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Effect of Spacing and Foliar Spray of Liquid Organic Manures on Yield and Economics of Zaid Groundnut (*Arachis hypogea*)

Dulam Sriram [a++*], Rajesh Singh [a#] and Thakur Indu [aT]

[a] *Department of Agronomy, Naini Agricultural institute, SHUATS, Prayagraj, Uttar Pradesh, India.*

Authors' contributions

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

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ABSTRACT

The field experiment entitled "Effect of spacing and foliar spray of liquid organic manures on Yield and Economics of zaid groundnut (*Arachis hypogea*)"was conducted during *rabi* season, 2022 at Crop Research Farm in the Department of agronomy, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj Uttar Pradesh. The treatment consisted of Row spacing 50 x 10 cm, 60 x 10 cm, 70 x 10 cm and Liquid Organic formulation panchagavya 3%, vermiwash 10%, Cow urine 10% and control. The experiment was layout in Randomized Block Design (RBD) with 10 treatments and replicated thrice. Application of (Spacing 60x10 cm + Cow urine 3%) produces higher pod yield (3053 kg/ha.), Haulm yield (5142 kg/ha.), Gross Return (INR 124106/ha.), Net Return (INR 77696/ha.) and B:C Ratio (2.67).

[++]*M.Sc. Scholar;*
[#]*Associate Professor;*
[T]*Ph.D. Scholar;*
**Corresponding author: E-mail: dulam.sriram1999@gmail.com;*

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1. INTRODUCTION

Groundnut (*Arachis hypogaea* L.), a grain legume and significant oil seed crop, is cultivated primarily for its edible seeds. Other names for it include peanut, goober, and monkey nut. After China, India is the second-largest producer of groundnuts. The most widely produced oil seed and a significant cash crop in India is groundnut. Due to its high oil content, it is categorized as both a grain legume and an oil crop. The Groundnut, a member of the leguminaceae family and frequently referred to as "The King of Oilseeds," is the fourth-largest source of edible oil and the third-largest source of vegetable protein. Farmers in both kharif and zaid cultivate it since it is a legume that contributed to sustainable agriculture.

Its greater amount of protein (22.0%), carbohydrate (10.0%), and minerals (3.0%), as well as niacin (17 mg/100 g). India is major groundnut cultivated country, cultivated in an area with 6.09 lakhs ha. with the production of 10.21 million tonnes and productivity of 1676 kg/ha. Total groundnut cultivated area in Uttar Pradesh was about 0.39 million hectares with the production of 0.74 million tonnes and productivity of 1879 kg/ha"(GOI) [1]. The dietary requirements of women and children heavily rely on groundnuts. Haulm is used as a feed for animals. Groundnut oil is made up of mixed glycerides and contains a lot of the unsaturated fatty acids oleic (50–65%) and linoleic acid (18–30%). Groundnuts contain cysteines, an amino acid required for animal growth. Groundnut cake, which is strong in protein, significant organic manure, and animal feed, is created after the oil has been extracted. Additionally, it contains 7 to 8% N, 1.5% P, and 1% K. The leguminous nature of groundnuts helps to maintain soil fertility, and their high protein content allows them to supply a sizable amount of the country's protein requirements.

The need for more agricultural output and the desire for greater profits have made the application of nutrients in agriculture inefficient, with greater loss resulting in soil, water, and air pollution. The primary purposes of farmyard manure are to replace and maintain the humus quality of the soil and to maintain the ideal circumstances for the activities of soil microorganisms. Vermicompost's effects on soil conditions are likely to expedite seedling germination and vigour, facilitating early emergence.

Due to its high porosity, aeration, water-holding capacity, and availability of growth- promoting substances, vermi-compost application had a good effect on seedling emergence and germination. Among the many elements that affect peanut yield, population density and appropriate row spacing are crucial. One of the key elements that affects the growth, yield, and quality of peanuts is planting density.

When the crop is grown with the right spacing, it was discovered that plant dry matter accumulation and branch formation were greater, and yield parameters like pod/plant, yield/plant, and 1000-grain weight were at their highest. Through optimum use of solar radiation, nutrients, water, land, and air gaps, optimal spacing ensures appropriate growth of the plant's aerial and subsurface parts. For a higher crop production per unit area, adequate row spacing must be used to obtain the proper plant stand. Research on low-cost production technologies is crucial if summer groundnut planting is to become more economical and widespread for such a big society. Partha Sarathi [2] reported that the application of 2.5t/ha vermicompost resulted in highest plant height (48.1 cm) and highest pods/plant (41.00), no. of branches/plant (6.3), comparing with the application of fym 10t/ha plant height (42.00 cm) and highest pods/plant (33.3), no. of branches/plant (4.7), highest pod yield (1960 kg/ha) and haulm yield (2122 kg/ha).

2. MATERIALS AND METHODS

This experiment was laid out during the *Rabi* season of 2022 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). The crop research farm is situated at 25^0 39" 42" N latitude, 81^0 67" 56" E longitude and at an altitude of 98 m above mean sea level. The experiment was laid out in Randomized Block Design Which consisting of ten treatments with T1 Spacing 50 × 10 cm + Panchagavya 3%, T2 Spacing 50 × 10 cm + Vermiwash 10%, T3 Spacing 50 × 10 cm + Cowurine 10%, T4 Spacing 60 × 10 cm + Panchagavya 3%, T5 Spacing 60 × 10 cm + Vermiwash 10%, T6 Spacing 60×10cm + Cowurine 10%, T7 Spacing

70 × 10 cm + Panchagavya 3%, T8 Spacing 70 × 10 cm + Vermiwash 10%, T9 Spacing 70 × 10 cm + Cowurine 10%, T10 Control 30 × 10 cm+ RDF (20:40:40 NPK kg/ha)The soil in the experimental area was sandy loam with pH (8.0), organic carbon (0.42%), available N (180.58 kg/ha), available P (15.54 kg/ha), and available K (198.67 kg/ha). Seeds are sown at a spacing of 30×10cm to a seed rate of 80 kg/ha. The recommended dose of nitrogen (20 kg/ha), phosphorus (50 kg/ha) and potassium (20 kg/ha) and Biofertilizer and phosphorus were applied as per the treatments. Data recorded on different aspects of crop, *viz.,* growth, yield attributes were subjected to statistically analysis by analysis of variance method [3] and economic data analysis mathematical method.

3. RESULTS AND DISCUSSION

3.1 Pod Yield (kg/ha)

The data revealed that Treatment 4 [spacing 60 x 10 cm + panchgavya 3%] was recorded significantly maximum pod yield (3053 kg/ha) which was superior over all other treatments. However, the treatment 6 [spacing 60 x 10 cm + Cow urine 10%] were found to be statistically at par with the treatment 9 [*Rhizobium* + PSB + Phosphorus 60kg/ha] in (Table 2).

Vasumathi [4] and Sanjutha et al., [5] stated that the growth enzymes found in panchagavya may have favored rapid cell division and multiplication for enhanced growth characteristics. Optimal spacing allowed the plant to obtain enough heat, water, and nutrients from the soil, resulting in a larger pod output. Similar results have been reported by Pandey et al. [6].

Haulm yield (kg/ha):

The data revealed that Treatment 4 [spacing 60 x 10 cm + panchgavya 3%] was recorded significantly maximum Haulm yield (5142 kg/ha) which was superior over all other treatments. However, the treatment-6 [spacing 60 x10 cm + Cowurine 10%], 2 [spacing 50 x 10 cm + Vermiwash 10%], treatment 3 [spacing 50 x 10 cm + Cowurine 10%], treatment 7 [spacing 70 x 10 cm + Panchgavya 3%] and treatment 9 [spacing 70 x 10 cm + Cowurine 10%] was found to be statically at par with treatment-4 [spacing 60 x 10cm + Panchgavya 3%] in (Table 2).

Beaulah et al. [7] came to the conclusion that the presence of helpful microorganisms from panchagavya in the rhizosphere environment of the root zone affects plant growth and crop yield. The optimal row spacing has successfully utilized the growth resources, particularly sun radiation. Devi et al. [8] reported similar findings. Harvest Index:

At harvest, maximum harvest index (37.3%) was recorded in Treatment 4 [spacing 60 x 10 cm + Panchgavya 3%], there was no significant difference among the treatments.

3.2 Cost of Cultivation (INR/ha)

Cost of production (INR 46410/ha) was found to be highest in treatment 4 [spacing 60 x 10 cm + Panchgavya 3%], as compared to other treatment.

Table 1. Effect of spacing and foliar spray of liquid organic formulation on yield of summer groundnut

S. No.	Treatment combinations	At Harvest		
		Pod Yield (kg/ha)	Haulm Yield (kg/ha)	Harvest Index
1.	Spacing 50 x 10 cm + Panchgavya 3%	2774	5013	35.6
2.	Spacing 50 x 10 cm + Vermiwash 10%	2503	4914	33.7
3.	Spacing 50 x 10 cm + Cowurine 10%	2611	4982	34.4
4.	Spacing 60 x 10 cm + panchgavya 3%	3053	5142	37.3
5.	Spacing 60 x 10 cm + Vermiwash 10%	2567	4921	34.3
6.	Spacing 60 x 10 cm + Cowurine 10%	2940	5050	36.8
7.	Spacing 70 x 10 cm + panchgavya 3%	2742	4993	35.4
8.	Spacing 70 x 10 cm + Vermiwash 10%	2410	4886	33.0
9.	Spacing 70 x 10 cm + Cowurine 10%	2584	4955	34.3
10.	Control (NPK 20:40:40 kg/ha)	2123	4566	31.7
	F-test	S	S	NS
	Sem (±)	48.43	82.0	-
	CD (p=0.05)	143.91	243.32	-

Table 2. Effect of spacing and foliar spray of liquid organic formulation on economics of summer groundnut

S. No.	Treatment combination	Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net return (INR/ha)	B:C ratio
1.	Spacing 50 x 10 cm + Panchgavya 3%	45798	112856	67058	2.46
2.	Spacing 50 x 10 cm + Vermiwash 10%	44286	101928	57642	2.30
3.	Spacing 50 x 10 cm + Cowurine 10%	45084	106283	61199	2.36
4.	Spacing 60 x 10 cm + panchgavya 3%	46410	124106	77696	2.67
5.	Spacing 60 x 10 cm + Vermiwash 10%	44479	104509	60030	2.35
6.	Spacing 60 x 10 cm + Cowurine 10%	46290	119550	73260	2.58
7.	Spacing 70 x 10 cm + panchgavya 3%	45108	111566	66458	2.47
8.	Spacing 70 x 10 cm + Vermiwash 10%	44097	98178	54081	2.23
9.	Spacing 70 x 10 cm + Cowurine 10%	44962	105195	60233	2.34
10.	Control (NPK 20:40:40 kg/ha)	43810	86606	42796	1.98

3.3 Gross Return (INR/ha)

Gross return (INR 124106/ha) was found to be highest in treatment 4 [Spacing 60 x 10 cm + Panchgavya 3%], as compared to other treatment.

3.4 Net Return (INR/ha)

Net return (INR 77696/ha) was found to be highest in treatment 4 [Spacing 60 x 10 cm + Panchgavya 3%], as compared to other treatment.

3.5 B: C Ratio

Benefit Cost Ratio (2.67) was found to be highest in treatment 4 [spacing 60 x 10 cm + Panchgavya 3%], as compared to other treatment.

Panchagavya preparation is simple, reduces investment costs, and provides high net returns, which aid in the farmer achieving a high B:C ratio. Panchagavya promotes sustainability while being safe and environmentally friendly Chunchu Suchith Kumar and Gurpreet Singh [9].

4. CONCLUSION

On the basis of the aforementioned findings, it can be said that Groundnut with the application of [spacing 60 x 10 cm + Panchgavya 3%], (Treatment 4) was observed highest pod yield, Haulm yield, gross return, net return and benefit-cost ratio.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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