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# Effect of Varieties and Graded Levels of Sulphur on Yield, Quality and Economics of Summer Sesame

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## ABSTRACT

**Background:** India is experiencing a severe scarcity of edible oil, owing to high demand caused by population growth, rising living standards and increased demand from oil-consuming sectors. Sesame crop cultivation is gaining traction as a way to overcome the oilseed gap. The main aim of this study is to identify the suitable high yielding cultivar of sesame and to standardize the sulphur levels to obtain higher yield and quality.

**Methods:** The present investigation was carried out at S.V. Agricultural College Farm, Tirupati campus of Acharya N.G. Ranga Agricultural University during summer, 2019 in factorial randomized block design (RBD) with four varieties (YLM-66, YLM-17, YLM-11 and Madhavi) and four levels of sulphur (0, 20, 40 and 60 kg S ha$^{-1}$).

**Result:** The variety madhavi ($V_4$) took fewer days to attain 50 % flowering and maturity and the variety YLM 66 ($V_1$) recorded higher number of capsules plant$^{-1}$, seed yield, protein content, gross returns, net returns and benefit: cost. Application of 60 kg S ha$^{-1}$ recorded higher yield and yield attributes, oil content, gross returns and net returns of sesame which was however found on par with 40 kg S ha$^{-1}$. The interaction between sesame varieties and sulphur levels in influencing all the above parameters were found to be non-significant. In conclusion, the present study revealed that the variety YLM 66 ($V_1$) with application of 60 kg S ha$^{-1}$ gave higher yield and quality of sesame.

**Key words:** Madhavi, Sesame, Sulphur, Varieties, YLM-11, YLM-17, YLM-66.

## INTRODUCTION

Oilseeds are the primary source of fat and protein, predominantly for vegetarians. These play a significant role in the Indian economy, accounting for around 15% of total cropped area, almost 6% of gross national product and 7% of global edible oil consumption (Anonymous, 2013). India is experiencing a severe scarcity of edible oil, owing to high demand caused by population growth, rising living standards and increased demand from oil-consuming sectors. Soybean, sunflower and palm oil are used to provide most of this demand. In such circumstances, it is necessary to increase oil production self-sufficiency in order to fulfil rising consumer and industrial demand. Sesame crop cultivation is gaining traction as a way to overcome the oilseed gap (Daisy *et al.,* 2020).

Sesame (*Sesamum indicum* L.) is one of the world's oldest agricultural oilseed crops, having been cultivated in Asia for over 5000 years and commonly known as til, simsim, benised, gingelly, gergelim, *etc.* It is considered as most significant oilseed crop next to groundnut and mustard and is known as the "Queen of Oilseed Crops" due to its high quality. It is principally cultivated for the seeds, which contain 46-64 per cent oil and 25 per cent protein (Raja *et al.,* 2007). Sesame oil is high in polyunsaturated fatty acids, with 47 per cent oleic acid and 39 per cent linoleic acid. In India sesame productivity is restricted due to a lack of high yielding varieties, poor crop stand establishment, uneven ripening, lesser nutrient supply, capsule shattering, indeterminate growth habit and vulnerability to diseases. To overcome this situation, proper agronomic management practices should be adopted. Among the different adopted agronomic practices selecting varieties and nutrient application plays a significant role which determines the production potential of sesame crop (Ramakrishna, 2013).

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The majority of farmers cultivate indeterminate varieties with shattering capsules. They are thermo photosensitive and have limited flexibility. As a result, there is a need to discover varieties with greater adaptability, which can be cultivated in a wider range of environments and seasons. Oilseed crops, in comparison to cereals, require a higher level of sulphur for their growth and development. Among essential macro nutrients, sulphur is considered as the fourth most required element after nitrogen, phosphorus and potassium. Oilseed crops can make significant yields and quality if they have access to the right quantity of sulphur. It is essential for the synthesis of essential oils, the formation of chlorophyll and it also improves cold tolerance and drought hardiness of crops, particularly oilseed crops. It also boosts the availability of other minerals like phosphorus, potassium and zinc while lowering the intake of salt and chlorine, both of which are harmful to plant growth and development. Hence, there is utmost need to optimize the levels of sulphur for oilseed production. In the light of above consideration, the present study entitled "Effect of varieties and graded levels of sulphur on yield, quality and economics of summer sesame".

## MATERIALS AND METHODS

The present investigation was carried out at S.V. Agricultural College Farm, Tirupati campus of Acharya N.G. Ranga Agricultural University during summer, 2019 in factorial randomized block design (RBD) with four varieties (YLM-66, YLM-17, YLM-11 and Madhavi) and four levels of sulphur (0, 20, 40 and 60 kg S ha$^{-1}$) (Fig 1). The soil of the experimental field was sandy clay loam in texture, neutral in reaction, low in organic carbon, available nitrogen and available sulphur, medium in available phosphorus and potassium. Nitrogen (60 kg ha$^{-1}$ was supplied through urea in two equal splits at sowing and at 30 DAS.), phosphorus (30 kg ha$^{-1}$ through diammonium phosphate as basal) and potassium (15 kg ha$^{-1}$ through muriate of potash as basal) was applied as common to all the treatments. Sulphur was applied two days before sowing as per the treatments through bentonite sulphur.

## RESULTS AND DISCUSSION

### Days to 50% flowering and maturity

Among the different varieties tested, the earliest flowering and maturity was noticed with the variety Madhavi ($V_4$) which was followed by YLM-17 ($V_2$) with significant disparity between them (Table 1). This might be due to the genetic characters of the sesame varieties. These results are in accordance with Kalaiyarasan *et al.* (2016). The delay in flowering and maturity was observed with the variety YLM-66 ($V_1$).

No significant differences were found in days to 50 % flowering and maturity with regard to different levels of sulphur tried (Table 1). However, the application of sulphur @ 60 kg ha$^{-1}$ ($S_4$) took more number of days to attain 50 % flowering and maturity when compared to control. This might be attributed to higher uptake of nitrogen at higher sulphur levels, that promotes the vegetative growth there by delay in flowering and maturity. The results were in line with Abrha (2018).

### Yield and yield attributes

The sesame variety YLM-66 ($V_1$) recorded higher yield and yield attributes which was however found comparable with YLM-17 ($V_2$) except for number of seeds capsule$^{-1}$ and thousand seed weigh where former was significantly superior over the later variety (Table 1 and Fig 2). The improvement in yield and yield components of YLM-66 ($V_1$) might be attributed mostly to its genetic ability to more effectively use and translocate photosynthates from source to sink under a given set of climatic circumstances. The variety madhavi ($V_4$) recorded lowest yield and yield attributes of sesame. Similar results were reported by Mohan *et al.* (2017), Kumara *et al.* (2014), Tahir *et al.* (2014), Adebisi *et al.* (2005).

Among the different levels of sulphur tried, application of highest dose of sulphur @ 60 kg ha$^{-1}$ ($S_4$) registered higher yield and yield components (number of capsules plant$^{-1}$, number of seeds capsule$^{-1}$, thousand seed weigh and seed yield) of sesame which was found statistically at par with the application of sulphur @ 40 kg ha$^{-1}$ ($S_3$) (Table 1 and Fig 3). This might be due to proper partitioning of photosynthates, balanced nutritional environment as well as the stimulatory action of sulphur on protein synthesis, which improved photosynthesis and yield contributing components, resulting in maximum seed yields. The lower number of capsules plant$^{-1}$, number of seeds capsule$^{-1}$, thousand seed weigh and seed yield was recorded with control. The results are in agreement with Jat *et al.* (2017) and Tahir *et al.* (2014).

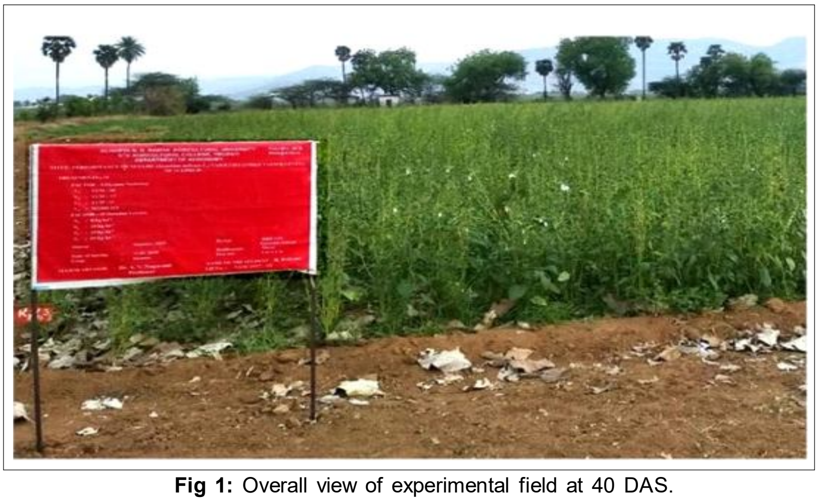

**Fig 1:** Overall view of experimental field at 40 DAS.

**Quality parameters**

Higher oil content (42.66 %) of sesame was recorded with the variety YLM-17 ($V_2$) which was however comparable with the variety YLM-66 ($V_1$). Among the different varieties tested, YLM-66 ($V_1$) registered higher oil content closely followed by YLM-17 ($V_2$) without significant difference between them (Table 2). Significantly lower values of oil content and protein content was recorded with the variety madhavi ($V_4$). This might be due to the genetic potential of the varieties. Similar results were reported by Chongdar *et al.* (2015), Tahir *et al.* (2014).

Application of sulphur @ 60 kg ha$^{-1}$ recorded significantly higher values of protein content when compared to the other lower levels of sulphur tried, however higher values of oil content was recorded with application of sulphur @ 60 kg ha$^{-1}$ which was found on par with 40 kg S ha$^{-1}$ (Table 2). Increase in sulphur levels increases oil content and protein content of sesame which might be due to more sulphur storage in plants at higher sulphur levels resulted in a better nutritional environment for the development of metabolites involved in plant oil biosynthesis and higher protein content of sesame was achieved by increasing the synthesis of sulphur containing aminoacids such as cystin, cysteine and methionine. The lowest values of quality parameters were recorded with control. These results were

**Table 1:** Days to 50 per cent flowering, maturity, yield and yield attributes of sesame as influenced by varieties and varied sulphur levels.

| Treatments | Days to 50 per cent flowering | Days to maturity | Number of capsules plant$^{-1}$ | Number of seeds capsule$^{-1}$ | Thousand seed weight (g) | Seed yield (kg ha$^{-1}$ ) |
|---|---|---|---|---|---|---|
| **Varieties** | | | | | | |
| $V_1$ : YLM-66 | 44.41 | 83.16 | 69.91 | 49.04 | 3.15 | 908 |
| $V_2$ : YLM-17 | 42.00 | 79.83 | 67.31 | 46.58 | 2.86 | 865 |
| $V_3$ : YLM-11 | 43.33 | 81.16 | 63.31 | 45.08 | 2.72 | 794 |
| $V_4$ : Madhavi | 40.41 | 77.50 | 58.45 | 42.87 | 2.48 | 732 |
| SEm± | 0.41 | 0.56 | 1.29 | 0.70 | 0.07 | 19.5 |
| CD ( P = 0.05) | 1.19 | 1.63 | 3.76 | 2.03 | 0.21 | 57 |
| **Sulphur levels** | | | | | | |
| $S_1$ : 0 kg ha$^{-1}$ | 42.08 | 79.50 | 58.84 | 42.37 | 2.57 | 708 |
| $S_2$ : 20 kg ha$^{-1}$ | 42.58 | 80.33 | 63.39 | 45.25 | 2.79 | 812 |
| $S_3$ : 40 kg ha$^{-1}$ | 42.66 | 80.75 | 67.75 | 47.54 | 2.89 | 873 |
| $S_4$ : 60 kg ha$^{-1}$ | 42.83 | 81.28 | 69.01 | 48.41 | 2.96 | 906 |
| SEm± | 0.41 | 0.56 | 1.29 | 0.70 | 0.07 | 19.5 |
| CD ( P = 0.05) | NS | NS | 3.76 | 2.03 | 0.21 | 57 |
| **Varieties × Sulphur levels** | | | | | | |
| SEm± | 0.82 | 1.12 | 2.59 | 1.40 | 0.15 | 39.1 |
| CD ( P = 0.05) | NS | NS | NS | NS | NS | NS |

**Table 2:** Oil content, protein content and economics of sesame as influenced by varieties and varied sulphur levels.

| Treatments | Oil content (%) | Protein content (%) | Gross returns (₹ ha$^{-1}$ ) | Net returns (₹ ha$^{-1}$ ) | B: C ratio |
|---|---|---|---|---|---|
| **Varieties** | | | | | |
| $V_1$ : YLM-66 | 42.24 | 21.37 | 54479 | 34171 | 2.67 |
| $V_2$ : YLM-17 | 42.66 | 20.16 | 51926 | 31618 | 2.55 |
| $V_3$ : YLM-11 | 41.33 | 18.40 | 47642 | 27334 | 2.34 |
| $V_4$ : Madhavi | 40.99 | 17.63 | 43891 | 23583 | 2.15 |
| SEm± | 0.24 | 0.41 | 1175.3 | 1175.2 | 0.05 |
| CD ( P = 0.05) | 0.69 | 1.21 | 3411 | 3411 | 0.16 |
| **Sulphur levels** | | | | | |
| $S_1$ : 0 kg ha$^{-1}$ | 39.83 | 16.56 | 42472 | 23814 | 2.27 |
| $S_2$ : 20 kg ha$^{-1}$ | 41.60 | 18.60 | 48720 | 28962 | 2.46 |
| $S_3$ : 40 kg ha$^{-1}$ | 42.52 | 20.33 | 52359 | 31501 | 2.51 |
| $S_4$ : 60 kg ha$^{-1}$ | 43.28 | 22.13 | 54385 | 32427 | 2.47 |
| SEm± | 0.24 | 0.41 | 1175.3 | 1175.2 | 0.05 |
| CD ( P = 0.05) | 0.69 | 1.21 | 3411 | 3411 | 0.16 |
| **Varieties × Sulphur levels** | | | | | |
| SEm± | 0.48 | 0.83 | 2351 | 2351 | 0.11 |
| CD ( P = 0.05) | NS | NS | NS | NS | NS |

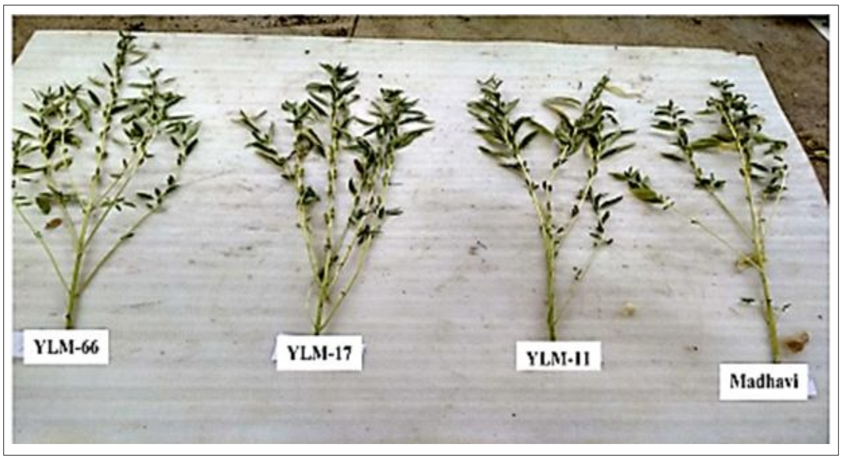


**Fig 2:** Performance of sesame varieties at 60 DAS.


**Fig 3:** Performance of sesame at varied levels of sulphur at 60 DAS.

in accordance with those reported by Mathew *et al.* (2013) and Tahir *et al.* (2014).

### Economics

Gross returns, net returns and benefit: cost ratio were significantly influenced by varieties and sulphur levels (Table 1). The highest gross returns, net returns and benefit: cost ratio were registered with the cultivation of variety YLM 66 ($V_1$) which was statistically on par with YLM 17 ($V_2$) (Table 2). The lower gross returns, net returns and benefit: cost was apprehended with Madhavi ($V_4$). Application of sulphur @ 60 kg ha$^{-1}$resulted in higher gross returns and net returns which was however at par with 40 kg S ha$^{-1}$ where as higher benefit: cost ratio was obtained with application of 40 kg S ha$^{-1}$ followed by application of 60 kg S ha$^{-1}$ without any significant disparity between them. With increase in levels of sulphur there is increase in yield and yield components that directly influences the increase in gross returns, net returns and benefit: cost of sesame. The lowest values were recorded with control. The present findings were in conformity with those of Parmar *et al.* (2018), Ravi *et al.* (2008) and Sharma (2011).

## CONCLUSION

In conclusion, the present investigation revealed that sesame variety YLM 66 in combination with 60 kg S ha$^{-1}$ is the best option for obtaining higher yield and quality. But in view of the economic returns, 40 kg S ha$^{-1}$ seems to be optimum since the discount in yield and economic returns was also not so large and have performed nearly equal with that of 60 kg S ha$^{-1}$.

**Conflict of interest:** None.

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