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Effect of organic amendments on termite population and yield of wheat in arid eco-system of Rajasthan

Ajay Kumar, Veer Singh, Hem Singh and Abhishek Yadav

Abstract
The research experiment was conducted at Research Farm of College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner (Rajasthan) during *rabi* 2013-14. Eight organic amendments *viz.,* Bone meal, cotton cake, mustard cake, groundnut cake, neem cake, FYM, Vermi-compost and poultry manure were tested against termites in wheat as soil application at the time of land preparation before sowing. All the organic amendment treatments were found significantly superior to control till 15 week after sowing.The application of neem cake as organic amendments resulted the lowest 2.75 per cent plant damage and found significantly superior in managing the termite infestation in wheat crop over all the evaluated organic amendments except bone meal (3.66%) and vermi-compost (3.97%). The plots treated with cotton cake (6.02%), were not equally effective as neem cake and found at par with poultry manure (6.10%).Out of these evaluated organic amendments, the highest (9.76%) damaged plants were observed in plots treated with FYM and it was at par with groundnut cake (9.74%) treated plots. the application of neem cake, bone meal and vermi-compost @ 1 tonne/ha were found highly effective against termite in wheat as organic amendments. The maximum (4210 kg ha^{-1}) grain yield was obtained from the plots treated with neem cake and it was at par with bone meal (3852 kg ha^{-1}) and vermi-compost (3728kg ha^{-1}).

Keywords: Bioefficacy, Newer Insecticides, *Helicoverpa armigera*, Chickpea

Introduction
Wheat [*Triticumaestivum* (Linnaeus) Em. Thell] belongs to family Gramineae, believed to have originated from South West Asia. It is most important cereal cultivated crop in temperate area of the world. Wheat is second important staple food crop after rice. Its value in human diet, both as a source of carbohydrates and protein and its baking qualities make it relatively more important crop than other cereal grains. Wheat flour is used in the form of *chapatti*, *puri*, *bread*, *cake*, *sweetmeats*, *halwa*, etc. It provides characteristic substance "Gluten" which is very essential for bakers.Wheat straw is also used in paper industries and for making temporary huts and roof. The bran, husk and other portion of grain and straw are valuable feed for livestock as well as good source of bedding material for livestock. The ripe unthreshingearheads are used to decorate items. It provides 20 per cent of total calories for human. Wheat grain contains 12.2 per cent protein, which is more than other cereals. Wheat is one of the leading cereal crop which have provided daily sustenance for a large proportion of the world's population for millennia.

There are many biotic constraints that hamper wheat production of which infestation of insect pests is major one. Wheat crop is attacked by 24 species of insect pests (Singh, 1998). Major insect pests of wheat are termite, *Odontotermesobesus* (Rambur), gujhia weevil, *Tanymecusindicus* (Faust), cutworm, *Agrotisipsylon* (Hufnagel), brown wheat mite, *Petrobia lateens* (Muller), armyworm, *Mythimnaseparata* (Walker), thrips, *Anapothripsflavicinctus* (Karny), aphids, *Macrosiphumgranarium* (Kirby), shoot fly, *Antherigonasoccata* (Rondani), stem borer, *Sesamiainferens* (Walker), surface grasshopper, *Atractomorphacrenulata* (Fabrikins), desert locust, *Schistocercagregaria* (Forkall), stink bug, *Aeliaeostrata* (Boheman), cereal leaf beetle, *Oulemamelanopa* (Linnaeus), hessian fly,*Mayetiola destructor* (Say), wheat stem maggot, *Meromyzeamericana* (Fitch), sawfly, *Cephuscinctus* (Nort), white grub, *Holotrichiaconsanguinea* (Blanch), wireworm, *Agroitesmancus* (Say), cricket, *Gryllodessigillatus*, (Linnaeus) and stalk borer, *Chiloauricilius* (Dudgeon). Over and above these insect pests damaging the wheat crop, the non insectpestsmollusca, slugs, *Derocerasreticulatum* (Muller) and snails, *Cepaeahortensis* (Muller) also damage the crop.Mehta and Verma (1968) calculated the loss due to termite up to 230 million rupees for all the agricultural crops. The work on different aspect in relation to termite in wheat is lacking in the arid ecosystem of Rajasthan. Hence, the present investigations were carried out.

Materials and Methods

The field experiment was conducted at Research farm, Collage of Agriculture, Swami Keshwanad Rajasthan Agricultural University, Bikaner (Rajasthan) during *rabi*season 2013-14.In order to study the effect of various organic amendments on incidence oftermites in wheat, a field trail was conducted in randomized block design with three replications. Wheat variety Raj-3077 was sown during 25th November 2013 in an area of 3.0 x 2.0 m in spacing of 20 cm between rows. The crop was raised successfully by adopting standard recommended agronomical practices. The organic amendments bone meal, cotton cake, groundnut cake, mustard cake, neem cake, poultry manure, vermi-compost @ 1 tonne/ha and FYM @ 10 tonne/ha were applied at the time of land preparation before sowing. Germination counts were recorded from 2 m length area of each plot after 10 days of sowing to know the effect of organic amendments on seed. The tillers were recorded from 10 randomly selected plants from each plot after 28 days of germination. The grain and straw yield of each treatment was recorded from each plot after harvesting and separating the grain. On the basis of seed yield harvested from various treatments under study, the per cent increase in yield over control was calculated by applying following formula:

Per cent increase in yield

$$\text{over control} = \frac{\text{Yield of treatment} - \text{Yield of control}}{\text{Yield of treatment}} \text{ X } 100$$

On the basis of yield of various treatments under study, the avoidable losses due to termite infestation in wheat were calculated by applying the formula of Poul (1976) which is mentioned as under:

$$Loss(\%)\, due\, to\, pest = \frac{\text{Yield in treatment which gave the highest yield} - \text{Yield in any other treatment}}{\text{Yield in treatment which gave the highest yield}} \times 100$$

Results and Discussion

Effect of organic amendments on termite incidence in wheat.

Termite damage

Eight different organic amendments were tested to find out their effects for the management of the termite in wheat as soil application at the time of land preparation before sowing. The data presented in Table 1 showed that all the organic amendment treatments were found significantly superior to control till 15 week after sowing. There was no pest incidence up to 4th week of crop age. After five week after sowing, the lowest (0.35%) termite damage was noted in plots treated with neem cake and it was at par with bone meal (0.36%) and vermi-compost (0.86%) These threeamendments were significantly superior to rest of the amendments. Vermi-compost (0.86%) and cotton cake (1.09%) and poultry manure (1.84%) were effective against termites in wheat and they were at par with neem cake (0.35%). Among the tested organic amendments, the higher (3.20%) damaged plants were observed in plots treated with groundnut cake and it was at par with mustard cake (2.02%) and FYM (2.16%).

The application of neem cake showed lower plant damage (0.49%) in wheat and it was statistically at par with bone meal (0.63%) and vermi-compost (0.90%) after 6thweek after sowing. Vermi-compost, cotton cake (1.27%) and poultry manure (1.94%) were significantly effective against termite in wheat. The highest per cent plant damage (3.50%) was observed in the treatment of groundnut cake and it was at par with mustard cake (2.15%) and FYM (2.61%).

After seven week after sowing, the lowest (0.75%) plant damage was noted in the plots treated withneem cake and it was at par with bone meal (1.10%) and vermi-compost (1.0%). The treatments of cotton cake, poultry manure, mustard cake, groundnut cake and FYM exhibited plant damage between 1.91 and 3.97 per cent. Among all the tested organic amendments, the highest (3.97%) plant damage was observed in plots treated with groundnut cake and it was at par with and FYM (3.40%).

The minimum (1.23%) damage was observed in the treatment of neem cake it was closely at par with bone meal (1.54%) and vermi-compost (1.41%) after eight week after sowing. Cotton cake (2.57%) and poultry manure (2.65%) applied plots were also found as effective as neem cake (1.23%) and vermi-compost (1.41%). Among the evaluated amendments, the highest (4.15%) damage was recorded in the plots received groundnut cake and it was at par with mustard cake (3.45%) and FYM (4.03%) treated plots.

After nine week after sowing, the lowest (1.46%) plant damage was noted in the treatment of neem cake and it was at par with bone meal (1.83%) and vermi-compost (1.68%). Cotton cake (3.06%) treated plots was found equally effective as neem cake and vermi-compost in controlling the termite in wheat (Table1). Poultry manure (3.15%), Mustard cake (4.10%), groundnut cake (4.95%) and FYM (4.79%) were found equally effective in checking the incidence of termite in wheat. Among the evaluated organic amendments, the highest (4.95%) plant damage was noticed in plots treated with groundnut cake and it was at par with FYM (4.79%) and mustard cake (4.10%).Plots treated with neem cake (1.82%) showed significantly superior in controlling the termite in wheat than all the evaluated organic amendments except bone meal and vermi-compost in which the plant damage was found as 2.53 and 2.82 per cent respectively after ten week after sowing. In cotton cake (4.8%), poultry manure (4.29%) mustard cake (4.96) was found equally effective against termite in wheat crop. The highest (6.39%) damaged plants was recorded in plots treated with groundnut cake and it was at par with FYM (6.04%).

More or less similar trend was noticed after eleven to thirteen week after sowing in which the less (2.99 to 5.16) per cent plant damage was noted in plots treated with neem cake and it was at par with bone meal (3.88-6.99%) and vermi-compost (4.12-7.69%).Among the evaluated organic amendments, the higher (8.73-17.83%) damaged plants exhibited in plots treated with FYM and it was at par with groundnut cake (9.27-17.81%). All the amendments treated plots were found superior over control.

Likewise after fourteen and fifteen week after sowing the similar trend of effectiveness was observed in suppression of termite in wheat crop. In which, the lowest per cent plant

(5.59 and 6.31%) damage was noted in the treatments ofneem cake and it was at par with bone meal (7.54 and 8.52%) and vermi-compost (8.26 and 9.32%). The treatment of cotton cake (12.61 and 14.25%) and poultry manure (12.08 and 13.65%) was found at par with each other. The treatments of mustard cake, groundnut cake and FYM were statistically equally effective against termite in wheat. Among the tested organic amendments, the highest (19.35 and 25.48%) damaged plants were observed in plots treated with FYM and it was at par with groundnut cake (19.22 and 21.72%) treated plots.

The pooled over data results presented in Table-1revealed that the application of neem cake as organic amendments resulted the lowest 2.75 per cent plant damage and found significantly superior in managing the termite infestation in wheat crop over all the evaluated organic amendments except bone meal (3.66%) and vermi-compost (3.97%). The plots treated with cotton cake (6.02%), were not equally effective as neem cake and found at par with poultry manure (6.10%).Out of these evaluated organic amendments, the highest (9.76%) damaged plants were observed in plots treated with FYM and it was at par with groundnut cake (9.74%) treated plots.

Termite population

Eight different organic amendments were tested to know their effects on termite management in wheat as soil application at the time of land preparation before sowing. All the treatments of organic amendments were found significantly superior to control till 14 week after sowing. Pooled over data presented in Table4.11showed that the significantly lowest (9.06 termite/stick) population were observed in plots treated with neem cake over all the tested amendments. Vermi-compost (13.51) and bone meal (13.56) were found at par to each other. Cotton cake and poultry manure registered 24.40 and 25.50 termites per stick, respectively and were found at par with each other. Out of these evaluated organic amendments, the highest30.70 termite/stick were observed in plots treated with FYM and it was at par with groundnut cake and mustard cake treated plots in which the termite population was found as 26.06 and 25.70 per stick, respectively.

From the above results, it can be exposed that the application of neem cake, bone meal and vermi-compost @ 1 tonne/ha were found highly effective against termite in wheat as organic amendments. The treatments of cotton cake and poultry manure and mustard cake were found mediocre in their effectiveness. On the other hand, the applications of FYM and groundnut cake were found least effective in suppressing the termite population.

Gadhiya (2012) reported the soil application of castor cake, vermi-compost and neem cake @ 1 tonne/ha at the time of land preparation before sowing were found to be more effective in suppressing the termite population in wheat.

Table 1: Effect of organic amendments on termite damage in wheat

Treatments	Termite damaged plants (%) week after sowing											Pooled
	5	6	7	8	9	10	11	12	13	14	15	
FYM @ 10 tonne/ha	2.16 (8.45)	2.61 (9.29)	3.40 (10.63)	4.03 (11.58)	4.79 (12.64)	6.04 (14.23)	8.73 (17.19)	12.95 (21.09)	17.83 (24.98)	19.35 (26.10)	25.48 (30.31)	9.76 (18.20)
Vermi-compost @ 1 tonne/ha	0.86 (5.32)	0.90 (5.45)	1.0 (5.74)	1.41 (6.83)	1.68 (7.45)	2.82 (9.66)	4.12 (11.71)	5.62 (13.71)	7.69 (16.10)	8.26 (16.70)	9.32 (17.78)	3.97 (11.49)
Poultry manure @ 1 tonne/ha	1.84 (7.80)	1.87 (7.86)	1.94 (8.01)	2.65 (9.36)	3.15 (10.22)	4.29 (11.96)	6.04 (14.23)	8.41 (16.86)	11.23 (19.58)	12.08 (20.34)	13.65 (21.68)	6.10 (14.30)
Cotton cake @ 1 tonne/ha	1.09 (5.98)	1.27 (6.47)	1.91 (7.95)	2.57 (9.22)	3.06 (10.07)	4.08 (11.65)	6.05 (14.24)	8.29 (16.73)	11.03 (19.40)	12.61 (20.80)	14.25 (22.18)	6.02 (14.22)
Neem cake @ 1 tonne/ha	0.35 (3.39)	0.49 (4.02)	0.75 (4.97)	1.23 (6.36)	1.46 (6.93)	1.82 (7.75)	2.99 (9.95)	4.11 (11.70)	5.16 (13.13)	5.59 (13.67)	6.31 (14.55)	2.75 (9.54)
Mustard cake @ 1 tonne/ha	2.02 (8.17)	2.15 (8.44)	2.53 (9.16)	3.45 (10.70)	4.10 (11.68)	4.96 (12.87)	7.09 (15.44)	10.06 (18.49)	13.17 (21.28)	14.30 (22.22)	16.17 (23.71)	7.27 (15.64)
Groundnut cake @ 1 tonne/ha	3.20 (10.31)	3.50 (10.79)	3.97 (11.50)	4.15 (11.76)	4.95 (12.85)	6.39 (14.64)	9.27 (17.73)	12.92 (21.07)	17.81 (24.96)	19.22 (26.0)	21.72 (27.78)	9.74 (18.19)
Bone meal @ 1 tonne/ha	0.36 (3.42)	0.63 (4.55)	1.10 (6.03)	1.54 (7.12)	1.83 (7.77)	2.53 (9.16)	3.88 (11.36)	5.40 (13.44)	6.99 (15.33)	7.54 (15.94)	8.52 (16.97)	3.66 (11.03)
Control	4.39 (12.09)	4.98 (12.90)	6.10 (14.30)	7.18 (15.54)	7.96 (16.39)	10.08 (18.51)	16.23 (23.76)	24.11 (29.41)	33.56 (35.40)	37.09 (37.52)	39.33 (38.84)	17.36 (24.62)
S. Em. ±	**0.56**	**0.52**	**0.47**	**0.49**	**0.54**	**0.53**	**0.65**	**0.86**	**1.08**	**1.14**	**1.25**	**0.85**
C. D. at 5 %	**(1.67)**	**(1.49)**	**(1.42)**	**(1.46)**	**(1.63)**	**(1.64)**	**(1.97)**	**(2.50)**	**(3.07)**	**(3.29)**	**(3.61)**	**(2.50)**
C. V. %	**13.31**	**11.19**	**9.62**	**8.73**	**8.98**	**7.85**	**7.70**	**8.17**	**8.59**	**8.82**	**9.04**	**8.20**

Figures in parentheses are arcsine value

Table 2: Effect of organic amendments on population of termite in wheat

Treatments	No. of termites/stick week after sowing														Pooled
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
FYM @ 10 tonne/ha	5.45 (2.44)	6.00 (2.55)	11.26 (3.43)	38.19 (6.22)	31.76 (5.68)	29.53 (5.48)	33.26 (5.81)	36.59 (6.09)	36.10 (6.05)	33.02 (5.79)	26.64 (5.21)	37.82 (6.19)	47.94 (6.96)	56.35 (7.54)	30.70 (5.54)
Vermi-compost @ 1 tonne/ha	0.00 (0.71)	0.00 (0.71)	3.00 (1.87)	15.66 (4.02)	12.46 (3.60)	13.19 (3.70)	20.02 (4.53)	21.50 (4.69)	18.25 (4.33)	11.40 (3.45)	9.93 (3.23)	19.75 (4.50)	21.03 (4.64)	23.02 (4.85)	13.51 (3.68)
Poultry manure @ 1 tonne/ha	2.63 (1.77)	3.11 (1.90)	6.68 (2.68)	35.38 (5.99)	29.31 (5.46)	23.41 (4.89)	31.08 (5.62)	34.55 (5.92)	33.49 (5.83)	20.11 (4.54)	17.31 (4.22)	28.55 (5.39)	33.61 (5.84)	40.72 (6.42)	25.50 (5.09)
Cotton cake @ 1 tonne/ha	1.63 (1.46)	2.45 (1.72)	6.31 (2.61)	24.70 (5.02)	22.82 (4.83)	22.15 (4.76)	21.77 (4.72)	25.20 (5.07)	25.20 (5.07)	18.16 (4.32)	15.18 (3.96)	24.40 (4.99)	32.67 (5.76)	38.93 (6.28)	24.40 (4.98)
Neem cake @ 1 tonne/ha	0.00 (0.71)	0.00 (0.71)	1.01 (1.23)	9.42 (3.15)	8.32 (2.97)	8.50 (3.00)	11.26 (3.43)	12.46 (3.60)	11.40 (3.45)	7.97 (2.91)	6.31 (2.61)	15.98 (4.06)	15.58 (4.01)	18.60 (4.37)	9.06 (3.01)
Mustard cake @ 1 tonne/ha	4.43 (2.22)	4.47 (2.23)	8.32 (2.97)	28.55 (5.39)	25.82 (5.13)	26.13 (5.16)	32.10 (5.71)	35.90 (5.95)	32.91 (5.78)	23.22 (4.87)	21.68 (4.71)	34.55 (5.92)	39.95 (6.36)	41.75 (6.50)	20.11 (4.49)
Groundnut cake @ 1 tonne/ha	5.12 (2.37)	5.65 (2.48)	9.42 (3.15)	36.47 (6.08)	32.56 (5.75)	28.77 (5.41)	32.45 (5.74)	35.74 (6.02)	34.90 (5.95)	25.92 (5.14)	24.40 (4.99)	36.47 (6.08)	46.56 (6.86)	52.50 (7.28)	29.06 (5.39)
Bone meal @ 1 tonne/ha	0.00 (0.71)	0.46 (0.98)	2.29 (1.67)	11.96 (3.53)	12.68 (3.63)	10.86 (3.37)	12.03 (3.54)	11.82 (3.51)	12.53 (3.61)	9.80 (3.21)	8.26 (2.96)	17.65 (4.26)	17.65 (4.26)	21.22 (4.66)	13.56 (3.67)
Control	10.79 (3.36)	9.36 (3.14)	18.08 (4.31)	54.26 (7.40)	48.50 (7.00)	46.70 (6.87)	46.01 (6.82)	54.26 (7.40)	57.56 (7.62)	47.25 (6.91)	43.72 (6.65)	50.77 (7.16)	72.26 (8.53)	102.93 (10.17)	47.31 (6.88)
S. Em. ±	**0.12**	**0.15**	**0.21**	**0.31**	**0.30**	**0.31**	**0.32**	**0.34**	**0.31**	**0.29**	**0.32**	**0.30**	**0.37**	**0.37**	**0.34**
C. D. at 5 %	**(0.35)**	**(0.44)**	**(0.60)**	**(0.91)**	**(0.87)**	**(0.90)**	**(0.93)**	**(1.00)**	**(0.92)**	**(0.86)**	**(0.93)**	**(0.88)**	**(1.08)**	**(1.10)**	**(0.98)**
C. V. %	**11.95**	**14.24**	**13.55**	**10.10**	**10.49**	**11.25**	**10.82**	**11.06**	**10.32**	**11.04**	**12.80**	**9.57**	**10.78**	**9.97**	**10.53**

Figures in parentheses are $\sqrt{X+0.5}$ transformed value.

as the result was non-significant. The seed germination in all the evaluated organic amendments was observed between 83 and 90 per cent. The plot treated with cotton cake showed 85 per cent germination. The germination was noted 83.20 to 89 per cent in the plots treated with mustard cake, bone meal, groundnut cake, neem cake, vermi-compost and FYM. The highest (90.00%) seed germination was noticed in the treatment of poultry manure followed by FYM, vermi-compost and neem cake.

Tillers

The numbers of tillers per meter row length were counted after 28 days of sowing. The tillers count showed in Table-3 indicated significant effect of organic amendments on tillering of wheat. The tillers counted varied from 83.16 to 99.96 per meter row length in the organic amendment treated plots. The minimum (83.16) number of tillers were noted in the plots treated with mustard cake, whereas it was maximum (99.96/meter row length) in the treatment of FYM.

Grain and straw yield, Increase in yield, Avoidable losses and Economics

Data on grain and straw yield, increase in yield, avoidable losses and economics are presented in Table 4.12 and 4.13.

Grain yield

The organic amendment applied plots produced significantly higher yield over control (Table 4.12). The maximum (4210 kg ha^{-1}) grain yield was obtained from the plots treated with neem cake and it was at par with bone meal (3852 kg ha^{-1}) and vermi-compost (3728kg ha^{-1}). Among the evaluated organic amendments, the minimum (3311kg ha^{-1}) yield was obtained from the plots treated with FYM (Fig. 4.4)and it was at par with groundnut cake (3416kg ha^{-1}),cotton cake (3524 kg ha^{-1}) and mustard cake (3526 kg ha^{-1}).

Singh *et al.* (2010) reported that use of dry powder of immature neem kernels and leaves @ 50 kg ha^{-1} in the integration of plant nutrients gave significantly higher economic return of wheat by 45.80 q ha^{-1} and checked the incidence of termites in Uttar Pradesh. These findings also supported the present investigations.

Increase in yield

The per cent increase in grain yield over control in wheat was also worked out and presented in Table4.12. The maximum 30.99 per cent grain yield was increased in the plots treated with neem cake followed by bone meal (24.58%) and vermi-compost (22.07%). The increase in yield ranged from17.56 and 18.03 per cent in mustard cake, cotton cake and poultry manure treated plots. The increase in yield over control was 12.26and14.95 per cent in plots treated with FYM and groundnut cake.

Avoidable losses

The avoidable losses showed in Table-3 indicated that the grain yield of wheat varied from 8.50 to 30.99 per cent in different treatments, considering the maximum (4210kg ha^{-1}) yield of neem cake taken as base. The avoidable loss was 8.50 and 11.44 per cent in the treatments of bone meal and vermi-compost, respectively. It varied from15.82 to 21.35 per cent in poultry manure, cotton cake, mustard cake, groundnut cake and FYM. The avoidable losses comparatively higher (18-22%) in the treatments of groundnut cake and FYM.

Table 3: Effect of organic amendments on germination and yield of grain and straw due to termite in wheat

Treatments	Germination (%)	No. of tillers/ m row length	Yield (kg/ha)		Increase in yield over control (%)		Avoidable loss (%)	
			Grain	Straw	Grain	Straw	Grain	Straw
FYM @ 10 tonne/ha	88.33	99.96	3311	4128	12.26	12.20	21.35	19.31
Vermi-compost @ 1 tonne/ha	87.00	92.40	3728	4633	22.07	21.77	11.44	09.44
Poultry manure @ 1 tonne/ha	90.00	90.72	3544	4423	18.03	18.06	15.82	13.54
Cotton cake @ 1 tonne/ha	83.50	84.00	3524	4411	17.56	17.84	16.29	13.78
Neem cake @ 1 tonne/ha	87.00	88.76	4210	5116	30.99	29.16	-	-
Mustard cake @ 1 tonne/ha	83.20	83.16	3526	4396	17.61	17.56	16.24	14.07
Groundnut cake @ 1 tonne/ha	86.33	88.76	3416	4233	14.95	14.38	18.85	17.25
Bon0e meal @ 1 tonne/ha	85.33	92.40	3852	4823	24.58	24.86	08.50	05.73
Control	88.00	87.64	2905	3624	-	-	30.99	29.16
S. Em. ±	**5.18**	**0.69**	**188.16**	**210.83**	**-**	**-**	**-**	**-**
C. D. at 5%	**(NS)**	**(2.09)**	**(564.16)**	**(632.16)**	**-**	**-**	**-**	**-**
C. V. %	**10.33**	**1.35**	**9.16**	**8.26**	**-**	**-**	**-**	**-**

Straw yield

The organic amendment treated plots produced significantly higher straw yield than control are presented in Table-3. The highest (5116kg ha^{-1}) straw yield was obtained from the plots treated with neem cake than rest of the treatments except bone meal and vermi-compost which produced 4823 and 4633kg ha^{-1}straw, respectively. Among the tested organic amendments, minimum (4128kg ha^{-1}) straw yield was produced in plots treated with FYM (Fig. 4.4) and it was statistically at par with groundnut cake (4233kg ha^{-1}), poultry manure (4423kg ha^{-1}) and cotton cake (4411 kg ha^{-1}).

Increase in yield

The per cent increase in wheat straw yield over control presented in Table4.12 revealed that the maximum (29.16%) straw yield was recorded in the plot treated with neem cake followed by bone meal (24.86%) and vermi-compost (21.77%). The increase in yield over control was lowest (12.20%) in plots received FYM followed by groundnut cake (14.38%), mustard cake (17.52%), cotton cake (17.84%) and poultry manure (18.06 %).

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