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Effect of different levels of sulphur and spacing on growth and yield of zaid sesame (*Sesame indicum* L.)

Koneti Sai Kumar and Shikha Singh

Abstract
A field experiment was conducted during zaid season of 2020, at the crop research farm of the Department of Agronomy at Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj with the objective to study the effect of different levels of Sulphur and Spacing on Growth, Yield and Economics of Zaid Sesame (*Sesame indicum* L.) with 2 different Spacing and 4 different levels of Sulphur. Maximum plant height (93.73cm), highest no. of branches (8.47),maximum dry weight (14.53), Maximum no. of capsules/plant (57.10), Highest no of seeds/capsule (50.2), test weight (2.67), Grain yield (1.156 kg/ha), Stover yield (2,076 kg/ha), Harvest index (41.00), Highest gross return (80,920 INR/ha), maximum net return (52,542 INR/ha), and Benefit: cost ratio (1.8) was recorded with the application of treatment no.8 RDF+ 35 S kg/ha + 45 X 10 cm Spacing. However, Highest crop growth rate (2.37) and relative growth rate (0.0040) were recorded with treatment no.9 i.e., control. Hence, concluded that treatment no. 8 RDF +35 S kg/ha + 45 X 10 cm spacing was economically sound, preferred for farmers.

Keywords: seasame, sulphur, spacing, growth, yield, economics

Introduction

Sesame (*Sesamum indicum* L.) is among the oldest cultivating oilseed crops across the world and is under cultivation in Asia for more than 5000 years in Asia (Bisht *et al.*, 1998) [1]. Sesame has its prime origin roots in East Africa and India. Presently, India and China top the list of leading producers in the world followed by countries like Myanmar, Uganda, Pakistan, Tanzania, Sudan, Ethiopia, Nigeria, Guatemala, and Turkey. It is familiar in diverse names such as til, gingelly, simsim, gergelim etc. Sesame stands tall in the line for having the highest oil content (46-64%) and dietary energy (6355 Kcal/kg) in seeds (Sanjay Kumar and Goel 1994) [2]. Sesame oil accounts for 85 percent of unsaturated fatty acid is tremendously stable and has to plunge effect on cholesterol and prevents coronary heart disease. For that reason, sesame is often referred to as the *"Queen of oil seeds"* by the high caliber of its incredible quality and efficacy (Sivagamy and Rammohan, 2013) [3].

The yield potential of sesame can be defined by the enhanced and better-employed agronomic techniques. Of the benchmark agronomic practices which can echo the actual yield potential of zaid sesame, plant geometry and sulphur application are the vital components in determining the yield and quality parameters. Over the past years the sulphur deficiencies have been reported (Scherer, 2001) [4]. Sulphur being a crucial nutrient to hike the growth and productivity of sesame (Saren *et al*., 2004) [5]. Plays a vital role in chlorophyll formation and helps in the synthesis of oil as the sulphur requirement is of paramount importance for oilseed crop when compared to that of cereals as the oil storage organs are mostly proteins, thus rich in sulphur, (Singh *et al.*, 2000) [6] and the crop is very responsive to sulphur (Nagavani *et al.*, 2001) [7]. The situation gets still more worst when sulphur deficiency by the unremitting application of NPK fertilizers besides the more discrepancy of organic matter for oilseed crops, thus show the superior result with the sulphur utilization (Jadav *et al*., 2010) [8]. Productivity can be impinged by the flawed canopy architecture which poignant the light interception and CO2 assimilation this can be distorted by the plant geometry. Yield and yield attribute viz., number of capsules/plant, and number of seeds/capsules can be persuaded by the spacing. (Subrahmaniyan *et al.*, 2001) [9]. In the view of above consideration the present investigation entitled "Effect of different levels of Sulphur and Spacing on Growth and Yield of zaid sesame (*Sesame indicum* L.)" was carried out.

Materials and Methods

The experiment was carried out during the Zaid season of 2020 at the CRF (Crop Research Farm) SHUATS, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. To assess the effect of different levels of Sulphur and Spacing on Growth, Yield and Economics of Zaid Sesame (*Sesame indicum* L.). The experiment was laid out in Randomized Block Design comprising of 9 treatments which are replicated thrice. Treatment combination consisted of two factors, one with two different spacing i.e., 30 x 15cm and 45 x 10 cm and the other with four levels of sulphur i.e., Sulphur S1: 20 kg/ha, Sulphur S2: 25 kg/ha, Sulphur S3: 30 kg/ha, Sulphur S4: 35 kg/ha. The factors are combined to frame the 9 treatment combinations that are depicted in Table-1. The nutrient sources were Urea, SSP, MOP and Caso4 2H2o to fulfill the requirement of Nitrogen, Phosphorus, Potassium and Sulphur. Each treatment was given a blanket recommendation of nitrogen, potassium and phosphorus (50:40:30 kg/ha) respectively. Plant protection measures were followed as per recommendations for the region. Five random plants were selected and tagged properly in each plot for recording plant height, number of branches/plant and number of Capsules/plant at an interval of 20,40,60,80 DAS and at harvest stages of the crop. To record plant dry weight three random plants were selected from border rows of each plot. The crop was harvested from the net plot area (1 m2) and manual threshing was carried out after proper drying. Later winnowed, cleaned and weighed the grain per net plot value, the grain yield per ha was computed and expressed in tonnes per hectare. The data were computed and analyzed by following the statistical method of Gomez and Gomez (1984) [10]. After thorough field preparation, initial soil samples were taken to analyze for available major nutrients. Nitrogen (N), phosphorous (P), potassium (K), Organic Carbon (OC), pH and soluble salts. The type of soil in the experimental field is sandy loam. The pH of the experimental field was 7.1, EC of 0.41 d/Sm, organic carbon was 0.28%. The N status of the experimental field was 225 kg/ha, available P was 19.60 kg/ha, while available K status was 92 kg/ha. Yield parameters grain yield kg/ha, straw yield kg/ha, were recorded as per the standard method. The monetary parameters like cost of cultivation, gross returns, net returns, and Benefit: Cost ratios were worked out as per the standard method.

Table 1: Treatment combination

S. No	Treatment no	Treatment combination
1	T1	RDF + 20 kg S/ha + 30 cm X 15 cm
2	T2	RDF + 25 kg S/ha + 30 cm X 15 cm
3	T3	RDF + 30 kg S/ha + 30 cm X 15 cm
4	T4	RDF + 35 kg S/ha + 30 cm X 15 cm
5	T5	RDF + 20 kg S/ha + 45 cm X 10 cm
6	T6	RDF + 25 kg S/ha + 45 cm X 10 cm
7	T7	RDF + 30 kg S/ha + 45 cm X 10 cm
8	T8	RDF + 35 kg S/ha + 45 cm X 10 cm
9	T9	Control

Results and Discussions

Growth parameters

At harvest maximum plant height of 93.73cm was recorded with treatment T8. However, treatment T7 was recorded statistically at par with T8. This might be due to more synthesis of amino acids, boost in chlorophyll content and recuperating the photosynthetic activity; eventually enhancing cell division thus improved plant height. Similar results were observed by Tekseng *et al.*, (2018) [11] and Shekh *et al.* (2014) [12]. The spacing 45 x 10 cm might be the optimal spacing for sesame as competition for resources has hindered the plant height which was in close conformity with Yadav *et al.*, (2007) [13]. An increase in plant height may be due to a better nutritional environment for plant growth at active vegetative stages as a result of improvement in root growth, cell multiplication, elongation and cell expression in the plant body and indirect involvement of Sulphur in the photosynthesis process of plants. Parmar *et al.*, (2018) [14].

Table 2: Effect of Sulphur and Spacing on growth parameters of sesame

S. No	Treatment no	Plant height (cm)	No. of Branches/ plant	Dry weight (g/plant)	Crop growth rate g/m2/day	Relative growth rate (g/g/day)
1	T1	89.23	7.50	12.73	1.33	0.0022
2	T2	89.00	7.57	13.20	1.70	0.0027
3	T3	89.90	7.83	13.50	1.59	0.0024
4	T4	91.50	8.07	13.50	1.04	0.0016
5	T5	89.70	7.73	13.40	1.63	0.0025
6	T6	90.50	7.93	13.37	1.19	0.0018
7	T7	92.73	8.20	13.80	0.96	0.0014
8	T8	93.73	8.47	14.53	1.37	0.0019
9	T9	88.67	7.20	12.60	2.37	0.0040
	F-test	S	S	S	S	S
	SEm±	0.34	0.06	0.08	0.13	0.0002
	CD (P=0.05)	1.02	0.19	0.24	0.39	0.0014

*S-Significant at $P < 0.05$; NS-Non-significant at $P > 0.05$

A significantly higher number of branches/plant (8.47), plant dry weight (14.53 g/plant), and maximum crop growth rate at 80-100 DAS (2.37 g/m2/day) was recorded with treatment T8. This drastic significance might be due to better exploitation of minerals, nutrients, water, solar radiation, etc because of wide inter-row spacing which may have led to less competition for the aforesaid resources. Similar findings were also reported by Patel *et al.*, (2018) [15]. During the growth interval of 80-100 DAS, the highest RGR value (0.0027 g/g/day) was recorded with Treatment T2. However, the rest of the other treatments have shared statistical parity with Treatment T2. Similar results were obtained by Sarkar and Banik (2002) [19]. The data was presented in Table-2.

Effect on yield and yield attributes of sesame

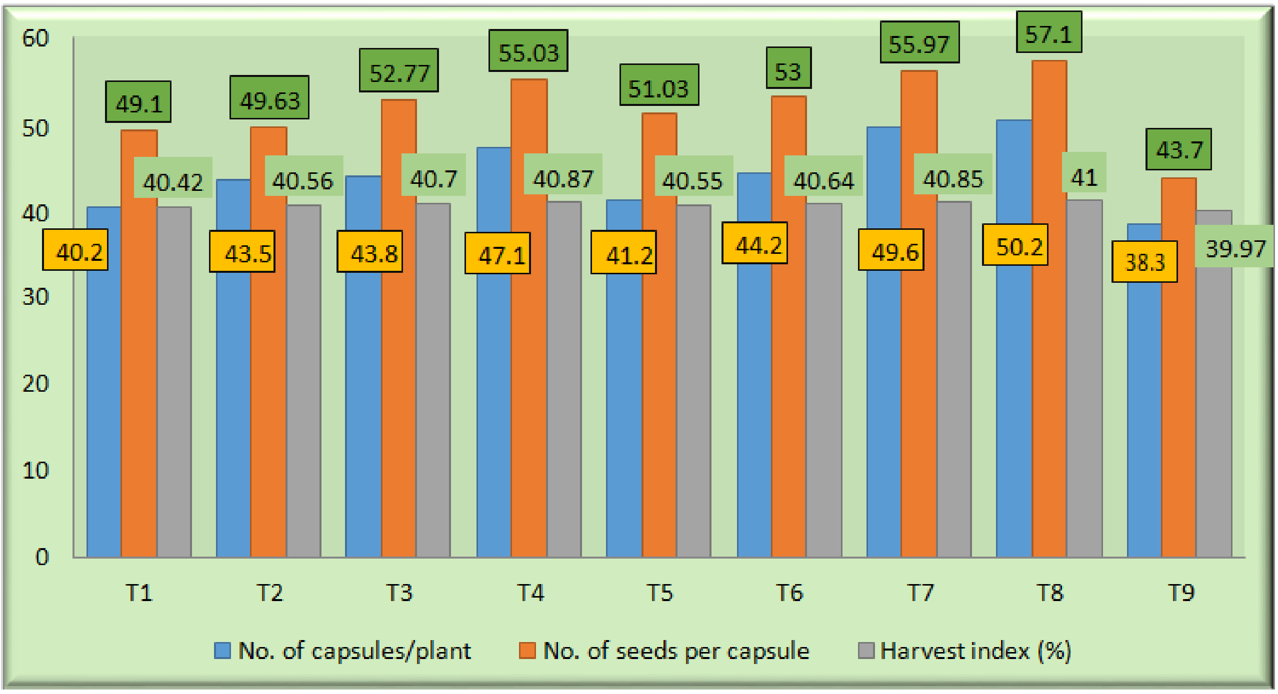
The statistical data regarding yield and yield attributes were presented in Table-3.

Maximum no. of capsules per plant (50.2) and highest no. of seeds per capsule (57.10) was recorded by the treatment T8. However, the treatment T7 has shared the statistical parity with maximum i.e., T8. The rise in the yield attributes by the application of Sulphur might be due to the role of Sulphur in cell division, cell elongation and setting of cell structure and Sulphur might have been involved in the enhancement of yield-related traits of the sesame crop. Similar findings were also reported by Shekh *et al.* (2014) [12]; Murmu *et al.*, (2015) [17]; Duary and Mandal (2006) [18] and Shah *et al.* (2011) [19]. Test weight was not influenced by the application of Sulphur and Spacing which might be due to yield characters were highly influenced by its genetic makeup. However, the highest test weight (2.67 g) was recorded with treatment T8. The grain yield showed an escalating trend with the application of Sulphur and Spacing in sesame. The highest grain yield (1156 kg/ha) and straw yield (2076 kg/ha) were recorded by treatment T8. However, treatment T7 was found to be statistically at par with T8. Wide inter-row spacing might have helped the crop in gaining the higher grain and stover yield because the competition between plants might have reduced and equal distribution of all the resources like solar radiation, minerals, nutrients, and water. Increased trend of yield with sulphur dosage shows that it might have played a crucial role in enhancing the yield by its role in physiologically improved dry matter accumulation further led to hiking the stover yield. Similar results were obtained by Shekh *et al.* (2014) [12]; Modhavidya *et al.*, (2017) [20]; Kale *et al.*, (2018) [21]; Dayanand *et al.* (2002) [22] and Jadav *et al.* (2010) [13]. Graphs depicting yield attributes and yield are represented in Graph-1 &2 respectively.

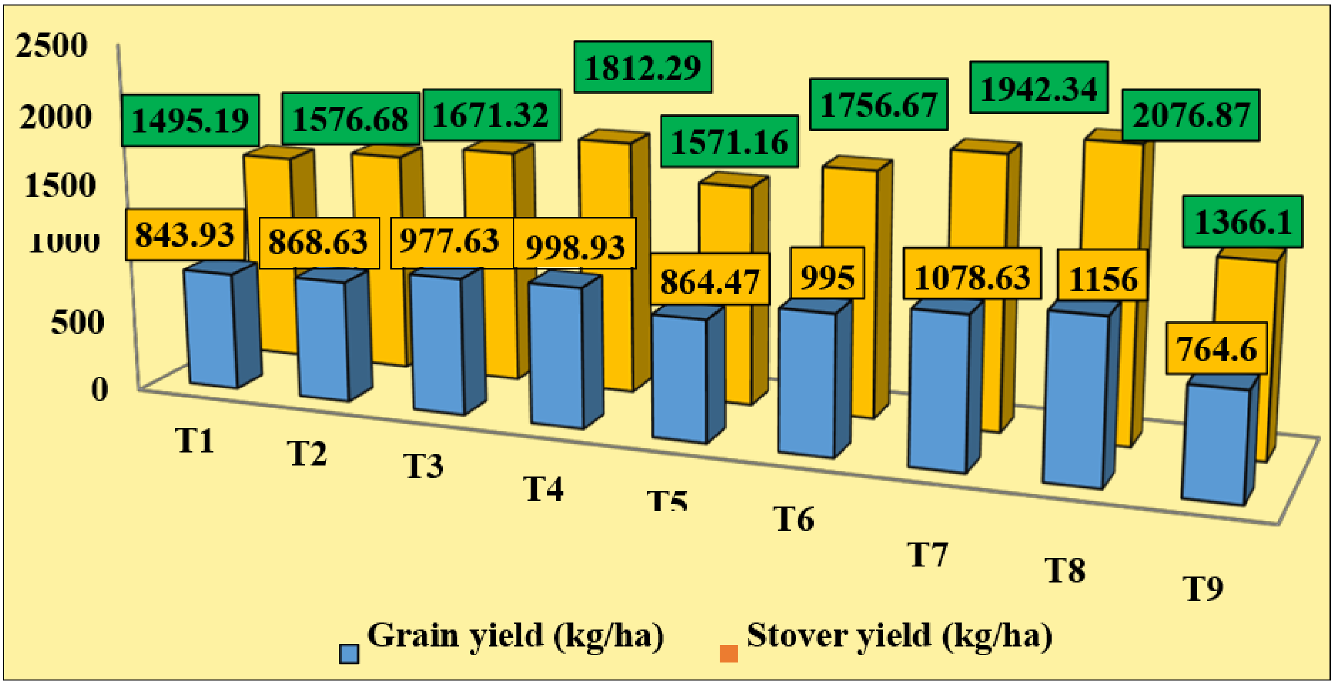
Table 3: Effect of Sulphur and Spacing on yield and yield attributes of sesame

S. No	Treatment no	No. of capsules/plant	No. of seeds/capsule	Test weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)
1	T1	40.2	49.10	2.57	843.93	1495.19	40.42
2	T2	43.5	49.63	2.53	868.63	1576.68	40.56
3	T3	43.8	52.77	2.53	977.63	1671.32	40.70
4	T4	47.1	55.03	2.53	998.93	1812.29	40.87
5	T5	41.2	51.03	2.57	864.47	1571.16	40.55
6	T6	44.2	53.00	2.63	995.00	1756.67	40.64
7	T7	49.6	55.97	2.57	1078.63	1942.34	40.85
8	T8	50.2	57.10	2.67	1156.00	2076.87	41.00
9	T9	38.3	43.70	2.63	764.60	1366.10	39.97
	F-test	S	S	NS	S	S	S
	SEm±	0.64	0.56	0.03	3.61	46.27	0.12
	CD (P=0.05)	1.93	1.70	-	91.73	137.49	0.35

*S-Significant at P < 0.05; NS-Non-significant at P > 0.05



Graph 1: Graph depicting the yield attributes of sesame



Graph 2: Graph depicting the grain and stover yield of sesame

Effect on monetary parameters of sesame

The data regarding monetary parameters were presented in Table-4.

Maximum gross return (80920.00 INR/ha), net return (52542.50 INR/ha), and Benefit: cost ratio of 1.8 was obtained by the treatment T8, which have shown tremendous superiority over the rest of the treatments. Whereas, minimum gross return (53522 INR/ha) and net return (27254 INR/ha), Lowest Benefit: cost ratio (2.16) was recorded by the treatments T9. Monetary parameters are the prime criteria to weigh up the superlative treatment which represents the economically sound and that be able to be time-honoured by farming society. In the present study, the maximum gross returns, net returns, and B: C ratios were obtained by treatment T8. Similar findings were supported by Sivagamy K and Rammohan, (2013) [3] and Parmar *et al.*, (2018) [14].

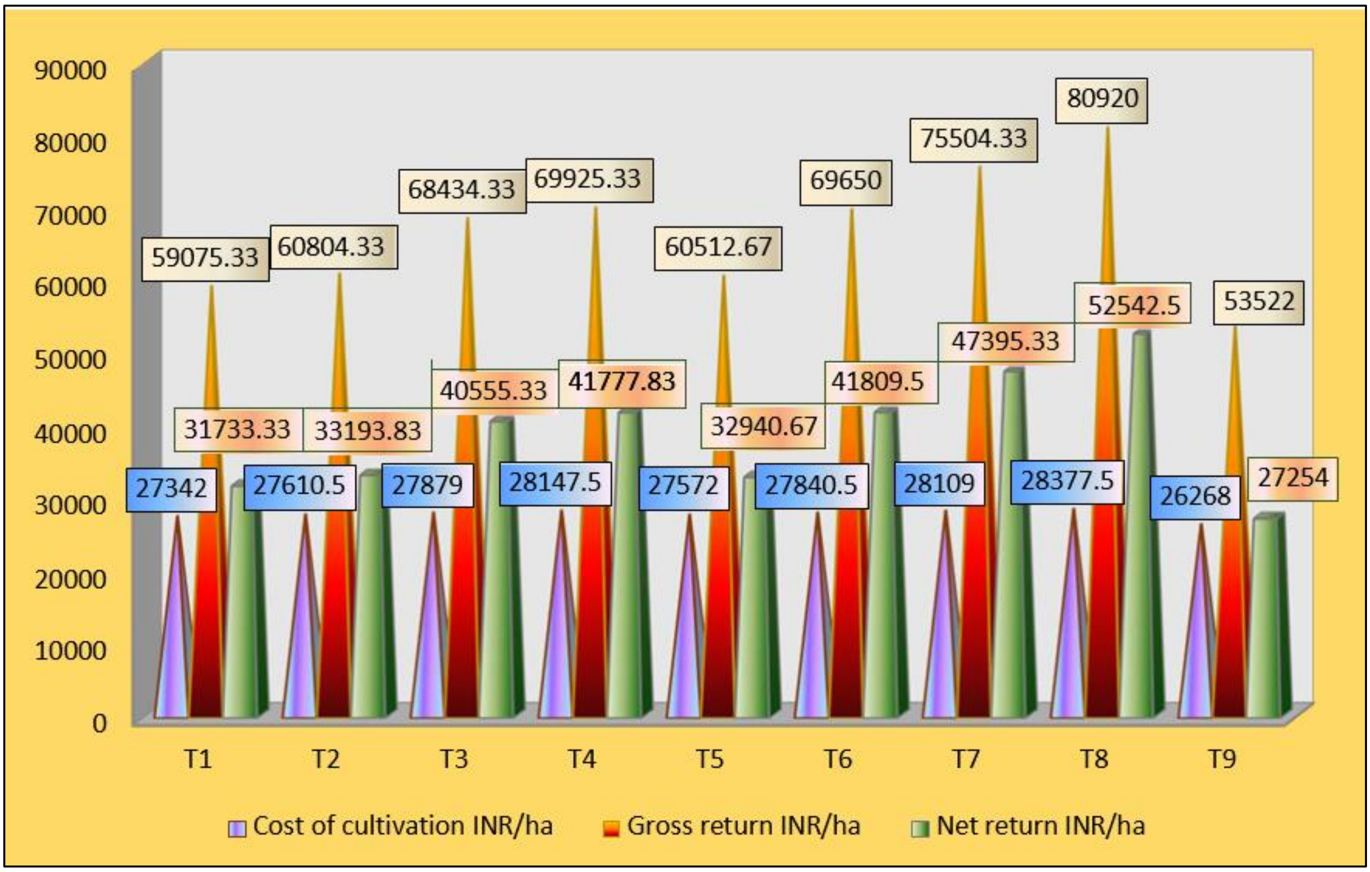


Fig 3: Monetary Parameters of sesame

Table 3: Effect of spacing and sulphur levels on monetary parameters of sesame

S. no	T. no	Cost of cultivation (INR/ha)	Gross returns (INR/ha)	Net returns (INR/ha)	Benefit cost ratio
1	T1	27342	59075	31733	1.16
2	T2	27610	60804	33193	1.20
3	T3	27879	68434	40555	1.45
4	T4	28147	69925	41777	1.48
5	T5	27572	60512	32940	1.19
6	T6	27840	69650	41809	1.50
7	T7	28109	75504	47395	1.68
8	T8	28377	80920	52542	1.8
9	T9	26268	53522	27254	1.03

Note: Monetary parameters were not subjected to statistical analysis

Conclusion
As the monetary units are the supreme importance in the farmer perspective, for obtaining the highest yield, yield attributes and monetary parameters the treatment T8 is the best treatment combination.

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