

## Influence of Organic Manures and Molybdenum on Growth and Yield of Groundnut (*Arachis hypogaea* L.)

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**ABSTRACT:** A Field experiment was carried out during kharif season of 2020 at Research Farm, Krishi Vignana Kendra, Yagantipalli, Kurnool District, (A. P.), to study the effect of organic manures and molybdenum on growth and yield of groundnut (*Arachis hypogaea* L.) experiment laid with 3 treatments of organic manures (FYM 10t/ha, Vermi Compost 4t/ha, Poultry Manure 5t/ha) and another three levels of molybdenum (0.5, 1.0, 1.5 kg/ha). These 9-treatment combination was laid out in Randomize Block Design. The results revealed that viz: Plant height (49.93cm), number of nodules per plant (38.57), dry weight (37.93 g/plant) were recorded significantly higher with application of 5 t/ha PM + 1.5 kg/ha Molybdenum. Number of pods per plant (22.67), seed yield (2325 kg/ha) and haulm yield (3396 kg/ha) were recorded significantly higher with application of 5 t/ha PM + 1.5 kg/ha Molybdenum. Higher gross returns (1,22,661.3 ₹/ha), net return (53,925.39 ₹/ha) and benefit cost ratio (1.13) was obtained with application of 5 t/ha PM + 1.5 kg/ha Molybdenum. The challenges faced during crop period was heavy rains which made crop to turn yellow, and similar to Chlorosis leads iron deficiency was somehow managed by spraying Foliar spray of 1% Feso4 after 40 days of sowing. Early and late leaf spots were observed and controlled by 2-3 spray application of Carbendazim 1gm and 2gm of Mancozeb in liter of water. Therefore it doesn't showed any greater effect on yield.

**Keywords:** Molybdenum, Vermicompost, Poultry manure, FYM, Groundnut yield attributes.

### INTRODUCTION

Groundnut is considered to be the most important food legume and oilseed crops of India. In India, groundnut production is estimated at 63.11 lakh tonnes during kharif 2019-20. As per state agriculture department of Gujarat, groundnut yield is likely to increase upto 1800kg/ha due to good rainfall compared to last year 1085kg/ha due to scanty rains.

Groundnut, being an unpredictable legume, its response to nutrient application is always not optimistic (Veeramani *et al.*, 2012). Groundnut is an ideal crop in rotational systems to improve fertility due to its natural ability to fix atmospheric nitrogen (Jaiswal *et al.* 2017). To meet the demand, it is essential to enhance the productivity of prominent oilseed crops of the country like groundnut through location specific nutrient management practices (Karunakaran *et al.*, 2010). Organic manure can improve soil fertility, increase water holding capacity, promote beneficial organisms and improve microbial biomass (Hamza and Abd-Elhady, 2010; Esmailian *et al.* 2012). FYM improving physical, chemical and biological environment of soil conducive to better plant growth (Deshmukh *et al.*, 2005). Vermicompost also aids in lowering the C:N ratio and increasing soil humus content, as well as providing a wide range of nutrients

is readily available form to plants, including nitrate, soluble nitrate, soluble phosphorus, exchangeable potassium, calcium, magnesium, and a variety of biologically active substances such as plant growth regulators and hormones. Plants that collect poultry manure grew taller than other plants possibly more concentrated nutrients or minerals were made readily available and easily observable by the receiving plants leading to faster growth and development (Enujeke, 2013). Better organic farming system can give high yield and sustainability in groundnut production (Nagaraj *et al.*, 2001). Organic manure increases soil fertility and crop production potential possibly by changing physical and chemical properties of soil (Muhammad and Khattak, 2009). Molybdenum is an essential molybdenum element, it is a constituent of the nitrogenase enzyme and every bacterium, which fixes nitrogen, needs molybdenum during the fixation processes. Molybdenum has a positive effect on yield, quality and nodules forming in legume crops. The functions of molybdenum in leguminous plants include nitrate reduction, nodulation, nitrogen fixation and general metabolism (Togay *et al.*, 2008). Combined use of minerals and organic fertilizers like manures, compost and vermicompost is becoming increasingly important (Saadania and Riahi, 2009;

chouichom and Yamao, 2011). To sustaining the yield of groundnut, by following integration of organic manures and inorganic micronutrients has become necessary in the precession agriculture. Hence the present investigation was to find out optimum quantity and judicious combinations of organic manures and molybdenum levels.

Gunri and Nath (2012) studied the effect of organic manure, bio-fertilizer and bio-pesticides on productivity of groundnut and found that the significantly higher pods per plant and shelling out turn was recorded when recommended dose fertilizer was applied along with 10 t/ha FYM or 5 t/ha PM as compared to other treatments. Nadia Gad (2012) conducted experiment on groundnut and concluded that cobalts and molybdenum in combination significantly increased the content of N, P, K, Mn and Zn as well as chemical contents.

Kumar et al. (2013) reported that application of farmyard manure 7.5 t/ha inoculated with microbes PSB + PSM + pseudomonas 15 days before sowing (heapit) and followed by foliar spray of NSKE 5 percent gave significantly higher pod yield (2750 kg/ha) and haulm yield (4081 kg/ha) of groundnut variety Girnar-2 in sandy loam soils of Rajasthan.

Sarangi and Lama (2013) reported that application of vermicompost 6.0 t/ha prepared with 5.0 percent of lime increased the pod yield of groundnut variety JL 220 (5.08 t/ha) when compared to control (2.45 t/ha) in silty clay loam soils of Meghalaya during Kharif 2009 under rainfed situations.

Khan *et al.* (2014) conducted field experiment with different levels of molybdenum (0, 0.25, 0.50 kg/ha), iron (0, 2.0, 5.0 kg/ha) & found that molybdenum at 0.5 kg/ha & Iron at 2.0 kg/ha significantly increased the dry matter production over control in chickpea.

Vekariya *et al.* (2014) reported that application of FYM 5.0 t/ha recorded significantly higher pod yield (1821 kg/ha) and haulm yield (3440 kg/ha) of groundnut variety GG-20 when compared to pod yield (494 kg/ha) and haulm yield (2157 kg/ha) of control (no NPK) while lopping of glyricidia applied as mulch on black clay soils during rainy season, 2005-06.

Chaudhari *et al.* (2015) observed that better yield performance under poultry manure and vermicompost application may be explained due to increase activities of N-fixing bacteria and increased rate of humification. Humic acid in poultry manure and vermicompost may enhanced the availability of both native and added micronutrients in soil, thus improved plant growth, yield attributes and yield.

Choudary *et al.* (2017a) reported that the results of present study could be concluded that for higher productivity and profitability from groundnut cultivation, it should be supplied with poultry manure 5 t/ha along with optimum application of 1.0 kg molybdenum/ha. This combination also provides good quality produce.

Choudary *et al.* (2017b) reported that the application of 0.5, 1.0 and 1.5 kg Mo/ha increased pod yield over control by the margins of 292, 522 and 594 kg/ha or 15.1, 27.1 and 30.8 %, respectively. Almost similar increase was observed in biological and haulm yields due to increased Mo application.

## MATERIALS AND METHODS

The Experiment was undertaken at Research Farm, Krishi Vignana Kendra, Yagantipalli, Kurnool District, Andhra Pradesh, during kharif 2020 which is located at 15° 32' 79" N latitude, 78° 18' 71" E longitude and 273m altitude above the mean sea level (MSL). 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 (230 kg/ha), available P (32.10 kg/ha) and available K (235 kg/ha). The treatments consist three levels of molybdenum and three different organic manure sources. The experiment was laid out in Randomized Block Design with nine treatments each replicated thrice. The treatments were T1: 10 t/ha Farm Yard Manure + 0.5 kg/ha Molybdenum; T2:10 t/ha Farm Yard Manure + 1.0 kg/ha Molybdenum; T3:10 t/ha Farm Yard Manure + 1.5 kg/ha Molybdenum; T4:4 t/ha Vermicompost + 0.5 kg/ha Molybdenum; T5:4 t/ha Vermicompost + 1.0 kg/ha Molybdenum; T6:4 t/ha Vermicompost + 1.5 kg/ha Molybdenum; T7:5 t/ha Poultry manure + 0.5 kg/ha Molybdenum; T8:5 t/ha Poultry manure + 1.0 kg/ha Molybdenum; T9:5 t/ha Poultry manure + 1.5 kg/ha Molybdenum. The recommended dose of inorganic fertilizer (RDF) was 20 kg N + 60 kg P<sub>2</sub>O<sub>5</sub> + 40 kg K<sub>2</sub>O per ha and the sources were urea, single super phosphate and muriate of potash respectively. Treatment wise FYM, vermicompost, poultry manure and molybdenum were applied during final land preparation of the experiment respectively with the spacing of 30 cm × 10 cm. Five random plants were selected from each plot to record observations on plant growth attributes. Similarly, five random plant samples were collected from each plot at the time of harvest for recording observations on plant yield attributes. Experimental data collected was subjected to statistical analysis by adopting Fisher's method of Analysis of Variance (ANOVA) as outlined by Gomez and Gomez (2010). Critical Difference value were calculated whenever the 'F' test was found significant at 5% level.

## RESULTS AND DISCUSSION

Plant height of groundnut increased towards maturity with combine increasing level of poultry manure and molybdenum fertilizer. The significantly higher plant height (38.77 cm) was observed in treatment with application of 5 t/ha Poultry manure + 1.5 kg/ha molybdenum treatment, which was statistical at par with T6 treatment. Crop dry matter production increased significantly with increased level of poultry manure and molybdenum. The significantly higher dry weight (28.18 g/plant) was obtained from 5 t/ha poultry manure + 1.5 kg/ha molybdenum treatment, which was statistically at par with T6, T7 and T8 treatments. Number of nodules per plant was also increased with increasing dose of poultry manure and molybdenum, significantly higher number of nodules per plant (80.77) were observed in treatment 5 t/ha poultry manure + 1.5 kg/ha molybdenum treatment, which was statistically at par with T6 and T8 treatments. Significantly higher crop growth rate (17.37 g/m<sup>2</sup>/day) was observed in 4 t/ha Vermicompost + 1.5 kg/ha Molybdenum which is

at par with rest of the all treatments except T9 and T1 treatments.

Vermicompost and poultry manure progressively enhanced the average total N uptake by the plant and this increase in N uptake may be attributed to increase in vegetative growth, number of branches of plant and dry matter due to increasing levels reported by Marimuthu *et al.* (2002). Application of vermicompost and poultry manure to groundnut which result to slowly

releasing available nutrients were had favourable effect of growth and biomass production similar results were reported by Chaudary *et al.* (2017). Also 1.5 kg Mo/ha has improved in growth characters might be due to the fact that molybdenum is a constituent of enzyme nitrogenase, which is essential for the process of symbiotic N<sub>2</sub> fixation, these findings are in close conformity with the results observed by Shiva Kumar and Kumutha (2003).



**Fig. 1.** Spraying and overview of Groundnut crop at Research Farm, Krishi Vigna Kendra, Yagantipalli, Kurnool District, (A. P.), during Kharif, 2020.

**Table 1: Effect of organic manures and molybdenum on growth attributes of groundnut.**

Treatments	Plant height (cm)	Dry weight (g/plant)	Number of nodules per plant	Crop growth rate (g/m <sup>2</sup> /day)
	60 DAS	60 DAS	60 DAS	40-60 DAS
10 t/ha FYM + 0.5 kg/ha Molybdenum	33.57	24.13	67.43	14.65
10 t/ha FYM + 1.0 kg/ha Molybdenum	34.97	26.34	69.03	16.87
10 t/ha FYM + 1.5 kg/ha Molybdenum	35.50	25.41	71.23	15.35
4 t/ha VC + 0.5 kg/ha Molybdenum	36.13	26.42	71.63	16.65
4 t/ha VC + 1.0 kg/ha Molybdenum	35.33	26.31	72.8	17.09
4 t/ha VC + 1.5 kg/ha Molybdenum	38.03	27.47	77.79	17.37
5 t/ha PM + 0.5 kg/ha Molybdenum	35.73	27.58	75.67	17.27
5 t/ha PM + 1.0 kg/ha Molybdenum	37.10	27.72	79.33	16.68
5 t/ha PM + 1.5 kg/ha Molybdenum	38.77	28.18	80.77	14.65
F test	S	S	S	S
SEm (±)	0.38	0.42	0.99	0.71
CD (p=0.05)	1.13	1.26	2.98	2.12

The increase in combine dose of poultry manure and molybdenum the number of pods per plant, seed yield and haulm yield were increased. The significantly maximum number of pods per plant was obtained in 5 t/ha poultry manure + 1.5 kg/ha molybdenum treatment, which was statistically at par with T<sub>6</sub>

treatment. Significantly higher seed yield (2325 kg/ha) was observed in 5 t/ha poultry manure + 1.5 kg/ha molybdenum, which was statistically at par with T<sub>6</sub> treatment. Same trend was followed in haulm yield. Test weight and harvest index were found non-significant.

**Table 2: Effect of organic manures and molybdenum on yield attributes of groundnut.**

Treatments	Number of pods/plant	Test weight (g)	Seed Yield (kg/ha)	Haulm Yield (kg/ha)	Harvest Index (%)
10 t/ha FYM + 0.5 kg/ha Molybdenum	18.67	36.67	1948	2740	41.55
10 t/ha FYM + 1.0 kg/ha Molybdenum	18.47	37.27	2117	3011	41.27
10 t/ha FYM + 1.5 kg/ha Molybdenum	18.5	37.1	2150	3079	41.11
4 t/ha VC + 0.5 kg/ha Molybdenum	18.33	37.2	2154	3168	40.46
4 t/ha VC + 1.0 kg/ha Molybdenum	18.6	37.8	2191	3208	40.57
4 t/ha VC + 1.5 kg/ha Molybdenum	20.97	37.43	2278	3379	40.12
5 t/ha PM + 0.5 kg/ha Molybdenum	19.07	37.57	2216	3231	40.67
5 t/ha PM + 1.0 kg/ha Molybdenum	19.2	37.13	2202	3208	40.70
5 t/ha PM + 1.5 kg/ha Molybdenum	22.67	37.37	2325	3396	40.64
<b>F test</b>	S	NS	S	S	NS
<b>SEm (±)</b>	0.68	0.57	24.39	13.36	0.25
<b>CD (p=0.05)</b>	2.04	1.7	73.12	40.05	0.76

Improvements in photosynthesis and carbohydrate metabolism resulted in more photosynthetic and metabolite creation in the source, which was then translocated to newly created sinks, resulting in an increase in pods/plant, kernels/pod, and seed index. These findings are consistent with Shivkumar and Kumutha's findings (2003). The better yield performance under poultry manure and vermicompost application may be explained due to increase activities of N-fixing bacteria and increased rate of humification. Humic acid in poultry manure and vermicompost may enhanced the availability of both native and added micronutrients in soil, thus improved plant growth, yield attributes and yield. These results corroborate with the finding of Chaudhari *et al.* (2015). The unique role of Mo in enhancing N-fixation might have increases N availability to plants for Efficient growth and development reported by Choudary *et al.* (2017), such yield increases with increased Mo application could be due to increased growth characters and yield attributes, which could have enhanced photosynthesis

and synthesis of other metabolites for plant use. Caires and Rosolam reported similar findings (2000).

The maximum gross return (1,22,661.3 ₹/ha), net return (53,925.39 ₹/ha) was obtained in 5 t/ha poultry manure + 1.5 kg/ha molybdenum treatment, Significantly lowest B:C ratio of (0.70) was computed under vermicompost application and highest B:C ratio (1.13) under poultry manure was attributed to highest yield and low cost of manure. Vermicompost could not compete with poultry manure due to much higher cost of manure which reduced B:C ratio increased with increasing levels of Mo application significantly with up to 1.0kg Mo/ha which might be attributed to crop yields. Though further increase in Mo up to 1.5kg/ha increased net return and B:C ratio but margin of increase beyond 1.0 Mo kg/ha was not significant, these findings were similar to results reported by Caires and Rosolam (2000) in Groundnut and Khan *et al.*, (2014) in chickpea.

**Table 3: Effect of organic manures and molybdenum on economics of groundnut.**

Treatments	Gross return (INR/ha)	Net return (INR/ha)	B:C ratio
10 t/ha FYM + 0.5 kg/ha Molybdenum	1,02,792.2	44,241.23	0.75
10 t/ha FYM + 1.0 kg/ha Molybdenum	1,06,713.3	48,069.81	0.81
10 t/ha FYM + 1.5 kg/ha Molybdenum	1,08,559.5	49,823.56	0.72
4 t/ha VC + 0.5 kg/ha Molybdenum	1,13,623.5	34,072.56	0.73
4 t/ha VC + 1.0 kg/ha Molybdenum	1,15,592.8	35,949.39	0.70
4 t/ha VC + 1.5 kg/ha ssssMolybdenum	1,20,164.5	40,428.56	1.10
5 t/ha PM + 0.5 kg/ha Molybdenum	1,16,894.0	48,343.06	1.02
5 t/ha PM + 1.0 kg/ha Molybdenum	1,16,173.1	47,529.64	1.01
5 t/ha PM + 1.5 kg/ha Molybdenum	1,22,661.3	53,925.39	1.13

## CONCLUSION

It was concluded that combination of poultry manure 5 t/ha with 1.5 kg/ha molybdenum recorded significantly higher Productivity and profitability from Groundnut cultivation with grain yield (2325 kg/ha), gross return (1,22,661.3 INR/ha), net returns (53,925.39 ₹/ha) benefit cost ratio (1.13) for profitable cultivation of groundnut. As this combination provides good quality produce in groundnut cultivaton with lesser impact on human health and environment and improving organic matter content in soil.

## FUTURE SCOPE

Based on research work done, it can be used as reliable work futherreference. The findings of present studies basedon only one season. Hence further trails are needed to confirm the findings of the present experiment. The levels of organic manures (FYM, Poultry manure, Vermicompost) would be tested with different levels of Molybdenum.

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people or organizations that would inappropriately influence the bias of content in paper.

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