RESEARCH ARTICLE Legume Research- An International Journal, Volume 49 Issue 3: 470-475 (March 2026)

Growth, Yield and Quality of Groundnut as Influenced by Organic Nutrient Sources in Groundnut-Finger Millet Cropping Sequence

Santosh Araganji[1], B. Boraiah[1], N.S. Saniga[1], Kushal[1]

10.18805/LR-5352

ABSTRACT

Background: Groundnut based cropping system are prime importance in global oilseed production. This study aimed to evaluate the performance of groundnut in groundnut-finger millet cropping sequence under organic nutrient management condition.

Methods: A field experiment entitled "growth, yield and quality of groundnut as influenced by organic nutrient sources in groundnut - finger millet cropping sequence" was conducted at the Research Institute on Organic Farming (RIOF), University of Agricultural Sciences, Bangalore, Karnataka during summer season of 2022-23 and 2023-24 by employing randomized complete block design experiment with eight treatments replicated thrice. The study evaluated the effect of different organic inputs, including vermicompost, farmyard manure, urban compost, poultry manure, deoiled cake, bio digester liquid organic manure and integrated nutrient management with50% FYM + 25% vermicompost + 25% bio digester liquid organic manure on growth, yield and quality attributes of groundnut in groundnut-finger millet cropping sequence.

Result: The results of the experiment revealed that the application of 100% nitrogen equivalent through poultry manure resulted in significantly higher growth, yield and quality parameters of groundnut in groundnut-finger millet cropping sequence.

Key words: Cropping sequence, Groundnut, Organic sources, Poultry manure.

INTRODUCTION

Since the onset of the green revolution, the sustainability of the prevalent cereal-cereal cropping system in South East Asia has been questioned due to its detrimental impact on soil fertility (Jat *et al.,* 2016). The best way to overcome the drawbacks of mono-cropping and increase the nation's food production is by adopting cropping systems that incorporate both cereals and legumes (Bhuva *et al.,* 2017) and (Lenka *et al.,* 2023).

Groundnut (*Arachis hypogaea* L.) is regarded as the king of oilseeds and sometimes referred to as the "poor man's almond" (Biswal *et al.,* 2023). It has a productivity of 1764 kg ha^{-1} and a production of 4.59 m t, occupying an area of 7.40 m ha in India. Groundnut and finger millet are widely grown in Karnataka particularly in rainfed areas. These areas face significant challenges such as low soil moisture, insufficient organic matter content and poor soil fertility, all of which contribute to limitations in yield and productivity for these crops. The primary reasons for the low yields in groundnut are attributed to insufficient and imbalanced nutrient application, leading to nutrient deficiencies.

In recent years, there has been a growing interest in exploring organic nutrient sources as alternatives or supplements to conventional fertilizers. The use of organic sources such as farm yard manure, vermicompost *etc* is helpful for improving soil aggregation, structure, fertility, moisture holding capacity and thereby increasing crop yield (Veeral and Kalaimathi, 2021). The application of organic manure help in mitigating multiple nutrient deficiencies at same time provides better environment for growth and development by improving in physical, chemical and biological properties of soil. Keeping these things in view, the research was conducted at Research Institute on Organic Farming Block, University of Agricultural Sciences, GKVK, Bengaluru to know the effect of different organic nutrient sources on growth, yield and quality of groundnut in groundnut-finger millet cropping sequence.

MATERIALS AND METHODS

Two year field trial was carried out at Research and Demonstration Block of Research Institute on Organic Farming (RIOF), Gandhi Krishi Vignan Kendra (GKVK), University of Agricultural Sciences, Bangalore in the year 2022-2023 and 2023-2024 respectively. The groundnut was

[1]Department of Agronomy, University of Agricultural Sciences, Bangalore-560 065, Karnataka, India.

Corresponding Author: Santosh Araganji, Department of Agronomy, University of Agricultural Sciences, Bangalore-560 065, Karnataka, India. Email: santoshgkvk@gmail.com

How to cite this article: Araganji, S., Boraiah, B., Saniga, N.S. and Kushal (2026). Growth, Yield and Quality of Groundnut as Influenced by Organic Nutrient Sources in Groundnut-Finger Millet Cropping Sequence. *Legume Research.* **49(3):** 470-475. doi: 10.18805/LR-5352.

Submitted: 11-05-2024 **Accepted:** 16-10-2024 **Online:** 27-12-2024

sown in the month of February and harvested in month of June in 2022-23 and 2023-24, respectively. Soil of experimental area was red sandy loamy soil with slightly acidic in pH (6.42), electrical conductivity (0.25 dSm^{-1}), medium level of organic carbon content (0.62%), available nitrogen (274.3 kg ha^{-1}), available phosphorus (25.6 kg ha^{-1}) and available potassium (222.5 kg ha^{-1}). The nutrient composition of organic sources used in the experiment is detailed in Table 1. The experiment was laid out in a randomized complete block design (RCBD) replicated thrice with eight treatments consisting of absolute control (T_1), 100% nitrogen equivalent [farm yard manure (T_2), vermicompost (T_3), urban compost (T_4), poultry manure (T_5), deoiled cake (T_6), bio digester liquid organic manure (T7) and Integrated organic nutrient management *i.e* 50% FYM + 25% Vermicompost + 25% bio digester liquid organic manure]. In both the years of experiment groundnut variety of Kadiri Lepakshi (K-1812) was sown at a spacing of 30 cm × 15 cm and followed agronomic practices for cultivating the crop.

Biometric observations on growth parameters were recorded randomly on average data of selected five tagged plants at 30, 60, 90 days after sowing and at harvest in net plot. Data related to yield and their attributes was recorded at the time of harvest of the crop. The data were analyzed statistically using the method described by (Gomez and Gomez, 1984) aligning with the observed patterns and findings. To know the effect of individual treatment to compare with control, statistical procedure of randomized complete block design was followed, respectively.

RESULTS AND DISCUSSION

Plant height

The year wise and pooled data on plant height, number of leaves, dry matter accumulation and number of nodules per plant recorded at harvest of groundnut as effect of application of different organic sources in groundnut-finger millet cropping sequence is presented in Table 2.

Among the different organic sources, application of 100% nitrogen equivalent poultry manure (T_5) recorded significantly higher plant height at harvest throughout the study during 2022-23 (45.17 cm) and 2023-24 (46.52 cm) respectively and was on par with 100% nitrogen equivalent vermicompost T_3. On the contrary, absolute control (T_1) recorded significantly lowest plant height in 2022-23 (30.54 cm) and 2023-24 (32.68 cm). These findings align with the research conducted by Pant and Katiyar (1996) Naidu (2000) and Qureshi *et al.* (2005). Significantly higher plant height might be due to the gradual nutrient release from poultry manure and vermicompost, ensuring a steady and prolonged supply of nutrients especially nitrogen to the plants. Nitrogen is a crucial component of protoplasm, that plays a vital role in cell division and elongation, which in turn promotes vigorous crop growth. This enhanced growth, facilitates effective light interception and a higher rate of photosynthesis, contributing to uniform plant development and ultimately resulting in higher plant height.

Number of leaves per plant

Application of 100% nitrogen equivalent poultry manure (T_5) was noticed to be significantly superior in number of leaves per plant at harvest during two years of study (36.25 and 37.50) respectively which was on par with T_3 *i.e* 100% nitrogen equivalent vermicompost (35.79, 35.87) The lowest number of leaves were recorded in control plots (27.65, 28.14) during 2022-23 and 2023-24, respectively. The greater abundance of leaves can be linked to a higher supply of primary and secondary nutrients, particularly nitrogen to the crop (Vaghasia *et al.,* 2016). Moreover, organic source of nutrients has enhanced the formation of soil aggregates, likely due to the bonding effect of polysaccharides and other organic compounds released during organic matter decomposition. Consequently, these factors have resulted in taller plants, more leaves and finally higher yield at harvest. Channabasanagowda *et al.* (2008) experimental evidence proved that the unique impact of poultry manure and vermicompost could be associated with release of nitrogen and make them available to plants very quickly within short period of time compared to FYM.

Dry matter accumulation per plant

At harvest, significantly more dry matter accumulation per plant (32.34 and 34.56 g in 2022-23 and 2023-24, respectively) were recorded with the 100% nitrogen equivalent poultry manure (T_5) and was statistically on par with the T_3 *i.e.* 100% nitrogen equivalent vermicompost (31.05 and 32.33 g in 2022-23 and 2023-24, respectively) followed by the treatment T_6-100% 'N' equivalent deoiled cake (30.25 and 33.21 g in 2022-23 and 2023-24, respectively). However, lower dry matter accumulation was observed in control treatment (20.03 and 21.04 g 2022-

Table 1: Nutrient composition of organic sources.

Organic sources	Nitrogen (%)		Phosphorous (%)		Potassium (%)	
	2022	2023	2022	2023	2022	2023
Farm yard manure	0.43	0.47	0.24	0.23	0.40	0.44
Vermi compost	1.46	1.45	0.53	0.54	1.25	1.27
Urban compost	1.29	1.30	0.50	0.49	0.75	0.74
Poultry manure	2.23	2.19	1.62	1.60	1.24	1.29
Deoiled cake	1.48	1.43	0.62	0.59	0.95	0.98
Biodigester liquid organic manure	0.34	0.37	0.21	0.21	0.28	0.30

Table 2: Plant height, number of leaves per plant, dry matter accumulation per plant and number of nodules per plant of groundnut at harvest as influenced by organic sources in groundnut-finger millet cropping sequence.

Treatments	Plant height (cm)			Number of leaves/plant			Dry matter Accumulation/plant (g)			Number of nodules/plant		
	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled
T_1 : Absolute control	30.54	32.68	31.61	27.65	28.14	27.90	20.03	21.04	20.54	45.56	46.53	46.05
T_2 : 100% 'N' equivalent farm yard manure	33.13	34.71	33.92	29.23	30.25	29.74	22.15	23.56	22.86	48.72	50.47	49.60
T_3 : 100% 'N' equivalent vermicompost	42.57	44.91	43.74	35.79	35.87	35.83	31.05	32.33	31.69	63.14	64.35	63.75
T_4 : 100% 'N' equivalent urban compost	38.19	40.18	39.19	32.12	33.26	32.69	26.48	27.12	26.80	57.50	59.84	58.67
T_5 : 100% 'N' equivalent poultry manure	45.17	46.52	45.85	36.25	37.50	36.88	32.34	34.56	33.45	68.72	67.55	68.14
T_6 : 100% 'N' equivalent deoiled cake	41.35	43.12	42.24	34.11	35.86	34.99	30.25	33.21	31.73	62.53	63.54	63.04
T_7 : 100% 'N' equivalent BDLOM	35.72	37.86	36.79	30.27	31.59	30.93	24.15	25.06	24.61	51.68	50.68	51.18
T_8 : 100% 'N' equivalent integrated organic nutrient management	36.65	38.43	37.54	30.58	32.04	31.31	25.36	26.73	26.05	55.42	56.24	55.83
S.Em±	1.59	1.67	1.63	1.34	1.39	1.36	1.12	1.18	1.15	2.38	2.41	2.39
C.D. (p=0.05)	4.83	5.07	4.95	4.07	4.20	4.14	3.39	3.59	3.49	7.22	7.30	7.26

N = Nitrogen, BDLOM = Biodigester liquid organic manure, Integrated organic nutrient management = 50% FYM + 25% Vermicompost + 25% BDLOM.

Table 3: Number of pods per plant, percentage of matured pods per plant, 100 kernal weight and shelling percentage of groundnut as influenced by organic sources in groundnut-finger millet cropping sequence.

	Number of pods/plant			Matured pods/plant (%)			100 Kernal weight (g)			Shelling %		
Treatments	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled
T_1 : Absolute control	27.68	28.13	27.91	65.32	66.23	65.78	33.25	34.15	33.70	62.43	64.28	63.36
T_2 : 100% 'N' equivalent farm yard manure	28.63	29.54	29.09	70.58	71.74	71.06	35.46	36.01	35.74	65.23	66.35	65.79
T_3 : 100% 'N' equivalent vermicompost	36.50	37.82	37.16	81.54	80.57	81.06	43.74	43.85	43.80	73.56	74.82	74.19
T_4 : 100% 'N' equivalent urban compost	32.56	34.01	33.29	75.01	74.53	74.77	38.54	39.07	38.81	67.26	68.11	67.69
T_5 : 100% 'N' equivalent poultry manure	37.41	38.63	38.02	84.95	85.02	84.99	44.21	44.28	44.25	76.54	77.85	77.20
T_6 : 100% 'N' equivalent deoiled cake	35.14	35.87	35.51	80.01	82.63	81.32	42.13	43.05	42.59	74.58	75.85	75.22
T_7 : 100% 'N' equivalent BDLOM	29.01	29.47	29.24	72.15	72.56	72.36	37.56	38.75	38.16	67.14	68.34	67.74
T_8 : 100% 'N' equivalent integrated organic nutrient management	30.87	31.59	31.23	74.28	73.92	74.10	38.14	38.96	38.55	67.02	68.57	67.80
S.Em±	1.35	1.39	1.37	3.16	3.18	3.17	1.64	1.67	1.66	2.90	2.96	2.93
C.D. (p=0.05)	4.11	4.22	4.16	9.58	9.64	9.61	4.98	5.07	5.02	8.81	8.97	8.89

N = Nitrogen, BDLOM = Biodigester liquid organic manure, Integrated organic nutrient management = 50% FYM + 25% Vermicompost + 25% BDLOM.

23 and 2023-24, respectively). The accumulation of dry matter in plants intricately linked to nutrient availability and number of leaves. Slow release of nutrients from poultry manure, vermicompost, deoiled cake coinciding with nutrient uptake resulted in building higher biomass and robust growth of plants leading to increased number of leaves, photosynthetic ability ultimately contributing to greater dry matter accumulation in plants (Sen *et al.,* 2022).

Number of nodules per plant

Different organic sources of nutrients had significant influence on the root nodules and the highest number of nodules were noticed with the application of 100% nitrogen equivalent poultry manure (T_5) (68.72 and 67.55 nodules in 2022-23 and 2023-24, respectively) which was statistically on par with T_3 *i.e* 100% nitrogen equivalent vermicompost (63.14 and 64.35 nodules in 2022-23 and 2023-24, respectively) followed by T_6-100% 'N' equivalent deoiled cake (62.53 and 63.54 nodules in 2022-23 and 2023-24, respectively). On the contrary, absolute control (T_1) recorded significantly the lowest nodules per plant at harvest (45.56 and 46.53 in 2022-23 and 2023-24, respectively). It was due to the high phosphorus concentration of poultry manure which resulted in more proliferation of root nodules and also provided an ideal habitat for nitrogen fixing bacteria. Phosphorus is also necessary for several important plant functions, such as root growth and energy transfer. These results are in conformity with previous research conducted on groundnut and soybean by Kumar *et al.* (2008); Meena *et al.* (2015); Jeetarwal *et al.* (2015); Kalita *et al.* (2015) and Pandey and Pandey, (2019).

Number of pods per plant and matured pods per plant

Effect of application of various organic sources on yield attributes *i.e* number of pods per plant, percentage of matured pods per plant, 100 kernel weight and shelling percentage of groundnut in groundnut-finger millet cropping sequence are illustrated in Table 3.

In the both the years (2022-23 and 2023-24) and pooled data, 100%nitrogen equivalent poultry manure (T_5) registered significantly higher number of pods per plant and percentage of matured pods per plant (37.41, 38.63, 38.02 and 84.95, 85.02, 84.99 % in 2022-23, 2023-24 and pooled results, respectively), which was on par with T_3 *i.e* 100% nitrogen equivalent vermicompost (36.50, 37.82, 37.16 and 81.54, 80.57, 81.06 % in 2022-23, 2023-24 and pooled results, respectively) followed by the treatment T_6-100% 'N' equivalent deoiled cake (35.14, 35.87, 35.51 and 80.01, 82.63, 81.32% in 2022-23, 2023-24 and pooled results, respectively). Conversely, control plot recorded lowest number of pods per plant and percentage of matured pods per plant (27.68, 28.13, 27.91 and 65.32, 66.23, 65.78% in 2022-23, 2023-24 and pooled results, respectively).

Table 4: Pod yield, haulm yield, oil content and protein content of groundnut as influenced by organic sources in groundnut-finger millet cropping sequence.

Treatments	Pod yield (kg ha^{-1})			Haulm yield (kg ha^{-1})			Oil content (%)			Protein content (%)		
	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled
T_1 : Absolute control	1328	1374	1351	2012	2047	2030	47.05	47.82	47.44	22.04	23.21	22.63
T_2 : 100% 'N' equivalent farm yard manure	1384	1405	1395	2098	2144	2121	47.97	48.01	47.99	23.12	23.76	23.44
T_3 : 100% 'N' equivalent vermicompost	1642	1672	1657	2598	2687	2643	50.08	49.84	49.96	25.84	26.02	25.93
T_4 : 100% 'N' equivalent urban compost	1479	1521	1500	2386	2426	2406	48.06	49.23	48.65	24.61	25.14	24.88
T_5 : 100% 'N' equivalent poultry manure	1712	1785	1749	2689	2735	2712	50.35	50.04	50.20	26.02	26.58	26.30
T_6 : 100% 'N' equivalent deoiled cake	1526	1598	1562	2548	2614	2581	49.38	49.37	49.38	25.76	26.00	25.88
T_7 : 100% 'N' equivalent BDLOM	1403	1484	1444	2286	2323	2305	49.22	47.99	48.61	23.84	24.31	24.08
T_8 : 100% 'N' equivalent integrated organic nutrient management	1436	1496	1466	2314	2398	2356	49.87	49.95	49.91	24.03	24.47	24.25
S.Em±	62	64	63	99	101	100	2.05	2.05	2.05	1.02	1.04	1.03
C.D. (p=0.05)	189	196	192	301	308	304	NS	NS	NS	NS	NS	NS

N = Nitrogen, BDLOM = Biodigester liquid organic manure, Integrated organic nutrient management = 50% FYM + 25% Vermicompost + 25% BDLOM.

100 Kernel weight and Shelling percentage

The maximum 100 kernel weight (44.21, 44.28 and 44.25 g) and shelling percentage (76.54, 77.85 and 77.20%) was observed through application of 100% nitrogen equivalent poultry manure (T_5) during 2022-23, 2023-24 and pooled results, respectively. The treatment T_5 was on par with (T_3) 100% nitrogen equivalent vermicompost (43.74, 43.85, 43.80 g and 73.56, 74.82, 74.19%) and (T_6) 100% nitrogen equivalent deoiled cake (42.13, 43.05, 42.59 g and 74.58, 75.85, 75.22%) in 2022-23, 2023-24 and pooled results, respectively. On other hand absolute control (T_1) recorded significantly the lowest 100 kernal weight and shelling percentage (33.25, 34.15, 33.70 g and 62.43, 64.28, 63.36%) in 2022-23, 2023-24 and pooled results, respectively and this is because more roots growing from organic sources probably allowed for better nutritional absorption, especially calcium, which is essential for the formation of pods and shells. Larger kernel size and shell output were also probably caused by enhanced photosynthesis as a result of improved nitrogen and phosphorus availability in organic systems and effective translocation within plants favoring reproductive activities. Similar opinion were also mentioned by Murthy *et al.* (2009); Patra *et al.* (2011) and Narayana swamy *et al.* (2013).

Pod yield and haulm yield

Pod yield, haulm yield, oil content and protein content of groundnut in groundnut-finger millet cropping sequence presented in Table 4.

Higher pod and haulm yield of groundnut were obtained in the treatment (T_5) 100% nitrogen equivalent poultry manure (1712, 1785, 1749 and 2689, 2735, 2712 kg ha^{-1} in 2022-23, 2023-24 and pooled results, respectively) which was statistically on par with (T_3) 100% nitrogen equivalent vermicompost (1642, 1672, 1657 and 2598, 2687, 2643 kg ha^{-1} in 2022-23, 2023-24 and pooled results, respectively) followed by T_6-100% 'N' equivalent deoiled cake (1526, 1598, 1562 and 2548, 2614, 2581 kg ha^{-1} in 2022-23, 2023-24 and pooled results, respectively). Lower pod and haulm yield were obtained in control plots (1328, 1374, 1351 and 2012, 2047, 2030 kg ha^{-1} in 2022-23, 2023-24 and pooled results, respectively).

The productivity of groundnut is influenced by multiple factors that affect their output. Together with advantageous growth qualities, improved movement of nutrients from their point of production to their point of utilization accounts for the increased pod and haulm yield in groundnut. More leaf area, more dry matter accumulation, improved yield components and increased nutrient availability during the growing season were all included in these growth-related factors. Variation in the pod and haulm weight of groundnut across treatments is mostly caused by variations in the nutritional contents of the various organic sources used as treatments. These findings also support with the outcomes of (Ananda *et al.,* 2006), (Waghmode, 2010), (Shashidara, 2014), (Latha and Sharanappa, 2014) and (Sharma *et al.,* 2016).

Oil content and protein content

Oil and protein content was higher in (T_5) 100% nitrogen equivalent poultry manure (50.20 and 26.30%) in pooled results, respectively but organic method of nutrient management did not have noticeable impact on the oil and protein levels in groundnut kernels. The synthesis of oil is a complex process, making it challenging to adjust its content through agricultural practices. These results align with the research conducted by Panwar and Munda in 2007.

CONCLUSION

The outcomes of two years of field experimentation clearly show that the application of 100% nitrogen equivalent poultry manure resulted in significantly higher growth, yield and quality parameters of groundnut in groundnut-finger millet cropping sequence.

Conflict of interest

All authors declare that they have no conflict of interest.

REFERENCES

Ananda, M.G., Ananda, M.R., Reddy, V.C. and Ajayakumar, M.Y. (2006). Influence of different nutrient sources on yield and its components and BC ratio of paddy and groundnut in paddy-groundnut cropping system. *Crop Research*. **31(3):** 329-333.

Bhuva, H.M., Kumawat, P.D., Mehta, A.C., Chaudhari, N.N. and Patel, P.R. (2017). Effect of groundnut (*Arachis hypogaea* L.)-based intercropping systems on yield and economics under rainfed condition. *Indian Journal of Agricultural Research.* **51(5):** 448-452. doi: 10.18805/IJARe.A-4823.

Biswal, B., Kashyap, S., Bhattacharjee, S., Kumar, R., Kumar, D., Ram, H. and Saxena, A. (2023). Scope of horse gram and bambara groundnut as food and feed legume: A review. *Legume Research*. **46(2):** 127-133.doi: 10.18805/LR-4875.

Channabasanagowda, N.K., Patil, B.B.N., Patil, J.S., Awaknavar, B.T., Ninganur, H. and Hunge, R. (2008). Effect of organic manures on growth, seed yield and quality of wheat. *Karnataka Journal of Agriculture Science.* **21(3):** 366-368.

Gomez, K.A. and Gomez, A.A. (1984). Statistical Procedures for Agricultural Research (2nd ed.). John Willey, New York. p. 693.

Jat, H.S., Jat, M.L., Sharma, P.C., Sidhu, H.S. and McDonald, A.J. (2016). Sustainable Intensification of Cereal Based Systems in Semi-arid North West India-climate and Non-climate Drivers of Change. In: Natural Resource Management in Arid and Semi-arid Ecosystems for Climate Resilient Agriculture. [Pareek, N.K. and Arora, S. (eds.)]. Soil Conservation Society of India, New Delhi. pp. 1-11.

Jeetarwal, R.L.,Shivaran, A.C.,Dhaka, M.S., Jat, M.L. and Choudhary, G.L. (2015). Influence of phosphorus and zinc fertilization on economics, quality and nutrient uptake of ground (*Arachis hypogaea* L.). *Environment and Ecology*. **33(1):** 19-22.

Kalita, B., Barman, P.D., Gogoi, B. and Deori, B.B. (2015). Effect of levels of phosphorus and lime on the yield attributes and pod yield of irrigated summer groundnut. *Journal of AgriSearch*. **2(3):** 229-232.

Kumar, A., Sharma, M. and Mehra, R.K. (2008). Effect of phosphorus and sulphur on yield and nutrient uptake by groundnut in inceptisols. *An Asian Journal of Soil Science.* **3(1):** 139-141.

Latha, H.S. and Sharanappa. (2014). Effect of organic crop production technique on the quality of soil and crops, sustainability of yield in groundnut onion sequential cropping system. *Indian Journal of Agricultural Science.* **84(8):** 999-1003.

Lenka, S., Swain, S.K. and Pradhan, K.C. (2023). Performance of different groundnut (*Arachis hypogaea* L.) based intercropping systems with millets under rainfed condition of Odisha. *Legume Research*. **46(2):** 154-159. doi: 10.18805/LR-4690.

Meena, I., Meena, R.H., Sharma, S.K., Jat, G. and Choudhary, J.L. (2015). Effect of phosphorus and sulphur on yield and quality of soybean (*Glycine max*) in Typic Haplustept. *Annals of Agricultural Research.* **36(1):** 98-102.

Murthy, R.K., Vasudev, H.S., Devagiri, G.M., Umashankar, N. and Raveendra, H.R. (2009). Effect of integrated nutrient management on growth and yield parameters and nutrient uptake of groundnut (*Arachis hypogaea* L.). *Mysore Journal of Agricultural Sciences*. **43(4):** 696-699.

Naidu, P.H. (2000). Response of bunch varieties of groundnut to Rhizobium inoculation. *Legume Research.* **23(2):** 130-132.

Narayanaswamy, S., Siddaraju, R. and Rajendraprasad, S. (2013). Influence of organic source of nutrients *vs* conventional method of seed production on growth parameters and pod yield in groundnut (*Arachis hypogaea* L.). *Mysore Journal of Agricultural Science.* **47(2):** 328-332.

Pandey, M. and Pandey, A.C. (2019). Study of sulphur and phosphorus application on physical characteristics of groundnut (*Arachis hypogaea* L.) for sustainable oil seed production in Indo-Gangetic Plains of Eastern Uttar Pradesh. *International Journal of Agricultural Sciences.* **15(1):** 25-31.

Pant, L.M. and Katiyar, A.K. (1996). Response of groundnut to fertilizer nitrogen, farmyard manure and Brady rhizobium inoculation. *Agricultural Science Digest.* **16(1):** 52-54.

Panwar, A.S. and Munda, G.C. (2007). Response of groundnut (*Arachis hypogaea* L.) to organic and inorganic sources of nutrient supply under mid-hill altitude conditions. *Indian Journal of Agricultural Sciences*. **77(12):** 814-818. doi: 10.18805/lr.v0iOF.9438.

Patra, P.S., Sinha, A.C. and Mahesh, S.S. (2011). Yield, nutrient uptake and quality of groundnut kernels as affected by organic sources of nutrient. *Indian Journal of Agronomy.* **56(3):** 237-241.

Qureshi Aziz, A., Narayanasamy, G., Chhonkar, P.K. and Balasundram, U.R. (2005). Direct and residual effect of phosphate rocksin presence of phosphate solubilizers and F.Y.M. on the available P, organic carbon and viable counts of phosphate solubilized in soil after soybean, mustard and wheat crops. *Journal of the Indian Society of Soil Science*. **53:** 97-100.

Sen, P.K., Sirothiya, P. and Vikram, N. (2022). Effect of the vermicom post and poultry manure on groundnut (*Arachis hypogaea* L.) under rain-fed condition. *Agricultural Reviews.* **43(4):** 489-497. doi: 10.18805/ag.R-2275.

Sharma, R.K., Sharma, S.K. and Dangi, N.L. (2016). Influence of different organic nutrient sources on productivity and profitability of groundnut (*Arachis hypogaea* L.) in Southern Rajasthan, India. *Indian Journal of Agricultural Research.* **50(6):** 623-626. doi: 10.18805/ijare.v50i6.6682.

Shashidara. (2014). Development and evaluation of organic production package for table purpose groundnut varieties in dry zones of Karnataka (Ph.D. Thesis). University of Agricultural Sciences, Bangalore.

Vaghasia, P.M., Bhalu, V.B. and Kachhadiya, V.H. (2016). Nutrient requirement for confectionery groundnut (*Arachis hypogaea* L.) under irrigated condition. *Agricultural Science Digest.* **36(1):** 48-51. doi: 10.18805/asd.v35i1.9310.

Veeral, D.K. and Kalaimathi, P. (2021). Improving physiological and yield traits of groundnut (*Arachis hypogaea* L.) by using various sources of organic wastes and bio fertilizers, rhizobia. *Indian Journal of Agricultural Research.* **55(4):** 473-477. doi: 10.18805/IJARe.A-5255.

Waghmode, B.R. (2010). Response of sweet corn (*Zea may ssaccharata* L.) to different sources of organics. M.Sc. (Agri.) Thesis. University of Agricultural Sciences, Dharwad.