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Effect of nitrogen and sulphur levels on growth, yield and economics of spineless safflower (*Carthamus tinctorius* L.)

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Abstract
The field experiment was conducted in Rabi season comprised of Nitrogen levels (20, 30, 40) kg/ha and Sulphur (0, 20, 30) kg/ha. The experiment was conducted in Randomized Block Design with 3 Replications and 9 Treatments. Application of 40 kg Nitrogen +30 kg Sulphur was recorded maximum Plant height (105.30 cm), Number of Branches (24.80), Dry weight (42.67g), Capsules per Plant (22.0), Seeds per Capsule (21.1) and Seed yield was (1650.50) kg/ha, and highest benefit cost ratio was recorded in the treatment combination of Nitrogen 40 kg/ha +Sulphur 30 kg/ha was 2.93.

Keywords: Spineless safflower, nitrogen, sulphur, growth yield and economics

Introduction
Oil seeds 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 (Babulkar *et al.*, 2000). It originated in southern Asia and is cultivated in China, India, Persia, Egypt, and Pakistan. Safflower is used as a source of dye, medicines and food. It is cultivated as a source of oil and protein. It contains 34% oil and 22–24% protein and its seeds are rich source of natural antioxidant (tocopherol). Safflower oil is preferred for its higher poly unsaturated fatty acid (78% linoleic acid) which reduces blood cholesterol level (Dhubey *et al.*, 1999) also contains tocopherols, known to have antioxidant effect and high vitamin E content. For this reason, safflower oil is used in the diets of patients with cardiovascular disease, and bears great importance for its anti-cholesterol effect (Harshal *et al.*, 2010) [6]. Nitrogen is essential in plant processes such as photosynthesis. Thus, plants with sufficient nitrogen will experience high rates of photosynthesis and typically exhibit vigorous plant growth and development. N availability is an important factor in determining crop productivity, managing fertilizer rate can be a suitable strategy to improve crop growth and yield when crops need to enhance nutrient uptake (Patel *et al.*, 1995) [9]. Sulphur is master nutrient of oil seed production, it is essential for protein production because, it is constituent of three main amino acid *viz*., cysteine, and methionine. The available sulphur content of majority of soils of in the country is already low because of low organic matter build up and increase loss of sulphur through leaching and erosion. The oil seed crop requires more quantity sulphur than cereals. Sulphur application in suitable quantities through appropriate source may be the corrective measure to improve the safflower yield in such areas. (Maheshwara reddy *et al.*, 2003) [10] 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.

Materials and Methods
The experiment was carried out during Kharif season of 2019 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj which is located at 25o 24' 42" N latitude, 81o 50' 56" E longitude and 98 m altitude above the mean sea level. This area is situated on the right side of the river Yamuna by the side of Allahabad Rewa Road about 5 km away from Prayagraj (Allahabad). and carried out with 9 treatments and 3 replications were carried out along with three levels of Nitrogen (20, 30, 40) kg/ha and three levels of Sulphur (0, 20, 30) kg/ha with the treatment combination of following treatments T_1:20 kg Nitrogen + 0 kg Sulphur, T_2:20 kg Nitrogen + 20 kg Sulphur,T_3:30 kg Nitrogen + 30 kg Sulphur,T_4: 30 kg Nitrogen + 0 kg Sulphur, T_5:30 kg Nitrogen + 20 kg Sulphur, T_6:30 kg

Nitrogen + 30 kg Sulphur, T_7:40 kg Nitrogen + 0 kg Sulphur, T_8:40 kg Nitrogen + 20 kg Sulphur, T_9: 40 kg Nitrogen + 30 kg Sulphur and the seeds were sown with the recommended agronomic practices. And seed rate was 20 kg/ha, and the basal application of fertilizers was done and seeds were sown in various plots and all the fertilizers were applied at the basal dose (40:40:20) NPK kg/ha and plot size was 3x3m, the plants are spaced at 45x20cm followed by line sowing. And parameters like Plant height, No. of branches/Plant, dry weight (g), postharvest observations (Capsules/Plant, Seeds /capsules, Seed yield kg/ha).

Results and Discussion

Plant height

Maximum plant height was recorded in the treatment combination Nitrogen 40 kg/ha + Sulphur 30 kg/ha was 105.30 cm was significantly higher among all the treatments and statistically at par with Nitrogen 30 kg/ha + Sulphur 0 kg/ha, Nitrogen 30 kg/ha + Sulphur 20kg/ha, Nitrogen 30 kg/ha, Nitrogen 40 kg/ha + Sulphur 20 kg/ha, Nitrogen 40 kg/ha + Sulphur 30 kg/ha. The increase in plant height with higher levels of nitrogen was probably due to its beneficial effect on cell elongation which might have resulted in internodal elongation. The nitrogen was an integral part of protein, the blocks of the plant and it also helps in maintaining higher auxin level which might have resulted in better plant height (Singh *et al*., 2000) [12, 13]. Similar findings were also reported by Singh and Singh, 2013 [12, 13] and Katara and Bansal, 1995 [8].

Number of branches/plant

Maximum number of branches was recorded in the treatment combination of Nitrogen 40 kg/ha + Sulphur 30 kg/ha was higher among all the treatments and minimum branches was recorded in the treatment combination of Nitrogen 20kg/ha + Sulphur 0 kg/ha (17.40). The data was shown in the table 1. Increase in more number of branches may be probably due to adequate application of nitrogen, which was directly involved in better absorption of applied nutrients and cell multiplication as well as expansion of deep green Color of leaves due to better chlorophyll synthesis in comparison with plants deficient in nitrogen (Vishwanath *et al.*, 2006) [14]. These results are in agreement with the findings of Baviskar *et al.*, (2005) [2], Ravi *et al*., (2010) [11], Bhagat and Soni (2000) [3].

Table 1: Effect of nitrogen and sulphur levels on growth, yield and economics of spineless safflower

Treatments	Plant height (cm)	No. of branches/plant	Dry weight (g)	No. of capsules/plant	No. of seeds/capsule	Seed yield kg/ha	B:C Ratio
Nitrogen 20 kg/ha + Sulphur 0 kg/ha	96.20	17.40	38.00	18.4	17.2	1091.00	2.12
Nitrogen 20 kg/ha + Sulphur 20 kg/ha	98.50	18.20	37.66	18.6	17.9	1273.00	2.34
Nitrogen 20 kg/ha + Sulphur 30 kg/ha	99.30	19.60	39.33	19.1	18.3	1347.33	2.41
Nitrogen 30 kg/ha + Sulphur 0 kg/ha	101.50	20.50	39.33	18.7	18.0	1257.00	2.44
Nitrogen 30 kg/ha + Sulphur 20 kg/ha	103.80	22.20	41.33	20.6	19.5	1438.67	2.64
Nitrogen 30 kg/ha + Sulphur 30 kg/ha	104.60	22.80	41.33	21.1	20.1	1513.00	2.70
Nitrogen 40 kg/ha + Sulphur 0 kg/ha	102.20	21.50	40.00	19.5	19.2	1367.67	2.65
Nitrogen 40 kg/ha + Sulphur 20 kg/ha	104.80	23.20	41.67	21.5	20.5	1550.00	2.90
Nitrogen 40 kg/ha + Sulphur 30 kg/ha	105.30	24.80	42.67	22.0	21.1	1643.19	2.93
SEm(±)	1.84	0.28	0.61	0.31	0.05	19.29	-
C.D (P = 0.05)	5.53	0.83	1.84	0.92	NS	57.82	-

Dry weight (g)

Maximum dry weight was recorded in the treatment combination of Nitrogen 40 kg/ha + Sulphur 30 kg/ha was 42.67 was higher among all the treatments and the minimum dry weight was recorded in treatment combination of Nitrogen 20 kg/ha + Sulphur 20 kg/ha (37.66). The data pertaining to the number of branches was shown in the table. 1 Application of Sulphur significantly increased the Nitrogen uptake, stimulated the photosynthetic activity and synthesis of chloroplast protein which might have resulted in higher dry matter production. Similarly, better Sulphur nutrition to plants resulted in more height and number of branches and other growth parameters, which resulted in higher dry matter production (Harendra Kumar and Yadav, 2007) [7]. These results are in line with findings of Baviskar *et al.*, (2005) [2], Venkatesh *et al*., (2002) [15] and Babhulkar *et al*., (2000) [1].

Number of capsules/plant

Maximum Number of Capsules/Plant was found in the treatment combination of Nitrogen 40 kg/ha + Sulphur 30 kg/ha was 22.0 was significantly higher among all the treatments and statistically at par with Nitrogen 30 kg/ha + Sulphur 30 kg/ha, Nitrogen 40 kg/ha + Sulphur 20 kg/ha. The data pertaining to the number of capsules was shown in the table 1. The number of capsules plant increased because the application of N fertilizer increased branches. Other investigation also reported the positive effects on number of capsules per plant Singh and Singh (2013) [12, 13].

Number of seeds/capsules

Maximum seeds per capsules was recorded in the treatment combination of Nitrogen 40 kg/ha + Sulphur 30 kg/ha was 21.1 was higher among all the treatments and minimum number of seeds /capsules was recorded in the treatment combination of Nitrogen 20 kg/ha + Sulphur 0 kg/ha. Which was statistically Non-significant. The data was represented in the table 1.

Seed yield (kg/ha)

Maximum seed yield was recorded in the treatment in the combination of Nitrogen 40 kg/ha + Sulphur 30 kg/ha was 1643.19 kg/ha was higher among all the treatments and minimum seed yield was recorded in the treatment combination of Nitrogen 20 kg/ha + Sulphur 0 kg/ha. The data was shown in the table 1. The increase in yield might be due to more accumulation of amino acids and amide substances and their translocation to the reproductive organs which influenced growth and yield due to application of Sulphur (Dongarkar, 2005) [4].

Conclusion

It is concluded that the treatment with Nitrogen 40 kg/ha + Sulphur 30 kg/ha was recorded highest Seed yield (1643.19)

kg/ha and highest benefit cost ratio (2.93). So Spineless safflower (variety NARI-6) can be recommended to the farmers.

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References

1. Babhulkar PS, Dineshkar, Badole WP, Balpande SS. Effect of sulphur and zinc on yield, quality and nutrient uptake by safflower in vertisol. Journal of Indian Society of Soil Science 2000;48(3):541-543.
2. Baviskar PK, Varsha VT, Jagdale RB, Sarika VS, Bhatia NH. Effect of levels of sulphur and its sources on S uptake, growth and yield of safflower. Journal of Soils and Crops 2005;15(2):466-469.
3. Bhagat KL, Soni KC. Effect of nitrogen and sulphur on growth, seed and oil yield of mustard (*Brassica juncea*). Journal of Oilseeds Research 2000;17(1):96-99.
4. Dongarkar KP, Pawar WS, Khawale VS, Khutate NG, Gudadhe NN. Effect of nitrogen and sulphur on growth and yield of mustard (*Brassica juncea* L.). Journal of Soils and Crops 2005;15(1):163-167.
5. Dubey SD, Shukla P, Chandra R. Effect of nitrogen and sulphur on their content and uptake in linseed. Journal of Oilseeds Research 1999;16(1):43-47.
6. Harshal S, Salunke Ommala D, Kuchanwar, Padmaja H, Kausadikar, Patangray AJ. Effect of different levels of sulphur on content and uptake of major nutrients of different genotypes of linseed. Journal of Soils and Crops 2012;22(2):415-419.
7. Harendra Kumar, Yadav DS. Effect of phosphorus and sulphur levels on growth, yield and quality of Indian mustard (*Brassica juncea* L.) cultivars. Indian Journal of Agronomy 2007;52(2):154-157.
8. Katara GS, Bansal KN. Effect of irrigation and nitrogen on yield, uptake and water use efficiency of safflower (*Carthamus tinctorius* L.). Indian Journal of Agronomy 1995;40(2):338-339.
9. Patel PT, Patel GG, Patel GA, Sonani VV, Patel HB. Effect of sources and levels of sulphur on seed and oil yield of safflower (*Carthamus tinctorius* L.). Journal of oilseed research 1995;19(1):76-78.
10. Reddi Ramu Y, Maheswara Reddy P. Yield, quality and economics of sunflower as influenced by nitrogen and sulphur nutrition. Journal of Oilseeds Research 2003;20(1):131-132.
11. Ravi S, Channal HT, Shailendra Kumar. Response of sulphur and micronutrients (Zn and Fe) on yield and available nutrients of safflower (*Carthamus tinctorius* L.). An Asian Journal of Soil Science 2010;5(2):402-405.
12. Singh MV. Sulphur management for oilseed and pulse crops. Indian Institute of Soil Science 2000, P29.
13. Singh RK, Singh AK. Effect of nitrogen, phosphorus and sulphur fertilization on productivity, nutrient-use efficiency and economics of safflower (*Carthamus tinctorius* L.) under late-sown condition. Indian Journal of Agronomy 2013;58(4):583-58.
14. Vishwanath H, Pujari BT, Prakash SS, Ramesh Babu, Deshmanya JB. Growth attributes, dry matter production and its partitioning and nutrient uptake studies in spineless safflower (*Carthamus tinctorius* L.) var, NARI-6 as influenced by nitrogen and sulphur levels. Karnataka Journal of Agricultural Science 2006;19(4):913-917.
15. Venkatesh MS, Hebsur NS, Satyanarayana T. Evaluation of sulphur carriers for safflower in vertisol of North Karnataka. Karnataka Journal of Agricultural Science 2002;15(2):284-287.