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## Effect of organic manures and bio-fertilizers on growth and yield of Groundnut (*Arachis hypogaea* L.)

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### Abstract

A field experiment entitled “Effect of organic manures and bio-fertilizers on growth and yield of groundnut (*Arachis hypogaea* L.)” was conducted at SMOF (SHIATS Model Organic Farm) of SHUATS in *Kharif* 2021. The treatments consist of three levels of organic manures and three different bio-fertilizers, experiment was laid out in randomized block design with nine treatments each replicated thrice. The result showed that *viz*: plant height (64.8cm), number of branches per plant (8.50), dry weight (38.27 g/plant), number of root nodules per plant (16.59), crop growth rate between 40-60 days interval (18.99 g/m<sup>2</sup>/day), number of pods per plant (24.80), seed yield (2733.87 kg/ha), haulm yield (3365.1 kg/ha), biological yield (5630.2 kg/ha) and benefit cost ratio (2.31) were recorded in poultry manure 5 t/ha + PSB 20 g/kg seeds.

**Keywords:** Groundnut, FYM, bio-fertilizers, yield and yield attributes

### Introduction

Groundnut (*Arachis hypogaea* L.) is also known as “The king of oilseeds”. Groundnut is an important oilseed crop in India which occupies first position in terms of area and second position in terms of production after soyabean. China ranks first in groundnut production with 17.57 million tonnes followed by India 6.73 million tonnes. According to the all India *kharif* crop coverage report, Government of India, as on 17<sup>th</sup> September 2021, groundnut was sown in around 49.14 lakh hectares as compared to last year (50.97 lakh ha). Among the states, Gujarat stood first in area coverage with 19.09 lakh ha followed by Rajasthan (7.76 lakh ha), Andhra Pradesh (6.27 lakh ha), Karnataka (4.75 lakh ha) and Madhya Pradesh (3.82 lakh ha) (Groundnut Outlook - November 2021). The optimization of the mineral nutrition is the key to optimize the production of groundnut, as it has very high nutrient requirement and the recently released high yielding groundnut varieties remove still more nutrients from the soil. On contrary groundnut farmers, most part of the semi-arid region use very less nutrient fertilizer and sometime only one or two nutrients resulting in severe mineral nutrient deficiencies due to inadequate and imbalance use of nutrients is one of the major factors responsible for low yield in groundnut. India is the world’s largest producer of groundnut where nutritional disorders cause yield reduction from 30 to 70% depending upon the soil types. Thus it is high time to look into the mineral nutrition aspects of groundnut for achieving high yield and advocate the suitable package of practices for optimization of yield (Veeramani *et al.*, 2012) [12]. Many studies have shown that organic farming methods can produce even higher yields than conventional methods. Significant difference in soil health indicators such as nitrogen mineralization potential and microbial abundance and diversity, which were higher in the organic farms can also be seen. Keeping the points in view field experiment entitled “Effect of organic manures and bio-fertilizers on growth and yield of groundnut (*Arachis hypogaea* L.)”.

### Materials and Methods

The experiment was conducted during the *Kharif* 2021, at the SMOF, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). The soil of the experimental field constituting a part of central Gangetic alluvium is neutral and deep. The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.3), low in organic carbon (0.57%), available N (230kg/ha), available P (32.10kg/ha) and available K (235kg/ha). The treatments consist of three levels of organic manures and three different bio-fertilizers. The experiment was laid out in randomized block design with nine treatments each replicated thrice.

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T<sub>1</sub>: FYM 6 t/ha + Rhizobium 20 g/kg seeds, T<sub>2</sub>: FYM 6 t/ha + VAM15 g/kg seeds, T<sub>3</sub>: FYM 6 t/ha + PSB 20 g/kg seeds, T<sub>4</sub>: Vermicompost 4 t/ha + Rhizobium 20 g/kg seeds, T<sub>5</sub>: Vermicompost 4 t/ha + VAM 15 g/kg seeds, T<sub>6</sub>: Vermicompost 4 t/ha + PSB 20 g/kg seeds, T<sub>7</sub>: Poultry manure 5 t/ha + Rhizobium 20 g/kg seeds, T<sub>8</sub>: Poultry manure 5 t/ha + VAM 15 g/kg seeds, T<sub>9</sub>: Poultry manure 5 t/ha + PSB 20 g/kg seeds. The source of fertilizer was used urea, single super phosphate and murate of potash. Kadiri-1812 is the variety was sow on 5<sup>th</sup> July 2021. The crop was harvested on 21<sup>st</sup> October 2021 (109 DAS). During the growing season, the mean weekly maximum and minimum temperature, relative humidity and rainfall were 34.12 °C, 25.08°C, 85.11%, 54.09% and 23.01 mm respectively. Observations on yield and yield attributes of groundnut were recorded and their significance was tested by the variance ratio (F-value) at 5% level (Gomez and Gomez, 1984) [3]. Relative economics was calculated as per the prevailing market prices of the inputs and produced during *kharrif* season 2021.

## Results and Discussion

### Growth parameters

The one season data revealed that growth and yield parameters of groundnut were significantly influenced by the treatments. Plant height (Table 1) of groundnut at harvest higher plant height was observed in treatment with the application of (T<sub>9</sub>) poultry manure 5 t/ha + PSB 20 g/kg seeds (64.8cm) was significant which is statistically at par with (T<sub>8</sub>) poultry manure 5 t/ha + VAM 15 g/kg seeds (64.0cm), (T<sub>7</sub>) poultry manure 5 t/ha + rhizobium 20 g/kg seeds (64.5cm) and (T<sub>6</sub>) vermicompost 4 t/ha + PSB 20 g/kg seeds (63.6cm). Significantly maximum number of branches per plant (8.50) recorded with (T<sub>9</sub>) poultry manure 5 t/ha + PSB 20 g/kg seeds, which is statistically at par with (T<sub>8</sub>) poultry manure 5 t/ha + rhizobium 20 g/kg seeds treatment. Significantly superior dry weight (38.27 g/plant) was recorded with (T<sub>9</sub>) poultry manure 5 t/ha + PSB 20 g/kg seeds, which is statistically at par with (T<sub>7</sub>) poultry manure 5 t/ha + rhizobium 20 g/kg seeds treatment and (T<sub>8</sub>) poultry manure 5 t/ha + VAM 15 g/kg seeds. Significantly highest number of root nodules per plant (16.59) was recorded with (T<sub>9</sub>) poultry manure 5 t/ha + PSB 20 g/kg seeds, which is statistically at par with (T<sub>7</sub>) poultry manure 5 t/ha + rhizobium 20 g/kg seeds treatment. Due to sufficient supply of nutrients through organic manures, plant growth is become vigorous, growth parameters number of branches and number of root nodules are combinly increases the plant vegetative parts. Similar results are reports by Senthilkumar and Naveen (2020) [9]. And highest crop growth rate between 40-60 days interval (18.99 g/m<sup>2</sup>/day) recorded with (T<sub>9</sub>) poultry manure 5 t/ha +

PSB 20 g/kg seeds, which is statistically at par with (T<sub>8</sub>) poultry manure 5 t/ha + VAM 15 g/kg seeds and (T<sub>7</sub>) poultry manure 5 t/ha + rhizobium 20 g/kg seeds treatments. Poultry manure is relatively resistant to microbial degradation. However, it is essential for establishing and maintaining optimum soil physical condition and important for plant growth (Rahman, 2004) [6]. Poultry manure is excellent organic manure, as it contains high nitrogen, phosphorus, potassium and other essential nutrients. In contrast to mineral fertilizer, it adds organic matter to soil which improves soil structure, nutrient retention, aeration, soil moisture holding capacity, and water infiltration (Deksissa *et al.*, 2008) [2].

### Yield parameters

The data revealed that (Table 2) significantly higher number of pods per plant (24.80) was observed in (T<sub>9</sub>) poultry manure 5 t/ha + PSB 20 g/kg seeds. Which is statistically at par with the application of (T<sub>7</sub>) poultry manure 5 t/ha + rhizobium 20 g/kg seeds. In test weight (100 seed weight) there is no significant difference between the treatments. Significantly higher seed yield (2733.87 kg/ha), haulm yield (3365.1 kg/ha) and biological yield (5630.2 kg/ha) were recorded in (T<sub>9</sub>) poultry manure 5 t/ha + PSB 20 g/kg seeds. (T<sub>8</sub>) poultry manure 5 t/ha + VAM 15 g/kg seeds and (T<sub>7</sub>) poultry manure 5 t/ha + rhizobium 20 g/kg seeds treatments were recorded statistically at par with (T<sub>9</sub>) poultry manure 5 t/ha + PSB 20 g/kg seeds in seed yield. (T<sub>8</sub>) Poultry manure 5 t/ha + VAM 15 g/kg seeds treatment was recorded at par with (T<sub>9</sub>) poultry manure 5 t/ha + PSB 20 g/kg seeds in both biological yield and haulm yield parameters. Maximum benefit cost ratio (2.31) was also recorded in (T<sub>9</sub>) poultry manure 5 t/ha + PSB 20 g/kg seeds treatment. The optimum growth of the plant due to favourable nutritional environment and higher uptake of nutrients might have favoured significant increase in number of pegs per plant and thus a greater number of pods per plant. However, Panwar and Singh (2003) [5], Satpute *et al.* (2021) [8], and Zalate and Padmani (2009) [11] reported same. The important growth and yield contributing characters *viz.*, plant spread, number of branches, dry matter accumulation, number of pods and kernels and their weight and thousand kernel weight were significantly increased with the application of P-solubilizer treatments with poultry manure due to additional nitrogen and phosphorous uptake, resulting in increased dry pod yield. Increase in root nodules due to P-solubilizer and nitrifying bacteria also helped in increasing better root development and dry pod yield by fixing more nitrogen and consequently increasing its absorption. These results were found to be in conformity with Raychaudari *et al.* (2003) [7] and Chavan *et al.* (2013) [1].

**Table 1:** Influence of organic manures and bio-fertilizers on growth parameters of groundnut

Treatment	Plant height (cm) at harvest	Number of branches/plant	Dry weight (g/plant) at harvest	Root nodules At harvest	CGR (g/m <sup>2</sup> /day) 40-60 DAS	RGR (g/g/day) 40-60 DAS
T <sub>1</sub>	61.95	7.53	33.81	10.63	15.66	0.0450
T <sub>2</sub>	61.78	7.33	33.30	9.54	14.97	0.0443
T <sub>3</sub>	62.29	7.63	34.88	11.77	15.84	0.0446
T <sub>4</sub>	63.11	7.90	36.27	12.68	16.68	0.0453
T <sub>5</sub>	62.69	7.73	35.81	11.05	16.14	0.0446
T <sub>6</sub>	63.59	8.00	36.55	13.54	16.97	0.0450
T <sub>7</sub>	64.50	8.43	37.81	15.41	18.27	0.0463
T <sub>8</sub>	64.03	8.17	37.37	14.47	18.02	0.0463
T <sub>9</sub>	64.75	8.50	38.27	16.59	18.99	0.0466

S.Em ( $\pm$ )	0.46	0.08	0.32	0.57	0.43	0.0002
CD (5%)	1.39	0.24	0.98	1.72	1.31	-

**Table 2:** Influence of organic manures and bio-fertilizers on yield and yield parameters of groundnut

Treatment	Number of pods/plant	Test weight (g)	Seed yield (kg/ha)	Haulm yield (kg/ha)	Biological yield (kg/ha)	Harvest Index (%)	B:C ratio
T <sub>1</sub>	21.62	46.98	2341.33	2578.0	4296.9	47.58	1.56
T <sub>2</sub>	20.74	45.89	2111.47	2390.7	4008.0	46.85	1.48
T <sub>3</sub>	21.91	47.75	2399.47	2681.4	4453.6	47.22	1.70
T <sub>4</sub>	22.71	50.32	2502.93	2946.2	4894.9	45.93	1.76
T <sub>5</sub>	22.23	48.84	2439.47	2788.2	4614.2	46.67	1.65
T <sub>6</sub>	23.27	51.03	2069.33	3092.8	5089.7	40.05	1.88
T <sub>7</sub>	24.13	52.59	2683.20	3280.9	5452.8	44.98	2.11
T <sub>8</sub>	23.57	52.29	2635.73	3182.8	5245.7	44.61	2.03
T <sub>9</sub>	24.80	53.40	2733.87	3365.1	5630.2	44.81	2.31
S.Em ( $\pm$ )	0.29	0.39	34.95	34.12	45.49	0.54	
CD (5%)	0.89	-	104.79	102.30	136.68	-	

### Conclusion

It is concluded that application of (T<sub>9</sub>) poultry manure 5 t/ha + PSB 20 g/kg seeds recorded significantly higher seed yield (2733.87 kg/ha) and haulm yield (3365.1 kg/ha). These findings are based on one season; therefore, further trail may be required for further confirmation.

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