# Response of Irrigation and Sulphur on Growth and Yield of Semi-*rabi* Sesamum (*Sesamum indicum* L.)

**Nand Kishor Devanda, R.A. Patel* and H.K. Patel**

Department of Agronomy, B. A. College of Agriculture,
Anand Agricultural University Anand - 388 110, India.

(Received: 15 April 2015; accepted: 15 June 2015)

**A field experiment was conducted at College Agronomy Farm, Anand Agricultural University, Anand, Gujarat to study the effect of irrigation and sulphur on performance of sesamum (*Sesamum indicum* L.) during semi-*rabi* season of the year 2011-12. Higher values of growth characters, yield attributes, seed and stalk yield were recorded under irrigation treatment ($I_3$) i.e. Irrigation at branching+flowering +capsule formation+at seed filling stages. Each successive increase in the levels of sulphur from 0 to 40 kg ha$^{-1}$ significantly increased the growth and yield attributes as well as seed and stalk yield. Higher net realization and BCR ha$^{-1}$ were recorded under irrigation treatment $I_3$ (Irrigation at branching+flowering +capsule formation+at seed filling stages) and 40 kg S ha$^{-1}$.**

**Key words:** Irrigation, Sulphur, Sesamum and Yield.

Sesamum (*Sesamum indicum* L.) is an important edible oilseed crop in India and it is called "Queen" of oilseed, because of its quality. In India, sesame is cultivated under 1.80 m ha with a production of 0.46 m tones annually (Anonymous, 2011). Its average productivity (422 kg/ha) is below that of the worlds 489 kg/ha. This lower productivity was ascribed to lack of high yielding varieties and gap in adopting crop management technology and also due to the vagaries of monsoon during *kharif*. Hence, semi-*rabi* cultivation is practiced, which requires less frequent irrigations and sulphur fertilization.

Water plays a vital role in plant life.Assured water supply through efficient irrigation practice is an essential basic input for obtaining higher yield. Application of irrigation at branching, flowering and seed development stages increased yield attributing characters and yield of summer sesame (Dutta *et al.*, 2000).Sesame is usually not fertilized and it is grown under residual fertility of the previous crop. Sulphur as a 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. Sulphur is one of the 16 essential nutrients required by all plants for oil seed production, as one unit of sulphur produce 3-5 units of edible oil. Hence, the present study was carried out to know the effect of different irrigation regimes and sulphur on growth and yield of semi-*rabi*sesamum.

* To whom all correspondence should be addressed.
E-mail: rajni_abhishek@yahoo.co.in

## MATERIALS AND METHODS

An experiment was conducted at College Agronomy Farm, Anand Agricultural University, Anand (Gujarat) during *rabi* season of the year 2011-12. The soil of experimental field was loamy sand in texture, having low in organic carbon (0.45%) available nitrogen (221.54 kg ha$^{-1}$) and medium in available phosphorus (29.97 kg ha$^{-1}$), and available potash (187.54 kg ha$^{-1}$). The field capacity, wilting point and bulk density of experimental field were 13.92 %, 4.86 % and1.38 g/cc respectively, with good drainage capacity. The treatments comprising four levels of irrigation ($I_1$ - Irrigation at branching+ flowering stage (B+F), $I_2$-

Irrigation at branching+ flowering + capsule formation stages (B+F+C), $I_3$ - Irrigation at branching+ flowering + capsule formation + at seed filling stages (B+F+C+S) and $I_4$-0.6 IW: CPE ratio)and three levels of sulphur (0, 20 and 40 kg/ ha). The experiment was laid out in split plot design with four replications. Irrigation water of 50 mm (measured with the help of parshall flume) was allowed to run in each plot at each irrigation. Nitrogen and phosphorus were supplied through urea and DAP, respectively. Sulphur wasapplied as per treatment in the form of gypsum. N (25 kg / ha) and P (25 kg/ha) were applied as basaland mixed with the soil of the individual plots. Crop was harvested in the fourth week of December. The data recorded during the course of investigation were subjected to statistical analysis as per method of analysis of variance (Panse and Sukhatme, 1967).Sesame was sown on 23$^{rd}$September with seed rate of 5 kgha$^{-1}$.

## RESULTS AND DISCUSSION

### Effect of Irrigation

Data presented in Table 1 indicated that application of Irrigation at branching+flowering +capsule formation+at seed filling stages ($I_3$) recorded significantly higher plant height (102.03 cm) and the highest number of branches plant$^{-1}$ (4.13). These might be due to more availability of essential nutrients under irrigated condition, which resulted into balance nourishment of plants and the formation of taller, thicker stem ultimately increased number of branches plant$^{-1}$. Other reason for increasing in number of branches plant$^{-1}$ is maintenance of higher plant water status and cooler canopy which resulted in to more absorption of photosyntheticaly active radiation and higher rate of photosynthesis (Dutta *et.al*.,2000)

Further data revealed that number of capsules plant$^{-1}$ (36.77), length of capsules (2.79 cm) and number of seeds capsules$^{-1}$ were significantly higher under application of irrigation at branching+flowering +capsule formation+at seed filling stages ($I_3$). The reason for increasing length of capsule was frequent water supply and higher amount of water to soil that resulted in increasing uptake of water and provided the longest reproductive phase with larger photosynthetic green surface and reproductive storage capacity to attain higher allocation of dry matter in seed.The present finding is inclose agreement with those reported bySarkar *et al.*,2006).

Application of irrigation at branching+flowering +capsule formation+at seed filling stages ($I_3$) recorded significantly the highest seed yield (808 kg ha$^{-1}$) and higher stalk yield (2036 kg ha$^{-1}$). The increase in seed yield might be due to increase in irrigation frequency and consumptive use because of increased number of irrigations. Thus, progressive increase in seed yield due to favorable soil moisture conditions and better availability of soil moisture at higher frequency of irrigation throughout the crop growth period, which remarkably stimulated the yield attributes and finally on seed yield.The present findingsare inclose agreement with those reported byGarai and Dutta 2002, Khade*et.al*.,2006 and Saren*et.al*.,2005

### Effect of sulphur

Application of 40 kg S ha$^{-1}$ recorded significantly higher plant height (98.38 cm) and the highest number of branches plant$^{-1}$ (3.73). The increase in plant height might be due to the beneficial effect of sulphur on the various metabolic activities and also play important role in cell division, photosynthetic process and formation of chlorophyll in leaf.The increase in number of branches plant-1 might be due to sulphur is a part of amino acid (Cystine), which helps in chlorophyll formation, photosynthetic process (Bhosale*et.al*., 2011 and Sarkar and Banik 2002).

The presented result revealed that sulphur application @ 40 kg S ha$^{-1}$ recorded significantly the highest number of capsules plant$^{-1}$ (37.14), higher capsule length (2.75 cm) and number of seeds capsules$^{-1}$ (73.00). Increase in different yield attributing characters might be due to sulphur which is a part of amino acid (Cystine and Methionine), and helps in chlorophyll formation, photosynthetic process, activation of enzymes and seed formation (Sarkar & Banik 2002 and Patel *et.al.*, 2009).

Significantly the highest seed yield (781 kg ha$^{-1}$) and higher stalk yield (1943 kg ha$^{-1}$) were recorded under treatment $S_2$ (40 kg S ha$^{-1}$). The increase in seed yield under treatment $S_2$ (40 kg S ha$^{-1}$) was to the tune of 7.81 and 13.31 per cent over treatments, $S_0$ (0 kg S ha$^{-1}$) and $S_1$ (20 kg S ha$^{-1}$), respectively. The higher yield with sulphur application could be ascribed to accelerated

**Table 1.** Effect of irrigation and sulphur on growth and yield attributing characters, yield and economics of sesamum

| Treatments | Plant height (cm) | No. of branches plant$^{-1}$ | No. of capsules plant$^{-1}$ | Length of capsule (cm) | No. of seeds capsule$^{-1}$ | Seed yield (kg ha$^{-1}$) | Stalk yield (kg ha$^{-1}$) | Net realization (ha$^{-1}$) | BCR |
|---|---|---|---|---|---|---|---|---|---|
| Irrigation (I) at | | | | | | | | | |
| $I_1$: B + F | 88.08 | 2.45 | 32.83 | 2.57 | 64.67 | 634 | 1696 | 47257 | 2.78 |
| $I_2$: B + F + C | 94.54 | 3.25 | 34.95 | 2.72 | 71.17 | 730 | 1854 | 56566 | 3.26 |
| $I_3$: B + F + C + S | 102.03 | 4.13 | 36.77 | 2.79 | 73.75 | 808 | 2036 | 64087 | 3.61 |
| $I_4$: 0.6 IW:CPE ratio | 95.72 | 3.72 | 36.07 | 2.74 | 72.75 | 732 | 1860 | 56769 | 3.27 |
| S.Em.± | 2.68 | 0.09 | 0.71 | 0.03 | 1.07 | 29.91 | 68.26 | - | - |
| C.D. at 5% | 8.56 | 0.28 | 2.26 | 0.10 | 3.43 | 96 | 218 | - | - |
| C.V. % | 9.75 | 8.81 | 6.97 | 3.89 | 5.27 | 14.27 | 12.70 | - | - |
| Sulphur (S) (kg ha$^{-1}$) | | | | | | | | | |
| $S_0$: 0 kg S ha$^{-1}$ | 91.19 | 2.95 | 32.97 | 2.63 | 67.63 | 677 | 1794 | 53086 | 3.42 |
| $S_1$: 20 kg S ha$^{-1}$ | 95.71 | 3.49 | 35.34 | 2.73 | 70.88 | 720 | 1847 | 56993 | 3.58 |
| $S_2$: 40 kg S ha$^{-1}$ | 98.38 | 3.73 | 37.14 | 2.75 | 73.00 | 781 | 1943 | 62841 | 3.87 |
| S.Em.± | 1.24 | 0.06 | 0.37 | 0.02 | 0.76 | 15.61 | 38.73 | - | - |
| C.D. at 5% | 3.61 | 0.16 | 1.07 | 0.07 | 2.20 | 46 | 113 | - | - |
| C.V. % | 5.21 | 6.55 | 4.19 | 3.67 | 4.28 | 8.60 | 8.32 | - | - |

B = Branching stage, F = Flowering stage, C = Capsule formation stage, S = Seed filling stage

nutrients uptake helped the plant to put optimum growth. The stimulatory effect of applied sulphur on the synthesis of chloroplast and protein which in turn promoted greater photosynthesis ultimately resulted in higher seed yield (Duary and Mandal 2006 and Sarkar and Saha 2005).

**Interaction effect (IXS)**

Interaction effect of irrigation and sulphuron seed yield of sesamum was found significant (Table 2). Irrigation at branching, flowering, capsuleformation stages ($I_2$) with application of 40 kg S/ha ($S_2$) registered the higher seed yield (833 kg ha$^{-1}$) withnet return (66132 ha$^{-1}$),being at par with treatment combination $I_3S_1$, $I_4S_2$, $I_3S_0$, $I_3S_2$and $I_4S_1$.These findings are in line of the findings of those reported by Ghosh *et al*. (1997) and Saren*et al*. (2005).

**Table 2.** Interaction effect of irrigation and sulphur on seed yield of sesamum

| S\I | Seed yield (kg ha$^{-1}$) | | |
|---|---|---|---|
| | $S_0$ | $S_1$ | $S_2$ |
| $I_1$ | 583 | 631 | 687 |
| $I_2$ | 673 | 684 | 833 |
| $I_3$ | 813 | 818 | 793 |
| $I_4$ | 638 | 748 | 811 |
| S. Em. ± | | 31.23 | |
| C.D. at 5% | | 91 | |
| C.V. (%) | | 8.60 | |

**Economics**

From the presented data in Table-1 revealed that treatment $I_3$ (irrigation at branching+flowering +capsule formation+at seed filling stages) recorded significantly higher net realization (64087 Rs. ha$^{-1}$) with BCR 3.61 and application of 40 kg S ha$^{-1}$ recorded significantly higher net realization (62841 Rs. ha$^{-1}$) with BCR 3.87.

## CONCLUSION

From the above study it can be concluded that for securing higher yield and net return of sesamum. It is advised to irrigate the crop at branching + flowering + capsule formation + at seed filling stages conjunction with 40 kg S ha$^{-1}$.

## REFERENCES

1. Anonymous, (2011). Agricultural statistics at a Glance 2010, Department of agriculture & co-operation, ministry of agriculture Government of India, New Delhi.
2. Bhosale, N.D., Dabhi, B.M., Gaikwad, V.P. and

Chavan, A.B. Growth, yield and quality parameters of sesamum (*Sesamumindicum*L) as influenced by different levels of potash and sulphur, *Inter. J. Forestry & Crop Improv.*, 2011; **2**(2) : 121-123.
3. Duary, B. and Mandal, S. Response of summer sesame (*Sesamumindicum* L.) to varying levels of nitrogen and sulphur under irrigated condition. *J. Oilseeds Res*., 2006; **23** (1):109-112.
4. Dutta, D.; Jana, P. K.; Bandyopadhyay, P. and Maity, D. Response of summer sesame (*Sesamumindicum* L.) to irrigation. *Indian J. Agron.*, 2000; **45**(3): 613-616.
5. Garai, A. K. and Datta, J. K. Effect of different moisture regimes and growth retardants on consumptive use and water use efficiency in summer sesame (*Sesamumindicum* L. cv. Rama). *Agricultural Sci. Digt*., 2002; **22**(2): 96-98.
6. Ghosh, P., Jana, P. K. and Sounda, G. Effect of sulphur and irrigation on growth, yield, oil content and nutrient uptake by irrigated summer sesame. *Environ. and Eco.*, 1997; **15** (1): 83-89.
7. Khade, V. N.; Jadhav, S. N. and Khanvilkar, S. A. Studies on scheduling of irrigation and phosphate fertilization to sesamum. *J. Maharashtra Agril. Univ.*, 1996; **21**(3): 410- 411.
8. Panse, V. G. and Sukhatme, P. V. Statistical Methods for Agriculture Workers. ICAR, New Delhi, 1978; pp. 152-157.
9. Patel, P. N., Patel, P. G. and Patel B. T. Response of sesamum (*Sesamumindicum* L.) varieties to different levels of nitrogen and sulphur in loamy sand soils of north Gujarat. *GAU Res. J*., 2009; **34**(2): 150-151.
10. Saren B.K.; Nandi, P. and Tudu P. Effect of irrigation and sulphur on yield attributes and yield, oil content and oil yield and consumptive use efficiency of summer sesame (*Sesamumindicum* L.). *J. of Oilseeds Res.*, 2005; **22** (2):383-384.
11. Sarkar, R.K. and Banik, P. Effect of planting geometry, direction of planting and sulphur application on growth and productivity of sesamum (*Sesamumindicum* L.). *Indian J. of Agric. Sci*., 2002; **72** (2): 70-73.
12. Sarkar, R.K. andSaha, A. Analysis of growth and productivity of sesame (*Sesamumindicum* L.) in relation to nitrogen, sulphur and boron. *Indian J. Plant Physiol.*, 2005; **10**(4): 333-337.
13. Sarkar,S.,Dutta, J and Bardhu, S. Influenced of growth regulators on performance of seasamum under varying irrigation levels. *J. crop and weed*, 2006; **2**(2):1-4.