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Influence of different Organic sources of Nitrogen on Yield and Quality of Groundnut (*Arachis hypogaea* L.)

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ABSTRACT

An experiment was conducted during kharif 2009 and 2010 to evaluate varying organic sources of nitrogen on yield and quality of groundnut (Arachis hypogaea L.). The results revealed thatcombinations of different organic sources of nitrogen significantly influenced the yield, quality, nutrient uptake and economics of groundnut. The maximum pod yield (3.22 tha^{-1}) and haulm yield (3.78 tha^{-1}) were found to be higher with combination of FYM + vermicompost + poultry manure + neem cakethan the other treatments. Combination of different organic sources of nitrogen had significantly affected oil yield and protein yield of groundnut. Increased uptake of major nutrient was recorded with application 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through poultry manure + 25% RDN through neem cake than all other treatments. The application of organic manures to preceding crop had a significantly direct effect on the oil content and oil yield of succeeding groundnut crop, which ultimately increased the oil content and oil yield. There was simultaneous increase in protein content and protein yield also.

Key words: Organic fertilizer, Nutrient uptake, Yield, Quality and Economics

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INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of important legume crop of tropical and semi-arid tropical countries, where it provides a major source of edible oil and vegetable protein.Groundnuthas the first place among all the oilseed crops in India accounting for more than 40 percent acreage and 60 percent production in the country. India ranks first in area of 8.4 million hectares contributing 8.4 million tonnes production of groundnut (Tank *et al.,* 2006). Groundnut oil is primarily used in the manufacture of vegetable oil. Use of organic manures to meet the nutrient requirement of crop would be inevitable practices in the years to come for sustainable agriculture since, organic manures generally improve the soil physical, chemical and biological properties along with conserving the moisture holding capacity of soil and thus resulting in enhanced crop productivity along with maintaining the quality of crop produce.Organic farming in recent years is gaining significance due to realization of inherent advantages.It confers in sustaining crop production and also in maintaining dynamic soil nutrient status and safe environment.

MATERIAL AND METHODS

The experiment was carried out during *kharif* season 2009-2010 at Crop Research Farm, Department of Agronomy, Sam Higginbottom Institute of Agriculture, Technology &



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Sciences, Allahabad, U.P., India. The farm is situated at 25.57° North latitude and 81.5° East longitudes at an altitude of 98m above sea level.

The soil was a sandy loam (61.5% sand, 23.5% silt and 15% clay) with a pH 7.7. It was low in available nitrogen (204.25 Kg ha⁻¹), available phosphorus (25.1 Kg ha⁻¹) and available potash (314.5 Kg ha⁻¹). The experiment was laid out in randomized block design, replicated thrice with 12 treatment combinations viz. Control (R.D. of N.P.K. through fertilizer), 100% RDN through FYM, 100% RDN through vermicompost, 100% RDN through poultry manure, 100% RDN through neem cake, 50% RDN through FYM + 50% RDN through vermicompost, 50% RDN through FYM + 50% RDN through poultry manure, 50% RDN through FYM + 50% RDN through neem cake, 50% RDN through vermicompost + 50% RDN through poultry manure, 50% RDN through vermicompost +50% RDN through neem cake, 50% RDN through poultry manure + 50% RDN through neem cake, 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through poultry manure + 25% RDN through neem cake). Recommended dose of fertilizer (Control) $N_{30} P_{60} K_{40}$ kg ha⁻¹, recommended dose of nitrogen (RDN) and P and K inorganic fertilizer basal dose in all treatments. The N-P-K content of Farmyard manure, vermicompost, poultry manure and neem cake was 0.5-0.2-0.5, 3.0-1.0-1.5 and 5.2-1.0-1.4 respectively. Groundnut cultivar Kaushal (G-201) was sown on 17 July 2009 and 27 July 2010 with a spacing of 30cm x 15cm. All the recommended agronomic practices were followed to raise the crop. Various yield and yield attributes were recorded at harvest. The data on yield and yield attributes from randomly selected five plants from each net plot was recorded and mean value was found out. After harvesting the crop from net plot, the pods were separated from plants from the each experimental plot; sun dried, cleaned thoroughly and weighed. All data were statistically analyzed by using WINDOSTAT Software Version-7. Significance of the treatments was determined on the basis of F test. Critical differences were calculated at 5% level of probability.

RESULTS AND DISCUSSION

Yield attributes

The present study indicated that application of organic manures significantly increased yield attributes of groundnut. The highest pod yield (3.22 t ha⁻¹) of groundnut was recorded with the application of 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through poultry manure + 25% RDN through neem cake which was followed by application of 50% RDN through vermicompost + 50% RDN through neem cake (2.88 t ha⁻¹) which was significantly higher than all other combination of organic manure. The lowest value (1.40 t ha⁻¹) of pod was recorded with the application of 100% recommended dose of poultry manure. Among the sole application of organic manures, 100% RDN through neem cake produced highest pod yield (1.91 t ha⁻¹) which was followed by vermicompost, FYM and poultry manure. Combined application of organic manure improved the soil environment which encouraged proliferous root system resulting in better absorption of water and nutrients from lower soil layers and resulting in higher pod yield.

Application of 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through poultry manure + 25% RDN through neem cake resulting highest haulm yield (3.78 t ha^{-1}) which was significantly increased (52.11%) haulm yield.

The increment of shelling percentage (19.59%) and maximum shelling percentage (73.48%) were recorded with the combination of different organic manures (25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through poultry manure + 25% RDN through neem cake) which was significantly higher as compared to other treatments. shelling percentage too exhibited similar trend as the different organic treatments helped to increase the pod filling and test weight, which in turn favored the improvement in shelling percentage. Similar results have been reported by Abraham*et al.*[1].

The maximum harvest index (46%) and increment of harvest index (33.41%) were recorded under the combination of different organic manures (25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through poultry manure + 25% RDN through neem cake).The beneficial effect of organic manuring might be due to improvement in the physical condition of soil as well as increased availability of plant nutrients. This finding has been supported by Mishra [3] and Rao and Shaktawat [4].

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Treatment	Shell	ing	Haulm yield				
	Pod Y	ïeld	Harvest index				
	(%)	(t/ha)	(t/ha)	(%)			
Control (R.D. of N.P.K through fertilizer)	70.08	2.05	3.06	40.14			
100% RDN through farm yard manure	61.44	1.56	2.66	38.30			
100% RDN through vermicompost	68.27	1.73	2.76	39.98			
100% RDN through poultry manure	63.75	1.40	2.48	34.48			
100% RDN through neem cake	70.65	1.91	2.88	39.80			
50% RDN through farm yard manure + 50% RDN							
through vermicompost	73.11	2.61	3.40	43.38			
50% RDN through farm yard manure + 50% RDN							
through poultry manure	72.23	1.99	3.45	36.69			
50% RDN through farm yard manure + 50% RDN							
through neem cake	73.34	2.72	3.36	43.49			
50% RDN through vermicompost + 50% RDN through							
poultry manure	72.46	2.37	3.23	42.32			
50% RDN through vermicompost + 50% RDN through							
neem cake	72.02	2.88	3.75	43.44			
50% RDN through poultry manure + 50% RDN through							
neem cake	72.31	2.48	3.29	42.92			
25% RDN through farm yard manure + 25% RDN							
through vermicompost + 25% RDN through poultry	73.48	3.22	3.78	46.00			
manure + 25% RDN through neem cake							
SEm±	0.69	0.14	0.16	2.05			
CD (P=0.05)	1.38	0.30	0.33	4.25			

Table 1. Effect of different organic sources of nitrogen on yield attributes of groundnut (Pooled data of two seasons)

Table 2. Effect of different organic sources of nitrogen on quality parameters of groundnut (Pooled data of two seasons)

		Oil	Protein		
Treatment	Content	Yield	Content	Yield	
	(%)	(t/ha)	(%)	(t/ha)	
Control (R.D. of N.P.K through fertilizer)	45.21	0.65	16.78	0.24	
100% RDN through farm yard manure	37.50	0.34	20.01	0.18	
100% RDN through vermicompost	39.28	0.45	17.33	0.21	
100% RDN through poultry manure	37.36	0.33	17.28	0.15	
100% RDN through neem cake	43.75	0.58	19.56	0.26	
50% RDN through farm yard manure + 50% RDN through	45.61	0.89	20.23	0.38	
vermicompost					
50% RDN through farm yard manure + 50% RDN through	34.60	0.52	22.21	0.31	
poultry manure					
50% RDN through farm yard manure + 50% RDN through					
neem cake	46.81	0.93	22.85	0.45	
50% RDN through vermicompost + 50% RDN through poultry					
manure	45.23	0.79	20.78	0.36	
50% RDN through vermicompost + 50% RDN through neem					
cake	47.20	0.97	23.65	0.49	
50% RDN through poultry manure + 50% RDN through neem					
cake	45.91	0.83	22.05	0.39	
25% RDN through farm yard manure + 25% RDN through					
vermicompost + 25% RDN through poultry manure + 25%	48.13	1.12	24.31	0.56	
RDN through neem cake					
SEm±	0.91	0.02	0.65	0.01	
CD (P=0.05)	1.89	0.04	1.36	0.02	

Quality characteristics

Combination of different organic sources of nitrogen hassignificantly influenced quality characteristics of groundnut. Application of 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through poultry manure + 25% RDN through neem cake recorded significantly higher oil content and oil yield followed by 100% RDN through

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vermicompost + 100% RDN through neem cake. Increase in protein content and protein yield with application of 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through poultry manure + 25% RDN through neem cake which was significantly higher followed by 50% RDN through vermicompost + 50% RDN through neem cake. Similar results have been reported by Thimmegowda [7]. Application of 100% RDN through FYM, 100% RDN through vermicompost, 100% RDN through poultry manure and 100% RDN through neem cake was alone then not able to adequately supply plant nutrients. Direct effect of organic manure significantly increased yield and quality characteristics of groundnut.

- Treatment	N uptake	P uptake	K uptake		
	(kg/ha)	(kg/ha)	(kg/ha)		
Control (R.D. of N.P.K through fertilizer)	108.2	15.6	63.8		
100% RDN through farm yard manure	94.4	14.4	58.3		
100% RDN through vermicompost	96.2	14.7	59.5		
100% RDN through poultry manure	96.5	15.0	60.2		
100% RDN through neem cake	97.9	17.1	60.9		
50% RDN through farm yard manure + 50% RDN through vermicompost	99.8	18.9	62.8		
50% RDN through farm yard manure + 50% RDN through poultry manure	97.6	18.2	65.1		
50% RDN through farm yard manure + 50% RDN through neem cake	106.1	19.9	64.2		
50% RDN through vermicompost + 50% RDN through poultry manure	98.6	19.5	64.9		
50% RDN through vermicompost + 50% RDN through neem cake	115.5	20.2	68.5		
50% RDN through poultry manure + 50% RDN through neem cake	117.7	20.5	71.5		
25% RDN through farm yard manure + 25% RDN through vermicompost + 25% RDN through poultry manure + 25% RDN through neem cake	119.0	21.1	72.3		
SEm±	1.21	0.76	0.96		
CD (P=0.05)	2.32	1.24	2.53		

Table 3.	Effect of	f different	organic	manures	on yield	and	nutrient	uptake	of grou	ndnut
			(Pool	ed data of	two sea	sons)			

Table 4.	Effect of	different	organic	sources	of nitrogen	on	economics	of groun	idnut ((Pooled
				data of t	wo seasons)				

	Cost of	Net returns	B:C
Treatment	Cultivation	(× 103 R/ha	Ratio
	(× 103 R/ha)		
Control (R.D. of N.P.K through fertilizer)	21.86	42.02	2.91
100% RDN through farm yard manure	27.49	21.29	1.77
100% RDN through vermicompost	26.49	27.67	2.08
100% RDN through poultry manure	22.49	21.56	1.95
100% RDN through neem cake	27.26	32.35	2.18
50% RDN through farm yard manure + 50% RDN through			
vermicompost	26.99	38.86	2.99
50% RDN through farm yard manure + 50% RDN through poultry			
manure	24.99	36.93	2.47
50% RDN through farm yard manure + 50% RDN through neem cake	27.37	56.74	3.06
50% RDN through vermicompost + 50% RDN through poultry manure	24.49	49.27	3.51
50% RDN through vermicompost + 50% RDN through neem cake	26.87	62.42	3.31
50% RDN through poultry manure + 50% RDN through neem cake	24.87	52.12	3.09
25% RDN through farm yard manure + 25% RDN through			
vermicompost +	21.51	78.00	4.62
25% RDN through poultry manure + 25% RDN through neem cake			

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Nutrient uptake

Maximum uptake of N, P and K: 119, 21.1 and 72.3 kg ha⁻¹ was recorded with the application of 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through poultry manure + 25% RDN through neem cake followed by 50% RDN through poultry manure + 50% RDN through neem cake (N, P and K: 117.7, 20.5 and 71.5 kg ha⁻¹) found significantly higher than all other combination of organic manure. Among the sole application of organic manures, 100% RDN through neem cake was recorded uptake of N, P and K: 97.9, 17.1 and 60.9 kg ha⁻¹ followed by100% RDN through poultry manure(N, P and K: 96.5, 15.0 and 60.2 kg ha⁻¹),100% RDN through vermicompost(N, P and K: 96.2, 14.7 and 59.5 kg ha⁻¹) and 100% RDN through FYM (N, P and K: 94.2, 14.4 and 58.3 kg ha⁻¹). Organic manures make N availability directly and also through N- fixation by inducing the growth of associated microorganism. Similar results was recorded Rao and Shaktawat [5].

Economics

Table 4 presents data on cost of cultivation, and benefit cost ratio of different treatment combination. The maximum cost of cultivation $(27.49 \times 10^3 \text{INR ha}^{-1})$ was found with application of 100% RDN through farm yard manure and the minimum cost of cultivation $(21.51 \times 10^3 \text{ INRha}^{-1})$ recorded with application of 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through poultry manure + 25% RDN through neem cake. Sole application of organic manures, 100% RDN through FYM (27.49 ×10³INRha⁻¹) was recorded maximum cost of cultivation followed by 100 % RDN through neem cake $(27.26 \times 10^3 \text{INRha}^{-1})$, 100% RDN through vermicompost (26.49 ×10³INR ha⁻¹) and 100 % RDN through poultry manure (22.49 ×10³ ha⁻¹).

The maximum net return (78.00 ×10³ INR ha⁻¹) was observed with application of 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through Poultry manure + 25% RDN through neem cake followed by 50% RDN through vermicompost + 50% RDN through neem cake (62.42×10^{3} INR ha⁻¹). Sole application of organic manures, 100% RDN through neem cake(32.35×10^{3} INR ha⁻¹) was recorded maximum net return followed by 100 % RDN through vermicompost (27.67×10^{3} INR ha⁻¹), 100 % RDN through poultry manure (21.56×10^{3} INR ha⁻¹) and 100% RDN through FYM (21.29×10^{3} INR ha⁻¹). The highest benefit cost ratio was recorded as 4.62.

CONCLUSION

The findings of experiment, it may be concluded that combination organic manure (25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through poultry manure + 25% RDN through neem cake), have a significantly direct effect on groundnut production. Application of different organic manure may be adopted for obtaining increased yield, quality and nutrients uptake of groundnut.

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