

Original Research Article

<https://doi.org/10.20546/ijcmas.2021.1002.050>

Effect of Sulphur and Spacing on Yield and Economics of Safflower (*Carthamus tinctorius* L.)

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ABSTRACT

Keywords

Safflower, Spacing, Growth, Sulphur, Yield Attributes, and B: C Ratio

Article Info

Accepted:

18 January 2021

Available Online:

10 February 2021

A field experiment was conducted to determine the effect of sulphur and spacing on yield and economics of safflower. The experiment was laid out in randomized Block Design, with 8 treatments, each replicated thrice, in the *rabi* 2019 with the different levels of Sulphur (0,10,20,30 kg S/ha) and Spacing (20cm x 10cm,30cm x 10cm) respectively at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj,(U.P). Application of Sulphur and Spacing significantly influenced the yield and economics. Addition of 30 kg S/ha +30cm x 10cm recorded highest yield attributes and yield viz., Grain yield (1604.44 kg/ha), Stover yield (4515.21 kg/ha) and the Maximum gross return (100781.42 `/ha), net return (73379.901 `/ha) and B: C ratio (2.67).

Introduction

Oilseeds are of great value in nutritional demands of mankind, animal feeding, and medicine. Among them, safflower (*Carthamus tinctorius* L.) is an important annual industrial crop. Safflower is broadleaf oilseed crop of the family Asteraceae, predominantly adapted to dry land (Bahrami *et al.*, 2014). It originated in southern Asia and is cultivated in China, India, Persia, Egypt, and Pakistan. In the world it was cultivated over an area 0.964 million hectare, and had a production of 0.651 million tones with average productivity of 827.9 kg /ha.

India is a major safflower growing country and contributes 60 per cent of the total world production. India ranks first in area and production of safflower grown across the world. In India, safflower is grown in an area of 1,78,400 ha with a production of 1.453 lakh tons and productivity of 498 kg/ha (Indiastat, 2012).

Safflower is an important oilseed crop of the world. In India, it is grown in winter season and accounts for about 8.0% of the value of total oilseeds produce. Safflower has a deep root system and thus, can capture leached nutrients below the rooting-zone of other

crops. In northern India, sowing of safflower gets delayed due to late harvesting of long-duration rice crop as well as in areas where moisture from rice fields cannot be receded out in time. Late sown safflower is exposed to high temperature during the reproductive phase, along with reduced growing season and consequently, results in reduced growth and productivity.

Sulphur application in suitable quantities through appropriate source may be the corrective measure to improve the safflower yield in such areas. Erdal *et al.*, (2006) reported that soil pH decreased with the application of S, resulting in increases in nutrient concentration, plant nutrient uptake, chlorophyll concentration, root nodules and dry matter production. Hence, an attempt was made to study the effect of Sulphur levels and sources on growth, yield and nutrient uptake parameters of safflower (*Carthamus tinctorius* L.) The deficiency of secondary and micronutrients is wide spread in many parts of the country due to cultivation of high-yielding varieties, intensive agriculture and increasing use of sulphur – free fertilizers in large quantities with concomitant decrease in use of organic manures. Oilseeds are energy- rich crops, so phosphorus and sulphur nutrition assumes greater importance in comparison to other nutrients. This application of these elements as they have becoming limiting factor for obtaining higher yields of several oilseed crops including safflower.

Propagation, Sowing and Spacing in Safflower Cultivation. Propagation is done by seeds. In India, usually this is sown as Rabi season crop from October to November. Avoid late sowing as this may result in low yield due to high temperatures before maturity of the crop. Actually, sowing time depends on the region/states. When it comes to spacing for pure or solo crop, row spacing of 45-50 cm x 20-25 cm and for mixed crop

or intercrop, row spacing of 20-25 cm x 20-25 cm and for rain-fed crop, a row spacing of 60 cm x 30-35 cm should be followed. Safflower is usually planted at a depth of 30 to 45 mm. On an average, 10 kg of seeds are enough for covering 1 hectare land. Again seed rate depends on the area and variety. Healthy seeds of improved varieties should be selected for sowing. Find the high yielding cultivar for your region from agriculture department.

Materials and Methods

The experiment was carried out during Rabi season of 2019 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P). The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.2), low in organic carbon (0.58%), medium in available N (238 Kg/ha), high in available P (32.10 Kg/ha) and low in available K (189 Kg/ha). The treatment consisted of 4 levels of sulphur *viz.* S0 (0 Kg S/ha), S1 (10 Kg S/ha), S2 (20 Kg S/ha) S3 (30 Kg/ha) and 2 levels of spacing (20cm x 10cm) and (30cm x 10cm). There are 8 treatments each replicated thrice. The experiment was laid out in Randomized Block Design. It was sown on 7th December 2019 with recommended doses of nitrogen phosphorous and potassium were applied.

Results and Discussion

Yield

Application of 30kg/ha + 30 cm x 10 cm recorded the highest and significant grain yield (1604.44 /ha) and stover yield (4515.21 kg/ha). Seed yield significantly varied with row spacing and levels of sulphur. (Ali Zadeh *et al.*, 2012), Sharif Maghaddasi and Omid (2016) also reported that seed yield increase using 30 cm row spacing. Also plant spacing effect was significant on seed yield. Many researchers studied row spacing and plant

distance effect in safflower crop and demonstrated that low to medium densities produced more seed yield but in too narrow plant spacing, yield reduced due to increasing competing to uptake water, nutrients and light (Emami *et al.*, 2011; Zarei *et al.*, 2011; Hamza,2015)With increasing supply of sulphur the process of tissue differentiation from somatic to reproductive, meristematic

activity and development of floral primordial might have increased, resulting in more flowers and capsules and longer capsules as reported by Jat and Mehra (2007). Increase in stover yield can be ascribed to the overall improvement in plant organs associated with faster and uniform vegetative growth of the crop under the effect of sulphur application. Similar results were reported by Singh (2001).

Table.1 Effect of Sulphur and Spacing on yield and Economics of Safflower

Treatment Combinations	Grain yield (kg/ ha.)	Stover yield (kg/ ha.)	Cost of production (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C Ratio
T ₁ 0 kg/ha + 20 cm x 10 cm	1032.03	3029.30	22570.8	64951.09	42380.29	1.87
T ₂ 0 kg/ha + 30 cm x 10 cm	1097.73	3235.68	22570.8	69099.47	46528.67	2.06
10 kg/ha +20 cm x 10 cm	1247.16	3184.27	24181.04	78013.87	53832.83	2.22
10 kg/ha +30 cm x 10 cm	1314.40	3490.30	24181.04	82354.29	58173.25	2.40
20 kg/ha + 20 cm x 10 cm	1389.76	3715.44	25791.28	87101.04	61309.76	2.37
20 kg/ha + 30 cm x 10 cm	1509.87	3742.02	25791.28	94334.22	68542.94	2.65
30 kg/ha + 20 cm x 10 cm	1495.74	3891.68	27401.52	93636.07	66234.55	2.41
30 kg/ha + 30 cm x 10 cm	1604.44	4515.21	27401.52	100781.42	73379.90	2.67
SEm(±)	26.80	24.21	-	-	-	-
CD (p=0.05)	79.65	74.91	-	-	-	-

Economics

Cost of production (Rs./ha): The maximum cost of production was recorded under T₈ (30 kg/ha + 30 cm x 10 cm) (27401.52 Rs./ha).

Gross return (Rs./ha): Higher gross return was found in (100781.42 Rs./ha) T₈ (30 kg/ha + 30 cm x 10 cm).

Net return(Rs./ha): Higher Net return was found in (73379.90 Rs./ha) T₈ (30 kg/ha + 30 cm x 10 cm).

B: C ratio: Higher B: C Ratio was found in (2.67) T₈ (30 kg/ha + 30 cm x 10 cm).

In conclusion, it is inferred from the present investigation that application of 30 kg/ha + 30 cm x 10 cm in addition to the full doses of

nitrogen and potassium is recommended for farmers for receiving higher yield and economic benefits of Safflower.

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How to cite this article:

Kethavath Narender, Rajesh Singh and Ekta Singh. 2021. Effect of Sulphur and Spacing on Yield and Economics of Safflower (*Carthamus tinctorius* L.). *Int.J.Curr.Microbiol.App.Sci*. 10(02): 424-427. doi: <https://doi.org/10.20546/ijcmas.2021.1002.050>