International Journal of Plant & Soil Science

34(23): 405-409, 2022; Article no.IJPSS.91200
ISSN: 2320-7035

Influence of Different Spacing and Organic Manure on the Yield and Economics of Groundnut (*Arachis hypogea* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2022/v34i2331604

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/91200

Original Research Article

Received 05 July 2022
Accepted 03 September 2022
Published 05 October 2022

ABSTRACT

Aim: The trail was taken to find out the influence of different spacing and organic manure on the yield and economics of the groundnut (*Arachis hypogea* L.)
Study Design: Factorial randomized block design.
Place and Duration of Study: The experiment was taken during the kharif season of 2021 at G.H. Raisoni University at Agronomy farm, Chhindwara, M.P.
Methodology: The set of nine treatment combination consist of three different spacing and three different OM which is applied at 12 kg/ha of FYM, at 6 kg/ha VC and at 6 kg/ha of PM. The experiment was carried out in Factorial Randomized Block Design with three replication and the treatment combination is T_1: S_1O_1 (30 cm x 10 cm + FYM), T_2: S_1O_2 (30 cm x 10 cm + VC), T_3: S_1O_3 (30 cm x 10 cm + PM), T_4: S_2O_1 (30 cm x 15 cm + FYM), T_5: S_2O_2 (30 cm x 15 cm +VC), T_6: S_2O_3 (30 cm x 15 cm + PM), T_7: S_3O_1 (45 cm x 10 cm + FYM), T_8: S_3O_2 (45 cm x 10 cm + VC) and T_9: S_3O_3 (45 cm x 10 cm + PM) and total number of plots is 27. At the time of experiment, the maximum mean of temperature was 41.6^{0}C whereas the minimum mean temperature was 5.68^{0}C.

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The economics of groundnut crop was calculated as per the fundamental market prices of the input and produced during the kharif season 2021.
Results: Maximum no. of pods/plant (30.67), length of pod (2.72), no. of kernels/pod (2.07), seed index (43.22 g), shelling percentage (74.76 %), pod weight/plant (18.66 g), pod yield/plot (1.53 kg), pod yield (63.01 kg/ha), kernel yield (23.45 kg/ha), haulm yield (39.56 kg/ha) and harvest index (24.07 %) were recorded with T_3–30 cm x 10 cm with Poultry manure at 30, 60 and 90 DAS.
Conclusion: Based on this experiment, it was said that with spacing 30cm x 10cm in combination with poultry manure gives the maximum and significantly higher kernel yield (23.45 kg/ha), gross return Rs.1,72,022.00/ha) as well as highest net return Rs.99,367.00)/ha).

Keywords: Spacing; Organic manure (OM); Farm Yard Manure (FYM); Vermicompost (VC); Poultry Manure (PM); Yield; Economics.

1. INTRODUCTION

In Indian Agriculture, oilseeds are the second vital component which accounted for 19% of the world's area and 2.7% of production that is why it is popularly known as King of oilseed crops. Groundnut, the oilseed crop plays vital role in India which secure first place in area (4.94 mha), second place in production (6.69 mt) and fourth place in productivity (1,335 kg /ha) in 2021-22 [1].

The groundnut was initially introduced by a Jesuit Father in the first part of the 16th century. Shri Padmabhai Patel, a Tamil Nadu native, introduced groundnut to Gujarat in 1910. Its seeds may be eaten raw, roasted, or boiled, and they can also be used to extract oil, which is typically used to make vanaspati ghee, soap, cosmetics, and cold creams in addition to serving as a cooking medium. With a protein concentration of between 30% and 50%, the organic worth of protein is quite high and is comparable to the protein value of cow's milk. It also includes vitamins A, B, C, and D and has a 15–20% fat content. Animals are fed groundnut waste and its by products including seeds, oil pressings, green or dried haulms, and raw materials for manufacturing things like oil and oiled cakes or organic manure3,14]. Additionally, groundnut shells are used as boiler fuel and as filler in a variety of organic and biological products, including hard boards, activated charcoal, and cork alternatives. Due to its numerous uses, groundnut is a top cash crop for both internal and international commerce in several developing and industrialized nations [2].

But if only use of organic manure gives higher and organic production and also improves the soil health. Organic agriculture in that application of organic matter soil and no use of mineral compounds that aims to promote and enhance ecosystem health, including biological cycles and soil biological activity and minimize the use of external inputs [3]. Now a day, Organic farming is gaining a worth as a result of the awareness of inherent advantages, it put heads together in sustaining crop production and also in upholding dynamic soil nutrient status and safe environment as well as enhancing moisture retention capacity and crop output [4-6]. By increasing the physical, chemical, and biological qualities of soil, organic manures serve to mitigate several nutrient deficits while also providing a better environment for growth and development [7].

Field crop, soil physical, synthetic, and biological efficiency is greatly enhanced by the use of organic manure. Use of FYM at 10 to 15 t/ha increased groundnut unit and haulm yields and further established yield boundaries, such as shelling rate, 100 seed weight, and sound mature portion, in contrast to the recommended portion of manures [8]. Farm Yard Manure (FYM) is traditionally used in India, but due to increased cropping intensity and area as well as other competing applications for cow manure, FYM is becoming less readily available. The FYM treatment had boosted the dry matter output, which may have been caused by a greater extraction of groundnut-derived macro- and micronutrients. Utilizing FYM increased the soils' moisture content and enhanced the accessibility of potassium to plants, boosting its availability to crops [9-12]. The addition of FYM may have prevented soil from being depleted in potassium, resulting in a favourable potassium balance and maximal P fixation [13]. The beneficial effects of FYM in combination with the necessary amount of fertilisers may be due to the improvement of the physical, chemical, and biological conditions of the soil brought about by organic matter, which promotes better plant development [14].

Poultry farming is growing in India. A small source of both macronutrients (N, P, K, Ca, Mg, S) and micronutrients (Cu, Fe, Mn, B), chicken farming can increase soil porosity, oil, carbon, and N content, and oil microbial activity. Given the high concentration of nutrients in chicken manure, adding a little quantity of it to an integrated nutrition management system might somewhat make up for the absence of FYM. In this situation, organic manures including farmyard manure (FYM), vermicompost (VC), and poultry manure (PM) may be able to supply sufficient micronutrients to crops in useable form while also enhancing the quality of agricultural output with a combination with various spacings.

2. MATERIALS AND METHODS

The field experiment was conducted at Agronomy Farm, Department of Agronomy, School of Agricultural Sciences, G.H. Raisoni University, Saikheda, Chhindwara, M.P. Chhindwara district lays in the Satpura Range. Average annual rainfall is 1,183 mm. The soil of experimental plot was sandy loam in texture, nearly neutral and low in organic carbon. Soil was medium in nitrogen contain (193.00 kg/ha), low in phosphorus contain (19.89 kg/ha) and high in potassium contain. The set of nine treatment combination consist of three different spacing and three different OM which is applied at 12 kg/ha of FYM, at 6 kg/ha VC and at 6 kg/ha of PM. Here, we used FYM which is doubled of VC and PM because of nutrient availability in the manure to fulfil the requirement of the crop. The experiment was carried out in Factorial Randomized Block Design with three replication and the treatment combination is T_1: S_1O_1 (30 cm x 10 cm + FYM), T_2: S_1O_2 (30 cm x 10 cm + VC), T_3: S_1O_3 (30 cm x 10 cm + PM), T_4: S_2O_1 (30 cm x 15 cm + FYM), T_5: S_2O_2 (30 cm x 15 cm +VC), T_6: S_2O_3 (30 cm x 15 cm + PM), T_7: S_3O_1 (45 cm x 10 cm + FYM), T_8: S_3O_2 (45 cm x 10 cm + VC) and T_9: S_3O_3 (45 cm x 10 cm + PM) and total number of plots is 27. At the time of experiment, the maximum mean of temperature was 41.6^0C whereas the minimum mean temperature was 5.68^0C. The economics of groundnut crop was calculated as per the fundamental market prices of the input and produced during the *kharif* season 2021. In this trail, Gujarat groundnut 34 (GG 34) variety were used. The seedlings were prepared in same field of agronomy research farm. The data collected during the course of present investigation were statistically analysed by adopting standard methods known as 'Analysis of Variance' Panse and Sukhatme, 1967.

3. RESULTS AND DISCUSSION

3.1 Yield and Yield Attributes

Yield attributes, yield and haulm yield affected by treatment combination (Table 1). Among all the treatment combination, PM with the spacing of 30 x 10 cm recorded significantly highest number of pods/plant (No.), length of pods (cm), kernels/pod (No.), seed index (g), shelling percentage (%), haulm yield (kg/ha) and harvest index (%). This was happened due to PM contains greater no. of manure. Vitale et al. shows in their trail, PM completes the recommended nutrient requirement of groundnut crop which helps in increase in yield attributing character. The pod/plant shows significantly result with (T_3) 30 cm x 10 cm + PM (30.67) and was statistically at par with the application of (T_6)

Table 1. Influence of different spacing and organic manure on the yield attributes and yields of groundnut

	Treatments combination	Pods/ plant (No.)	Kernel/ pod (No.)	Seed index (g)	Kernel yield (q/ha)	Haulm yield (q/ha)	Harvest index (%)
T_1	30 cm X 10 cm + FYM	21.07	1.60	39.92	19.85	37.85	23.51
T_2	30 cm X 10 cm + VC	29.93	1.93	40.64	21.85	38.05	23.89
T_3	30 cm X 10 cm + PM	30.67	2.07	43.22	23.45	39.56	24.07
T_4	30 cm X 15 cm + FYM	20.87	1.53	39.60	19.65	35.66	23.65
T_5	30 cm X 15 cm + VC	25.60	1.67	40.31	20.75	36.61	23.52
T_6	30 cm X 15 cm + PM	30.40	2.00	41.33	22.15	38.98	23.98
T_7	45 cm X 10 cm + FYM	18.07	1.13	30.20	18.54	32.75	23.00
T_8	45 cm X 10 cm + VC	18.73	1.20	34.88	19.05	35.63	23.96
T_9	45 cm X 10 cm + PM	20.40	1.40	37.59	19.45	35.45	23.99
	S. Em (±)	0.83	0.14	0.34	0.72	0.51	0.24
	CD (P = 0.05)	1.76	-	0.71	1.52	1.09	-

DAS: Days after sowing, FYM: Farm Yard Manure, VC: Vermicompost, PM: Poultry Manure

Table 2. Influence of different spacing and organic manure on the economics of Groundnut

	Treatments combination	Cost of cultivation (Rs./ha)	Gross monetary return (Rs./ha)	Net monetary return (Rs./ha)	B: C ratio
T_1	30 cm X 10 cm + FYM	69437.51	150413.00	80975.5	1.17
T_2	30 cm X 10 cm + VC	73181.51	161593.00	88411.5	1.21
T_3	30 cm X 10 cm + PM	72655.01	172022.00	99367.00	1.37
T_4	30 cm X 15 cm + FYM	68209.01	146908.00	78699.00	1.15
T_5	30 cm X 15 cm + VC	70256.1	153981.00	83724.5	1.19
T_6	30 cm X 15 cm + PM	71251.01	164260.00	93009.00	1.31
T_7	45 cm X 10 cm + FYM	66395.51	137624.2	71228.69	1.07
T_8	45 cm X 10 cm + VC	67916.51	142487.00	74570.49	1.10
T_9	45 cm X 10 cm + PM	68443.01	145581.00	77137.99	1.13

DAS: Days after sowing, FYM: Farm Yard Manure, VC: Vermicompost, PM: Poultry Manure

30 cm x 15 cm + PM (30.40) and (T_2) 30 cm x 10 cm + VC (29.93). It shows that appropriate spacing gives the higher numbers of pods per plant as compared to far spacing and it was also influenced using suitable organic manure which provides more nutrients for the plant growth. The results are also in conformity with the findings of Premanandarajah, [15] and Konlan et al. [16].

The kernels/pod and kernel yield was recorded highest result with (T_3) 30 cm x 10 cm + PM (2.07) and (23.45 q/ha) and gives higher haulm yield, seed index, shelling % and harvest index (%) which 39.56 q/ha, 43.22 g, 74.76 % and 24.07% resp. The treatment number three (T_3) were recorded statistically at par with (T_6) 30 cm x 15 cm + PM (2.00 and 22.15 q/ha) and (T_2) 30 cm x 10 cm + VC (1.93 and 21.85 q/ha). For any crop to give significant yield attributes required optimum spacing and nutrients for better growth and development of crop. The result supports the findings of Premanandarajah, 2018 who reported that the maximum number of kernels in pod and kernel yield.

3.2 Economics Analysis

Data on Table 2. The study of the economics achievability of the different treatment combination in groundnut revealed that (Table 2), the highest cost of cultivation (73181.51 Rs./ha) recorded in (T_2, T_3 and T_6) 30 cm x 10 cm + VC, 30 cm x 10 cm + PM and 30 cm x 15 cm + PM due to variation in seed rate and cost of manure as compared to other two manures. The maximum gross return (172022.00 Rs./ha), net return (99367.00 □/ha) and maximum B: C ratio (1.37) was obtained with (T_3) 30 cm x 10 cm + PM.

4. CONCLUSION

It can be concluded, from the outcomes of the groundnut cultivation that, to get maximum kernel yield (23.45 q/ha), haulm yield (39.56 q/ha) and net return (99367.00 □/ha), groundnut should grow with the optimum spacing of 30 cm x 10 cm and to fulfil their nutrient value through poultry manure used.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
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