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Influence of Organic and Inorganic Sources of Nutrients on the Incidence of Sucking Pests of Eggplant (*Solanum melongena* Linn.) and their Natural Enemies

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ABSTRACT

The relative influence of organic and inorganic sources of nutrients on the incidence of sucking pests was studied during 2008-09. Treatments *viz*., Neemcake 50% (@125 kg/ha) + RDF 50 % (NPK @ 50-30-30 Kg/ha), vermicompost 50% (@1500 kg/ha) + RDF 50 % (NPK @ 50-30-30 Kg/ha) and FYM 50% (@10000 kg/ha) + RDF 50 % (NPK @ 50-30-30 Kg/ha) recorded significantly lower population of sucking pests. The overall influence of various treatments revealed that the higher number of coccinellids per plant were recorded in the experimental plots applied with neemcake 50% + RDF 50% (6.49), vermicompost 50% + RDF 50% (5.73) and FYM 50%+RDF 50% (4.94) respectively compared to control plot (2.37). Whereas the higher spider populations were recorded in the plots applied with neemcake 50% + RDF 50% (6.96 spiders/plant).

Key words : *Amrasca biguttula biguttula*, *Bemisia tabaci*, Coccinellids, Spiders.

Eggplant, *Solanum melongena* (Linn.) is an important vegetable crop; it is attacked by more than 70 insect pests. Among them sucking pests like leafhopper *Amrasca biguttula biguttula* (Ishida) and whitefly *Bemisia tabaci* (Gennadius) are important. As eggplant is a vegetable crop and harvesting of fruits is done at regular short intervals. Indiscriminate use of synthetic insecticides leading to resurgence of sucking pests and mite problems is well documented (Reddy and Srinivas, 2005). The imbalanced use of fertilizers is resulting in much havoc due to succulent growth of plants and thereby inviting all the pest problems and to combat the pest problems the cultivator invariably has to resort to chemical sprays which in turn nullifies the natural control existing in nature.On the other hand if organic manures are applied in larger quantities either alone or in combination with chemical fertilizers, the plant will get all the required nutrients throughout its growth *i.e*. balanced nutrition which reduces pest incidence. This in turn reduces the dependence on chemical pesticides and the crop automatically invites parasites and predators which generally help in pest suppression. Keeping this in view, the present investigation was proposed to study the relative influence of organic and inorganic sources of nutrients on the incidence of sucking pests of egg plant and their natural enemies.

MATERIAL AND METHODS

The experiment was laid out in simple randomized block design with eight treatments and three replications at the orchard block of Agricultural College Farm, Bapatla during 2008-09. the threatments include : Neem cake @250 kg/ha, Vermicompost @3000 kg/ha, Farm Yard Manure @20000 kg/ha, (RDF) NPK @100-60-60 kg/ha, neemcake 50% (@125 kg/ha) + RDF 50 % (NPK @ 50-30-30 Kg/ha), vermicompost 50% (@1500 kg/ha) + RDF 50 % (NPK @ 50-30-30 Kg/ha), FYM 50% (@10000 kg/ha)+ RDF 50 % (NPK @ 50-30-30 Kg/ha), and untreated control. The plot size for individual treatment was 24 m^2 (6 m x 4 m) and provided with raised bunds all around with irrigation channel in between the replications.

The respective treatments like Farm Yard Manure, Vermicompost and Neemcake were incorporated in to soil, a week before transplanting. The recommended doses of inorganic fertilizers phosphorous (60 kg /ha), potash (60 kg /ha) were applied in last plough in the form of single super phosphate and murate of potash respectively, whereas Nitrogen (100 kg /ha) was applied in three equal splits at 30, 60 and 70 days after transplanting. The seedlings of one month age were transplanted with a spacing of 75×50 cm and the two seedlings per hill. Data on the pest populations were recorded

at weekly intervals, and pooled data was used for presenting the results. Observations were recorded on five randomly selected and tagged plants for sucking pests in each plot leaving the border rows. The populations of adults (whitefly), nymphs and adults (leafhopper) were counted during early morning hours on five leaves (top two, middle one and bottom two) from each of five selected and tagged plants at 40 DAT, 55 DAT, 70 DAT, 85 DAT and 100 DAT.

RESULTS AND DISCUSSION

Whitefly:

Influence of various treatments on the population of whiteflies was recorded on 40,55,70,85 and 100 DAT .The overall influence of different treatments revealed that the lowest populations of 24.21 whiteflies were recorded in neemcake 50% + RDF 50% treated plots. The next best treatments were that of the plots treated with vermicompost 50% + RDF 50% and FYM 50% + RDF 50% which recorded 33.22 and 36.54 whiteflies per plant respectively. The highest population (57.09) were observed in control followed by the plots treated with RDF @ 100-60-60 NPK kg/ha (52.24), vermicompost @ 3000 kg/ha (46.70), FYM @ 20000 kg/ha (44.77) and neemcake alone 100 kg/ acre (45.16), later three treatments were statistically on par with each other. The results obtained in the present investigations to study the influence of certain organic and inorganic sources of nutrients against whiteflies (Table 1) showed lower incidence of whiteflies in the plots treated with neemcake 50%+ RDF 50 %, vermicompost 50%+RDF 50% and farm yard manure 50%+ RDF 50 % where the population ranged between 24.21 to 36.54 as against the control plot 57.09 and RDF @ 100-60-60 NPK (52.24) kg/ha. Lower populations of whiteflies were observed in neemcake @ 250 kg/ha, vermicompost @ 3000 kg/ha and FYM @ 20000 kg/ha applied plots. However, the gradual decrease in whitefly population at different intervals may be attributed to the continuous increase in the population of natural enemies. The present results with regard to less incidence of whiteflies on organic manured plots are in conformity with the findings of Scriber and Slansky (1981) who reported that the Nitrogen content in the plants grown with organic manured plots like neemcake and vermicompost leads to increased phenols, tannins and lignins. This contributes to leaf toughness and production of more cell wall related structural compounds undesirable for herbivores. This type of induced resistance through intrinsic production of defense compounds which reduces pest attack has also been reposted by Rajasekhara Rao (2003). Godase and Patel (2003a) also reported less intensity of whiteflies (24.32 adults/ 9 leaves) in neemcake applied plots on brinjal crop. Effect of neemcake and vermicompost at varied dosages in reducing the sucking pests of chlli are on record (Verghese 2003, Varma and Supare 1997). Zadda Kavitharagavan *et al*. (2006) recorded more number of whiteflies on brinjal shoots collected from NPK treated plants than on organic treated plants due to increased feeding preference of whiteflies with increased levels of nitrogenous fertilization. A similar result of increased whitefly incidence with increased fertilization was reported by Prakash *et al.* (1979) on brinjal, Yein and Harcharan Singh (1982) on green gram and Rote and Puri (1992) on cotton.

Leaf Hoppers :

The overall influence of different treatments mentioned in table, revealed that the lowest population of 13.87 leafhoppers per plant was recorded in the plots applied with neemcake 50% + RDF 50% followed by FYM 50% + RDF 50% (15.30) and vermicompost 50% + RDF 50% (15.41) respectively. The highest population of 24.07 leafhoppers per plant was observed in the control plot followed by RDF @ 100-60-60 NPK kg/ha (20.91), FYM @ 20000 kg/ha (18.31), vermicompost @ 3000 kg/ha (17.04) and neemcake @ 250 kg/ha (16.55) respectively.

The results obtained during the present investigations to evaluate the influence of various treatments on the leafhoppers incidence showed that neemcake 50%+ RDF 50% was superior to the rest of the treatments in decreasing the leafhoppers incidence to 13.87 per cent as against 24.07 per cent of control; however, it was on par with vermicompost 50%+RDF 50% and FYM 50% + RDF 50% treatments. More or less similar trend was observed in all the counts recorded at different intervals. The present results with regard to the less incidence of leafhopper population on neemcake applied plot is in line with the findings of Krishnaiah and Kalode (1990) who reported that

Table 1. Influence of various treatments on the incidence of sucking pests *on* eggplant.

Treatments	Mean Whitefly and leaf hopper Population Per five leaves											
	40 DAT		55 DAT		70 DAT		85 DAT		100 DAT		Mean	
	WF	LH	WF	LH	WF	LH	WF	LH	WF	LH	WF	LH
T_1: Neem cake @ 250 kg/ha	62.92 (7.96)^{c}	10.12 (3.25)^{a}	61.20 (7.85)^{c}	23.30 (4.87)^{bc}	51.20 (7.19)^{e}	19.12 (4.42)^{cd}	30.24 (5.54)^{c}	18.21 (4.32)^{e}	20.26 (4.55)^{cd}	12.00 (3.53)^{d}	45.16 (6.62)^{de}	16.55 (4.08)^{cd}
T_2: Vermicompost @ 3000 kg/ha	65.12 (8.10)^{d}	13.42 (3.73)^{cd}	64.06 (8.03)^{d}	24.95 (5.04)^{de}	52.22 (7.26)^{e}	19.26 (4.44)^{de}	32.14 (5.71)^{d}	16.29 (4.09)^{cd}	19.98 (4.52)^{bc}	11.29 (3.43)^{cd}	46.70 (6.72)^{e}	17.04 (4.15)^{de}
T_3: Farm Yard Manure @ 20000 kg/ha	63.20 (7.98)^{c}	15.00 (3.93)^{de}	62.24 (7.92)^{c}	25.25 (5.07)^{e}	48.00 (6.96)^{d}	20.21 (4.55)^{e}	29.26 (5.45)^{c}	17.20 (4.20)^{de}	21.15 (4.65)^{d}	13.89 (3.79)^{e}	44.77 (6.59)^{d}	18.31 (4.31)^{e}
T_4: (RDF) NPK @ 100-60-60 kg/ha	70.46 (8.42)^{e}	20.15 (4.54)^{e}	69.24 (8.35)^{e}	27.16 (5.25)^{f}	58.16 (7.65)^{f}	22.00 (4.74)^{f}	40.21 (6.38)^{f}	20.24 (4.55)^{f}	23.15 (4.86)^{e}	15.00 (3.93)^{e}	52.24 (7.13)^{f}	20.91 (4.60)^{f}
T_5: Neem cake 50% + RDF 50%	32.82 (5.77)^{a}	9.00 (3.07)^{a}	31.00 (5.61)^{a}	20.12 (4.54)^{a}	22.24 (4.76)^{a}	17.29 (4.21)^{ab}	20.64 (4.59)^{a}	13.13 (3.69)^{a}	14.36 (3.85)^{a}	9.83 (3.21)^{b}	24.21 (4.92)^{a}	13.87 (3.74)^{a}
T_6: Vermicompost 50%+RDF 50%	46.24 (6.84)^{b}	11.79 (3.50)^{b}	44.20 (6.70)^{b}	22.46 (4.79)^{b}	35.28 (5.98) ^{b}	18.22 (4.32)^{bc}	25.14 (5.06)^{b}	14.20 (3.83)^{ab}	15.24 (3.96)^{a}	10.40 (3.30)^{bc}	33.22 (5.71)^{b}	15.41 (3.95)^{bc}
T_7: Farm Yard Manure 50%+ RDF 50%	47.12 (6.90)^{b}	12.14 (3.55)^{bc}	45.20 (6.76)^{b}	24.16 (4.96)^{cd}	37.15 (6.13) ^{c}	17.00 (4.18)^{a}	34.07 (5.88)^{c}	15.00 (3.93)^{bc}	19.20 (4.43)^{b}	8.24 (2.95)^{a}	36.54 (6.02)^{c}	15.30 (3.91)^{ab}
T_8:Control (Untreated)	76.42 (8.77)^{f}	22.93 (4.84)^{f}	74.20 (8.64)^{f}	30.42 (5.56)^{g}	63.46 (7.99) ^{g}	26.00 (5.14)^{g}	44.06 (6.67)^{g}	23.58 (4.90)^{g}	27.34 (5.27)^{f}	17.46 (4.23)^{f}	57.09 (7.47)^{g}	24.07 (4.93)^{g}
F-test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
CD(P=0.05)	0.10	0.20	0.10	0.16	0.14	0.18	0.10	0.21	0.22	0.22	0.13	0.19

Sig: Significant, WF: whitefly, LH: leaf hopper
RDF – Recommended dose of fertilizer,
DAT-Days after transplanting
Means followed by the same letter are not significantly different (P=0.05) DMRT.

Table 2. Influence of various treatments on the population of natural enemies on eggplant.

Treatments	Mean spider and coccinellid Population Per five leaves											
	40 DAT		55 DAT		70 DAT		85 DAT		100 DAT		Mean	
	S	C	S	C	S	C	S	C	S	C	S	C
T_1: Neem cake @ 250 kg/ha	4.20 (2.16)^{bc}	2.00 (1.58)^{bc}	4.00 (2.12)^{b}	3.00 (1.87)^{bc}	4.20 (2.16)^{a}	5.80 (2.51)^{de}	4.00 (2.11)^{bc}	5.20 (2.38)^{d}	3.40 (1.97)^{ab}	4.86 (2.31)^{d}	3.96 (2.10)^{ab}	4.17 (2.13)^{d}
T_2: Vermicompost @ 3000 kg/ha	4.60 (2.25)^{cd}	2.60 (1.75)^{ef}	3.00 (1.85)^{a}	3.64 (2.03)^{de}	4.60 (2.25)^{ab}	5.42 (2.43)^{cd}	3.80 (2.07)^{ab}	5.00 (2.34)^{cd}	3.60 (2.02)^{bc}	4.00 (2.12)^{c}	3.92 (2.08)^{a}	4.13 (2.13)^{cd}
T_3: Farm Yard Manure @ 20000 kg/ha	5.00 (2.33)^{de}	2.40 (1.59)^{cd}	3.80 (2.07)^{b}	4.24 (2.17)^{ef}	5.02 (2.34)^{cd}	5.00 (2.34)^{c}	3.20 (1.92)^{a}	4.80 (2.30)^{c}	3.00 (1.86)^{a}	3.40 (1.97)^{b}	4.00 (2.10)^{bc}	3.97 (2.09)^{c}
T_4: (RDF) NPK @ 100-60-60 kg/ha	3.00 (1.85)^{a}	1.80 (1.51)^{ab}	5.00 (2.34)^{c}	3.00 (1.86)^{ab}	6.00 (2.54)^{ef}	4.28 (2.18)^{b}	5.00 (2.34)^{de}	4.00 (2.12)^{b}	4.00 (2.11)^{cd}	3.00 (1.86)^{b}	4.60 (2.23)^{cd}	3.22 (1.91)^{b}
T_5: Neem cake 50% + RDF 50%	6.00 (2.54)^{g}	4.00 (2.12)^{g}	7.00 (2.73)^{f}	5.20 (2.38)^{g}	7.80 (2.88)^{g}	8.64 (3.02)^{g}	7.20 (2.77)^{g}	8.20 (2.94)^{f}	6.80 (2.70)^{g}	6.40 (2.62)^{f}	6.96 (2.72)^{g}	6.49 (2.62)^{g}
T_6: Vermicompost 50%+RDF 50%	5.80 (2.51)^{fg}	3.80 (1.87)^{f}	6.20 (2.58)^{ef}	4.86 (2.31)^{fg}	5.00 (2.33)^{bc}	7.80 (2.88)^{fg}	5.30 (2.40)^{ef}	7.00 (2.73)^{e}	4.00 (2.12)^{de}	5.20 (2.38)^{e}	5.26 (2.38)^{ef}	5.73 (2.44)^{f}
T_7: Farm Yard Manure 50%+ RDF 50%	5.20 (2.38)^{ef}	2.40 (1.69)^{de}	6.00 (2.54)^{de}	3.28 (1.93)^{cd}	5.20 (2.38)^{de}	7.40 (2.81)^{ef}	4.80 (2.30)^{cd}	6.60 (2.66)^{e}	4.60 (2.25)^{ef}	5.00 (2.34)^{de}	5.16 (2.37)^{de}	4.94 (2.29)^{e}
T_8:Control (Untreated)	4.00 (2.11)^{ab}	1.60 (1.44)^{a}	5.60 (2.47)^{cd}	2.80 (1.86)^{a}	6.00 (2.54)^{f}	3.00 (1.86)^{a}	5.80 (2.51)^{f}	2.45 (1.71)^{a}	5.00 (2.33)^{f}	2.00 (1.57)^{a}	5.28 (2.39)^{f}	2.37 (1.68)^{a}
F-test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
CD(P=0.05)	0.30	0.17	0.21	0.16	0.19	0.14	0.20	0.10	0.19	0.13	0.21	0.14

Sig: Significant, S: spider, C: coccinellid
RDF – Recommended dose of fertilizer,
DAT-Days after transplanting
Means followed by the same letter are not significantly different (P=0.05) DMRT.

application of neemcake @ 150 kg/ha resulted in less leaf folder incidence on rice. Saxena *et al.* (1984) reported that superior performance of neemcake treated plots against rice pests might be due to translocation of persistent antifeedant principles in neemcake from treated soil into the rice plants. Viswanathan and Kandiannan (1990) reported that the mixture of neemcake-urea at 1:5 ratio significantly reduced the population of Green leafhopper and Brown planthopper on rice. Fewer incidences of leafhoppers on FYM applied plots are in conformity with the findings of Surekha and Arjuna Rao (2000) who reported that population of leafhoppers on okra was significantly lower in FYM treatment compared to straight fertilizer treatments. The possible reason for the higher population buildup of leafhoppers on inorganic fertilizer applied plants is that the inorganic form increases the plant growth and provides the nutrients to the plant in large quantities for shorted period, there by the plants endowed with luxuriant growth offers adequate food to the insects leading to heavy insect population. This is in corroboration with the findings of Godase and Patel (2001) and Kavitharagavan *et al.* (2006) who reported the heavy incidence of leafhoppers on brinjal grown with higher levels of inorganic nitrogenous fertilization.

Spiders:

The overall influence of various treatments on the spider population mentioned in table 2, revealed that the higher spider populations were recorded in the plots applied with neemcake 50% + RDF 50% (6.96 spiders/plant) followed by control plot (5.28 spiders/plant), FYM 50% + RDF 50% (5.16 spiders/plant), vermicompost 50% + RDF 50% (5.26 spiders/plant), whereas less spider population was observed in the plots applied with vermicompost @ 3000 kg/ha (3.92 spiders/plant), neemcake @ 250 kg/ha (3.96 spiders/plants) and FYM @ 20000 kg/ha (4.00 spiders/plant).

Coccinellids:

Influence of various treatments on the population of coccinellids was recorded on 40,55,70,85 and 100 DAT are presented in table 2. At 40 DAT, the higher coccinellids population *viz*., 4.00 and 3.80 per plant were observed in the plots applied with neemcake 50% + RDF 50% and vermicompost 50% + RDF 50% and were on par with each other, whereas 1.60, 1.80 and 2.00 coccinellids per plant were recorded in control plot, RDF @ 100-60-60 NPK kg/ha and neemcake @ 250 kg/ha applied plots respectively. At 55 DAT the higher coccinellid population per plant *viz.,* 5.20 and 4.86 were recorded in neemcake 50% + RDF 50% and vermicompost 50% + RDF 50% applied plots and were on par with each other. Lower number of coccinellids per plant 2.80, 3.00, 3.00, 3.28, 3.64 and 4.24 were recorded in control plot, neemcake 100 kg/acre, RDF @ 100-60-60 NPK kg/ha, FYM 50% + RDF 50%, vermicompost @ 3000 kg/ha and FYM @ 20000 kg/ha applied plots respectively. At 70 DAT the higher coccinellids per plant *viz.,* 8.64, 7.80 and 7.40 were observed in the plots applied with neemcake 50% + RDF 50% ,vermicompost 50 %+ RDF 50 % and FYM 50%+ RDF 50 %. However, later two treatments were on par with each other. The lower number of coccinellids per plant were recorded in the control plot (3.00) followed by RDF @ 100-60-60 NPK kg/ha (4.28), FYM @ 20000 kg/ha (5.00), vermicompost @ 3000 kg/ha (5.42) and neemcake @ 250 kg/ha (5.80) respectively. Similar trend in the coccinellids population per plant were observed in various treatments at 85 and 100 days after transplanting. The overall influence of various treatments revealed that the higher number of coccinellids per plant were recorded in the plots applied with neemcake 50% + RDF 50% (6.49), vermicompost 50% + RDF 50% (5.73)and FYM 50%+RDF 50% (4.94) respectively. However, the lower number of coccinellids per plant were recorded in control plot (2.37) followed by RDF @ 100-60-60 NPK kg/ha (3.22), FYM @ 20000 kg/ha (3.97), vermicompost @ 3000 kg/ha (4.13) and neemcake @ 250 kg/ha (4.17) applied plots respectively. The results obtained in the present studies against the natural enemies indicated that the lowest populations of coccinellids were observed in plots treated with RDF @ 100-60-60 NPK kg/ha treatment. Highest population of both spiders and coccinellids were observed in neemcake 50%+RDF 50% treatment. The present findings regarding the presence higher number of natural enemies on neemcake 50% + RDF 50% applied plots is in conformity with the findings of Manju and David (2004) who reported that parasitism by *Telenomus dingus* and *Tetrastichus schoenobii* was more in neemcake treated plots than NPK

treated plots with no plant protection. The findings are also in conformity with the observations of Nagaraja *et al.* (2008).

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