-1}). Highest (1 : 5.27) incremental cost benefit ratio (ICBR) was observed in case of plots supplied with FYM @ 5 t ha^{-1} + 50% RDF from CF followed by FYM @ 10 ha^{-1} (1: 4.07). Though the treatment with neem cake registered maximum net realization, but gave relatively low ICBR (1:2.11).

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