

Original Research Article

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Amalgamation of Irrigation and Major Nutrient with Sulphur Application for Augmentation of Yield and Economic Returns from Summer Sesame (*Sesamum indicum* L.)

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ABSTRACT

Keywords

Summer Sesame, IW/CPE, RDF, Sulphur, Seed yield, Stover, Net monetary return, B: C ratio.

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A field study was setup to amalgamate best irrigation with nutrient levels combination for higher yield of summer sesame var. AKT 101 during 2012 and 2013 at Agronomy Farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The results revealed that the seed and stover yield was significantly elevated with irrigation application at 1.0 IW/CPE followed by 0.8 IW/CPE. Nutrient management with 150 % RDF recorded significantly highest seed yield over rest of the combinations. Sulphur application @ 40 kg ha⁻¹ noted significant higher effect on yield contributing characters. Application of irrigation at 0.8 IW/CPE ratio fetched highest net return of Rs. 22728 ha⁻¹ with B: C ratio of 1.89 than 0.6 IW/CPE ratio, but it was par with irrigation at 1.0 IW/CPE ratio. Application of 150% RDF fetched 97% more net return than 50% RDF, with highest B: C ratio of 2.17. Irrigation at 0.8 IW/CPE with 150 % RDF recorded significantly highest net monetary return of Rs. 31157 ha⁻¹ over rest of the combinations which was at par with 1.0 IW/CPE.

Introduction

Sesame (*Sesamum indicum* L.) is one of the most important oilseed crops extensively grown in India which is variously known as sesamum, til, simsim, benised, gingelly, gergelim etc. Sesame is an important oilseed is cultivated under different agro-climatic regions of India because of its fast growth rate, short duration, less water requirement and wide adaptability under varying soil types. Its seeds contain about 50-52% oil, 17-19% protein, 0.1-0.5% fatty acids and 16-18% carbohydrates (Kahyaoglu and Kaya, 2006). Sesame oil is used as food (cooking and salad), medicine and soap manufacturing etc. Its seeds and young leaves are eaten as stews

and soaps in Asia (Pakissan.com, 2010). In India, during 2014-15, sesame is cultivated on 19.51 lakh ha area with annual production of 8.50 lakh tonnes. Its average productivity (436 kg ha⁻¹) is below than that of the world (535 kg ha⁻¹), whereas, Maharashtra produced 0.70 lakh tonnes sesame from an area of 0.25 lakh hectare with the average productivity of 280 kg ha⁻¹ (Annonymous, 2014).

Firstly, Sesame has low input requirement and high price of produce. Secondly, incidence of pest and diseases in summer condition is very low on sesame; it can be very well harvested. Considering these benefits, this crop is

decidedly preferred by farmers, who are having irrigation facility in summer. Among agronomic inputs, irrigation and nutrient are the most important input for boosting the yield and quality of summer sesame. Keeping in view the above facts, the present investigation was undertaken to evaluate the influence of irrigation, major nutrients and sulphur levels on yield and economics of summer sesame in Vidarbha region.

Materials and Methods

A field experiment was conducted on sesame variety AKT 101 at University Department of Agronomy Farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during summer season of 2012 and 2013. Experimental soil was clay loam in texture and slightly alkaline in reaction (pH 8.06) and EC (0.37). It was analyzed low in available nitrogen (223.72 kg ha⁻¹), medium in organic carbon (0.46%), medium in available phosphorus (16.92 kg ha⁻¹) and high in available potassium (394.13 kg ha⁻¹).

The experiment was laid out in split plot design with three replications. The treatments consisted of three moisture regimes (0.6, 0.8 and 1.0 IW/CPE) and three fertilizer levels viz. 50% RDF (12.5:12.5:0 kg NPK ha⁻¹), 100% RDF (25:25:0 kg NPK ha⁻¹) and 150% RDF (37.5:37.5:0 kg NPK ha⁻¹) were taken as main plot treatments while two levels of sulphur (20 kg and 40 kg S ha⁻¹) were allotted as sub plot treatment. Fertilizers were drilled in the soil as per treatment. A half dose of N and full dose of P and S were applied at the time of sowing and the remaining half dose of N was applied in the rows at 30 days after sowing.

Net monetary return was calculated by subtracting the cost of cultivation from gross monetary return treatment wise and the B: C ratio was worked out dividing gross monetary

return by cost of cultivation. The experimental data thus collected during the course of investigation were statistically analyzed with split plot design programmed on computer by adopting statistical techniques of analysis of variance (Gomez and Gomez, 1984).

Results and Discussion

Seed and stover yield

Data relevant to influence of various irrigation, RDF and sulphur along with their interactions on seed and stover yield and economics of summer sesame was presented in Table 1.

Seed and Stover yield of summer sesame var. AKT-101 was significantly influenced due to different irrigation application, RDF and sulphur levels. Irrigation application at 1.0 IW/CPE ratio recorded 34.61 % significantly higher seed yield (5.64 q ha⁻¹) over irrigation at 0.6 IW/CPE ratio (4.19 q ha⁻¹), but found at par when applied at 0.8 IW/CPE ratio. Stover yield was significantly increased with increase in irrigation levels. Significantly highest stover yield (82.13 q ha⁻¹) was acquired with irrigation applied at 1.0 IW/CPE ratio which was near about double than yield (39.94 q ha⁻¹) gained with irrigation supplied at 0.6 IW/CPE ratio.

The increase in seed and stover yield might be due favorable plant water balance maintained through increased irrigation resulted in better translocation of photosynthates and maintenance of cell turgidity, consequently leading to better growth and beneficial effect on flowering, better capsule setting and seed filling. This might be due to increase in the yield contributing attributes as the plant gets required quantity of water at 1.0 IW/CPE ratio. These results are in agreement with those of Tripathy and Bastia (2012).

Linear increasing trend was observed in seed and stover yield of sesame due to increase in RDF dose from 50 to 150 %. Significantly highest seed (6.22 q ha⁻¹) and stover (86 q ha⁻¹) yield were noted with 150 % RDF which were 52.29 % and 112.48 % more, respectively, than the seed (4.08 q ha⁻¹) and stover (40.47 q ha⁻¹) yield with 50 % RDF.

It might happen due to the better response of yield attributes to the increasing fertilizer levels. The same results in case of sesame yield were reported by De *et al.*, (2013); whereas, Prasanna kumara *et al.*, (2014), recorded negative response of sesame to

increasing fertilizer levels in terms of seed and stalk yield.

Seed yield was significantly influenced due to different sulphur levels, whereas, stover yield did not affected significantly. Higher dose of sulphur i.e. 40 kg ha⁻¹ yielded significantly highest seed yield (5.23 q ha⁻¹) than the lower dose 20 kg ha⁻¹(5.07 q ha⁻¹). Supply of S in addition to N, P and K had positive effect on the yield attributes as it increases the oil content of seed and therefore, finally increased the seed yield. These findings are in accordance with the earlier reports of Sonia Shilpi *et al.*, (2012).

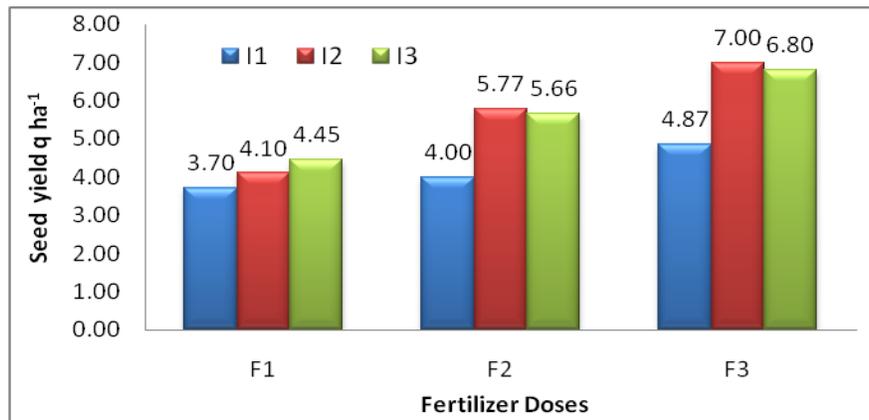
Table.1 Seed and Stover yield and economics of summer sesame as influenced by various irrigation, RDF and sulphur levels (Pooled)

Treatments	Seed yield (q ha ⁻¹)	Stover yield (q ha ⁻¹)	GMR (Rs. ha ⁻¹)	NMR (Rs. ha ⁻¹)	B:C ratio
Main Plot					
A) Irrigation Scheduling					
I ₁ – 0.6 IW/CPE	4.19	39.94	27226	14060	1.17
I ₂ – 0.8 IW/CPE	5.62	59.39	36555	22728	1.89
I ₃ – 1.0 IW/CPE	5.64	82.13	36640	22154	1.84
SE(m) ±	0.097	2.421	633.21	633.21	--
CD @5%	0.292	7.256	1898.17	1898.17	--
B) Fertilizer management					
F ₁ – 50 % RDF (12.5:12.5:0 kg NPK ha ⁻¹)	4.08	40.47	26552	13232	1.10
F ₂ – 100 % RDF (25:25:0 kg NPK ha ⁻¹)	5.14	55.00	33432	19606	1.63
F ₃ – 150% RDF (37.5:37.5:0 kg NPK ha ⁻¹)	6.22	86.00	40436	26104	2.17
SE(m) ±	0.097	2.421	633.21	633.21	--
CD @5%	0.292	7.256	1898.17	1898.17	--
Sub Plot					
C) Sulphur levels					
S ₁ – 20 kg S ha ⁻¹	5.07	59.28	32964	19798	1.64
S ₂ – 40 kg S ha ⁻¹	5.23	61.70	33982	19496	1.62
SE(m) ±	0.048	1.460	313.29	313.29	0.026
CD @5%	0.143	NS	930.74	NS	--
C.V. %	8.02	16.97	8.03	13.67	--
Interactions					
Irrigation x Fertilizer (AxB)					
SE(m) ±	0.17	4.19	1096.76	1096.76	--
CD @5%	0.51	12.57	3287.73	3287.73	--
Irrigation x Sulphur (AxC)					
SE(m) ±	0.08	2.53	542.64	542.64	--
CD @5%	NS	NS	NS	NS	--
Fertilizer x Sulphur (BxC)					
SE(m) ±	0.07	2.19	496.94	496.94	--
CD @5%	NS	NS	NS	NS	--
C.V. %	4.86	12.54	8.28	4.86	--

Table.2 Interaction effect of irrigation and RDF levels on NMR ha⁻¹ (Pooled)

Irrigation Levels	RDF Levels		
	F ₁ (50 % RDF)	F ₂ (100 % RDF)	F ₃ (150 % RDF)
I ₁ – 0.6 IW/CPE	11409	12805	17964
I ₂ – 0.8 IW/CPE	13337	23691	31157
I ₃ – 1.0 IW/CPE	14949	22322	29190
SE(m) ±	1096.76		
CD @5%	3287.73		

Fig.1 Sesame seed yield as influenced by irrigation and RDF levels interaction



Interaction effect of irrigation and RDF levels

Irrigation and RDF levels interacted significantly in respect of seed yield of sesame (Fig. 1). Irrigation at 0.8 IW/CPE ratio with 150 % RDF (I₂ x F₃) combination recorded significantly higher seed yield (7.00 q ha⁻¹) than all other combinations. However, it was found at par with irrigation at 1.0 IW/CPE with same level of RDF (I₃ x F₃) which yielded 6.80 q ha⁻¹. The increase in seed yield with the interaction between irrigation and RDF levels, might be due to the availability of water and N and P provides optimum ground for plant vegetative growth and increases plant photosynthesis area, assimilate production, number of capsules plant⁻¹ and number of seeds capsule⁻¹ and finally, significantly increases seed yield. These results are in line with the findings of Zeinolabedin Jouyban *et al.*, (2011) and Kashved *et al.*, (2010).

Economics

Data from table 1, pointed that Net monetary returns and Benefit: Cost ratio (B: C ratio) were significantly influenced with irrigation and RDF levels, whereas, sulphur levels didn't show significant appraisal. Application of irrigation at 0.8 IW/CPE ratio fetched highest net return of Rs. 22728 ha⁻¹ with B: C ratio of 1.89 than 0.6 IW/CPE ratio. But it was par with 1.0 IW/CPE ratio, recorded net return of Rs. 22154 ha⁻¹ with 1.84 B: C ratio.

Fertilizer application levels noted significant change in economic returns. Net monetary returns and B: C ratios were increased remarkably with raise in RDF levels from 50% to 150%. Application of 150% RDF fetched 97% more net returns than 50% RDF, with highest B: C ratio of 2.17. De *et al.*, (2013) also reported same trend of returns.

Interaction effect of irrigation and RDF levels on NMR

Records in Table 2 represented that significantly highest net returns of Rs. 31157 ha⁻¹ was obtained when crop was irrigated with 0.8 IW/CPE ratio along with 150 % RDF than other treatment combinations but found at par with 1.0 IW/CPE ratio along with 150 % RDF which fetches Rs. 29190 ha⁻¹ as net returns.

It can be concluded from the results and discussion of present investigation that the maximum seed yield (7.00 q ha⁻¹) with highest net returns of Rs. 31157 ha⁻¹ was harvested with irrigation schedule at 0.8 IW/CPE ratio in combination with application of 150 % RDF (37.5:37.5:0 kg NPK ha⁻¹).

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