Original Research Article

Effect of Plant geometry and Sulphur on yield, oil content and Economics of Sesame (*Sesamum indicum* L.)

Abstract

A field experiment entitled **"Effect of Plant geometry and Sulphur on yield and Economics of Sesame (*Sesamum indicum* L.)"** was conducted during *Zaid* season 2021 at Krishi Vigyan kendra, SHUATS, Allahabad, (U.P.). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 6.7). The experiment was laid out in Randomized Block Design with nine treatments consisted of Spacing (25x15cm^2, 30x15cm^2 , 35x15cm^2) and Sulphur (20 kg,30kg,40kg/ha) which were replicated thrice and effect was observed on Gujarat til-4 sesame variety. The result showed that there were significant increase in growth and yield parameters *viz*., The results obtained that yield parameters such as capsule (35.87/plant), seeds (38.47 /capsule), test weight (2.90 g), seed yield (867.97 kg/ha), stover yield (1554.20 kg/ha), harvest index (39.36%) and oil content (48.32%) were recorded maximum in the treatment combination of 30 cm x 15 cm + 40 kg sulphur at 75DAS. However, in economic point of view, maximum gross returns (INR 82,456.83/ha), net returns (INR 56,779.83/ha) and benefit: cost ratio (2.2) were obtained highest in the treatment combination of 30 cm x 15 cm + 40 kg Sulphur respectively.

Keyword: *Spacing, Sulphur, yield, oil content, Economics.*

INTRODUCTION

Sesame, (*Sesame indicum Linn.; syn. Sesamum* oriental Linn.),a member of order Tubiflorea, Family Pedaliaceae, is perhaps the oldest oilseed known and used of human-beings(Joshi,1961 ;Weiss, 1983). According to the Directorate of Economics and Statistics, GOI, all India kharif 2019 sesame acreage was 13,71,700 hectares. 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%) jointly accounted for 85 per cent of the national acreage. At the national level, there was an increase in acreage by 4 per cent with respect to kharif-2018. The decrease observed in Madhya Pradesh was quite large (29%). However, increases in Gujarat (49%) and Uttar Pradesh (26%) were substantial. Sesame is called as "Queen of oil seed crop" by virtue of its excellent quality. According to Assyrian legend, when the gods met to create the world, they drank wine made from sesame seeds. In early Hindu legends, tales were told in which sesame seeds represent a symbol of immortality. "Open sesame", the famous phrase from the Arabian Nights, reflects the distinguishing feature of sesame seed pod, which bursts open when it reaches maturity. Sesame is very drought tolerant crop of semiarid regions. It is superior to other oil seed crop due to adaptability to varied agro-climatic condition and higher degree of drought tolerance it is widely grown in countries such as India, China, Bangladesh, Turkey, and also in drier parts of African and Mediterranean countries. Worldwide, it is used for its Nutritional, Medicinal, and industrial purposes. It has been called survivor crop with an ability to grow where most crops fail. Sesame ranks first for having oil content of 46-64% and 6355 k cal/kg dietary energy in seeds (**Sanjay kumar & Goel, 1994**). Seeds of sesame is also rich source of protein (20-28%), sugar (14-16%) and minerals (5-7%). This oil has 85% unsaturated fatty acid is highly stable and has washing effect on cholesterol & prevents coronary heart disease. Sesame as a valuated oil seed appears to have numerous industrial applications. In India, sesamum seeds are used for oil extraction (78%), edible purposes (20%) and seed purpose (2 %). Out of that 70 % used for edible purpose as salad and cooking oil and remaining 30 % used for non-edible purpose like domestic and toilet soaps and for manufacture of margarine **(Rathore *et al*, 2005).**

Sesamum seed contains 50-60 % oil which has excellent stability due to the presence of natural antioxidants such as sesamolin, sesamin and sesamol. They enrich blood and are useful in snake bites, bleeding piles etc. Sesame oil is used for preparation of medicines for dry cough, Asthama, disease of lungs, burning sensation, ear and eyes disease. Recently Omega-6 fatty acid desaturase was also extracted from sesamum which is helpful for heart patients (Jin et al., 2001).

Sesame cake contains 6.0-6.2% N, 2.0-2.2% P2O5 and 1.0- 1.2% of K_2O and can be used as manure. Sulphur an essential plant nutrient can play a key role in augmenting the production and productivity of oilseeds in the country as it has a significant influence on quality and development of oil seeds and best known for its role in the synthesis of proteins, oils and vitamins. Available sulphur in soil is frequently lower than 5-10 ppm in light textured soil of Rajasthan. Sulphur deficiency is becoming more critical with each passing year which is severely restricting crop yield, produce quality and nutrient use efficiency. Sulphur, therefore, is now very much a part of balanced fertilization because in S deficient areas, applying N, P and K only, even at recommended rates cannot produce high yields unless S is also applied. Sulphur research work done in different parts of the country indicates that application of sulphur is highly profitable and seems to be essential for boosting the crop production.

MATERIALS AND METHODS

The experiment was conducted during Zaid season of 2021-2022. The experiment was conducted in Randomized Block Design consisting of nine treatment combinations with three replications and was laid out with the different treatments allocated randomly in each replication. The soil of the experimental field was sandy loam in texture, slightly alkaline reaction (pH 7.2) with low level of organic carbon (0.35%), available N (203.7 Kg/ha.), P (17.14kg/ha.) and higher level of K (92.00 kg/ha.). The treatment combinations are T1 - Spacing 25 x15 cm + sulphur - 20 kg/ha, T2 - Spacing 30 x15 cm + sulphur - 20 kg/ha, T3 - Spacing 35x 15 cm + sulphur - 20 kg/ha, T4 - Spacing 25x 15 cm + sulphur - 30 kg/ha, T5 - Spacing 30 x 15 cm + sulphur - 30 kg/ha, T6 - Spacing 35 x 15 cm + sulphur - 30 kg/ha., T7 - Spacing 25 x 15 cm + sulphur - 40 kg/ha, T8 - Spacing 30 x 15cm + sulphur - 40 kg/ha, T9 - Spacing 35 x 15cm + sulphur - 40 kg/ha. The observations were recorded on different yield parameters at harvest viz. Number of capsule per plant, number of seeds per capsule, test weight, grain yield , stover yield , Harvest index and Oil Content.

RESULT AND DISCUSSION

A. Yield Attributes

The data pertaining to yield parameters have been presented in table1. The important yield parameters capsule per plant, Test weight (g), seed yield (kg/ha), Stover yield (kg/ha), Harvest index (%) and Oil Content (%) were influenced significantly by various treatment.

Capsules per plant

Capsules per plant was found significant. The maximum number of capsules per plant was recorded highest (35.87) by T8 (30cmx15cm) +40kg Sulphur. Where T5 (30cmx15cm) +30kg Sulphur had recorded (35.60) were found statistically at par with T8 (30cmx15cm) +40kg Sulphur.

Seeds per capsules

Seeds per capsules was found significant. The maximum number of seeds per capsules was recorded (38.47) by T8 (30cmx15cm) +40kg Sulphur . Where T5 (30cmx15cm) +30kg Sulphur had recorded (37.33) were found statistically at par with T8 (30cmx15cm) +40kg Sulphur.

Test weight

Test weight was found significant. The maximum test weight was recorded (2.95) by T8 (30cmx15cm) +40kg Sulphur. Where T5 (30cmx15cm) +30kg Sulphur, T6 (35cmx15cm) +30kg Sulphur, T7 (25cmx15cm) +40kg Sulphur, T9 (35cmx15cm) +40kg Sulphur had recorded (2.87, 85, 2.81 and 2.85) were found statistically at par with T8 (30cmx15cm) +40kg Sulphur. These results are in accordance with the finding of **Duary et al., (2006).**

Seed yield

Seed yield was recorded significant. The maximum seed yield was recorded (867.97 kg/ha) by T8 (30cmx15cm) +40kg Sulphur. Where T5 (30cmx15cm) +30kg Sulphur, T6 (35cmx15cm) +30kg Sulphur had recorded (796.21 kg/ha and 778.65) which was statistically at par with T8 (30cmx15cm) +40kg Sulphur. Similar results were also reported by **Sujatha et al. (2020)** and **Kithan *et al.* (2017)**

Stover yield

Stover yield was recorded significant. The maximum Stover yield was recorded (1554.20 kg/ha) by T8 (30cmx15cm) +40kg Sulphur. Where T5 (30cmx15cm) +30kg Sulphur, T6 (35cmx15cm) +30kg Sulphur had recorded (1512.63 kg/ha and 1478.81) which was statistically at par with T8 (30cmx15cm) +40kg Sulphur.

Harvest index

Harvest index was recorded significant. The maximum Harvest index was recorded (39.36%) by T8 (30cmx15cm) +40kg Sulphur. Where T5 (30cmx15cm) +30kg Sulphur had recorded (38.03%) which was statistically at par with T8 (30cmx15cm) +40kg Sulphur.

Quality parameters

Oil content

Data presented in Table1. Stated that the oil content in sesame indicated the variation due to different treatments. The maximum Oil content was recorded (48.32%) by T8 (30cmx15cm) +40kg Sulphur. Progressive increase in level of sulphur were increased the quality i.e. oil content (46.75%). These results are equality with **Jat et al. (2017)** of sesame. Similar results were also reported by **(Nagavani *et al*., 2001) and (Gokhale *et al*., 2005)**.s

Fig1. Sowing

Fig 2. Reproductive stage

Table.1 Effect of Plant geometry and Sulphur on Yield Attributes and Yield of Sesame.

Treatments	No. of Capsule per plant	No. of Seeds per Capsule	Test Weight (g)	Seed Yield (kg/ha)	Stover Yield(kg/h.)	Harvest Index (%)	Oil Content (%)
Spacing 25 x15 cm + sulphur - 20 kg/ha	32.67	33.20	2.68	636.00	1205.42	32.94	45.34
Spacing 30 x15 cm + sulphur - 20 kg/ha	32.73	32.47	2.68	643.00	1280.17	34.72	46.06
Spacing 35x 15 cm + sulphur - 20 kg/ha	32.93	33.27	2.74	665.00	1314.38	34.28	46.11
Spacing 25x 15 cm + sulphur - 30 kg/ha	34.20	34.07	2.69	693.00	1378.00	35.06	47.10
Spacing 30 x 15 cm + sulphur - 30 kg/ha	35.60	37.33	2.87	796.21	1512.63	38.03	46.28
Spacing 35 x 15 cm + sulphur - 30 kg/ha	35.13	37.27	2.85	778.65	1478.81	37.58	45.86
Spacing 25 x 15 cm + sulphur - 40 kg/ha	33.70	35.47	2.81	705.04	1417.12	34.70	46.18
Spacing 30 x 15cm + sulphur - 40 kg/ha	35.87	38.47	2.90	867.97	1554.20	39.36	48.32
Spacing 35 x 15cm + sulphur - 40 kg/ha	35.00	36.53	2.85	755.65	1437.20	36.37	47.66
SEm (±)	0.33	0.39	0.08	17.10	24.34	0.32	0.83
CD (5%)	0.99	1.16	0.25	51.27	72.97	0.96	2.50

B. Economics

Cost of cultivation

Cost of cultivation (25,677.00 INR/ha.) was found to be highest in Spacing 30 x 15cm + sulphur - 40 kg/ha. As compared to other treatments.

Gross returns

Gross returns (82,456.83 INR/ha.) were found to be highest with the application of Spacing 30 x 15cm + sulphur - 40 kg/ha. As compared to other treatments.

Net returns

Net returns (756,779.83 INR/ha.) were found to be highest with the application of Spacing 30 x 15cm + sulphur - 40 kg/ha. As net return is calculated by multiplying the seed yield and their sale prices and subtracting the total cost of cultivation including treatment cost. Thus, higher net return could be primarily due to higher seed and stalk yields with comparatively lesser additional cost of input compared to additional yield under this treatment. Similar findings were also reported by Yadav et al. (2022).

Benefit Cost ratio

Benefit Cost ratio (2.2) was found to be highest in Spacing 30 x 15cm + sulphur - 40 kg/ha as compared to other treatments.

Table.2 Effect of Plant geometry and Sulphur on Yield and Economics of Sesame.

Treatments	Total Cost of Cultivation (INR/ha.)	Gross Returns (INR/ha.)	Net Returns (INR/ha.)	B:C ratio
Spacing 25 x15 cm + sulphur - 20 kg/ha	23,677.00	60,453.88	36,776.88	1.5
Spacing 30 x15 cm + sulphur - 20 kg/ha	23,677.00	61,140.42	37,463.42	5.5
Spacing 35x 15 cm + sulphur- 20 kg/ha	23,677.00	63,242.77	39,565.77	1.6
Spacing 25x 15 cm + sulphur - 30 kg/ha	24,677.00	65,843.87	41,166.87	1.6
Spacing 30 x 15 cm + sulphur - 30 kg/ha	24,677.00	75,639.95	50,962.95	2.0
Spacing 35 x 15 cm + sulphur - 30 kg/ha	24,677.00	73,972.07	49,295.07	1.9
Spacing 25 x 15 cm + sulphur - 40 kg/ha	25,677.00	66,979.12	41,302.12	1.6
Spacing 30 x 15cm + sulphur - 40 kg/ha	25,677.00	82,456.83	56,779.83	2.2
Spacing 35 x 15cm + sulphur 40 kg/ha	25,677.00	71,786.75	46,109.75	1.7

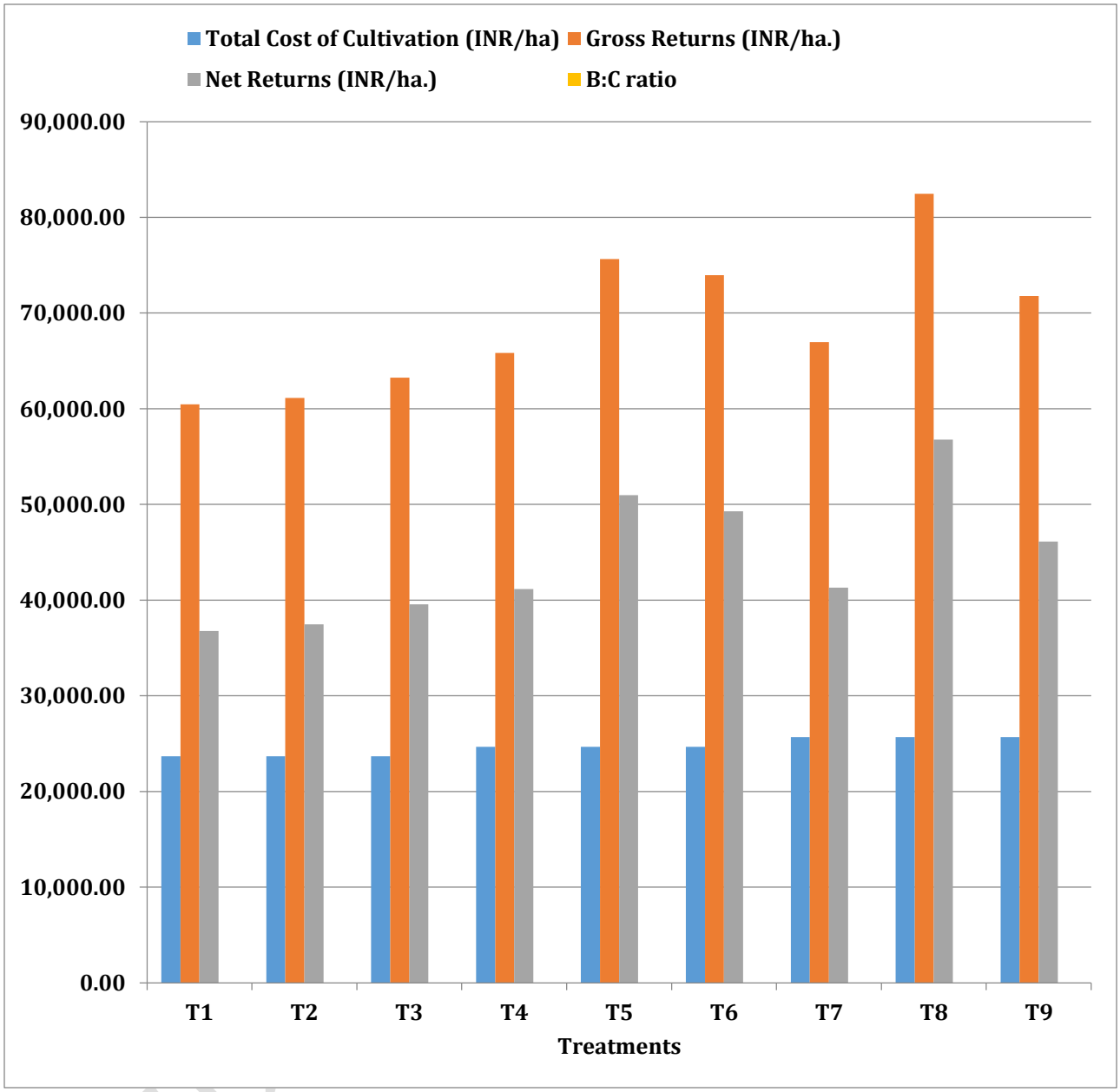

Fig 3: Histogram showing cultivation cost against treatment

CONCLUSION

On the basis of results it is concluded that individual as well as combined application of plant geometry and sulphur gave significant effect on seed and stover yield and economics by sesame. The application of (30cmx15cm) +40kg Sulphur was found more productive (867.00 kg/ha.) as well as economically viable (INR 56,779.83/ha.) also.

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