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Effect of Sulphur Levels on Growth and Yield of different Varieties of Sesame (*Sesamum indicum* L.)

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ABSTRACT: A field experiment was conducted in *Kharif* 2020 at Crop Research Farm (CRF), Department of Agronomy, SHUATS, Prayagraj (U. P.). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36%) available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). Sulphur (S) is crucial for the growth and development, plays a significant role in plant metabolism, indispensible for the synthesis of necessary oils, plays a vital role in chlorophyll production. The treatments which are T_1: G. Til 1+ 25 kg/ha S, T_2: G. Til 1+ 35 kg/ha S, T_3: G. Til 1 + 45 kg/ha S, T_4: G. Til 4+ 25 kg/ha S, T_5: G. Til 4+ 35 kg/ha S, T_6: G. Til 4+ 45 kg/ha S, T_7: Pragati + 25 kg/ha S, T_8: Pragati + 35 kg/ha S, T_9: Pragati + 45 kg/ha S used. The experiment was laid out in Randomized Block Design with nine treatments each replicated thrice. The results showed that viz: plant height (125.21 cm), maximum dry weight (19.48 g) and number of branches (3.47) were recorded significantly higher in the treatment T_9 which is Pragati + 45 kg/ha S. The maximum capsules/plant (41.00), seeds/capsule (55.33), test weight (3.42 g), higher seed yield (1.40 t/ha) and stover yield (6.91 t/ha) were recorded in the treatment T_9 which is Pragati + 45 kg/ha S as compared to all other treatments.

Keywords: Sesame, Sulphur (S), Varieties, G. Til 1, G. Til 4, Pragati.

INTRODUCTION

Sesame or gingelly (*Sesamum indicum* L.) usually known as Til as well called as "queen of oilseeds" and is been known to be one of the earliest domesticated edible oilseeds used by the mankind. Sesame (*Sesamum indicum* L.) belongs to the order Tubiflorae, family Pedaliace is an important oil seed crop and being cultivated in the tropics as well as in the temperate zone around the world and cultivated for its high quality oil (Chung *et al.,* 2003). It is the most ancient and traditional crop domesticated in India more than 5000 years ago (Duhoon *et al.*, 2000). Nearly 73 percent oil is used for edible purposes. Among the oil seeds, sesame contains the highest oil content of 46 percent to 52 percent with 25 percent protein and sesame oil contains vital antioxidants (sesamol and sesamolin) which prevent the rancidity. It contains anti-bacterial, anti-viral, anti-fungal and anti-oxidant properties. The sesame oil is a natural antibacterial for common skin pathogens such as Staphylococcus and Streptococcus as well as for common skin fungi such as athlete's foot fungus (Pathak *et al.*, 2014). Sesame seeds are consumed as a source of calcium, potassium, tryptophan and methionine. It is also used in pharmaceutical as well as cosmetic industries (Pornparn *et al.*, 2009). Beside food, sesame has also many potential applications in other areas such as pharmaceutics, industrial and as biofuel. Sesame is used as active ingredients in antiseptics, bactericides, viricides, disinfectants, moth repellants, antitubercular agents (Bedigian *et al*., 1985).

In *Kharif*-2019 all India sesame acreage was 13,71,700 hectares. Four states, Gujarat (1,16,200 ha; 8%), Uttar Pradesh (4, 17,435 ha; 30%), Rajasthan (2, 70,191 ha; 20%) and Madhya Pradesh (3, 14,300 ha; 23%) mutually accounted for 85 percent of the national acreage. At the national level, there was an increase in acreage by 4 per cent compared to *kharif*-2018. The decrease observed in Madhya Pradesh was quite large (29%). However, increases in Gujarat (49%) and Uttar Pradesh (26%) were substantial (*Kharif* 2019 survey of sesame crop – IOPEPC). India is one of the major exporter of sesame with yearly all season average about 17-20 lakh hectares. The crop requires 450-600 mm rainfall and temperature range of 25-35°C. Extreme low and very high temperature affect the growth.

The sellers mostly sell sesame seeds that are a blend of a few varieties under the name of any other popular genuine variety or allocate a new name to their seed stocks. As most farmers depend on local seed sellers and were not able to identify the true variety of the seed they -used for raising the crops. The existing varieties of sesame may behave differently under varying levels of sulphur. Therefore, choice of a variety with suitable dose of sulphur is of fundamental importance to boost the production. Response of sesame to major plant nutrients is well documented but sufficient literature regarding the influence of sulphur on sesame.

Sulphur has been known as one of the important elements for plant development and growth of mostly oilseed crops. Sulphur is the constituent of three amino acids generally found in plants *viz.*, cystine, cystenine and methionine, which are crucial components of proteins. Sulphur rises the oil content and gives pungency to oil as it forms certain disulphide linkages. Oilseed crops need more sulphur than cereals as their oil storing organs are mostly proteins, which are rich in S. Insufficiency of sulphur is known to hinder N metabolism in plants as well as production of S-containing amino acids and therefore exerts adverse effects on both seed yield and oil yield. Sulphur (S) is crucial for the growth and development, plays a significant role in plant metabolism, indispensible for the synthesis of necessary oils, plays a vital role in chlorophyll production (Singh *et al.*, 2000) which require for development of cells and it increases cold resistance and drought hardness (Patel and Shelke, 1995) and component of a number of organic compounds (Shamina and Imamul 2003), oil storing organs particularly oil glands (Jaggi *et al.*, 2000) and vitamin B1 (Thirumalaisamy *et al*., 2001). On the basis of the above facts, the present study was undertaken to increase the seed yield of different varieties of sesame by using sulphur fertilizers.

MATERIALS AND METHODS

This experimental trial was carried out during *kharif* 2020 at Crop Research Farm (CRF), Department of Agronomy, Sam Higginbottom University of Agriculture, Technology & Sciences (SHUATS), Prayagraj (U.P) located at 25˚39”42” North latitude, 81˚67”56” East longitude and 98 m altitude above the mean sea level. The experiment laid out in Randomized Block Design consisting of nine treatments which are T_1: G. Til 1+ 25 kg/ha S, T_2: G. Til 1+ 35 kg/ha S, T_3: G. Til 1+ 45 kg/ha S, T_4: G. Til 4+ 25 kg/ha S, T_5: G. Til 4+ 35 kg/ha S, T_6: G. Til 4+ 45 kg/ha S, T_7: Pragati + 25 kg/ha S, T_8: Pragati + 35 kg/ha S, T_9: Pragati + 45 kg/ha S replicated thrice to determine the effect of Sulphur on growth and yield of different varieties of Sesame. The soil of trial plot was sandy loam in texture nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36%), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The nutrient sources used in the research plot were urea, DAP and MoP to fulfill the requirements of nitrogen, phosphorous and potassium. The recommended dose of 50 kg N/ha, 40 kg P/ha and 30 kg K/ha and sulphur was applied according the treatment details. 10 days after sowing gap filling was done and there was no need of irrigation due to frequent rainfalls. Between the period of germination to harvest several plant growth parameters were recorded at equal intervals and after harvest several yield parameters were recorded. In growth parameters plant height (cm), plant dry weight (g) and number of branches/plant were recorded and yield parameters like capsules/plant, seeds/capsule, Test weight (1000 seed weight), seed yield (t/ha)stover yield(t/ha) and harvest index (%) were recorded and statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design (Gomez and Gomez 1984).

RESULTS AND DISCUSSION

A. Effect on growth of sesame

The statistical data regarding growth parameters is presented in Table 1.

Plant height (cm): Significantly higher plant height (125.21 cm) was observed in treatment Pragati + 45 kg/ha S. Whereas, plant height 119.53 cm with treatment G. Til 4 + 45 kg/ha S and 119.35 cm with treatment G. Til 4 + 35 kg/ha S were found at par with treatment Pragati + 45 kg/ha S compared to other treatments. The probable reason for the influence in plant height might be due to Pragati variety proved superior over remaining varieties and presence of sulphur plays a vital role photosynthetic process of plant which has a direct bearing on plant growth and development. The similar results observed by Yadav *et al*., (2008).

Table 1: Effect of Sulphur on growth parameters of different varieties of sesame.

Sr. No.	Treatments	Plant height (cm)	Dry weight (g/plant)	No. of branches/plant
1.	G. Til 1 + Sulphur @25kg/ha	112.48	10.54	2.13
2.	G.Til 1 + Sulphur @35kg/ha	112.69	13.63	2.40
3.	G.Til 1 + Sulphur @45kg/ha	116.87	14.94	2.67
4.	G.Til 4 + Sulphur @25kg/ha	115.06	14.00	2.53
5.	G.Til 4 + Sulphur @35kg/ha	119.35	16.50	3.07
6.	G.Til 4 + Sulphur @45kg/h	119.53	19.35	3.40
7.	Pragati + Sulphur @25kg/ha	113.41	13.70	2.53
8.	Pragati + Sulphur @35kg/ha	116.03	14.27	2.80
9.	Pragati + Sulphur @45kg/ha	125.21	19.48	3.47
	S. EM (±)	2.02	0.87	0.08
	CD (5%)	6.06	2.61	0.23

Dry weight (g): Significantly maximum dry weight (19.48 g) was recorded in treatment Pragati + 45 kg/ha S. However treatment G. Til 4 + 45 kg/ha S recorded with 19.35 g was statistically at par with Pragati + 45 kg/ha S. It has been reported that the Sulphur application not only improves the Sulphur availability itself but also improves availability of other nutrients too, which are essential for growth and development of plant. It has been also reported that Sulphur helps in reducing soil pH, which helps in the greater availability and mobility of nutrients especially P, Fe, Mn, and Zn (Hilal *et al.,* 1992).

Number of branches/plant: Significantly highest no. of branches (3.47) were recorded in the treatment Pragati + 45 kg/ha Sulphur. However, treatment G. Til 4 + 45 kg/ha is statistically on par to treatment Pragati + 45 kg/ha Sulphur. Sulphur helps in stimulation of cell division and photosynthetic process as well as chlorophyll. Application of Sulphur might be the reason that it causes improvement in soil physic-chemical properties and hence nutrients availability to the crop during vegetative growth and development period of plant. These results were in accordance with those of Srinivasan and Sankaran (2001).

B. Effect on yield and yield attributes of sesame

The statistical data representing yield and yield attributes is presented in Table 2.

Table 2: Effect of Sulphur on yield and yield attributes of different varieties of sesame.

Sr. No.	Treatments	No. of Capsules/plant	No. of seeds/capsule	Test weight (g)	Seed yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
1.	G. Til 1 + Sulphur @25kg/ha	36.07	46.67	2.84	0.75	3.74	16.73
2.	G. Til 1 + Sulphur @35kg/ha	36.67	48.00	2.99	0.80	4.96	13.61
3.	G. Til 1 + Sulphur @45kg/ha	39.13	49.33	3.25	1.07	6.25	14.55
4.	G. Til 4 + Sulphur @25kg/ha	38.13	47.33	3.03	0.93	4.77	15.99
5.	G. Til 4 + Sulphur @35kg/ha	39.87	53.33	3.23	1.07	5.57	16.10
6.	G. Til 4 + Sulphur @45kg/h	40.20	53.67	3.25	1.11	6.76	14.40
7.	Pragati + Sulphur @25kg/ha	37.20	46.67	2.96	0.85	4.70	15.28
8.	Pragati + Sulphur @35kg/ha	38..27	48.33	3.13	1.03	5.74	15.19
9.	Pragati + Sulphur @45kg/ha	41.00	55.33	3.42	1.40	6.91	16.50
	S. EM (±)	0.28	1.28	0.05	0.12	0.55	1.50
	CD (5%)	0.83	3.83	0.14	0.37	1.65	NS

Pragati + 45 kg/ha Sulphur recorded maximum No. of capsule/plant (41.00) followed by 40.20 with G. Til 4 + 45 kg/ha Sulphur which is statistically at par to pragati + 45 kg/ha sulphur. Maximum No. of seeds/capsules (55.33) were recorded in treatment Pragati + 45 kg/ha Sulphur followed by 53.67 with G. Til 4 + 45 kg/ha Sulphur and 53.33 with G. Til 4 + 35 kg/ha Sulphur which are statistically at par to Pragati + 45 kg/ha sulphur and in case of Test weight (g) Treatment Pragati + 45kg/ha Sulphur recorded maximum (3.42) which is superior all over other treatments. This indicated the synergistic effect of sulphur application in increasing productivity of Sesame. Similar, increase in sesame yield due to Sulphur application was reported by Chanda *et al.,* (2003).

Maximum seed yield (1.40 t/ha) recorded in the treatment pragati + 45kg/ha sulphur. However, the G.Til 1 + 45 kg/ha sulphur, G.Til 4 + 35 kg/ha sulphur, G.Til 4 + 45 kg/ha sulphur and pragati + 35 kg/ha sulphur treatments are statistically at par to the pragati + 45 kg/ha sulphur. Whereas, maximum stover yield (6.91 t/ha) recorded in the treatment pragati + 45 kg/ha sulphur. However, the G. Til 4 + 45 kg/ha sulphur, G.Til 1 + 45 kg/ha sulphur, pragati + 35 kg/ha sulphur, G. Til 4 + 35 kg/ha sulphur treatments are statistically at par to the treatment pragati + 45 kg/ha sulphur. The non-significant results were obtained in case of harvest index the highest (16.50%) and lowest (13.61 %) were recorded in pragati + 45kg/ha and G. Til 1 + 35 kg/ha Sulphur respectively.

The reason for higher seed yield in sesame due to application of 45 kg S/ha might be the significant increase in all yield traits like number of branches, capsules/plant, number of seeds/capsule and test weight (1000-seed weight). The similar results observed by Amudha *et al*., (2005), Sarkar and Saha (2005). The increase in stover yield might due to Sulphur plays important role in balanced nutrition, photosynthetic process of plant which has a direct bearing on plant growth and development. The results -corroborate to the findings of Yadav *et al*., 2008).

CONCLUSION

Based on the findings of the investigation it may be concluded that variety pragati + 45 kg/ha Sulphur performed exceptionally in all growth and yield parameters and in obtaining maximum seed yield of sesame. Hence, pragati + 45 kg/ha Sulphur is beneficial under eastern Uttar Pradesh conditions.

FUTURE SCOPE

Future scope for this experiment can be carried out on the basis of essentiality of Sulphur on different varieties of sesame. These findings are based on one season; therefore, further trails may be required for considering it as recommendation.

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