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Short Communication

Effect of organic sources of nutrients on fruit damage by shoot and fruit borer on Brinjal (*Solanum melongena* L.)

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An investigation was carried out to know the effect of organics sources of nutrients on fruit damaged by shoot and fruit borer on brinjal (*Solanum melongena* L.). The results revealed that plots applied with Vermicompost (VC) + biofertilizer (Silica solubalising bacteria, *Azatobactor* and Vasicular Arbuscular Mycoriza) + neemcake (T_6) and farm yard manure (FYM) + biofertilizer + neemcake (T_5) were found to be effective and recorded minimum percent fruit damage (5.93 and 6.12%), with the corresponding percent reduction of 66.68 and 65.61 over NPK (T_{11}). The next effective treatments were Vermicompost + biofertilizer + insecticide (T_8) and FYM + biofertilizer + insecticide (T_7), with percent reduction of 64.49 and 63.20 over NPK (T_{11}), respectively. The minimum percent reduction was recorded in the treatments VC + biofertilizer + NPK (18.93%) and FYM + biofertilizer + NPK (17.75%) as against inorganic NPK.

Key words: Organic sources, fruit damage, brinjal, *Solanum melongena* L., biofertilizer.

INTRODUCTION

The shoot and fruit borer (*Leucinodes orbonalis* Guen.) is the most serious pest of brinjal (*Solanum melongena* L.) in India. As much as 70% of the fruit has been reported to be affected by larvae of this pest (krishnaiah et al., 1978). The pest is very active during the rainy and summer season and often causes more than 90% damage (Ali et al., 1980). Chemical control is the widely used means of managing this pest. However, the effectiveness of insecticides has been largely handicapped due to internal feeding behavior of the borer. Repeated use of broad spectrum synthetic chemicals also results in environmental contamination, bioaccumulation and biomagnification of toxic residues and disturbance in ecological balance (Dadmal et al., 2004). Hence, there is an urgent need to look for an alternative and safe method. Organic farming is one such method. In view of this, an experiment was carried out to know the effect of organic sources of nutrients on fruit damaged by shoot and fruit borer on brinjal (*Solanum melongena* L.).

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MATERIALS AND METHODS

Field trials were conducted at University of Agricultural Sciences, Bangalore, Karnataka during Kharif 2006 to 2007, using a brinjal variety Arka Shirish at 60 × 60 cm spacing. The experiment was laid out in a Randomised complete block design with 12 treatments, and replicated thrice by adopting an individual plot size of 15 m^2. The treartments were as follows; T_1: Farmyard manure (FYM) (20 t/ha); T_2: Vermicompost (VC) (5 t/ha); T_3: Farmyard manure (20 t/ha) + biofertilizer (silica solubalising bacteria, *Azatobactor* and vasicular arbuscular mycoriza (each 2 kg/ha); T_4: Vermicompost (5 t/ha) + farmyard manure (20 t/ha) + biofertilizer (silica solubalising bacteria, *Azatobactor* and vasicular arbuscular mycoriza (each 2 kg/ha); T_5: Farmyard manure (20 t/ha) + biofertilizer (silica solubalising bacteria, *Azatobactor* and vasicular arbuscular mycoriza (each 2 kg/ha) + Neemcake (NC) (1000 kg/ha); T_6: vermicompost (5 t/ha) + biofertilizer (silica solubalising bacteria, *Azatobactor* and vasicular arbuscular mycoriza (each 2 kg/ha) + Neemcake (1000 kg/ha); T_7: Farmyard manure (20 t/ha) + biofertilizer (silica solubalising bacteria, *Azatobactor* and vasicular

Table 1. Effect of organic sources of nutrients on fruit damage by shoot and fruit borer on brinjal.

Treatment	Mean % fruit damage- Days after transplanting (DAT)											
	65		80		95		110		125		Mean	
	Fruit damage* (%)	Reduction over NPK (%)	Fruit damage* (%)	Reduction over NPK (%)	Fruit damage* (%)	Reduction over NPK (%)	Fruit damage* (%)	Reduction over NPK (%)	Fruit damage* (%)	Reduction over NPK (%)	Fruit damage (%)	Reduction over NPK (%)
T_1: FYM	9.09(17.54)^{d}	39.84	14.66(22.42)^{bc}	37.61	11.93(20.16)^{b}	44.27	10.41(18.80)^{c}	35.71	8.70(17.11)^{d}	32.03	10.95(19.20)^{de}	38.48
T_2: VC	8.88(17.34)^{cd}	41.23	14.41(22.21)^{bc}	38.68	11.81(20.08)^{b}	44.83	10.25(18.68)^{c}	36.72	8.51(16.94)^{cd}	33.51	10.77(19.05)^{de}	39.50
T_3: FYM + BF	7.45(15.84)^{bc}	50.69	11.61(19.83)^{b}	50.59	10.85(19.23)^{b}	49.32	8.62(17.04)^{b}	46.79	8.31(16.03)^{bc}	35.07	9.36(17.59)^{cd}	47.37
T_4: VC + BF	7.11(15.43)^{b}	52.94	11.15(19.44)^{b}	52.55	10.41(18.80)^{b}	51.37	8.10(16.52)^{b}	50.00	7.25(15.59)^{bc}	43.35	8.80(17.15)^{bcd}	50.53
T_5: FYM + BF + NC	4.72(12.51)^{a}	68.76	5.26(13.16)^{a}	77.61	8.29(18.73)^{a}	61.27	6.44(14.72)^{a}	60.24	5.89(13.92)^{a}	53.98	6.12(14.20)^{ab}	**65.61**
T_6: VC + BF +NC	4.61(12.37)^{a}	69.49	4.93(12.77)^{a}	79.02	8.11(16.52)^{a}	62.12	6.21(14.41)^{a}	61.66	5.83(13.76)^{a}	54.45	5.93(13.96)^{a}	**66.68**
T_7: FYM + BF + INS	3.90(11.38)^{a}	74.18	5.92(13.95)^{a}	74.80	8.76(17.21)^{a}	59.08	7.51(15.92)^{ab}	53.64	6.70(14.95)^{ab}	47.65	6.55(14.68)^{abc}	**63.20**
T_8: VC + BF + INS	3.82(11.23)^{a}	74.71	5.51(13.50)^{a}	76.55	8.44(16.90)^{a}	60.57	7.35(15.70)^{ab}	54.62	6.51(14.76)^{ab}	49.14	6.32(14.41)^{ab}	**64.49**
T_9: FYM + BF + NPK	12.17(20.37)^{e}	19.45	18.46(25.35)^{cd}	21.44	17.18(24.46)^{c}	19.80	13.26(21.32)^{d}	18.20	12.16(20.40)^{f}	5.07	14.64(22.38)^{fg}	17.75
T_{10}: VC + BF + NPK	12.03(20.28)^{e}	20.38	18.10(25.08)^{cd}	22.97	17.10(24.39)^{c}	20.13	13.11(21.23)^{d}	19.07	11.84(20.08)^{f}	7.57	14.43(22.21)^{fg}	18.93
T_{11}: NPK alone	15.11(22.87)^{f}		23.50(28.89)^{d}	-	21.41(27.56)^{d}	-	16.20(23.72)^{e}	-	12.80(20.92)^{f}	-	17.80(24.79)^{g}	-
T_{12}: Untreated control	11.15(19.48)^{e}	26.20	17.64(24.80)^{c}	24.93	16.07(23.58)^{c}	24.94	11.88(20.09)^{c}	26.66	10.88(19.19)^{e}	15.00	13.52(21.51)^{ef}	24.02

*Mean of three replications; five plants/ replicate; figures within parentheses are square root (x + 0.5) transformed values; In a column, means followed by same letter(s) are not significantly different at p = 0.05 as per DMRT; FYM, farmyard manure (20 t/ha); VC, Vermicompost (5 t/ha); BF, biofertilizer (silica solubalising bacteria *Azatobactor* ; VAM, Vasicular arbuscular mycoriza (each 2 kg/ha)); NC, Neemcake (1000 kg/ha); INS, insecticide (endosulfan 0.07%). NPK-125:100:50 kg/ha.

arbuscular mycoriza (each 2 kg/ha) + insecticide (endosulfan 0.07%); T_8: Vermicompost (5 t/ha) + biofertilizer (silica solubalising bacteria, *Azatobactor* and vasicular arbuscular mycoriza (each 2 kg/ha) + insecticide (endosulfan 0.07%); T_9: Farmyard manure (20 t/ha) + biofertilizer (silica solubalising bacteria, *Azatobactor* and vasicular arbuscular mycoriza (each 2 kg/ha) + Nitrogen 125 kg/ha: Phosphorus 100 kg/ha: Pottassium 50 kg/ha; T_{10} : Vermicompost (5 t/ha) + biofertilizer (silica solubalising bacteria, *Azatobactor* and vasicular arbuscular mycoriza (each 2 kg/ha) + Nitrogen 125 kg/ha: Phosphorus 100 kg/ha: Pottassium 50 kg/ha; T_{11}: Nitrogen 125 kg/ha: Phosphorus 100 kg/ha: Potassium 50 kg/ha (NPK alone); T_{12}: Untreated control.

Thirty days old seedlings were transplanted and the pest population was assessed from 65 days after transplanting (DAT) to 125 DAT, at 15 days intervals. The percent fruit damage was worked out by counting the total number of healthy fruits and the damaged ones for five plants in each replicate and maintained three replication. Insectide, endosulfan (0.07%), was sprayed at 30 and 60 DAT. The treatment means were compared by Duncan's multiple range test (DMRT) for their significance (Gomez and Gomez, 1985). All the agronomic practices as per the recommended package of practices were adopted uniformly for all the treatments.

RESULTS AND DISCUSSION

The fruit damage due to shoot and fruit borer was at minimum on 65 days after transplanting, as compared to other periods of observations. On 65 days after transplanting, the damage ranged from 3.82 and 3.90 in insecticide treated plots as compared to 15.11 and 11.15 in NPK (T_{11}) and untreated control (T_{12}), respectively. This was closely followed by application of T_6 treatments (4.61%) (that is, vermicompost + biofertilizer (silica solubalising bacteria, *Azatobactor* and vasicular arbuscular mycoriza + neemcake] and T_5 (4.72) [that is, farmyard mannure + biofertilizer (silica solubalising bacteria, *Azatobactor* and vasicular arbuscular mycoriza + neemcake] with percent reduction of 69.49 and 68.76 over T_{11} as an inorganic form (Table 1).

At 80 days after transplanting (DAT), treatments T_6 and T_5 were found to be effective in reducing the damage, and recorded 4.93 and 5.26% damage as against 23.50 and 17.64 in inorganic NPK (T_{11}) and untreated control (T_{12}). Further, the low percent reduction of 21.44 over NPK was recorded in plots treated with FYM in combination with biofertilizer and NPK. On 95 DAT, VC + biofertilizer + neemcake and FYM + biofertilizer + neemcake were found to be promising in reducing the fruit damage and recorded 8.11 to 8.29% against 21.41 inorganic NPK. Further, the above treatments were proved consistently effective in reducing fruit damage on 110 DAT. The damage in these treatments ranged from 5.83 and 5.89% against the maximum of 12.80% in NPK as inorganic form. The organic and inorganic combined treatments VC + biofertilizer + NPK and FYM + biofertilizer + NPK recorded less percent (7.57 and 5.07) reduction of damage over NPK on 125 DAT.

The overall mean data revealed that the organic treatments consisting of VC + biofertilizer + neemcake and FYM + biofertilizer + neemcake were found to be effective in reducing the damage by fruit borer with the corresponding percent reduction of 66.68 and 65.61 over NPK. The next effective set of treatments in descending order were VC + biofertilizer + insecticide and FYM + biofertilizer + insecticide with percent reduction of 64.49 and 63.20 over NPK, respectively. The minimum percent reduction over NPK was recorded in the treatments VC + biofertilizer + NPK (18.93%) and FYM + biofertilizer + NPK (17.75%).

In the present investigation, the fruit damage was less in the organic treatments VC + biofertilizer + neemcake and FYM + biofertilizer + neemcake. These findings are in agreement with results of Surekha and Arjuna Rao (2000) who reported that the fruit borer infestation in okra was less in vermicompost treated plots followed FYM against NPK. It is also in conformity with Varma (1994) who reported minimum fruit borer population on chilli from the plots that received vermicompost than from those that received straight fertilizers. Efficacy of neem cake and biofertilizers, along with VC and FYM, in reducing the BSFB, is in accordance with the findings of Godase and Patel (2003) who reported less shoot and fruit borer infestation in neem cake treated plots as against NPK as inorganic form. The treatment combined with organic and inorganic showed very low percent reduction of shoot and fruit infestation compared to organic treatments. This is in line with the findings of Mehto and Lall (1981) who reported that the application of nitrogen at higher doses induced the succulence of fruits and shoots of brinjal, and subsequently made them susceptible to pest injury.

The damages caused by brinjal shoot and fruit borer (BSFB) reduce a great amount of yield and incur huge economical losses. The most economical and eco friendly means of management is the use of different sources of organic nutrients: Neemcake, vermicompost, farmyard manure, biofertilizers, along with selected insecticides which helps to manage the insect in huge amount. The indiscriminate use of toxic, broad-spectrum insecticides is not giving satisfactory control of BSFB. At the same time, these pesticides are killing the natural enemies of brinjal shoot and fruit borer. These natural enemies were giving satisfactory control of the pest before the use of insecticides became widespread. Broad-spectrum chemicals sprayed to kill BSFB will also kill these beneficial insects.

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