Biological Forum – An International Journal **14(2): 35-38(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of Gypsum and Boron on Yield and Economics of Groundnut (*Arachis hypogaea* L.)

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(Received 03 January 2022, Accepted 12 March, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: A field experimental trial was undertaken during the *Kharif* season of 2021 at crop research farm (CRF), Department of Agronomy, SHUATS Prayagraj (U.P.) to investigate the effect of gypsum and boron on yield and economics of groundnut. The experimental plot's soil texture was sandy loam, and the soil reaction was neutral (Ph 7.3). The treatments comprised of three gypsum levels *viz.*, 200kg/ha, 300 kg/ha, 400 kg/ha and three boron levels *viz.*, 5kg/ha, 10 kg/ha, 15 kg/ha. which had an influence on groundnut. The experiment was consisted of Nine treatments and Three replications and was set up in a Randomized Block Design. The study revealed that the treatment with 400 kg/ha gypsum + 10 kg/ha boron was recorded significantly higher number of pods (31.36), seed yield (2674.17 kg/ha), haulm yield (3345.13 kg/ha) and harvest index (44.43%) compared to all other treatment combinations. The economic analysis demonstrates that 400 kg/ha gypsum + 10 kg/ha boron treatment produced higher gross returns (INR 149641.52/ha), net returns (INR 101010.90/ha) and B: C (2.07) ratio than all other treatment combinations. The challenges experienced throughout the research work were mostly related to the use of gypsum and boron, gypsum significantly raises all the parameters and use of boron improves nodulation of the plant. The application of 400 kg/ha gypsum increased the yield contributing features. The use of boron at a rate of 10kg/ha resulted in improved plant growth and yield indices, as well as improved groundnut crop economics.

Keywords: Gypsum, Boron, Yield attributes, Economics, Groundnut.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) Globally groundnut is grown on 295 lakh hectares with the yielding of 487 lakh tonnes at productivity of 1647 kg per hectare (FAOSTAT 2019). India ranks first in groundnut acreage and is the world's second-largest groundnut producer with 101 lakh tonnes with produced at an average yield of 1816 kg per hectare in 2020-21(agricoop.nic.in), producing about 15% of the world's peanut. Among India, Gujarat is the world's leading producer of groundnuts, accounting for 33% of global groundnut output, then follows Rajasthan (21%) Tamil Nadu (14%) and Uttar Pradesh ranks 10th in groundnut production (0.89%) (Groundnut Outlook Report 2021). Groundnut is called the King of oil seeds. It is one of our country's most important food and cash crops, and it is a low-cost commodity that provides all of the essential nutrients. Groundnut is sometimes known as "wonder nut" or "poor man's cashew nut". The crop's high edible oil content (50%) and protein level (25%) make it a popular human food (Ramjeet Yadav *et al.*, 2015). Groundnut, an oilseed crop, requires secondary nutrients and micronutrients, which are crucial for growth and production (Ariraman *et al.*, 2020). Flowers, peg formation and developing pods are all key yielding variables in groundnut, so potassium, sulphur, and calcium are all necessary for better output. (Srikanth and Singh 2021). It can fix atmospheric nitrogen via symbiotic nitrogen-fixing bacteria in the root nodules; requiring fewer nitrogen-containing fertilizers and improving soil nitrogen content, making it a good crop rotation plant (Haneena *et al.*, 2021). Groundnut is high in both oils and protein, it has a high sulphur need. Sulphur boosts chlorophyll production, nodulation. And the availability of other nutrients through the source gypsum (Singh, 2007). Groundnut requires essential nutrients for its growth and development at various stages of growth. Among these, gypsum and boron are essential.

For groundnuts, Gypsum is utilized as a calcium and sulphur source. The usage of gypsum improves soil structure and reduces crusting, which allows more effective pegging and encourages pod formation and filling of pods in groundnut. Gypsum dissolves quickly, allowing calcium and sulphur to quickly enter the podding zone (Vidya Sagar *et al.* 2020). Apart from providing calcium and Sulphur, gypsum plays a significant role in the reclamation of alkaline soil. These nutrients requirement is high during pod formation stage. The oil and protein content of

groundnut kernels increased considerably when gypsum was applied (Rao *et al.,* 2001).

Boron is necessary for appropriate seed setting and seed quality and nitrogen absorption by groundnut, boron aids in the growth of roots and nodules, which aids in nitrogen fixation in plant tissue. The boron deficiency in groundnut kernels results in "hallow- heart" results in poor quality and low yields in groundnut. Boron is engaged in sugar and starch transformation, as well as cell development and elongation, and proteins and amino acid synthesis (Naiknaware *et al*., 2015). Because boron promotes root and nodule formation, it aids in nitrogen fixation in plants (Hanumanthappa *et al.,* 2019). Among all the essential nutrients, Boron influences the growth of groundnut through arresting the flower drops and also involves the synthesis of carbohydrates and fats (Susan Poonguzhali *et al.,* 2019).

MATERIALS AND METHODS

During the *Kharif* season 2021, the present experiment was conducted at Crop Research Farm (CRF), Department of Agronomy, Naini Agricultural Institute, SHUATS Prayagraj (U.P.). with an objective of studying the effect of gypsum and boron on yield attributes and economics of groundnut (*Arachis hypogaea* L.) on sandy loam soils. The location is 25.75^0 N latitude, 87.19^0 E longitude, and 98 m altitude above the mean sea level. The experiment was laid out in Randomized Block Design with nine treatments and three replications. T_1: 200 kg/ha gypsum + 5 kg/ha boron, T_2: 200 kg/ha gypsum + 10 kg/ha boron, T_3: 200kg/ha gypsum + 15 kg/ha boron, T_4: 300 kg/ha gypsum + 5 kg/ha boron, T_5: 300 kg/ha gypsum + 10 kg/ha boron, T_6: 300 kg/ha gypsum + 15 kg/ha boron. T_7: 400 kg/ha gypsum + 5 kg/ha boron, T_8: 400 kg/ha gypsum + 10 kg/ha boron.T_9: 400kg/ha gypsum + 15 kg/ha boron. Gypsum and boron are applied through the soil. Borax is used as a source of boron. Urea, ssp, and mop were all applied through the soil. At regular intervals of 15, 30, 45, 60, 75, 90 DAS observations were taken from 5 randomly chosen competitive plants from each plot in each replication. The economics per hectare was calculated using different treatments and current commodity market prices. Later on Statistical analysis was performed at the 5% probability level for significant results.

RESULTS AND DISCUSSION

A. Effect of Gypsum and Boron on yield attributes and yield of Groundnut

The effect of Gypsum and Boron on Yield attributes and yield of Groundnut is presented in the Table (1).

No. of pods per plant: The maximum number of pods (31.36/plant) was recorded in the treatment with application of 400 kg/ha gypsum + 10 kg/ha boron which is significantly higher over rest of all treatment combinations except with treatment 300 kg/ha gypsum + 10 kg/ha boron (29.38). The rise in number of pods per plant could be attributed to sulphur's crucial involvement in energy storage and transformation, carbohydrate metabolism and enzyme activation, all of which improves plant's photosynthetic activity (Ruskar Banu *et al.,* 2017). Boron is involved in nitrogen fixation during nodule production and also helps in translocation of sugars and protein from leaves to the pods which results in a higher number of pods per plant and the seed index also increased.

Table 1: Effect of Gypsum and Boron on Yield attributes and Yield of Groundnut.

Treatment combinations	No. of pods/plant	Seed Index (g)	Seed Yield (kg/ha)	Haulm yield (kg/ha)	Harvest index (%)
1. 200kg/ha gypsum + 5 kg/ha boron	24.7	33.93	2013.18	2892.137	41.04
2. 200kg/ha gypsum + 10 kg/ha boron	25.46	35.81	2119.67	2860.22	42.54
3. 200kg/ha gypsum + 15 kg/ha boron	24.1	33.82	1959.18	2827.823	40.92
4. 300kg/ha gypsum + 5 kg/ha boron	27	36.55	2197.87	3024.813	42.11
5. 300kg/ha gypsum + 10 kg/ha boron	29.83	38.24	2564.12	3271.757	43.93
6. 300kg/ha gypsum + 15 kg/ha boron	28.86	36.97	2415.02	3216.047	42.89
7. 400kg/ha gypsum + 5 kg/ha boron	26.63	35.86	2118.63	3087.93	40.72
8. 400kg/ha gypsum + 10 kg/ha boron	31.36	40.04	2674.17	3345.13	44.43
9. 400kg/ha gypsum + 15 kg/ha boron	26.1	36.53	2159.82	3011.75	41.76
SEm(±)	0.57	1.24	41.44	45.31	0.63
CD(p=0.05)	1.71	-	124.24	135.85	1.88

Seed Yield: According to the findings in the research that the highest Seed yield (2674.17 kg/ha) was recorded in treatment 8 with 400 kg/ha gypsum + 10 kg/ha boron. However, the treatment with the application of 300 kg/ha gypsum + 10 kg/ha boron shows statistically at par with the treatment of 400 kg/ha gypsum + 10 kg/ha boron.

Haulm Yield: Significantly higher Haulm yield (3345.13 kg/ha) was obtained in the treatment with application of 400 kg/ha gypsum + 10 kg/ha boron. However, the treatment with 300 kg/ha gypsum + 10 kg/ha boron, 300 kg/ha gypsum + 15 kg/ha boron shows statistically at par with 400 kg/ha gypsum + 10 kg/ha boron. Higher seed and Haulm yield were recorded following the application of gypsum, with sulphur produced from the gypsum influencing the availability of other nutrients in the soil and their uptake by the plant, resulting in a nutritionally favourable environment for the plants. Further gypsum application increases the availability of sulphur and calcium to crops during the grand growth phase, resulting in improved pod growth and development. Calcium plays a major role in reproductive development of the groundnut crop, resulting in increasing pod yield. These results are in agreement with the findings of (Sreelatha *et al.,* 2004). The application of boron aids in the synthesis of chlorophyll, photosynthetic process, enzyme activation and grain formation, as well as carbohydrate metabolism, which leads to nutrient uptake and finally

results in an increase in groundnut yield (Naiknaware *et al.*, 2015).

The Higher Seed index (40.04 g), Harvest index (44.43%) was recorded higher in the treatment with application of 400 kg/ha gypsum + 10 kg/ha boron, which is higher over the rest of all the treatments. The highest yield was gained due to the use of gypsum, which releases sulphur and calcium. Sulphur helps with amino acid synthesis and protein production, while calcium aids in peg penetration by loosening the soil, resulting in the creation of more pods in the groundnut.

On the other hand, the increase in yield was attributed to the higher number of filled pods and the least number of unfilled pods due to Boron application (Susan Poonguzhali *et al.,* 2019).

B. Effect of Gypsum and Boron on Economics of Groundnut.

The data on economics given in the Table 2.

Cost of cultivation: The cost of cultivation of groundnut varied from INR 47067.60/ha to INR 50017.60/ha because different doses of fertilizers are used in different treatment combinations. The maximum cost of cultivation (50017.60 INR/ha) was obtained in the treatment 9, while minimum was observed in the treatment 1.

Gross Returns: The highest gross returns (INR 149641.52 /ha) was recorded in the treatment with application of 400 kg/ha gypsum + 10 kg/ha boron. While lowest gross returns (109714.08 INR/ha) was found in treatment 200 kg/ha gypsum + 15 kg/ha boron.

Net Returns: Net returns (INR 101010.90/ha) was recorded maximum in the treatment 400 kg/ha gypsum + 10 kg/ha boron and the treatment with 200 kg/ha gypsum + 15 kg/ha boron recorded minimum net returns (60096.48 INR/ha.)

Benefit-Cost ratio: The Highest B: C Ratio (2.07) was recorded in the treatment 8 with the application of 400 kg/ha gypsum + 10 kg/ha boron. In comparison to the treatments with a lower dose of inorganic fertilizer, treatments with a larger dose of fertilizer increased the B:C ratio. The use of a sensible combination of gypsum and boron boosted the net returns and B: C ratio of groundnut crop. The application of gypsum increases net returns and B:C ratio of groundnut crop because optimum availability of nutrients sulphur and calcium to crop during grand growth phase leads to better growth and development of pods (Vidya Sagar *et al*., 2020).

Table 2: Effect of Gypsum and Boron on Economics of Groundnut.

Treatment combinations	Cost of Cultivation (INR/ha)	Gross Returns (INR/ha)	Net Returns (INR/ha)	B: C Ratio
1. 200kg/ha gypsum + 5 kg/ha boron	47067.60	112738.08	65670.48	1.39
2. 200kg/ha gypsum + 10 kg/ha boron	48342.60	118701.52	70358.92	1.45
3. 200kg/ha gypsum + 15 kg/ha boron	49617.60	109714.08	60096.48	1.21
4. 300kg/ha gypsum + 5 kg/ha boron	47267.60	123080.72	75813.12	1.60
5. 300kg/ha gypsum + 10 kg/ha boron	48542.6	143590.72	95048.12	1.95
6. 300kg/ha gypsum + 15 kg/ha boron	49817.60	135241.12	85423.52	1.71
7. 400kg/ha gypsum + 5 kg/ha boron	47467.60	118643.28	71175.68	1.49
8. 400kg/ha gypsum + 10 kg/ha boron	48742.60	149641.52	101010.90	2.07
9. 400kg/ha gypsum + 15 kg/ha boron	50017.60	120949.92	70932.32	1.41

Gypsum application and earthing up in Groundnut

Groundnut Research crop

Spraying of Fungicides in Groundnut

Harvest and Yield of Groundnut

CONCLUSION

In conclusion from the above study the improved seed and haulm yield output of groundnut might be attributed due to a higher number of filled pods and more excellent nodule production as well as adequate fertilization with gypsum 400 kg/ha, boron 10 kg/ha at early stages of crop growth. The combination of gypsum and boron fertilizer is the most suitable combination for groundnuts because it is highly productive, profitable and economically efficient.

FUTURE SCOPE

The conclusions are drawn based on single season of experimentation which requires further confirmation for recommendations.

Acknowlegement. I am grateful to my advisor Dr. Rajesh Singh for his unwavering support and guidance. I owe thanks to all the professors, Department of Agronomy, SHUATS. I must also thank my parents Haribabu, Bhupamma and friends

for the immense support and assistance throughout my research work to complete the research successfully.
Conflict of Interest. None.

REFERENCES

Ariraman, R., Ravikumar, C. and Ganapathy, M. (2020). Studies on the effect of different sources and levels of Sulphur on yield and economics of irrigated summer groundnut (*Arachis hypogaea* L.), *Infokara Research*, *9*(3): 1021-9056.

FAOSTAT. Food and Agriculture Organization of the United Nations. (2019). Production: crops. http://faostat.fao.org

Groundnut outlook Report (2020-21). Agricultural Marketing Intelligence Centre, ANGRAU. https://angrau.ac.in/downloads/AMIC/GROUNDNUT%20OUTLOOK%20REPORT%20-%20January%20to%20May%202021.pdf.

Haneena, K. M., Venkata Subbaiah, P., Sujani Rao, CH. and Srinivasulu, K. (2021). Effect of Boron on Nutritional Quality of Groundnut Grown in Coastal Sandy Soils. *International Journal of Plant & Soil Science*, *33*(19): 189-197.

Hanumanthappa, D. C., Sushmitha, B. P., Ganesh, A. S., and Harsha Kumar, S. S. (2019). Influence of Different levels of Nano Boron on Germination and Seedling Vigour of Groundnut. *International Journal of Pure and Applied Bioscience*, *7*(1): 256-259.

Naiknaware, M. D., Pawar, G. R., and Murumkar, S. B. (2015). Effect of varying levels of boron and Sulphur on growth, yield, and quality of summer groundnut (*Arachis hypogaea* L.). *International Journal of Tropical Agriculture*, *33*(2): 471-474.

Rao, S. S., and Shaktawat, M. S. (2001). Effect of organic manure, phosphorus, and gypsum on growth, yield, and quality of groundnut (*Arachis hypogaea* L.). *Indian Journal Plant Physiology*, *6*(3): 306-311.

Ramjeet Yadav, Jat L. K, Shobh Nath Yadav, Singh, R. P., and Yadav, P. K. (2015). Effect of gypsum on growth and yield of groundnut (*Arachis hypogaea* L.). *Environment and ecology*, *33*(2): 676-679.

Ruskar Banu, Jagruti, C., Shroff, S. N., Shah (2017). Effect of sources of sulphur and biofertilizers on growth, yield and quality of summer groundnut. *International journal of Agricultural Science*, *13*(6): 67-70.

Singh, R. A. (2007). Effect of variable doses of potassium, sulphur and calcium on pod yield of short duration summer groundnut (*Arachis hypogaea* L.). *International Journal of Agricultural Science*, *3*(1): 196-198.

Sreelatha, N., Seshaiah, B. V., and Sankara Rao, V. (2004). Effect of phosphorus and sulphur nutrition on nutrient composition oil content and yield of groundnut. *The Andhra Agricultural Journal*, *15*(3-4): 380-383.

Susan Poonguzhali, R., Saravana Pandian, P., and Angelin Silvia, R. (2019). Effect of soil and foliar-applied boron on soil available boron yield and quality of groundnut in alfisols of Madurai district. *Bulletin of Environment, Pharmacology and Life Sciences*, *8*(10): 76-80.

Srikanth, T., and Shikha Singh. (2021). Effect of Potassium and Sulphur Levels on Growth and Yield of Groundnut (*Arachis hypogaea* L.). *Biological Forum - An International Journal*, *13*(3): 557-561.

Vidya Sagar, D. R. M. S., Joy Dawson and Ramasahayam Uday Kumar Reddy (2020). Effect of Phosphorus and Gypsum on Growth, Yield, and Economics of Groundnut (*Arachis hypogaea* L.). *International Journal of Current Microbiology and Applied Sciences*, *9*(10): 1635-1638.

How to cite this article: Pasala Ramya, Rajesh Singh and Thakur Indu (2022). Effect of Gypsum and Boron on Yield and Economics of Groundnut (*Arachis hypogaea* L.). *Biological Forum – An International Journal*, *14*(2): 35-38.