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Effect of the Vermicompost and Poultry Manure on Groundnut (*Arachis hypogaea* L.) under Rain-fed Condition

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ABSTRACT

Background: Use of organic manures to meet the nutrient requirement of the crop would be an inevitable practice for sustainable agriculture. Since organic manures generally improve the physical, chemical and biological properties along with conserving soil moisture and thus resulting in enhanced crop productivity along with maintaining the quality of crop production. Organic farming in recent years is gaining significance due to the realization of inherent advantages it confers in sustaining crop production and also in maintaining dynamic soil nutrient status and safe environment. Organic farming is also concerns to produce the quality food and human health, so that this research and studied the interaction effect of vermicompost and poultry manure on groundnut crop in Chitrakoot condition.

Methods: The experiment was conducted at Rajola Farm of the Faculty of Agricultural Sciences, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot in *kharif* 2019. The present experiment was conducted to evaluate the effect of different levels of poultry manure and vermicompost applications. The morphological and biochemical parameters were evaluated in experimental farm and departmental laboratory.

Result: The combination dose of V_3P_3 (6 ton ha^{-1} vermicompost and 4 ton ha^{-1} poultry manure) was found to be best giving the maximum values. The effect of V_3 on the number of pod per plant and number of seed per plant was maximum 15.20 and 3.22 and effect of P_3 on the number of pod per plant and number of seed per plant was maximum 14.156 and 3.11 respectively. The interaction of vermicompost and poultry manure of the V_3P_3 combination was recorded maximum 17.13 per plant. Seed per pod interaction of vermicompost and poultry manure of the V_3P_3 combination also recorded maximum 3.66 per pod. Effect of vermicompost and poultry manure on 100 kernel weight was maximum in V_3 (42.55 g) and P_3 (41.00 g) respectively. The shelling percentage also was recorded maximum in V_3 (69.77) and P_3 (67.77) and interaction of both parameters was recorded non significance. Effect on yield (q/ha) was recorded maximum in V_3 (1.05) and P_3 (0.99) and the interaction was recorded maximum in V_3P_3 combination (1.27). The effect of vermicompost on oil percentage, protein percentage and oil yield (kg/ha) was recorded maximum 48.46, 21.33 and 1573.5 in V_3 respectively. The effect of poultry manure recorded maximum in P_3 (48.03), 20.68 and 1411.2 kg/ha oil percentage, protein percentage and oil yield respectively. The interaction of vermicompost and poultry manure was recorded maximum with the combination of V_3P_3 and found 49.52 oil percentage, 21.76 protein percentage and 1696.00 kg/ha oil yield. The results indicated that all these parameters were significantly increased due to vermicompost and poultry manure application. Their interaction was also significant. It was evident that a combination dose of V_3P_3 (6 ton ha^{-1} vermicompost and 4 ton ha^{-1} poultry manure) was found to be best giving the maximum values.

Key words: Kernel, Oil content, Poultry manure, Protein content, Vermicompost.

INTRODUCTION

Groundnut is the single largest source of edible oils in India and constitutes roughly about 50% of the total oilseeds production. Currently, India grows about more than 8 million tons of groundnut (in the shell). Groundnut (*Arachis hypogaea* L.) belongs to family Leguminosae and sub-family papilionaceae. It is world's largest source of edible oil, ranks 13th among the food crops as well as 4th most important oilseed crops of the world. Groundnut has the primary place among all the oil seed crops in the Republic of India accounting for quite 40% surface area and 60% production within the country (Anonymous, 2011). *Kharif* 2019 all India groundnut acreage was 39,31,700 hectares, Gujarat (15,52,200 ha; 39%), Andhra Pradesh (5,53,383 ha; 14%), Rajasthan (5,73,889 ha; 15%), Karnataka (3,70,564 ha; 9%), Maharashtra (1,87,500 ha; 5%), Madhya Pradesh (2,21,700 ha; 6%) jointly accounted for about 88% of the national acreage. In four districts of Madhya Pradesh, the highest yield (1,215 kg/ha) was estimated for Tikamgarh and the lowest (952 kg/ha) for Shivpuri and Alirajpur. The highest production was estimated

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for Shivpuri which also accounted for the largest acreage (33%). The total production of in-shell groundnut was estimated at 2,27,243 MT with an average yield of 1,025 kg/ha. The use of organic manures to meet the nutrient requirement of the crop would be an inevitable practice for sustainable agriculture (Dutta *et al.,* 2009). Organic farming in recent years is gaining significance due to the realization of inherent advantages it confers in sustaining crop production and also in maintaining dynamic soil nutrient status and safe environment. The combination of vermicompost and poultry manure may play an important role in Chitrakoot condition especially on groundnut crop.

MATERIALS AND METHODS

The experiment was conducted Rajola Farm of the Faculty of Agricultural Sciences, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot Satna (Madhya Pradesh) located from 24° 31′ N latitude and 81° 15′ E latitude in *kharif* 2019. The present experiment was conducted to evaluate the effect of application vermicompost (0, 4, 6 ton/ ha) with different levels of poultry manure (0, 2, 4 ton/ha) on groundnut crop. The important physical and biochemical parameters observed in this research that affects the economics.

Plant height (cm)

Five plants were selected randomly from each plot and tagged permanently. The height of each plant was measured from base of the plant to the tip of main shoot at 30.60 and 90 DAS and at harvest. The mean plant height (cm) at each growth stage was worked out and recorded as plant height (cm) at respective stages.

Number of branches per plant

The number of branches of the five tagged plants from each plot were counted at 30.60 and 90 DAS and at harvest. The mean number of branches per plant in each experimental unit at aforesaid growth stages was worked out and recorded.

Number of nodules per plant

For counting the number of nodules per plant at 45 DAS, five plants in each plot were randomly selected in sampling rows and removed carefully after wetting the soil and taking the soil up to 30 cm depth. After removal of plants from soil, adhered soil was washed out with a fine jet of water. The nodules were removed with the help of forceps, counted and the mean of five plants was recorded as number of nodules per plant.

$$\text{Number of nodules per plant} = \frac{\text{Total number of nodules from five plants}}{\text{Number of plants}}$$

Number of pods per plant

Total number of well developed pods from five tagged plants of each plot were picked and counted for this purpose. The average number of pods/ plant was worked out.

$$\text{Number of pods per plant} = \frac{\text{Total number of pod/ total 1 number of plants}}{\text{Number of plants/ pod}}$$

Number of kernels per pod

Number of kernels per pod was assessed from randomly selected pod from harvested plants and the number of kernels was calculated as follows:

$$\text{Number of pods per kernel} = \frac{\text{Number of kernel}}{\text{Number of pod}}$$

Kernel yield

The kernel yield (kg/ha) was estimated by multiplying pod yield with their respective shelling percentage and divided by 100.

$$\text{Kernel yield} = \frac{\text{Pod yield} \times \text{shelling \%}}{100}$$

Pod yield

The pods were removed from the produce and weighed on physical balance. The weight was recorded as pod yield (kg) per plot.

$$\text{Pod yield (kg/ha)} = \frac{\text{Pod yield / plot (kg)} \times 10000\ (m^2)}{\text{Plot area } (m^2)}$$

100 kernel weight (g)

Hundred air dried kernels (at 15% moisture content) were taken randomly from the air dried samples randomly from the air dried samples and weight calculated.

Shelling percentage

Well matured 500 pods from each plot were shelled and weight of kernels was recorded and the shelling per cent was calculated with the help of following relationship:

$$\text{Shelling per cent} = \frac{\text{Kernel weight}}{\text{Pod weight}} \times 100$$

Oil content (%) and oil yield

The oil content in the kernel was determined by Soxhlet apparatus using petroleum ether (60-800 C) as an extractant. The oil yield (kg/ha) was calculated by multiplying per cent oil content with respective kernel yield (kg/ha).

Protein content in kernel

Protein content in kernel was calculated by multiplying nitrogen concentration in kernel (%) with a factor of 6.25 (Anonymous, 2011 and Lowery *at al.,* 1951).

RESULTS AND DISCUSSION

Effect and interaction of vermicompost and poultry manure on plant height

Plant height was observed in the range of 22.51, 25.62, 26.60 to 29.42, 29.07, 31.98 cm under different level of vermicompost application at 30, 60 and 90 DAS respectively. It is clear from Table 1 and 2 that the increasing level of vermicompost up to 6 ton ha^{-1} increased the plant height significantly at 30, 60 and 90 DAS and

maximum height was observed with 6 ton ha^{-1} vermicompost (V_3).

Plant height ranged from 23.07, 25.38, to 26.71 and 29.13, 29.20, to 31.49 cm under different level of poultry manure at 30, 60 and 90 DAS, respectively. It is inferred from Table 1 and 2 that application of poultry manure resulted significantly taller plant as compared to control at 90 DAS, whereas 60 and 30 DAS different levels of poultry manure significant effect on plant height. The interaction effect due to vermicompost and poultry manure on plant height was found non-significant statistically at 30 DAS whereas was significant during 60, 90 DAS.

The higher values of plant height were recorded with vermicompost and poultry manure (6ton/ha, 4ton/ha) and remained at par with organic manure. Pant and Katiyar (1996), Naidu (2000) and Qureshi *et al.*, 2005 obtained significantly higher plant height due to organic manure over control. Bhatt *et al.*, (2013) reported that due to the lower temperature in winter the mineralization of organic sources (poultry manure and vermicompost) is very less but in the

Table 1: Effect of different levels of vermin-compost and poultry manure on plant height (cm) of groundnut.

Treatments	Plant height (cm)		
	30 DAS	60 DAS	90 DAS
Levels of vermicompost (V)			
V_1: 0 ton ha^{-1} (cont.)	22.511	26.600	29.067
V_2 : 4 ton ha^{-1}	24.511	28.400	30.778
V_3: 6 ton ha^{-1}	25.622	29.422	31.978
S.E. (m)±	0.557	0.307	0.180
C.D. (5%)	1.685	0.929	0.544
Levels of poultry manure (P)			
P_1: 0 ton ha^{-1} (cont.)	23.067	26.711	29.200
P_2: 2 ton ha^{-1}	24.200	28.578	31.133
P_3: 4 ton ha^{-1}	25.378	29.133	31.489
S.E. (m)±	0.557	0.307	0.180
C.D. (5%)	1.685	0.929	0.544
V × P (Interactions)	NS	1.608	0.943

Table 2: Interaction effect of different level of vermicompost and poultry manure on plant height of groundnut.

Levels of vermicompost (V)	Levels of poultry manure (P)			Mean (V)
	P_1: 0 ton/ha (control)	P_2: 2 ton/ha	P_3: 4 ton/ha	
		30 DAS		
V_1: 0 ton/ha (control)	19.933	23.133	24.467	22.511
V_2: 4 ton/ha	24.000	24.667	24.867	24.511
V_3: 6 ton/ha	25.267	24.800	26.800	25.622
Mean (P)	23.067	24.200	25.378	
		60 DAS		
V_1: 0 ton/ha (control)	23.933	27.067	28.800	26.600
V_2: 4 ton/ha	27.867	29.200	28.133	28.400
V_3: 6 ton/ha	28.333	29.467	30.467	29.422
Mean (P)	26.711	28.578	29.133	
		90 DAS		
V_1: 0 ton/ha (control)	27.000	29.933	30.267	29.067
V_2: 4 ton/ha	30.267	31.400	30.667	30.778
V_3: 6 ton/ha	30.333	32.067	33.533	31.978
Mean (P)	29.200	31.133	31.489	
		V	**P**	**V × P**
30 DAS	S.E. (m)±	0.557	0.557	0.965
	C.D. (5%)	1.685	1.685	NS
60 DAS	S.E. (m)±	0.307	0.307	0.532
	C.D. (5%)	0.929	0.929	1.608
90 DAS	S.E. (m)±	0.180	0.180	0.312
	C.D. (5%)	0.544	0.544	0.943

kharif season the mineralization is relatively higher due to the higher temperature and thus, recorded taller plants height in *kharif* season. Thus, application of vermicompost and poultry manure at optimum level increased the plant height. The observed improvement in overall vegetative growth of the crop with the application of V abbreviate and P abbreviate in the investigation in conformity with those of Ola *et al.,* 2013, Borse *et al.,* 2008 and Kausale *et al.,* 2009 in groundnut.

Effect and interaction of vermicompost and poultry manure on number of branches plant^{-1}

Number of branches per plant as a measure of growth was recorded periodically at an interval of 30 DAS starting from 30 DAS to 90 DAS. Number of branches plant^{-1} observed in the range of 5.49, 5.89 to 8.96 and 10.60, 11.56 to 13.36 under different level of vermicompost application at 30, 60 and 90 DAS respectively. It is clear from Table 3 and 4 that the increasing level of vermicompost up to 6 ton ha^{-1} (V_3) increased the number of branches plant^{-1} significantly at

Table 3: Effect of different levels of vermicompost and poultry manure on number of branches plant^{-1} in groundnut.

Treatments	Number of branches/plant		
	30 DAS	60 DAS	90 DAS
Levels of vermicompost (V)			
V_1 : 0 ton ha^{-1} (cont.)	5.489	8.956	11.556
V_2 : 4 ton ha^{-1}	5.511	9.644	12.289
V_3 : 6 ton ha^{-1}	5.889	10.600	13.356
S.E. (m)±	0.141	0.154	0.091
C.D. (5%)	NS	0.465	0.276
Levels of poultry manures (P)			
P_1: 0ton ha^{-1} (cont.)	5.200	9.000	11.333
P_2: 2 ton ha^{-1}	5.689	10.067	12.756
P_3: 4 ton ha^{-1}	6.000	10.133	13.111
S.E. (m)±	0.141	0.154	0.091
C.D. (5%)	0.427	0.465	0.276
V × P (Interactions)	NS	NS	S*

Table 4: Interaction effect of different level of vermicompost and poultry manure on number of branches per plant of groundnut.

Levels of vermicompost (V)	Levels of poultry manure (P)			Mean (V)
	P_1: 0 ton/ha (control)	P_2: 2 ton/ha	P_3: 4 ton/ha	
		30 DAS		
V_1: 0 ton/ha (control)	4.733	5.867	5.867	5.489
V_2: 4 ton/ha	5.533	5.400	5.600	5.511
V_3: 6 ton/ha	5.333	5.800	6.533	5.889
Mean (P)	5.200	5.689	6.000	
		60 DAS		
V_1: 0 ton/ha (control)	7.933	9.333	9.600	8.956
V_2: 4 ton/ha	9.400	9.867	9.667	9.644
V_3: 6 ton/ha	9.667	11.000	11.133	10.600
Mean (P)	9.000	10.067	10.133	
		90 DAS		
V_1: 0 ton/ha (control)	10.133	12.067	12.467	11.556
V_2: 4 ton/ha	11.800	12.467	12.600	12.289
V_3: 6 ton/ha	12.067	13.733	14.267	13.356
Mean (P)	11.333	12.756	13.111	
		V	**P**	**VXP**
30 DAS	S.E. (m)±	0.557	0.557	0.245
	C.D. (5%)	NS	0.427	NS
60 DAS	S.E. (m)±	0.154	0.154	0.266
	C.D. (5%)	0.465	0.465	NS
90 DAS	S.E. (m)±	0.091	0.091	0.158
	C.D. (5%)	0.276	0.276	0.478

30, 60 and 90 DAS stages. Maximum number of branches plant^{-1} was observed with the application of 6 ton ha^{-1} vermicompost (V3). Number of branches ranged from 5.20, 6.00 to 9.00 and 10.13, 11.33 to 13.11 plant^{-1} under different level of poultry manure at 30, 60 and 90 DAS respectively. It is inferred from Table 3 and 4 at 60 and 90 DAS stages of 4 ton ha^{-1} poultry manure (P_3) resulted significantly higher number of branches plant^{-1} as compared to control at 90 DAS 6 ton ha^{-1} (V_3) stages. The interaction effect due to vermicompost and poultry manure on number of branches plant^{-1} was found non-significant statistically at 30, 60 DAS and significant at 90 DAS.

The significant increase in number of branches per plant at 30, 60 and 90 DAS was observed due to inoculation with vermicompost or poultry manure over control. However, higher values of above parameters were recorded with vermicompost and poultry manure (6 ton/ha, 4 ton/ha) and remained at par with organic manure specify clearly. Pant and Katiyar (1996) and Naidu (2000) obtained significantly number of branches per plant due to organic manure over control. Thus, application of vermicompost and poultry manure at optimum level increased the number of branches per plant in the present investigation over their lower doses.

Effect and interaction of vermicompost and poultry manure on yield attributes

There was significant response in yield due to different levels of vermicompost and poultry manure as compared to control (Tables 5, 6, 7, 8, 9, 10 and 11). Groundnut yield varied from 0.852 q/h to 1.059 q/h under different levels of vermicompost application. It is evident that the increasing level of vermicomposting increased the groundnut yield significantly up to 6 ton ha^{-1} (V_3). Maximum yield (1.059 q/h) was observed with the application 6 ton ha^{-1} (V_3) compared to 0 to 4 ton ha^{-1}. The groundnut yield ranged from 0.822 q/h to 0.994 q/h under different level of poultry manure application. Maximum yield of 0.994 q/h was observed with 4 ton ha^{-1} poultry manure (P_3) which was statistically at par with control and 4 ton ha^{-1} poultry manure (P_3). The interaction effect due to vermicompost and poultry manure on groundnut yield was found statistically significant.

Nodulation in Groundnut starts approximately after 45 days of sowing with a concomitant increase in root growth and proliferation. The period between 45 DAS is supposed to be the peak nodulation provided that the other factors are not limiting. It was clear that both vermicompost and poultry manure were effective in improving the nodulation in groundnut. The data are presented in Table 5. It was

Table 5: Effect of different levels of vermicompost and poultry manure on root length plant^{-1} and number root nodules plant^{-1}.

Treatment	Root length /plant	Root nodules /plant
	45 DAS	45 DAS
Levels of vermicompost (v)		
V_1: 0 ton ha^{-1} (cont.)	12.556	51.222
V_2 : 4 ton ha^{-1}	13.889	71.778
V_3: 6 ton ha^{-1}	16.000	97.444
S.E. (m)+.	0.513	2.796
C.D. (5%)	1.552	8.455
Levels of poultry manure (P)		
P_1: 0 ton ha^{-1} (cont.)	13.111	64.444
P_2: 2 ton ha^{-1}	13.889	73.000
P_3: 4 ton ha^{-1}	15.444	83.000
S.E. (m)±	0.513	2.796
C.D. (5%)	1.552	8.455
V × P (Interactions)	NS	NS

Table 6: Effect of different levels of vermicompost and poultry manure on yield attributes.

Treatment	No of pod/ plant	No of seed/ pod
Levels of vermicompost (v)		
V_1 : 0 ton ha^{-1} (cont.)	10.444	2.444
V_2 : 4 ton ha^{-1}	12.422	2.778
V_3 : 6 ton ha^{-1}	15.200	3.222
S.E. (m)±	0.336	0.203
C.D. (5%)	1.015	0.613
Levels of poultry manure (P)		
P_1: 0 ton ha^{-1} (cont.)	11.000	2.333
P_2: 2 ton ha^{-1}	12.911	3.000
P_3: 4 ton ha^{-1}	14.156	3.111
S.E. (m)±	0.336	0.203
C.D. (5%)	1.015	0.613
V × P (Interactions)	NS	NS

Table 7: Interaction effect of different level of vermicompost and poultry manure on number of pod/plant in groundnut.

Treatment	P-Levels			
	P_1: 0 ton/ha	P_2: 2 ton/ha	P_3: 4 ton/ha	Mean
V-levels				
V_1: 0 ton/ha	8.400	10.733	12.200	10.444
V_2: 4 ton/ha	11.467	12.667	13.133	12.422
V_3: 6 ton/ha	13.133	15.333	17.133	15.200
Mean	11.000	12.911	14.156	
Factors	**V**	**P**	**V × P**	
S.E (m.)±	0.336	0.336	0.582	
C.D. (5%)	1.015	1.015	NS	

Table 8: Interaction effect of different level of vermicompost and poultry manure on number of seed/pod in groundnut.

Treatment	P-Levels			
	P_1: 0 ton/ha	P_2: 2 ton/ha	P_3: 4 ton/ha	Mean
V-levels				
V_1: 0 ton/ha	2.000	2.667	2.667	2.444
V_2: 4 ton/ha	2.333	3.000	3.000	2.778
V_3: 6 ton/ha	2.667	3.333	3.667	3.222
Mean	2.333	3.000	3.111	
Factors	**V**	**P**	**V x P**	
S. E m. ±	0.203	0.203	0.351	
C.D. (5%)	0.613	0.613	NS	

Table 9: Effect of different levels of vermicompost and poultry manure on shelling percentage and 100 kernel weight.

Treatment	100 Kernel weight (g)	Shelling percentage
Levels of vermicompost (v)		
V1: 0 ton ha^{-1} (cont.)	36.222	63.889
V2 : 4 ton ha^{-1}	38.778	67.444
V3: 6 ton ha^{-1}	42.556	69.778
S.E. (m)±	0.444	0.372
C.D. (5%)	1.342	1.125
Levels of poultry manure (P)		
P1: 0ton ha^{-1} (cont.)	37.778	66.222
P2: 2 ton ha^{-1}	38.778	67.111
P3: 4 ton ha^{-1}	41.000	67.778
S.E. (m)±	0.444	0.372
C.D. (5%)	1.342	1.125
V × P (Interactions)	S*	NS

revealed that at 45 DAS nodule number varied from (V_1P_1) 51.22, 64.44 in control to 97.44 and 83.00 in (V_3P_3). All the treatments were significantly superior to control. V_3 were significantly superior to V0 but was at par with V_2. Similarly P_1 were significantly superior to control and P_3 were significantly better than P_2. The interaction effect of vermicompost and poultry manure was non-significant and general mean was 0.994.

Observations on root length were recorded at 45 DAS and the data are presented in Table 5. It was revealed that no definite trends in the variations of root length were visible due to different treatments and the results were not significant. Significant response, however, were observed due to vermicompost and poultry manure levels to root length at 45 DAS. Wherein it was revealed that root length with a mean of 12.56 and 16.00 cm on the application of vermicompost. The lowest and the highest values were recorded in control and V_3. Regarding the main effects of vermicompost all the treatments were significantly superior to control. V_3 was significantly superior to V_2 and were also significantly different from V_1. Similarly P_3 were significantly superior over control, P_1 and P_2. Vermicompost and poultry manure interactions was not significant.

Application of vermicompost and poultry manure significantly increased the number of pods per plant over control. The maximum number of pods of 15.20, 14.15 per plant was recorded under the treatment V_3P_3 (6 ton ha^{-1} and 4 ton ha^{-1}). The minimum number of pods per plant (10.44, 11.00) were recorded under control at the time of harvesting. The results are given in Table 6. Large variations were observed in pod number under the influence of different treatment vermicompost and poultry manure interaction was also non-significant.

At the time of harvesting, the data were recorded on number of seed pods $plant^{-1}$ and the results are given in Table 6. Low variations were observed in pod number under the influence of different treatment. The number ranged from 2.44, 2.33 to 3.22, 3.11 and these values were given by control and V_3P_3. V1 were significantly superior to V_2 and V_3 was significantly lower than control but the difference between V_2 and P_3 were not significant. Increasing levels of vermicompost gave a linear significant increase in pod number and P1 gave the lowest number.

100 kernel weight: Hundred kernel weight were recorded 36.22 g to 42.55 g with the application of 0 ton ha^{-1} to 6 ton ha^{-1} vermicompost and P_3 recorded significantly higher 42.55 g (P_3) which differed significantly from one treatment to another (Table 9). Hundred kernels ranged 37.77 g to 41.00 g with the application of poultry manure treatments and maximum recorded 41.00 g with the P_3 treatment. The interaction effect of application vermicompost and poultry manure was found statistically significant.

Shelling percentage: The data on shelling percentage of groundnut as influenced by application of organic manure are presented in (Table 9). Effect of row application of organic was not significant on shelling percentage of groundnut. However, higher shelling percentage was observed under application of 6 ton ha^{-1} (V_3) vermicompost with a value of 69.77%. The interaction effect due to vermicompost and poultry manure ($V_3 \times P_3$) on shelling percentage of groundnut was found statistically not-significant.

Application of vermicompost and poultry manure significantly enhanced the number of pods per plant, number of kernels per pod, shelling per cent, pod yield as well as haulm yield over control. The increased supply of N and P

and their higher uptake by plants might have stimulated the rate of various physiological processes in plant and led to increased growth and yield parameters and resulted in increased pod and haulm yields. Thus significant increase in biological yield with the application of nitrogen and phosphorous. The results of present investigation are in line with those of More *et al*. (2002), Rathore and Kamble (2008), who obtained increased yield attributes, pod, haulm and biological yields with the combined application of organic fertilizer (vermicompost and poultry manure).

The observed improvement in overall vegetative growth of the crop with the application of V and P in the investigation is in conformity with those of Borse *et al*. (2008) and Kausale *et al*. (2009) in groundnut, who supported increased plant height, number of branches per plant, number of nodules per plant, 100 kernel weight and shelling percentage.

Table 10: Effect of different levels of vermicompost and poultry manure on yield (q/ha) of groundnut.

Treatment	Yield (q/ha)
Levels of vermicompost (v)	
V_1: 0 ton ha^{-1} (cont.)	0.852
V_2 : 4 ton ha^{-1}	0.889
V_3: 6 ton ha^{-1}	1.059
S.E. (m)±	0.026
C.D. (5%)	0.077
Levels of poultry manure (P)	
P_1: 0 ton ha^{-1} (cont.)	0.822
P_2: 2 ton ha^{-1}	0.983
P_3: 4 ton ha^{-1}	0.994
S.E. (m)±	0.026
C.D. (5%)	0.077
V × P (Interactions)	S*

Oil Content (%), Oil yield (kg/ha) and Protein content (%) in groundnut kernel

The data pertaining to the oil content and oil yield in the groundnut kernels are presented in Table 12 and 13. Effect of 4 ton ha^{-1} poultry manure oil content in groundnut kernels was significant. However, higher oil content was recorded in P_3 (48.02 %). Effect of application of vermicompost and poultry manure was also significant on oil content in groundnut kernels. However higher oil content was recorded in the treatment vermicompost (V_3) 6 ton ha^{-1} (48.46 %) over other sources of organic. The interaction effect of application vermicompost and poultry manure on oil content in groundnut kernels was significant. Effect of vermicompost (V_3) 6 ton ha^{-1} recorded higher oil yield (1573.5 kg ha^{1}).

Table 11: Interaction effect of different level of vermicompost and poultry manure on number of yield (q/ha) in groundnut.

Treatment	P-Levels			
	P_1 : 0 ton/ha	P_2 : 2 ton/ha	P_3 : 4 ton/ha	Mean
V-levels				
V_1: 0 ton/ha	0.767	0.977	0.813	0.852
V_2: 4 ton/ha	0.827	0.940	0.900	0.889
V_3: 6 ton/ha	0.873	1.033	1.270	1.059
Mean	0.822	0.983	0.994	
Factors	**V**	**P**	**V × P**	
S. E m. ±	0.026	0.026	0.044	
C.D. (5%)	0.077	0.077	0.134	

Table 12: Effect of different levels of vermicompost and poultry manure on oil content (%), protein content in seed (%), oil yield (kg/ha) in groundnut.

Treatment	Oil content (%)	Protein content in seed (%)	Oil yield (kg/ha)
Levels of vermicompost (v)			
V_1: 0 ton ha^{-1} (cont.)	46.518	19.473	1109.6
V_2 : 4 ton ha^{-1}	47.547	20.443	1272.8
V_3: 6 ton ha^{-1}	48.464	21.330	1573.5
S.E. (m)±	0.100	0.075	15.911
C.D. (5%)	0.302	0.226	48.113
Levels of poultry manure (P)			
P_1: 0 ton ha^{-1} (cont.)	47.056	20.063	1229.2
P_2: 2 ton ha^{-1}	47.447	20.502	1315.6
P_3: 4 ton ha^{-1}	48.027	20.681	1411.2
S.E. (m)±	0.100	0.075	15.911
C.D. (5%)	0.302	0.226	48.113
V × P (Interactions)	S*	NS	NS

Table 13: Interaction effect of different level of vermicompost and poultry manure on oil content, protein content (%) and oil yield of groundnut.

Levels of vermicompost (V)	Levels of poultry manure (P)			Mean (V)
	P_1: 0 ton/ha (control)	P_2: 2 ton/ha	P_3: 4 ton/ha	
		Oil content (%)		
V_1: 0 ton/ha (control)	45.927	46.793	46.833	46.518
V_2: 4 ton/ha	47.360	47.557	47.723	47.547
V_3: 6 ton/ha	47.880	47.990	49.523	48.464
Mean (P)	47.056	47.447	48.027	
		Protein content (%)		
V_1: 0 ton/ha (control)	19.310	19.500	19.610	19.473
V_2: 4 ton/ha	20.047	20.610	20.673	20.443
V_3: 6 ton/ha	20.833	21.397	21.760	21.330
Mean (P)	20.063	20.502	20.681	
		Oil yield		
V_1: 0 ton/ha (control)	1025.333	1107.000	1196.667	1109.667
V_2: 4 ton/ha	1227.667	1250.000	1341.000	1272.889
V_3: 6 ton/ha	1434.667	1590.000	1696.000	1573.556
Mean (P)	1229.222	1315.667	1411.222	
		V	**P**	**V × P**
Oil content (%)	S.E. (m)±	0.100	0.100	0.173
	C.D. (5%)	0.302	0.302	0.522
Protein content (%)	S.E. (m)±	0.075	0.075	0.130
	C.D. (5%)	0.226	0.226	NS
Oil yield	S.E. (m)±	15.911	15.911	27.559
	C.D. (5%)	48.113	48.113	NS

The application of poultry manure 4 ton ha^{-1} recorded significantly higher (1411.2 kg ha^{1}) over no organic and was on par with vermicompost. The interaction effect of application vermicompost and poultry manure on oil yield was not significant.

The data pertaining to the protein content in the groundnut kernels are presented in Table 12 and 13. The effect of 4 ton ha^{-1} poultry manure on protein content in groundnut kernels was not significant. However, highest protein content was recorded in P3 (20.68 %) and the effect of application of vermicompost and poultry manure was also not significant on protein content in groundnut kernels. However higher protein content was recorded in the treatment vermicompost (V_3) 6 ton ha^{-1} (21.33%) over other sources of organics. The interaction effect of application vermicompost and poultry manure on protein content in groundnut kernels was not significant.

In this study application of organic manure significantly affected seed oil, protein and oil yield. Mohamedzien, (1996) showed that poultry manure significantly increased protein content of groundnut. Lal and Saran (1988) stated that seed oil and protein contents were increased significantly by application of 6 ton/ha vermicompost and 4 ton/ha poultry manure in groundnut. Elsheikh and Mohamedzein (1998) and El-Habbasha *et al.,* (2005) showed that poultry manure and vermicompost significantly increasing both oil and protein content of groundnut showed that increasing increased oil, protein and oil yield of groundnut. Ola *et al.,* 2013, Gobarah *et al*., (2006) Kumar and Ras (1990) and El Tahir (1997) observed that poultry manure and vermicompost had insignificant effect on oil content of groundnut. Positive effects of poultry manure, vermicompost and organic manures on chemical composition of groundnut.

CONCLUSION

In this research the results indicated that all these parameters were significantly increased due to vermicompost and poultry manure application. Their interaction was also significant. It was evident that a combination dose of V_3P_3 (6 ton ha^{-1}vermicompost and 4 ton ha^{-1} poultry manure) was found to be best giving the maximum values. Two things can be concluded from this finding, first increase in the organic manure application had significant effect on plant height and yield attributes. Combination of vermicompost and poultry manure during crop growth led to significant improvement over sole application of manure, resulted in better performance of crop in organic farming system. Analyses result showed that the yield performance of crop was significantly similar with 4 t/ha and 6 t/ha vermicompost integrated with poultry manure application. From this result, it can be concluded organic manure application is important for groundnut to obtain better yield of groundnut in organic farming.

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