

Effect of different organic sources and mulching on growth, yield and quality of groundnut (*Arachis hypogaea* L.)

MH Kavadi^a, KD Mevad^{ab} and PC Makavana^{c#}

Summary

Ten treatment combinations comprising five different organic sources viz., Vermicompost, FYM, NADEP-compost, Bangalore-compost and No manure and two levels of mulching viz., mulch with wheat straw @ 2.5t/ha and no mulch were evaluated in randomized block design with factorial concept with four replications. An application of vermicompost recorded significantly higher plant height (13.72, 30.00 and 54.56 cm at 30, 60 DAS and at harvest, respectively) and root length (12.52 cm) at 45 DAS, number of pods per plant (25.82), pod yield (2757 kg/ha), haulm yield (4615 kg/ha) shelling % (73.98%), protein content (24.85%) and oil content (51.68%). The effect of mulch on all the observations was found non-significant. All the interaction effects between organic sources and mulching on all the observations were found non-significant. For getting higher growth, yield and quality of *kharif* groundnut crop should be applied manures with 20 kg N/ha from vermicompost along with 250 kg PROM/ha.

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Introduction

Groundnut (*Arachis hypogaea* L.) is known to be a unique and essential legume cum oilseed crop of India, accounting 33% of world's groundnut area and about 27.3% production. It belongs to Fabaceae family. It is also known as peanut, monkey nut, earthnut, manila nut and goober. It is world's largest source of edible oil and ranks 13th among the food crops. It is grown in both tropical and sub-tropical regions and the continental part of temperate countries. Nutritionally and commercially, it is a significant source of oil and protein. The kernels also rich in vitamin E, K and all B vitamins except B₁₂. Out of the total edible oil production in the country, about 70% is obtained from groundnut alone. Groundnut cake contains 7 to 8% N, 1.5% P₂O₅ and 1.2% K₂O (Nazir et al. 2022). Organic manures play a vital role in increasing the productivity of pulses by several means e.g. FYM not only supplies all the macro and micronutrients but also acts as a soil conditioner. Farmyard manure also improves the physio-chemical properties of soil and encourages soil microbial activities too. Among the sources of

available organic manures, vermicompost is a potential source due to the presence of readily available plant nutrients, growth-enhancing substances such as auxins and gibberellins and several beneficial micro-organisms like nitrogen fixing, P-solubilizing and cellulose decomposing organisms. Compost provides a stable

organic matter that improves the physical, chemical, and biological properties of soils, thereby enhancing soil quality, crop production, and farm productivity on a sustainable basis. PROM is the phosphorus-rich organic fertilizer. Phosphorus-rich organic manure is a type of fertilizer used as an alternative to diammonium phosphate and single superphosphate. Which contains 10.2% phosphorus. Phosphate-rich organic manure is produced by co-composting high-grade rock phosphate in fine size with organic manure collected from various sources such as FYM, straw of paddy or wheat, press mud, karanj cake or waste from fruit industries and distillery etc. phosphate solubilizing bacteria (PSB) and nitrogen-fixing bacteria are added to improve the efficiency.

Materials and Methods

The present investigation was carried out during the *kharif* season of the year 2021 at College Agronomy Farm, BACA, Anand Agricultural University, Anand (Gujarat) on "Effect of different organic sources and mulching on growth, yield and quality of groundnut (*Arachis hypogaea* L.)" Soil of the experimental site is loamy sand and locally known as "Goradu" soil. The soil is alluvial by nature of origin, very deep, well-drained and

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fairly moisture retentive. Soil responds well to fertilizers, manures and irrigation. Soil is suitable for wide range of crops grown in tropical and sub-tropical regions. A composite soil sample was collected from the experimental plot No. 10 to a 0-15 cm depth before sowing. The statistical analysis of the data of the various characters evaluated in the research was carried out by a computer system at the computer centre, Department of Statistics, B. A. College of Agriculture, Anand, using the procedure appropriate to the design of the experiment as given by Panse and Sukhatme (1967). The 'F' test was used to determine the significance of differences. A five per cent level of significance was used to test the significance of the results. The critical difference was calculated when differences between the treatments were found significant by 'F' test. Only in the remaining situationss was the standard error of means calculated. The co-efficient of variation was calculated to determine the extent of variation within the blocks.

Treatment combination

Treatment	Description
Factor F=Organic Manures	
F ₀	No manure (Control)
F ₁	100% N through FYM
F ₂	100% N through Vermicompost
F ₃	100% N through NADEP-Compost
F ₄	100% N through Bangalore-Compost
Factor M = Mulch	
M ₀	No Mulch
M ₁	Mulch with wheat straw @ 2.5 t/ha

Result and Discussion

Growth parameters and quality parameters

The data presented in Table 1 and 2 revealed significant variations among the treatment on growth attributes. Maximum plant height at 30, 60 DAS and at harvest (13.72, 30.00 and 54.56 cm, respectively) was recorded in the treatment of 100% N through Vermicompost (F₂), which was remain at par with treatment FYM (F₁), NADEP-Compost (F₃) and Bangalore-Compost (F₄) at 30, 60 DAS and at harvest. It might be due to the addition of organic manure increased the organic carbon status in the soil, which accelerated microbial activities that increase the supply of balanced nutrition to the crop, resulted in hastened metabolic and physiological activity of the plant and put up more growth by assimilating more amounts of major nutrients as well as micronutrient

which ultimately increased the plant height. These results are in close conformity with the findings of Donga et al. (2021), Chatterji (2014), Ramakrishna et al. (2016) and Hiradeve et al. (2011). Maximum root dry biomass at 45 DAS (1.73 g/plant) was recorded in the treatment of 100% N through Vermicompost (F₂), which was found at par with NADEP-Compost (F₃). The increased root dry biomass ascribed to applied vermicompost might result from accelerated plant metabolic and physiological activities, resulting in higher cell division and increasing growth by assimilates. This ultimately increased the root dry weight. These results are in close conformity with the finding of Biswash et al. (2014) and Ramkrishna et al. (2016). Maximum root length at 45 DAS (12.52 cm) was recorded in the treatment of 100% N through Vermicompost (F₂), which was at par with treatment FYM (F₁), NADEP-Compost (F₃) and Bangalore-Compost (F₄) at 45 DAS. Vermicompost increases root length due to the fact that vermicompost promotes soil aggregation and stabilizes soil structure. This might improve the air-water relationship of soil, thus increasing the water retention capacity and encourages extensive development of the root system of the plant. These results corroborate the work of Khan & Ishaq (2011), Sharmila et al. (2019). The maximum dry weight of nodule at 45 DAS (79.33 mg/plant) was recorded in the treatment of 100% N through NADEP-Compost. It was found at par with vermicompost (F₂) and FYM (F₁) treatment. The increase in the dry weight of nodules might be due to an increase in root growth resulting from the porousness of the soil due to the addition of organic matter in the soil. This might be resulted into higher availability of nutrients at the initial stage through organic sources, making the additional supply of nitrogen and phosphorus help in the formation of new cells and thus, the proliferation of growth. This finding is closely followed by the results of Choubey et al. (2018). More branches per plant (9.42) were recorded in the treatment of 100% N through FYM. It was found at par with vermicompost (F₂) treatment. The increase in number of branches per plant due to FYM could be ascribed to the overall improvement in plant growth, vigour, root growth and higher dry matter production in plants which resulted in the effective utilization of applied resources. These results collaborate with the work of Karunakaran et al. (2010), Singh et al. (2011), Vishwakarma et al. (2012) and Nagar et al. 2017.

Table 1. Effect of organic sources and mulching on plant height, dry root biomass and dry weight of nodule of ground nut

Treatment	Plant height (cm)			Root dry biomass (g/plant)	Dry weight of nodule (mg/plant)
	30 DAS	60 DAS	At Harvest	45 DAS	45 DAS
[A] Organic sources (F)					
F ₀ : No Manure (control)	11.55	26.81	45.81	1.50	63.60
F ₁ : 100% N through FYM	12.95	29.18	52.00	1.58	76.12
F ₂ : 100% N through Vermicompost	13.72	30.00	54.56	1.73	74.21
F ₃ : 100% N through NADEP-Compost	13.22	28.06	53.56	1.63	79.33

F₄: 100% N through Bangalore-Compost	13.07	28.68	50.43	1.56	69.41
S.E.m.±	0.38	0.64	1.62	0.04	2.70
C.D. (P=0.05)	1.11	1.86	4.71	0.12	7.80
[B] Mulching (M)					
M₀: No Mulch	12.74	28.27	51.10	1.59	71.76
M₁: Mulch (wheat straw) @ 2.5 t/ha	13.07	28.82	51.45	1.61	73.30
S.E.m.±	0.24	0.40	1.02	0.02	1.70
C.D. (P=0.05)	NS	NS	NS	NS	NS
Interaction (F×M)	NS	NS	NS	NS	NS
CV %	8.40	6.35	8.96	7.64	10.53

The application of vermicompost (F₂) recorded significantly superior protein content (24.85 %) over the rest of the treatments, but it was found at par with FYM (F₁) and NADEP-Compost (F₃). The significant increase in protein content in kernel on application of vermicompost is due to increased availability of nitrogen to the plant from vermicompost resulting in increased nitrogen content in plant which has a significant role in protein synthesis in the kernel. The results obtained in the present investigation are in close conformity with those of Mathur (2000), Yadav (2001), Tak (2014), Kumawat *et al.* (2009) and Chaudhari *et al.* (2013). The application of FYM (F₁) recorded significantly superior oil content (51.68 %) over the rest of the treatments, but it was found at par with vermicompost (F₂) and NADEP-Compost (F₃). Significantly the lower protein content (44.95 %) was recorded under application of no manure (F₀). The application of FYM (F₁) recorded significantly superior oil content (51.68 %) over the rest of the treatments, but it was found at par with vermicompost (F₂) and NADEP-Compost (F₃). Better organic carbon

production and greater exchange of ions that enhanced the mobility of nutrients under this treatment led to a favourable environment in the plant system, thereby increasing oil content of groundnut. The results obtained in the present investigation are in close conformity with those of Patil *et al.* (2017), Sarade *et al.* (2016), Haldhar *et al.* 2017 and Pareek *et al.* (2020).

While application of No Manure (F₀) showed the lowest plant height at 30 DAS, 60 DAS and at harvest (11.55, 26.81, and 45.81 cm, respectively), lower root dry biomass (1.50 g/plant), root length (10.85 cm), dry weight of nodule (63.60 mg/plant), number of branches per plant (7.27) at 45 DAS, protein content (20.35 %) and oil content (44.95 %) of groundnut.

Data given in Table 1 and 2 revealed that the effect of mulching did not express a significant influence on the growth and quality parameters of groundnut. The interaction effect of organic sources and mulching was also found non-significant on groundnut growth and quality parameters.

Table 2. Effect of organic sources and mulching on root length, number of branches/ plants, protein and oil of ground nut

Treatment	Root length (cm) 45 DAS	Number of Branches/ plant	Protein (%)	Oil (%)
[A] Organic sources (F)				
F₀: No Manure (control)	10.85	7.27	20.35	44.95
F₁: 100% N through FYM	12.22	9.42	23.05	51.68
F₂: 100% N through Vermicompost	12.52	8.65	24.85	50.51
F₃: 100% N through NADEP-Compost	12.30	8.25	23.83	49.30
F₄: 100% N through Bangalore-Compost	11.68	8.02	22.96	48.05
S.E.m.±	0.33	0.33	0.74	1.22
C.D. (P=0.05)	0.98	0.96	2.15	3.55
[B] Mulching (M)				
M₀: No Mulch	11.78	8.25	22.45	48.39
M₁: Mulch (wheat straw) @ 2.5 t/ha	12.04	8.40	23.55	49.41
S.E.m.±	0.21	0.21	0.46	0.77
C.D. (P=0.05)	NS	NS	NS	NS
Interaction (F×M)	NS	NS	NS	NS
CV %	8.02	11.34	9.13	7.08

Yield parameters

The data presented in Table 3 revealed significant variations among the treatment on growth attribute. Maximum number of pods/plant (25.82), pod yield (2757 kg/ha) haulm yield (4615 kg/ha) and shelling (65.17%) was found in the treatment of 100% N through Vermicompost (F₂). It was remain at par with application of NADEP-Compost (F₃) and FYM (F₁) in number of pods/plant and shelling percentage while only NADEP-

compost was at par in pod yield and haulm yield Beneficial effect of vermicompost may be due to adequate nutrient supply from its decomposition, enhanced mobilization of nutrients from the soil, activation of beneficial soil biological activities which increased nutrient availability as well as the physical condition of soil which provided good food for the plant. Increased yield of the ground nut might be due to the proliferation of the root length, root length, number of

nodules and other parameters, which leads to maximum yield of groundnut crops. These results conform with Bhadu et al. (2018), Kumar & Yadav (2018), Yadav et al. (2017), Donga & Mathukia (2021) and Kumar & Haldhar

2022. The application of no manure (F_0) showed the lower pods per plant (20.30), pod yield (2055 kg/ha), haulm yield (3339 kg/ha) and shelling percentage (59.15%) at harvest of groundnut.

Table 3. Effect of organic sources and mulching on the number of pods/ plants, shelling, pod yield and haulm yield of ground nut

Treatment	Number of pods/ plant	Shelling (%)	Pod yield (kg/ ha)	Haulm yield (kg/ ha)
[A] Organic sources (F)				
F₀: No Manure (Control)	20.30	59.15	2055	3339
F₁: 100% N through FYM	23.52	61.60	2455	4107
F₂: 100% N through Vermicompost	25.82	65.17	2757	4615
F₃: 100% N through NADEP-Compost	23.82	60.98	2677	4424
F₄: 100% N through Bangalore-Compost	23.05	69.97	2267	3940
S.Em.±	0.80	1.51	84	128
C.D. (P=0.05)	2.32	3.79	243	373
[B] Mulching (M)				
M₀: No Mulch	23.00	60.73	2396	4022
M₁: Mulch (wheat straw) @ 2.5 t/ha	23.61	61.96	2489	4148
S.Em.±	0.50	0.95	53	81
C.D. (P=0.05)	NS	NS	NS	NS
Interaction (F×M)	NS	NS	NS	NS
C. V. %	9.72	6.67	9.73	8.92

Declaration of interests

The authors have no conflict of interest to declare.

Data Sharing

All relevant data are within the manuscript.

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