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Influence of organic amendments against brinjal shoot and fruit borer *Leucinodes qrbonalis* (Guenn.)

Zadda Kavitharaghavan, R. Rajendran and C. Vijayaraghavan*
Agricultural College and Research Institute, T.N.A.U., MADURAI (T. N.) INDIA

ABSTRACT
Among the various organic sources of nutrients tested, soil application of FYM (12.5 t/ha) + biofertilizers (2 kg/ha) followed by neem cake(1000 kg/ha) in three splits as one basal and two top dressings at 20 days interval was found consistently effective in reducing the incidence of shoot and fruit borer under field conditions. The shoot and fruit borer damage was consistently less in the plots treated with poultry manure + biofertilizers + neem cake. The next in descending order of effectiveness were FYM + biofertilizers + neem cake and FYM + biofertilizers + mahua cake. Poultry manure + biofertilizers + neem cake with the field release of biocontrol agents and FYM + biofertilizers + neem cake + field release of biocontrol agents significantly reduced the shoot and fruit borer damage throughout the period of experimentation. Next to this was poultry manure + biofertilizers + neem cake along with neem oil sprays.

Key words: Brinjal pests, Oil cakes, Organic manures

INTRODUCTION

Considering the seriousness of wide spread use of chemicals in vegetable pest management and subsequently considerable insecticide residues in the consumable products, inducing the resistance through organic means have become more viable. Induced resistance is the qualitative and quantitative enhancement of plant defence mechanisms and is the non heritable resistance where host plants are induced to impart resistance to tide over pest infestation. The inorganic fertilizers increase the plant growth and provide the nutrients to the plants in large quantities for shorter period there by the plants area endowed with luxuriant growth which offers adequate food to the insects leading to heavy insect population. The organic manures act like slow release fertilizers providing balanced nutrition to plants and facilitate balanced growth, finally making them less prone to pest incidence. Hence the investigation on the study of induced resistance through organic farming and its impact on brinjal pest were undertaken.

MATERIALS AND METHODS

A field experiment was conducted to evaluate the various organic sources of nutrients on the management of shoot and fruit borer of brinjal. Karatoor local was used as the test variety. Farm Yard Manure (FYM) @ 12.5 t/ha and poultry manure @3 t/ha were applied basally at the time of main field preparation. The biofertilizers *viz*. *Azospirillum*, phosphobacteria and silica solubilizing bacteria @ 2 kg/ ha were incorporated in the soil in the respective treatments. Half of the dose of the total requirements of other organic amendments *viz.,* neem cake, mahua cake and pungam cake (1000 kg/ ha) were applied as basal and the remaining of the dose was applied as top dressing in two equal splits at 20 days interval. Inorganic fertilizers were applied in the form of urea, single super phosphate and muriate of potash (100: 50: 30). Fifty per cent of total N and entire P and K were applied as basal and the rest of 50 per cent N was applied in two equal splits as top dressing at 20 days interval. Based on the results obtained from the field experiment I, the effective three promising treatments *viz.,* FYM + biofertilizers + neem cake, FYM + biofertilizers + mahua cake and poultry manure + biofertilizers + neem cake were choosen and integrated with botanicals (neem and mahua oils @ 3 %) and potential biocontrol agents *Trichogramma chilonis* (2.5 cc/ ha) and evaluated for their efficacy for shoot and fruit borer of brinjal in field experiment II. The egg parasitoid, *Trichogramma chilonis* has been released in the respective treatments at 30 DAT and at 60 DAT. The neem oil and mahua oil were sprayed in the respective treatments at 30, 45 and 70 DAT.

RESULTS AND DISCUSSION

Effect of organic sources of nutrients on brinjal pests (field experiment 1)

Shoot and fruit borer, Leucinodes orbonalis (Guenn.)

Poultry manure and FYM each in combination with biofertilizers and neem cake significantly reduced the shoot damage by 66.37 and 64.61 per cent over NPK as inorganic form (Table. 1). The above treatments were also effective in reducing the fruit damage by shoot and fruit bore with corresponding per cent reduction of 65.65 and 64.69 over NPK (Table. 2). In the present investigation the shoot and fruit bore infestation was less in poultry manure, FYM and neem cake applied treatments. This may be attributed to the high content of potassium in poultry manure and rational release of nitrogen on FYM treated plots and this is in line with the earlier findings of Venkatesan (2002). This was further in combination with the findings of Panda and Das (1975), who revealed that the lower larval population of shoot and fruit borer of brinjal in plots treated with higher potash doses, was due to the hardening of the plant that provided the mechanical resistance to the boring larvae. Mehto and Lall (1981) revealed that the application pf potash to brinjal plants promoted the early maturity and hardening of plant tissues which enabled the plant to resist the injuries of borer and the present investigation is in consonance with it. The efficacy of the neem cake in reducing the shoot and fruit borer infestation was proved in the present study, which is in agreement with findings of Godase and Patel (2003) and Krishnamoorhty et al (2001). This can be attributed to the presence of triterpenoids in neem cake which exhibited high antifeedant property.

The high fruit yield of 16.54 t/ha was recorded in the treatment with FYM + biofertilizers + neem cake which resulted in an increase of 8.70% in yield over NPK as inorganic form. Next to this was, FYM + biofertilizers + mahua cake (16.24 t/ha) with 7.01% increase of yield over NPK (Fig.1).

Integration and evaluation of the effect of organic sources of nutrients, botanicals and biocontrol agents on the incidence of brinjal pests. (Field experiment II)

Shoot and fruit borer:

FYM + poultry manure each when integrated with biofertilizers, neem cake, *Trichogramma chilonis* were found to be equally effective in reducing the shoot damage by 69.83 to 69.84% over NPK (Table. 3). The same treatment significantly reduced the fruit damage by 76.03 and 73.06% over NPK respectively (Table. 4). This is in corroboration with the findings of Bustamante et al (1994) who reported the lower incidence of brinjal shoot and fruit borer in Trichogramma chilonis released plots. Next to these treatments, FYM

***Author for correspondence**

Table 1: Effect of organic sources of nutrients on shoot damage by shoot and fruit borer in brinjal field experiment - I

Sl. No.	Treatments	Days after transplanting							
		30		45		60		Mean	
		% Shoot damage*	% reduction over NPK	% Shoot damage*	% reduction over NPK	% Shoot damage*	% reduction over NPK	% Shoot damage	% reduction over NPK
1	FYM + BF	7.44 (15.83)^{d}	23.53	10.03 (18.46)^{e}	22.60	11.44 (19.77)^{d}	28.32	9.64 (18.08)^{f}	24.81
2	FYM + BF + NPK	9.23 (17.69)^{fg}	5.13	12.56 (20.76)^{g}	3.08	15.12 (22.88)^{fg}	5.26	12.30 (20.53)^{i}	4.49
3	FYM + BF + NC	4.08 (11.65)^{a}	58.06	3.96 (11.48)^{a}	69.44	5.37 (13.40)^{a}	66.35	4.47 (12.21)^{a}	64.61
4	FYM + BF + MC	4.72 (12.55)^{b}	51.49	5.69 (13.80)^{bc}	56.09	6.49 (14.76)^{b}	59.33	5.63 (13.73)^{b}	56.63
5	FYM + BF + PC	6.83 (15.15)^{cd}	29.80	9.32 (17.77)^{de}	28.08	10.24 (18.66)^{cd}	35.83	8.79 (17.25)^{ef}	31.23
6	PM + BF	5.83 (13.97)^{c}	40.08	8.40 (16.85)^{de}	35.18	8.41 (16.86)^{c}	47.30	7.54 (15.94)^{d}	40.85
7	PM + BF + NPK	8.11 (16.55)^{e}	16.64	10.88 (19.26)^{f}	16.04	12.53 (20.73)^{e}	21.49	10.50 (18.91)^{g}	18.05
8	PM + BF + NC	3.59 (10.92)^{a}	63.10	4.67 (12.48)^{ab}	63.96	4.46 (12.19)^{a}	72.05	4.24 (11.88)^{a}	66.37
9	PM + BF + MC	5.23 (13.22)^{b}	46.24	6.72 (15.02)^{c}	48.14	7.40 (15.78)^{b}	53.63	6.45 (14.71)^{c}	49.33
10	PM + BF + PC	6.33 (14.57)^{cd}	34.94	7.69 (16.10)^{d}	40.66	9.33 (17.78)^{cd}	41.54	7.78 (16.20)^{de}	39.04
11	NPK alone	9.73 (18.18)^{g}	-	12.96 (21.10)^{h}	-	15.96 (23.55)^{g}	-	12.88 (21.03)^{i}	-
12	Untreated control	8.62 (17.07)^{ef}	11.40	11.59 (19.90)^{fg}	10.57	13.45 (21.51)^{ef}	15.72	11.22 (19.57)^{h}	38.73

* Mean of three replications Values in parenthesis are arc sine transformations

In a column mean followed by same letter(s) are not significantly different at P = 0.05 as per DMRT

Fig. 1 :

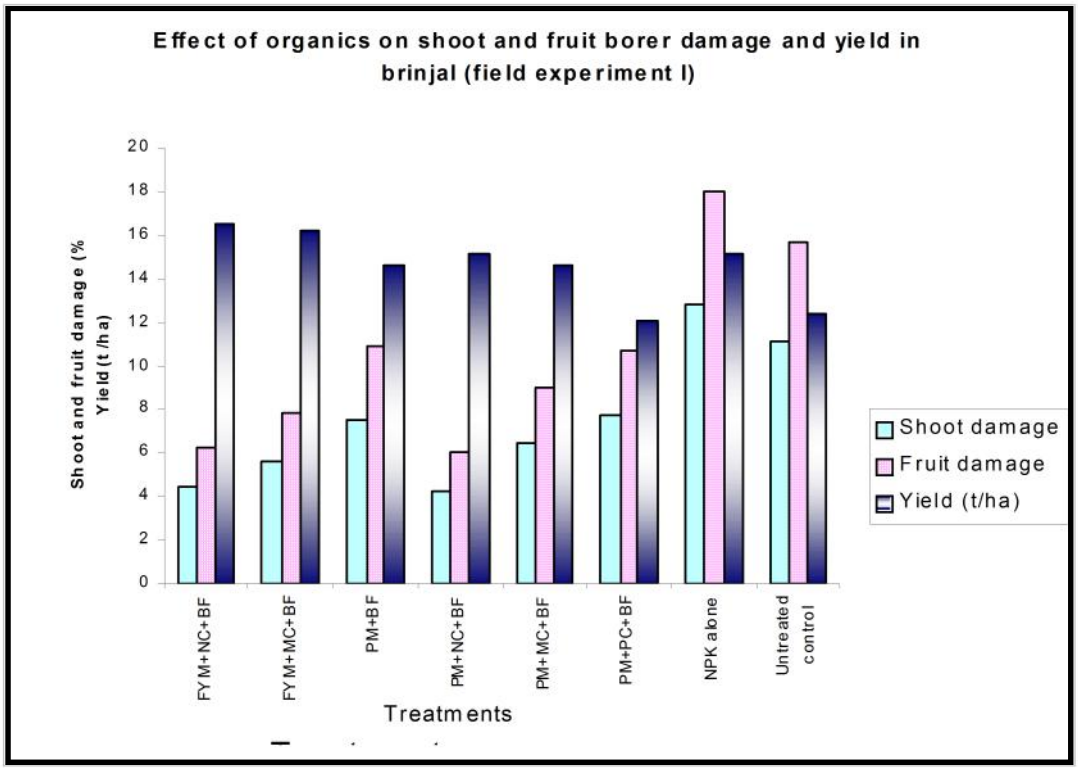

Table 2 : Effect of organic sources of nutrients on fruit damage by shoot and fruit borer in brinjal field experiment - I

Sl. No.	Treatments	Days after transplanting											
		60		75		90		105		120		Mean	
		% Fruit damage *	% reduction over NPK	% Fruit damage *	% reduction over NPK	% Fruit damage *	% reduction over NPK	% Fruit damage *	% reduction over NPK	% Fruit damage *	% reduction or increase** over NPK	% Fruit damage	% reduction over NPK
1	FYM + BF	11.36 (19.70)^{e}	25.89	17.25 (24.54)^{e}	27.67	16.06 (23.62)^{e}	25.85	12.18 (20.43)^{e}	24.48	10.11 (18.54)^{de}	22.17	13.39 (21.46)^{e}	25.21
2	FYM + BF + NPK	14.54 (22.41)^{g}	5.15	22.45 (28.28)^{g}	5.87	20.39 (26.84)^{g}	5.86	15.34 (23.06)^{g}	4.89	13.56 (21.61)^{gh}	4.20**	17.25 (24.54)^{g}	3.51
3	FYM + BF + NC	4.73 (12.56)^{a}	69.14	8.38 (16.83)^{a}	64.86	5.96 (14.13)^{a}	72.48	6.28 (14.51)^{a}	61.10	5.73 (13.85)^{b}	55.88	6.22 (14.44)^{a}	64.69
4	FYM + BF + MC	6.78 (15.09)^{b}	55.77	9.88 (18.32)^{b}	58.57	8.79 (17.25)^{b}	59.41	7.29 (15.66)^{b}	54.80	6.69 (14.99)^{c}	48.49	7.89 (16.31)^{b}	55.40
5	FYM + BF + PC	10.51 (18.92)^{de}	31.44	15.69 (23.33)^{de}	34.21	14.78 (22.61)^{de}	31.76	11.03 (19.40)^{de}	31.61	10.80 (19.19)^{e}	16.85	12.56 (20.76)^{e}	29.17
6	PM + BF	9.62 (18.07)^{de}	37.24	12.99 (21.13)^{c}	45.53	13.14 (21.25)^{de}	39.33	9.28 (17.74)^{c}	42.46	9.38 (17.83)^{de}	27.79	10.88 (19.26)^{d}	38.47
7	PM + BF + NPK	12.53 (20.73)^{f}	18.26	18.92 (25.78)^{f}	20.67	17.64 (24.83)^{f}	18.55	13.30 (21.39)^{f}	17.54	12.24 (20.48)^{g}	5.77	14.92 (22.72)^{f}	16.15
8	PM + BF + NC	5.58 (13.66)^{ab}	63.60	6.98 (15.32)^{a}	70.73	7.25 (15.62)^{ab}	66.52	5.40 (13.44)^{a}	66.52	5.08 (13.03)^{a}	60.89	6.06 (14.25)^{a}	65.65
9	PM + BF + MC	7.69 (16.10)^{c}	49.83	11.28 (19.62)^{bc}	52.70	10.27 (18.69)^{c}	52.58	8.16 (16.60)^{bc}	49.41	7.73 (16.14)^{c}	40.49	9.03 (17.49)^{c}	49.00
10	PM + BF + PC	8.77 (17.23)^{d}	42.79	14.30 (22.22)^{cd}	40.04	11.86 (20.14)^{d}	45.24	10.15 (18.58)^{cd}	37.07	8.69 (17.14)^{cd}	33.10	10.75 (19.14)^{d}	39.64
11	NPK alone	15.33 (23.05)^{g}	-	23.85 (29.23)^{g}	-	21.66 (25.74)^{g}	-	16.13 (26.68)^{g}	-	12.99 (21.13)^{h}	-	17.99 (25.10)^{g}	-
12	Untreated control	13.38 (21.46)^{f}	12.72	20.75 (27.10)^{f}	12.99	18.93 (25.79)^{f}	12.60	14.36 (22.27)^{f}	10.97	11.55 (19.87)^{f}	11.08	15.79 (23.41)^{f}	12.07

* Mean of three replications ** Per cent increase over NPK

Values in parenthesis are arc sine transformations

In a column mean followed by same letter(s) are not significantly different at P = 0.05 as per DMRT

Fig. 2 :

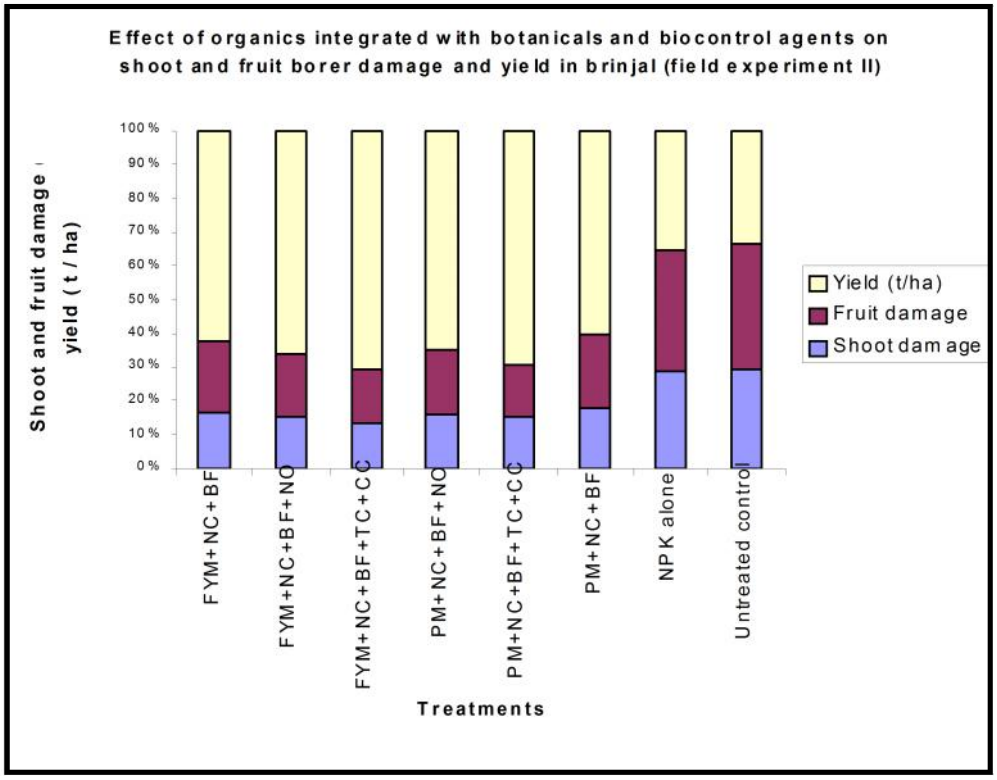

Table 3 : Effect of organic sources of nutrients integrated with botanicals and biocontrol agents on shoot damage by shoot and fruit borer in brinjal field experiment - II

No.	Treatments	Days after transplanting							
		35		50		65		Mean	
		% Shoot damage*	% reduction over NPK	% Shoot damage*	% reduction over NPK	% Shoot damage*	% reduction over NPK	% Shoot damage	% reduction over NPK
1	FYM + BF + MC	4.16 (11.77)^{e}	48.77	6.11 (14.31)^{g}	53.82	7.96 (16.39)^{e}	48.04	6.07 (14.26)^{f}	50.21
2	FYM + BF + MC + MO	3.72 (11.12)^{d}	54.19	5.57 (13.65)^{f}	57.90	7.89 (16.31)^{e}	48.50	5.72 (13.84)^{e}	53.53
3	FYM + BF + MC + TC + CC	4.13 (11.72)^{e}	49.14	4.86 (12.73)^{e}	63.26	6.53 (14.80)^{d}	57.37	5.17 (13.14)^{d}	56.59
4	FYM + BF + NC	3.46 (10.72)^{c}	57.39	4.25 (11.90)^{d}	67.87	5.67 (13.77)^{c}	62.99	4.46 (12.19)^{c}	62.75
5	FYM + BF + NC + NO	3.07 (10.09)^{b}	62.19	3.61 (10.95)^{c}	72.71	6.09 (14.29)^{cd}	60.25	4.25 (11.90)^{bc}	65.05
6	FYM + BF + NC + TC + CC	3.40 (10.62)^{c}	58.13	2.76 (9.56)^{a}	79.14	4.10 (11.68)^{a}	72.24	3.42 (10.66)^{a}	69.83
7	PM + BF + NC	3.12 (10.17)^{b}	61.57	4.78 (12.63)^{e}	63.87	6.04 (14.23)^{cd}	60.57	4.64 (12.44)^{c}	62.00
8	PM + BF + NC + NO	2.66 (9.38)^{a}	67.24	4.20 (11.82)^{d}	68.25	5.71 (13.82)^{c}	62.72	4.19 (11.81)^{b}	66.07
9	PM + BF + NC + TC + CC	2.96 (9.91)^{b}	63.54	3.11 (10.16)^{b}	76.49	4.67 (12.48)^{b}	69.51	3.58 (10.90)^{a}	69.84
10	NPK alone	8.12 (16.55)^{g}	-	13.23 (21.33)^{i}	-	15.32 (23.04)^{g}	-	12.22 (20.46)^{h}	-
11	Untreated control	7.06 (15.41)^{f}	13.05	11.88 (20.16)^{h}	10.20	13.14 (21.25)^{f}	14.23	10.69 (19.08)^{g}	12.49

* Mean of three replications Values in parenthesis are arc sine transformations

In a column mean followed by same letter(s) are not significantly different at P = 0.05 as per DMRT

Table 4 : Effect of organic sources of nutrients integrated with botanicals and biocontrol agents on fruit damage by shoot and fruit borer in brinjal field experiment - II

Sl. No.	Treatments	Days after transplanting											
		60		75		90		105		120		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
1	FYM + BF + MC	6.60 (14.88)^{d}	53 .55	9.26 (17.71)^{g}	56.36	7.28 (15.65)^{e}	57.62	7.19 (15.55)^{e}	52.10	5.36 (13.38)^{c}	47.81	7.14 (14.26)^{g}	53.49
2	FYM + BF + MC + MO	6.32 (14.56)^{d}	55.52	7.82 (16.24)^{e}	63.15	6.38 (14.63)^{d}	62.86	7.11 (15.46)^{e}	52.63	5.50 (13.56)^{c}	46.44	6.62 (13.84)^{f}	56.12
3	FYM + BF + MC + TC + CC	5.72 (13.84)^{c}	59.74	6.22 (14.44)^{c}	70.78	5.40 (13.44)^{c}	68.56	6.11 (14.31)^{e}	59.29	4.40 (12.11)^{b}	57.15	5.57 (13.14)^{de}	63.10
4	FYM + BF + NC	5.11 (13.06)^{b}	64 .04	8.46 (16.91)^{f}	60.13	5.41 (13.45)^{c}	68.51	5.28 (13.28)^{d}	64.82	4.35 (12.04)^{b}	57.64	5.72 (12.19)^{e}	63.03
5	FYM + BF + NC + NO	4.81 (12.67)^{b}	66.15	7.01 (15.35)^{d}	66.96	4.77 (12.61)^{b}	72.23	5.08 (13.02)^{cd}	66.15	4.41 (12.12)^{b}	57.06	5.21 (11.90)^{cd}	65.71
6	FYM + BF + NC + TC + CC	4.16 (11.77)^{a}	70.72	5.46 (13.51)^{b}	74.27	3.86 (11.33)^{a}	77.53	3.82 (11.27)^{b}	74.55	3.26 (10.40)^{a}	68.25	4.11 (10.66)^{b}	73.06
7	PM + BF + NC	5.66 (13.76)^{c}	60.17	6.65 (14.94)^{d}	68.66	6.16 (14.37)^{d}	64.14	4.72 (12.55)^{cd}	68.55	4.20 (11.82)^{b}	59.10	5.48 (12.44)^{cde}	64.12
8	PM + BF + NC + NO	5.23 (13.22)^{b}	63.19	5.43 (13.47)^{b}	74.41	5.46 (13.51)^{c}	68.21	4.70 (12.52)^{c}	68.68	4.35 (12.04)^{b}	57.64	5.03 (11.81)^{c}	66.42
9	PM + BF + NC + TC + CC	4.02 (11.56)^{a}	71.71	3.79 (11.22)^{a}	82.14	4.02 (11.56)^{a}	76.60	3.18 (10.27)^{a}	78.81	2.99 (9.96)^{a}	70.88	3.60 (10.90)^{a}	76.03
10	NPK alone	14.21 (22.14)^{f}	-	21.22 (27.43)^{i}	-	17.18 (24.49)^{g}	-	15.01 (22.79)^{g}	-	10.27 (18.69)^{e}	-	15.58 (20.46)^{i}	-
11	Untreated control	12.33 (20.56)^{e}	13.23	18.66 (25.59)^{h}	12.06	15.00 (22.79)^{f}	12.69	13.26 (21.35)^{f}	11.66	9.28 (17.73)^{d}	9.64	13.70 (19.08)^{h}	11.85

* Mean of three replications Values in parenthesis are arc sine transformations

In a column mean followed by same letter(s) are not significantly different at P = 0.05 as per DMRT

and poultry manure each in integration with neem oil sprays, neem cake and biofertilizers were proved to be effective in reducing the shoot and fruit borer damage. The efficacy of neem oil in reducing the shoot and fruit borer incidence was confirmed in the present investigation and this is in consonance with the findings of Gahukar and Balpande (1997) and Srinivasan and Sundarababu (1998), who reported the effectiveness of neem base d formulations against brinjal shoot and fruit borer. Further Raja et al. (1998) revealed that the minimum infestation of shoot and fruit borer was observed with 3 % neem oil spray.

Integration of organic sources of nutrients with bio control agents and Botanicals significantly increased the fruit yield of brinjal. The high fruit yield recorded was with the combination of FYM + biofertilizers + neem cake along with the neem oil sprays (18.72 t/ha) followed by the FYM + biofertilizers + neem cake with the release of biocontrol agents (17.92 t/ha) with corresponding per cent increase in fruit yield of 18.38 and 14.73% respectively over NPK as inorganic form (Fig.2).

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