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Effect of gypsum and micronutrients on growth and yield attributes of Groundnut

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ABSTRACT

The field experiment titled "Effect of gypsum and micronutrients on growth and yield attributes of Groundnut" was conducted during *Zaid*, 2023 at Crop Research Farm, Department of Agronomy, Naini Agriculture Institute, SHUATS, Prayagraj, Uttar Pradesh. The experiment was laid out in Randomized Block Design with ten treatments which are replicated thrice. The treatments include 200 kg/ha gypsum + 5 kg/ha zinc, 200 kg/ha gypsum + 2.5 kg/ha boron, 200 kg/ha gypsum + 1 kg/ha molybdenum, 250 kg/ha gypsum + 5 kg/ha zinc, 250 kg/ha gypsum + 2.5 kg/ha boron, 250 kg/ha gypsum + 1 kg/ha molybdenum, 300 kg/ha gypsum + 5 kg/ha zinc, 300 kg/ha gypsum + 2.5 kg/ha boron, 300 kg/ha gypsum + 1 kg/ha molybdenum and Control R.D.F 20:60:40 kg/ha NPK Results obtained that higher plant height (59.40 cm), plant dry weight (45.47 g/plant), root nodules/plant (91.67) and number of pods/plant (17.00), number of kernels/pod (1.87), seed yield (2.75 t/ha), haulm yield (3.72 t/ha), gross return (1,61,360.55 INR/ha), net returns (1,06,770.55 INR/ha) and B:C ratio was (1.95) were obtained by the application of 300 kg/ha gypsum in combination with 5 kg/ha Zinc in Treatment 7.

Key words: *Gypsum, Zinc, Boron, Molybdenum, Yield attributes, Yield, Economics.*

Introduction

Groundnut or peanut is commonly called the poor men's nut. This plant is native to south America and has never been found uncultivated. The botanical name for groundnut, *Arachis hypogia* linn., is derived from two Greek words arachis means legume and hypogia means below ground, referring to the formation of pods in the soil. Groundnut is an uprooted or prostrate annual plant. It is generally distributed in the tropical, sub- Tropical and warm temperate zones. Ethnological studies of the major Indian Tribes of south American document. Later trades were responsible for spreading the groundnut to Asia and Africa where it is now is grown between the latitudes 40^0 north and south. Groundnut is primarily used for extraction of oil, with an analysis of about 46.70%. It is also consumed directly because of its high food value, which is again due to its higher content of protein (22.0%), carbohydrate (10.0%) and minerals (3.0%). Haulm is used as livestock feed. Groundnut oil is composed of mixed glycerides and contains a high proportion of unsaturated fatty acids *viz.*, oleic (50 to 65%) and linoleic acid (18 to 30%). Groundnut contains amino acids including cysteines which are essential for animal growth, which contains 7 to 8% N, 1.5% P and 1% K. (Revoredo and Fletcher, 2002).

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Gypsum is widely used as a source of calcium and sulphur for groundnut worldwide. gypsum contains 18.6% sulphur and 23.3% calcium. Application of gypsum improves soil structure for increased water permission and decreased crusting, which favours effective pegging and encourages pod formation and better filling up of pods in groundnut. (Holborook and Stalker 2003).

The role of zinc in increasing the crop yield has been well established (Patil *et al.,* 2003). Zinc plays significant role in various enzymatic and physiological activities of the plant. Zinc catalysis the process of oxidation in plant cells and is vital for transformation of carbohydrates, regulates the consumption of sugar, increases source of energy for the production of chlorophyll, aids in the formation of auxins which produce more plant cells and more dry matter, that in turn, will be stored in seed as a sink and promotes absorption of water. The groundnut seed industry is faced with several challenges including diseases such as groundnut rosette disease (GRD) which is spread by the aphid vector Aphis craccivora, early and late leaf spot caused by Cercospora arachidicola and Phaesariopsis personata, respectively rust (*Pussinis arachidis* and mycotoxins such as aflatoxins (Vishwakarma 2008). Molybdenum has a positive effect on yield, quality and nodule formation in legume crops. The functions of molybdenum in leguminous plants include nitrate reduction, nodulation and nitrogen fixation (Naida 2012).

Materials and Methods

A field experiment was conducted during *Zaid* (March – June 2023), at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University ofagriculture Technology and Sciences, Prayagraj, Uttar Pradesh, India. Which is located at 25^0 39′ 42" N latitude, 81^0 67′56" E longitude and 98 m altitude above the mean sea level. This area is situated on the right side of Yamuna river by the side of prayagraj- Rewa Road above 12 km away from the city. The soil had a sandy loam texture, a pH 7.2, organic carbon(0.657%), potassium (247.3 kg/ha), and phosphorus (36.7 kg/ha). The soil had electrical conductivity of (0.387 ds/m). The experiment was laid out in Randomised Block Design with ten treatments each replicated thrice. The treatment consist of three levels of gypsum (200 kg/ha, 250 kg/ha, 300 kg/ha) one levels of zinc(5 kg/ha), one levels of boron (2.5 kg/ha) and one levels of molybdenum (1 kg/ha) and one control plot NPK 20:60:40 kg/ha was used and analysed of each treatment was completed to determine the best treatment combination. Net weight, benefit cost ratio were computed basedon the cost of cultivation, Grain and stover yield with their prevailing market price. The data collected for different parameters were statistically analysed using Gomez (1984). Randomized block design. The results are presented at (5%) level of significance for making comparison between treatments.

Results and Discussion

Growth attributes

Plant height: At 100 DAS, has significantly increase the plant height to (59.40 cm) were recorded withapplication of 300 kg/ha gypsum in combination with zinc 5 kg/ha, whereas the application of 200 kg/ha gypsum with 5 kg/ha zinc(57.27 cm) were found statistically at par with the higher. The plant height of groundnut increased significantly due to application of gypsum levels in combination with zinc, boron, molybdenum. The increase in plant height may be attributed to role of zinc as a catalyst or stimulant in most of physiological and metabolic process and it also important in synthesis of trytophane, a component of some protein and a compound needed for production of growth hormones (auxins) like indole acetic acid. Similar results were also reported by Halepyati (2001).

Plant dry weight -At 100 DAS, significantly higher plant dry weight (45.57 g/plant) was recordedwith the application of 300 kg/ha in combination with 5 kg/ha zinc. however, with the application of 250 kg/ha gypsum with 5 kg/ha zinc (43.47 g/plant) were found to be statistically at par with the higher. The dry weight of groundnut increased significantly due to application of molybdenum levels and zinc. The improvement in these 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_2 fixation. These findings are in close conformity with the results obtained by Singh *et al.* (2007).

Yield attributes and yield

The record and analysis of data on yield attributes indicates that a significant higher number of pods/ plant (17), number of kernels/pod (1.87), Seed index

Table 1. Effect ofgypsum and micronutrients on growth parameters of Groundnut

Treatments	100 DAS			100-80 DAS	
	Plant height (cm)	Dry weight (g/plant)	No. of Nodules	Crop growth rate ($g/m^2/day$)	Relative growth rate (g/g/day)
200 kg/ha gypsum + 5 kg/ha zinc	56.17	40.63	48.33	15.72	0.01
200 kg/ha gypsum + 2.5 kg/ha boron	55.87	39.60	44.33	16.10	0.01
200 kg/ha gypsum + 1 kg/ha molybdenum	55.23	39.40	41.67	16.83	0.01
250 kg/ha gypsum + 5 kg/ha zinc	57.27	43.47	49.33	17.77	0.01
250 kg/ha gypsum + 2.5 kg/ha boron	56.13	40.20	46.00	16.94	0.01
250 kg/ha gypsum + 1 kg/ha molybdenum	55.33	39.47	42.00	16.27	0.01
300 kg/ha gypsum + 5 kg/ha zinc	59.40	45.47	51.00	19.83	0.01
300 kg/ha gypsum + 2.5 kg/ha boron	56.60	40.50	48.00	16.77	0.01
300 kg/ha gypsum + 1 kg/ha molybdenum	55.80	40.23	43.33	17.10	0.01
Control R.D.F 20:60:40 kg/ha NPK	55.70	39.63	42.33	17.49	0.01
F test	S	S	S	S	NS
SEm(±)	0.47	0.59	0.98	1.19	0.00
CD (5%)	1.42	1.77	2.93	3.55	-

Table 2. Effect of gypsum and micronutrients on yield attributes of Groundnut

Treatments	Pods/plant (No.)	Kernals/ pod (No.)	Seed index (g)	Seed yield (t/ha)	Haulm yield (t/ha)	Harvest index (%)
200 kg/ha gypsum + 5 kg/ha zinc	16.98	1.84	26.12	2.70	3.61	42.82
200 kg/ha gypsum + 2.5 kg/ha boron	16.50	1.86	26.22	2.66	3.54	42.87
200 kg/ha gypsum + 1 kg/ha molybdenum	15.38	1.80	27.07	2.52	3.53	41.66
250 kg/ha gypsum + 5 kg/ha zinc	17.00	1.81	26.64	2.71	3.66	42.52
250 kg/ha gypsum + 2.5 kg/ha boron	16.10	1.85	26.90	2.68	3.59	42.76
250 kg/ha gypsum + 1 kg/ha molybdenum	15.82	1.79	25.80	2.57	3.55	42.00
300 kg/ha gypsum + 5 kg/ha zinc	17.00	1.87	27.35	2.75	3.72	42.57
300 kg/ha gypsum + 2.5 kg/ha boron	16.98	1.76	27.12	2.69	3.60	42.80
300 kg/ha gypsum + 1 kg/ha molybdenum	15.91	1.84	26.96	2.60	3.59	41.95
Control R.D.F 20:60:40 kg/ha NPK	16.00	1.73	25.87	2.57	3.55	41.98
F test	S	S	S	S	S	S
SEm(±)	0.47	0.16	0.70	3.11	1.83	0.48
CD (5%)	1.60	0.52	1.90	9.26	5.44	1.44

Table 3. Effect of gypsum and micronutrients on growth and economics of Groundnut

Treatments	Cost of cultivation (INR/ha)	Gross returns (INR/ha)	Net returns (INR/ha)	B:C Ratio
200 kg/ha gypsum + 5 kg/ha zinc	53,990.00	1,58,377.05	1,04,387.05	1.93
200 kg/ha gypsum + 2.5 kg/ha boron	53,780.00	1,55,826.45	1,02,046.45	1.89
200 kg/ha gypsum + 1 kg/ha molybdenum	54,890.00	1,47,811.95	92,921.95	1.69
250 kg/ha gypsum + 5 kg/ha zinc	54,290.00	1,58,944.50	1,04,654.50	1.92
250 kg/ha gypsum + 2.5 kg/ha boron	54,080.00	1,57,288.95	99,208.95	1.83
250 kg/ha gypsum + 1 kg/ha molybdenum	55,190.00	1,50,853.95	95,663.95	1.73
300 kg/ha gypsum + 5 kg/ha zinc	54,590.00	1,61,360.55	1,06,770.55	1.95
300 kg/ha gypsum + 2.5 kg/ha boron	54,380.00	1,57,815.45	1,03,435.45	1.90
300 kg/ha gypsum + 1 kg/ha molybdenum	55,490.00	1,52,334.00	96,844.00	1.74
Control (NPK 20:60:40 kg/ha)	51,840.00	1,50,696.00	98,856.00	1.90

(27.35 g), Seed yield (2.75 t/ha), Haulm yield (3.72 t/ha) and harvest index (42.57%) were recorded with the application of 300 kg/ha gypsum in combination with 5 kg/ha zinc. The improvement in photosynthesis and carbohydrate metabolism resulting into greater formation of photosynthetic and metabolites in source and later on translocated in the newly formed sinks which ultimately increased number of pods/plant These results are in agreement with the findings of Naiknaware *et al.* (2015). The regular supply of plant nutrients, which results in increase in oil content and kernels/pod which ultimately increases the pods/plant Sreelatha *et al.* (2004).

Economics

Gross returns(INR 1,61,360.55/ha), Net returns of (INR 1,06,770.55/ha) were found to be higher with application of 300 kg/ha gypsum with 5 kg/ha zinc and B:C ratio of (1.95)were recorded with the application of 300 kg/ha gypsum with 5 kg/ha zinc.

Conclusion

Based on the study it was concluded that application of 300 kg/ha in combination with 5 kg/ha zinc (treatment 7) in Groundnut was recorded significantly higher yield, yield attributes and economics returns under eastern Uttar Pradesh Agro-climatic conditions.

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