Original Research Article

Influence of Sulphur and Liquid Organic Nutrient on Growth and Yield of Groundnut (*Arachis hypogea* L.)

Abstract

A field experiment was conducted during *Zaid* season of 2023 at Crop Research Farm Department of Agronomy, Naini Agriculture Institute, Sam Higginbottom University of Agriculture Sciences and Technology. To determine "Influence of Sulphur and Liquid Organic Nutrient on Growth and Yield of Groundnut.''Theresult revealed that treatment 9 [sulphur (40 kg/ha) + seaweed (3%)]recorded significantly higher plant height (37.36 cm), maximum number of nodules/plant (18.66), higher plant dry weight (25.38 g), maximum number of pod/plant (24.92), higher number of kernels/pod (2.60), higher seed index (41.92 g),higher seed yield (2.72 t/ha), higher haulm yield (6.33t/ha)and higher harvest index (30.01%).

Keywords: Groundnut, Sulphur, Organic nutrient, Growth& yield.

1. INTRODUCTION

"Groundnut (*Arachis hypogea* L.) it belongs to Leguminosae family. It is also known as peanut, monkey nut, earthnut, manila nut, and goober. Groundnut is one of the most important edible oilseed crop in the world India occupying two third areas under oilseeds which constitute the second major agricultural crop in the country. It is premier oilseed crop of India popularly known as peanuts. The percentage of oil content is about (50%), (25%) to (30%), protein (20%) carbohydrate and (5%) fibre. It is valuable sources of vitamins E, K and B. It is richest source of thiamine and also rich in niacin which is low in cereals.

Groundnut rank fist in area and second in production after soyabean and is grown in almost all part of the country over wide range of agro-climatic condition. Globally, groundnut cover on area of 28.89 million hectares with the production of 54.41 million tons with the productivity of 1.88 tonnes/ha **(USDA, 2024).** In India Groundnut is grown over an area of about 5.75 million hectors with a production of 10.11 million tons and productivity of 1.7 t/ha **(GOI 2022)**. Total area coverage under groundnut in Uttar Pradesh 1.21 million hectares with a production of 1.24 million tone and the productivity 1.02 t/ha **(GOI, 2022)**.

Important reasons for low average yield of groundnut improper or excessive agronomic practices and application of fertilizers. The country is currently dealing with an edible oil consumption due to population growth. The primary cause of the low peanut production is the crop restricted kharif season cultivation, the issue is made harder during above average rainfall seasons by water logging, poor drainage, and difficulty the field for weed control techniques. Deficiency of sulphur has been frequently observed due to a number of reasons like increased removal of sulphur by the crop high yielding fertilizer responsive crop varieties increasing cropping intensity and extensive use of sulphur free fertilizer. Insufficient availability of sulphur to oil seed crop not only decline their growth and yield but can also deteriorate nutritional quality of the produce.

Sulphur plays an important role in groundnut metabolism. It is essential for protein synthesis. It is essential for the formation of chlorophyll. Sulphur is a secondary essential plant nutrient factor that plays a role in the formation of protein alongside nitrogen and phosphorus. The application of Sulphur fertilizer and groundnut has been found effective through increasing the number of pegs and pods /plant, kernel to shell ratio etc. Sulphur plays a significant role in the physiological growth and yield of crops such as groundnut **(Dileep *et al*., 2021)**.

The fish amino acid is liquid organic manure made from fish waste. Fish amino acid is of great value to both plants and microorganisms in their growth, because it contains various nutrients and types of amino acids. Foliar application or a soil drenching of fish amino acid could maximize uptake and minimize runoff or leaching, providing just enough N to the plant for the production of chlorophyll to maintain plant health. Fish amino acid diluted with water with other natural farming inputs and applied as a foliar spray as well as soil drench increased the yield **(Priyanka *et al*., 2019)**.

Panchagavya an organic product has potential to play the role in promoting growth and providing immunity in plant system. Use of organic liquid product such as *panchagavya*resulted in higher growth, and quality of crops. These liquid organic solution are prepared from five product of cow**(Choudhary *et al*., 2018).**

Seaweed extracts contain unidentified physiologically useful chemicals that commonly cause plants to produce phytohormones via internal signaling. Seaweed extracts are not biologically equivalent to chemical fertilizers. They are biodegradable and non-hazardous, making them ecologically benign substances with no chemical residues or risks **(Thillaigovindan, 2022).**

Keeping in view of the above fact, the experiment was conducted to find out "Influence of Sulphur and Liquid organic nutrient on growth and yield of Groundnut".

2. MATERIALS AND METHODS:

The experiment was conducted during *Zaid* season 2023 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of the experimental field was sandy loam in texture, with soil (pH 7.8), low level of organic carbon (0.62%), available N (225 Kg/ha), P (38.2 kg/ha), K (240.7 kg/ha) and zinc (2.32 mg/kg). The treatment consists of three levels of Sulphur along with the combination of three levels of organic nutrients. The experiment was laid out in RBD with 10 treatments each replicated thrice. The treatment combinations are T1- Sulphur (20 kg/ha) + Fish amino acid (3%), T2- Sulphur (20 kg/ha) + *Panchgavya*(3%), T3- Sulphur (20 kg/ha) + Seaweed (3%), T4- Sulphur (30 kg/ha) + Fish amino acid (3%), T5- Sulphur (30 kg/ha) + *Panchgavya* (3%), T6- Sulphur (30 kg/ha) + Seaweed (3%), T7- Sulphur (40 kg/ha) + Fish amino acid (3%), T8- Sulphur (40 kg/ha) + *Panchgavya* (3%), T9- Sulphur (40 kg/ha) + Seaweed (3%), T10- Control. Data recorded on different aspects of crop, *viz*., growth, yield attributes& yield were subjected to statistically analysed by analysis of variance method as described by **(Gomez and Gomez,1976).**

3. RESULT AND DISSCUSSION

3.1 Growth Attributes

3.1.1 Plant height (cm)

The data revealed that significant and higher plant height (37.36 cm) was recorded in treatment 9 [Sulphur (40 kg/ha) + Seaweed (3%)]. However, treatment 8 [Sulphur (40 kg/ha) + *panchgavya* (3%)] was found statically at par with treatment 9 [Sulphur (40 kg/ha) + Seaweed (3%)]. Significant and higher plant height was observed with the application of sulphur (40kg/ha) might be due to sulphur increased the nutrient supply to the plants and played a vital role in meristematic activities, higher apical growth, photosynthetic surface, and strong stem, this may resulted in increased plant height. These results are similar to that reported by **Dileep *et al*. (2021**). Further, the higher plant height was observed with the application of seaweed (3%) might be due to when seaweed is utilized via foliar application an increased in biological activity and cytokinin above it takes place and consequently affects the height of plant. These results are similar to that reported by **Dalwale*et al.* (2022).**

3.1.2 Number of nodules/plant

The data revealed that significant maximum number of nodules/plant (18.66) was recorded in treatment 9 [Sulphur (40 kg/ha) + seaweed (3%)]. However, treatment 8 [Sulphur (40 kg/ha) + *Panchgavya* (3%)] was found statistically at par with treatment 9 [Sulphur (40 kg/ha) + seaweed (3%)]. Significant and maximum number of nodules/plant was observed with the application of sulphur (40 kg/ha), might be due to increased leghaemoglobin, provide additional nitrogen, sufficient amount of glucose, ATP and ferredoxin, resulted in increased in number of nodules/plant. The similar findings was reported by **Rawal (2022)**. Further the maximum number of nodules/plant was observed which the application of seaweed (3%) might be due to foliar application of seaweed increased photosynthetic efficiency, chlorophyll content, increase the activity of rhizobia. Similar results was founded by **Kumawat *et al.* (2024).**

3.1.3 Plant dry weight (g)

Results revealed that significant higher plant dry weight (25.38 g) was recorded in treatment 9 [Sulphur (40 kg/ha) + seaweed (3%)]. However, treatment 8 [Sulphur (40 kg/ha) + *Panchgavya*(3%)] was found to be statistically at par with treatment 9 [Sulphur (40 kg/ha) + seaweed (3%)]. Significant and higher plant dry weight was observed with application of sulphur (40 kg/ha), might be due to more synthesis of amino acid, increase in chlorophyll content in growing region and improving the photosynthetic activity, ultimately enchancing cell division Similar result were reported by **Kalaiyarasan *et al.* (2019)**. Further, significant and higher plant dry weight was observed with the application of Seaweed (3%) which might be due to positive effect on plant as better partitioning of photosynthates from source to sink, ultimately increased plant dry weight. Similar results was reported by **Kewat*et al*. (2022).**

3.1.4 Crop Growth Rate (g/m2/day)

The data recorded during 60-80 DAS,intervals highest crop growth rate (16.15 g/m2/ day) was observed in treatment 9 [sulphur (40 kg/ha) + seaweed (3%)]. However there was found no significant difference was found among all the treatments.

3.1.5 Relative Growth Rate (g/g/day)

The data revealed that during 60-80DAS, intervals higher relative growth rate (0.0341 g/g/day) was recorded in treatment 1 [Sulphur (20 kg/ha) + fish amino acid (3%)] However there was found no significant difference was found among all the treatments.

3.2 Yield and Yield Parameters:

3.2.1 Number of pods/plant

The data recorded that significant and maximum number of pods/plant (24.92) was recorded in treatment 9 [sulphur (40 kg/ha) + seaweed (3%)]. However, treatment 8 [sulphur (40 kg/ha) + *panchgavya* (3%)] and treatment 7 [sulphur (40 kg/ha) + fish amino acid (3%)] were found to be statistically at par with the treatment 9 [sulphur (40 kg/ha) + seaweed (3%)]. Significant and maximum number of pods/plant was with the application of sulphur might be due to increase photosynthetic activity over all growing environment, greater partition of metabolites and adequate translocation of nutrient to developing structure leads to the maximum number of pod/plant in blackgram. The present findings are within the close proximity of **Gokila *et al*. (2017).** Further, significant and maximum number of pods/ plants was with the application of seaweed may be due to increase in photosynthate transport from the vegetative portion to the developing grains may be responsible for the improvement in groundnut yield parameters. These results were corroborated by **Layek*et al.* (2017)** in rice.

3.2.2 Number of kernels/pod

The data recorded that significant and maximum number of kernels/pod (2.60) was recorded in treatment 9 [sulphur (40 kg/ha) + seaweed (3%)]. However, treatment 8 [sulphur (40 kg/ha) + *panchgavya* (3%)] was found to be statistically at par with treatment 9 [sulphur (40 kg/ha) + seaweed (3%)]. Significant and maximum number of kernels/pod obtained with the application of Sulphur (40kg/ha) might be due facts that the adequate sulphur was available during the entire period of crop growth for better vegetative growth and development of groundnut crop. Similar result was reported by **Yeswanth and Debbarma(2022).** Further, significant and maximum number of kernels/pod was with the application of seaweed may be due to the presence of plant growth regulator in sap as well as the minerals element present in the seaweed exact which increase the rate of photosynthate available for gain filling. The findings agreed with those of **Singh *et al.* (2017).**

3.2.3 Seed index (g):

The data recorded that significant and higher seed index (41.92 g) was recorded in treatment 9 [sulphur (40 kg/ha) + seaweed (3%)]. However, the treatment 8 [sulphur (40kg/ha) + *panchgavya* (3%) treatment 7 [sulphur (40 kg/ha) + fish amino acid (3%)] and treatment 6 [sulphur (30 kg/ha) + seaweed (3%)] were found to be statistically at par with the treatment 9 [sulphur (40 kg/ha) + seaweed (3%)]. Significant and higher seed index was obtained with application of Sulphur (40kg/ha) might be might due to better for root growth, cell multiplication, elongation and cell expansion in the plant body by higher dose of sulphur application, which ultimately increased the seed yield. Similar result was reported by **Yeswanth and Debbarma (2022).** Further the higher seed index was observed with application of seaweed might be due to increase nutrient mobilization and partitioning, chlorophyll content and development vigorous root system. These results are similar to that reported by **Kumawat *et al*. (2023).**

3.2.4 Seed yield (t/ha)

The data recorded Significant and higher seed yield (2.72 t/ha) was recorded in treatment 9 [sulphur (40 kg/ha) + seaweed (3%)]. However, treatment 8 [sulphur (40 kg/ha) + panchgavya (3%)] were found to be statistically at par with the treatment 9 [sulphur (40 kg/ha) + seaweed

(3%)]. Significant and higher seed yield was with the application of sulphur might be due to the vigorous growth which might have helped in higher dry production resulting in more photosynthate accumulation in sink which ultimately reflected interms to higher seed yield. Similar result was reported by **Vyas *et al.* (2020**). Further, higher seed yield with the application of seaweed may be due to the presence of plant growth regulator in sap as well as the minerals element present in the seaweed extract, which increased the phosynthetic rate for a longer duration or delay the senescence of the leaves The present findings are within the close proximity of **Singh *et al.* (2017).**

3.2.5 Haulm yield (t/ha)

Significant and higher haulm yield (6.33 t/ha) was recorded in treatment 9 [sulphur (40 kg/ha) + seaweed (3%)]. However, treatment 8 [sulphur (40 kg/ha) + panchgavya (3%)] which was found to be statistically at par with the treatment 9 [sulphur (40 kg/ha) + seaweed (3%)]. Significant and higher haulm yield was with the application of sulphur might be due to enchances the plant metabolism and photosynthetic activity. Similar result was reported by **Raj *et al.*(2023).** Further higher haulm yield was with the application of seaweed might be due to increase root proliferation and establishment, plants were able to mine more nutrient even from distance places and deeper soil horizons, in balanced proportion. The present findings are within the close proximity of **Dilavarnaik*et al.* (2017).**

3.2.6 Harvest index (%)

Significant and higher harvest index (30.01%) was recorded in treatment 9 [sulphur (40 kg/ha) + seaweed (3%)]. However, treatment 8 [sulphur (40 kg/ha) + panchgavya (3%)] which was found to be statistically at par with the treatment 9 [sulphur (40 kg/ha) + seaweed (3%)]. Significant and higher harvest index was observed with application of sulphur might be due to the part of amino acid, which helps in chlorophyll formation, photosynthetic process, activation of enzymes and grain formation. These results are similar to that reported by **Raj *et al*. (2023).** Further, higher harvest index with the application of seaweed might be due to their effect on reduced flower and pod drop, delayed fruit senescence, increased size of flower and fruit. And also improves ability due trace elements, vitamins and amino acid. The present findings are within the close proximity of **Ghosh *et al.* (2020).**

Table 1: Effect of sulphur and liquid organic nutrient on growth attributes of groundnut.

S.No.	Treatment combinations	Plant height (cm) (80 DAS)	Number of nodules/plant	Plant dry weight (g)	CRG ($g/m^2/day$)	RGR (g/g/day)
1	Sulphur 20 kg/ha + Fish amino acid 3%	31.78	14	22.06	18.21	0.0341
2	Sulphur 20 kg/ha + *Panchgavya*3%	31.14	14.66	20.46	15.68	0.0307
3	Sulphur 20 kg/ha + Seaweed 3%	32.22	14.73	20.82	14.30	0.0266
4	Sulphur 30 kg/ha + Fish amino acid 3%	30.65	15.86	21.75	15.97	0.0290
5	Sulphur 30 kg/ha + *Panchgavya* 3%	31.75	14.6	22.18	17.35	0.0316
6	Sulphur 30 kg/ha + Seaweed 3%	31.72	14.6	21.36	14.91	0.0271
7	Sulphur 40 kg/ha + Fish amino acid 3%	34.11	16.73	22.67	16.29	0.0282
8	Sulphur 40 kg/ha + *Panchgavya*3%	36.09	17.26	23.55	15.89	0.0260
9	Sulphur 40 kg/ha + Seaweed 3%	37.36	18.66	25.38	16.15	0.0240
10	Control (RDF)	31.71	14.33	21.15	16.69	0.0321
	F-test	**S**	**S**	**S**	**NS**	**NS**
	SEm(±)	0.97	0.52	0.65	1.33	0.0023
	CD (P=0.05)	2.88	1.56	1.94	-	-

Table 2: Effect of sulphur and liquid organic nutrient on yield attributes and yield of groundnut.

S.No.	Treatment combination	Number of Pod/plant	Number of kernels/pod	Seed index (g)	Seed Yield (t/ha)	Haulm Yield (t/ha)	Harvest Index (%)
1	Sulphur 20 kg/ha + Fish amino acid 3%	21.75	1.67	38.10	1.38	4.80	22.37
2	Sulphur 20 kg/ha + *Panchgavya* 3%	22.04	1.53	37.92	1.29	4.52	22.00
3	Sulphur 20 kg/ha + Seaweed 3%	22.62	1.80	38.33	1.56	4.71	24.90
4	Sulphur 30 kg/ha + Fish amino acid 3%	21.98	1.47	38.50	1.24	4.78	20.60
5	Sulphur 30 kg/ha + *Panchgavya*3%	22.06	1.67	38.81	1.43	4.89	22.52
6	Sulphur 30 kg/ha + Seaweed 3%	21.46	1.60	38.93	1.34	4.59	22.54
7	Sulphur 40 kg/ha + Fish amino acid 3%	22.98	1.93	39.15	1.74	5.21	25.02
8	Sulphur 40 kg/ha + *Panchgavya* 3%	24.05	2.40	40.77	2.34	5.67	26.94
9	Sulphur 40 kg/ha + Seaweed 3%	24.92	2.60	41.92	2.72	6.33	30.01
10	Control	21.74	1.73	37.25	1.43	4.60	23.38
	F test	**S**	**S**	**S**	**S**	**S**	**S**
	SEm(±)	0.69	0.12	1.16	0.16	0.25	1.47
	CD (P=0.05)	2.04	0.37	3.44	0.47	0.75	4.37

CONCLUSION

From the results, it is concluded that (treatment 9), application of Sulphur 40 kg/ha and Seaweed 3%recorded highest growth and seed yield.

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