



## IMPACT OF GRADED LEVELS OF FERTILIZERS AND FOLIAR SPRAYS ON PRODUCTIVITY OF SUMMER SESAME (*Sesamum indicum* L.)

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ABSTRACT

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A field experiment was conducted during summer, 2021 on sandy loam soils of dryland farm of S.V. Agricultural College, Tirupati, Acharya N.G. Ranga Agricultural University, Andhra Pradesh. The experiment was laid out in split-plot design with three graded levels of fertilizers [75% RDF ( $N_1$ ), 100% RDF- 40:20:20 kg N,  $P_2O_5$  and  $K_2O$   $ha^{-1}$  ( $N_2$ ) and 125% RDF ( $N_3$ )] assigned to main plots and four foliar sprays [1% foliar spray of DAP ( $F_1$ ), 1% foliar spray of 19-19-19 ( $F_2$ ), 0.5% foliar spray of  $MnSO_4$  ( $F_3$ ) and 0.01% foliar spray of salicylic acid ( $F_4$ )] allotted to sub plots which were sprayed at 30 and 50 DAS replicated thrice. Supply of 125% RDF ( $N_1$ ) recorded significantly higher yield contributing parameters, seed and stalk yield while, lower values were noticed with supply of 75% RDF ( $N_3$ ). Among foliar sprays, 1% foliar spray of 19-19-19 scheduled at 30 and 50 DAS ( $F_2$ ) significantly enhanced yield attributes, seed and stalk yield. However, their lower values were realized with 0.5% foliar spray of  $MnSO_4$  given at same schedule ( $F_3$ ). Similar trend was followed with regard to per cent of oil content, oil yield and economic returns. Soil application of 125% RDF in combination with 1% foliar spray of 19-19-19 given twice, each at 30 and 50 DAS resulted in better performance of summer sesame.

**KEY WORDS:** Fertilizer levels, Foliar sprays, Summer sesame, Yield.

### INTRODUCTION

Sesame (*Sesamum indicum* L.) is an important oilseed crop cultivated in India. Sesame is better known as 'Queen of Oilseeds' which contain 50-60 per cent oil, 8 per cent protein, 5.8 per cent water, 3.2 per cent crude fiber, 18 per cent carbohydrate, 5.7 per cent ash and it is very rich in minerals such as Ca, P and vitamin E. Sesame oil contains two antioxidants, such as *sesamin* and *sesamol*. Sesame seeds are also referred as 'The Seeds of Immortality'. In India, sesame is cultivated in 16.22 lakh hectares of area with production 6.57 lakh tonnes and productivity 405 kg  $ha^{-1}$ . In Andhra Pradesh, sesame is grown in 39,000 hectares of area with 13,380 tonnes of production and productivity of about 343 kg  $ha^{-1}$  during 2019-2020 ([www.indiastat.com](http://www.indiastat.com)).

Sesame production in semi-arid regions of India is restricted by soil deficiencies in moisture and plant nutrients. Fertilizers are the most important inputs for successful crop production. Sesame responds very well to application of high dose of fertilizers in almost all growing areas of the country. Nitrogen is primarily responsible for vegetative growth and it is a component of chlorophyll and is required for several enzyme

reactions. Phosphorus plays a significant role in root development, crop maturity and seed production. Potassium enhances the plant resistance to extreme cold and hot temperatures, drought and pests. Hence, a sustainable increase in production can be obtained through balanced fertilization. Therefore, it is necessary to study the behaviour of sesame under various graded levels of fertilizers (Muneshwar *et al.*, 2019).

Certain physiological constraints faced by sesame at the time of its cultivation like slow dry matter accumulation, poor mobilization of photo assimilates from source to sink, heavy flower drop and thereby lower flower to pod ratio can be sorted out by foliar spraying of essential nutrients and plant growth hormones at critical stages of sesame crop. The purpose of applying water-soluble fertilizers like 19:19:19 and DAP through foliar spray helps to keep the leaves viable and longer by re-supplying nutrients that are being rapidly translocated to developing seeds. Hence, it improves the yield and quality of crop. Among the micronutrients, manganese one of the important micronutrient found to increase plant height and nodes for capsule development in sesame. Salicylic acid is a phytohormone and plays a crucial role in regulation of plant physiological stages, including

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photosynthesis, growth, nitrate metabolism, heat production, flowering and response to drought stress (Khatiby *et al.*, 2017).

## MATERIAL AND METHODS

A field trial was conducted at S.V. Agricultural College, dryland farm, Tirupati of Acharya N.G. Ranga Agricultural University during summer, 2021. The soil of the experiment field was sandy loam in texture, neutral in soil reaction (pH- 6.9), low in organic carbon (0.37%), available nitrogen (177 kg ha<sup>-1</sup>) and available phosphorus (21 kg ha<sup>-1</sup>), medium in available potassium (163 kg ha<sup>-1</sup>). The test variety of sesame 'YLM-17' was line sown with a spacing of 30 cm × 10 cm at a seed rate of 5 kg ha<sup>-1</sup> on 10<sup>th</sup> January, 2021. The plot size was 5.4 m × 4.2 m. The experiment was laid out in split-plot design with three replications, comprising of three graded levels of fertilizers *viz.*, 75% RDF (N<sub>1</sub>), 100% RDF- 40:20:20 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O ha<sup>-1</sup> (N<sub>2</sub>) and 125% RDF (N<sub>3</sub>) assigned to main plots and four foliar sprays *viz.*, 1% foliar spray of DAP (F<sub>1</sub>), 1% foliar spray of 19-19-19 (F<sub>2</sub>), 0.5% foliar spray of MnSO<sub>4</sub> (F<sub>3</sub>) and 0.01% foliar spray of salicylic acid (F<sub>4</sub>) allotted to sub plots which were sprayed at 30 and 50 DAS. The crop was harvested on 14<sup>th</sup> April, 2021.

## RESULTS AND DISCUSSION

### Yield attributes

The yield attributes of summer sesame *viz.*, number of capsules plant<sup>-1</sup>, number of seeds capsule<sup>-1</sup> except test weight were significantly higher with application of 125% RDF over the lowest level of fertilizer applied to soil 75% RDF (Table 1). This might be due to the plants equipped with luxuriant vegetative growth, activation of photosynthetic enzymes and better assimilates translocation which have ultimately lead to enhancement in yield components. These findings are in conformity with the findings of Shehu *et al.* (2010). Among the foliar sprays, significantly higher values of above said yield attributes were associated with 1% foliar spray of 19-19-19 twice, each at 30 and 50 DAS while, they were found to be lower with 0.5% foliar spray of MnSO<sub>4</sub> scheduled at same time. Timely and adequate supply of nutrients through foliar sprays at the peak physiological demand of sesame might be responsible for higher yield attributes. Similar views were also expressed by Mankar *et al.* (2014). Whereas, the interaction effect between these two factors was not statistically traceable.

### Seed and stalk yield

Graded levels of fertilizer applied to soil and foliar spray of nutrients significantly influenced the seed and stalk yield of summer sesame. However, interaction effect between these two factors was not statistically measurable (Table 1). Maximum seed yield (772 kg ha<sup>-1</sup>) and stalk yield (2165 kg ha<sup>-1</sup>) were realized with supply of 125% RDF and found significantly superior to 100% RDF 40:20:20 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O ha<sup>-1</sup> application. Seed yield (524 kg ha<sup>-1</sup>) and stalk yield (1675 kg ha<sup>-1</sup>) were found to be minimum with application of 75% RDF. Application of higher level of fertilizer might have enhanced total biomass accumulation and its efficient translocation from source to sink which in turn increased seed and stalk yield. These findings are inline with those reported by Thentu *et al.* (2014) and Muneshwar *et al.* (2019). With regards to the response of summer sesame in terms of seed and stalk yield due to foliar sprays, 1% foliar spray of 19-19-19 given at 30 and 50 DAS significantly enhanced seed yield (746 kg ha<sup>-1</sup>) and stalk yield (2123 kg ha<sup>-1</sup>) and found superior to rest of the foliar spray treatments. The seed and stalk yield realized due to 0.01% foliar spray of salicylic acid scheduled at 30 and 50 DAS and 1% foliar spray of DAP sprayed at same schedule were found to be on par with each other. Significantly lower values of seed (545 kg ha<sup>-1</sup>) and stalk yield (1722 kg ha<sup>-1</sup>) were noticed with 0.5% foliar spray of MnSO<sub>4</sub> given at 30 and 50 DAS. Supplementing major nutrients through foliar spray might have enhanced better retention and absorption of nutrients which led to higher vegetative and reproductive growth, thus enhancing seed and stalk yield of sesame. The results are in agreement with those reported by Deepthi *et al.* (2018) and Harisudan *et al.* (2018).

### Quality parameters

Per cent of oil content and oil yield of summer sesame seed were found to be maximum with application of 125% RDF and found significantly superior to other graded levels of fertilizers. While, the minimum values were realized with supply of 75% RDF (Table 2). Supply of adequate quantities of nitrogen duly balanced with phosphorus and potassium might have helped in absorption of greater amounts of nitrogen which is an important constituent of nucleic and fatty acids and phospholipids and thus played a crucial role in promoting oil accumulation in the seed which might be responsible for increase in oil yield of summer sesame. These findings are in corroboration with those reported by De *et al.*

**Table 1. Yield components and yield of summer sesame as influenced by graded levels of fertilizers and foliar sprays**

Treatments	Number of capsules plant <sup>-1</sup>	Number of seeds capsule <sup>-1</sup>	Test weight (g)	Seed yield (kg ha <sup>-1</sup> )	Stalk yield (kg ha <sup>-1</sup> )
<b>Fertilizer levels (3)</b>					
75% RDF	34	55	2.68	524	1675
100% RDF	39	61	2.72	654	1941
125% RDF	44	66	2.74	772	2165
<b>SEm±</b>	1.0	1.0	0.027	17.8	50.3
<b>CD (P = 0.05)</b>	4	4	NS	70	197
<b>Foliar sprays (4)</b>					
1% foliar spray of DAP	38	60	2.71	639	1895
1% foliar spray of 19-19-19	43	65	2.73	746	2123
0.5% foliar spray of MnSO <sub>4</sub>	34	55	2.69	545	1722
0.01% foliar spray of salicylic acid	39	61	2.71	669	1968
<b>SEm±</b>	1.2	1.1	0.021	18.7	55.2
<b>CD (P = 0.05)</b>	3	3	NS	56	164
<b>Interaction</b>					
<b>F at N</b>					
<b>SEm±</b>	2.0	1.9	0.036	32.4	95.7
<b>CD (P = 0.05)</b>	NS	NS	NS	NS	NS
<b>N at F</b>					
<b>SEm±</b>	2.0	1.9	0.041	33.2	96.9
<b>CD (P = 0.05)</b>	NS	NS	NS	NS	NS

(2013). Among foliar sprays, per cent of oil content and oil yield of summer sesame seed was found significantly higher with 1% foliar spray of 19-19-19 twice, each at 30 and 50 DAS while, they were found to be lower with 0.5% foliar spray of MnSO<sub>4</sub> given at 30 and 50 DAS. This may be due to requisite supply of nitrogen and phosphorus through foliar spray, the positive effect of potassium showed higher oil content and oil yield as it has an important role in enhancing enzyme activity and lipid metabolism. Similar reports were given by Deepthi *et al.* (2018). The interaction effect between these two factors was not found to be at statistically noticeable magnitude.

#### **Economic returns**

Among the graded levels of fertilizers supplied to soil, maximum gross and net returns as well as benefit cost ratio of summer sesame were realized with application of highest level of fertilizer, *i.e.* 125% RDF followed by 100% RDF-40:20:20 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O ha<sup>-1</sup> while, it was minimum with the lowest level of fertilizer applied 75% RDF. This might be due to the highest seed and stalk yields realized without proportionate increase in the total cost of cultivation. These results are similar with the findings of Shinde *et al.* (2014). With regard to foliar sprays, higher gross and net returns, as well as benefit

**Table 2. Quality parameters and economic returns of summer sesame as influenced by graded levels of fertilizers and foliar sprays**

Treatments	Oil content (%)	Oil yield (kg ha <sup>-1</sup> )	Gross returns (₹ ha <sup>-1</sup> )	Net returns (₹ ha <sup>-1</sup> )	B:C ratio
<b>Fertilizer levels (3)</b>					
75% RDF	41.4	217	39308	17012	1.80
100% RDF	46.3	305	49029	26145	2.18
125% RDF	51.2	397	57868	34396	2.50
<b>SEm±</b>	1.10	7.5	1336	1336	0.055
<b>CD (P = 0.05)</b>	4.3	29	5248	5248	0.22
<b>Foliar sprays (4)</b>					
1% foliar spray of DAP	46.1	299	47959	26867	2.27
1% foliar spray of 19-19-19	49.8	377	55981	33439	2.48
0.5% foliar spray of MnSO <sub>4</sub>	43.0	236	40843	13851	1.51
0.01% foliar spray of salicylic acid	46.4	314	50156	29246	2.39
<b>SEm±</b>	1.00	10.3	1404.1	1404.1	0.058
<b>CD (P = 0.05)</b>	3.0	31	4172	4172	0.17
<b>Interaction</b>					
<b>F at N</b>					
<b>SEm±</b>	1.73	17.9	2432.1	2432.1	0.101
<b>CD (P = 0.05)</b>	NS	NS	NS	NS	NS
<b>N at F</b>					
<b>SEm±</b>	1.86	17.2	2494.5	2494.5	0.103
<b>CD (P = 0.05)</b>	NS	NS	NS	NS	NS

cost ratio was noticed with 1% foliar spray of 19-19-19 sprayed at 30 and 50 DAS followed by 0.01% foliar spray of salicylic acid which was statistically on par with 1% foliar spray of DAP sprayed at same schedule. While, the gross and net returns as well as benefit cost ratio registered lower with 0.5% foliar spray of MnSO<sub>4</sub> given at 30 and 50 DAS. 1% foliar spray of 19-19-19 might have enabled to meet the nutritional demand efficiently in tune with the physiological needs to ultimately translocate into higher seed and stalk yield which inturn inflated monetary returns. These results are similar with the findings of Deshmukh *et al.* (2014).

The present investigation inferred that supply of 50:25:25 kg NPK ha<sup>-1</sup> (125% RDF) in combination with 1% foliar spray of 19-19-19 given twice, each at 30 and 50 DAS proved to be promising in realizing higher productivity and profitability of summer sesame on sandy loam soils of Southern Agro-climatic zone of Andhra Pradesh.

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