Quality and Economics of Summer Sesame (*Sesamum indicum* L.) as Influenced by Irrigation and Nutrient Levels

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Abstract

A field study aimed to evolve efficient and economically viable irrigation schedule and nutrient management for improving quality and economics of summer sesame var. AKT 101 was conducted on clay-loam soil during summer season of 2010. Irrigation applied at 1.0 IW/CPE resulted in higher oil yield ha^{-1} whereas, irrigation at 0.8 IW/CPE gave maximum returns with B:C ratio. Among the nutrient levels, each successive dose from 50 to 150% RDF increased oil yield as well as net returns with B:C ratio. However, irrigation and nutrient had no significant effect on oil%. Both oil% and oil yield ha^{-1} was significantly increased up to 40 kg S ha^{-1} over 20 kg S ha^{-1}. However, 20 kg S ha^{-1} fetched highest net returns as well as B:C ratio than 40 kg S ha^{-1}. Combination of 0.8 IW/CPE and 150% RDF gave maximum oil yield and net returns but found at par with 1.0 IW/CPE and 150% RDF treatment combination.

1. Introduction

Sesame crop is grown in *kharif*, semi-*rabi* and summer situations. Since the crop has fewer problems of pest and diseases in summer condition, it can be very well harvested. Sesame had more preference from farmers because of low input required and high price of produce. Now-a-days, there are tremendous possibilities to extend the area under summer sesame cultivation. Hence, its agronomic parameters need to be standardized to realize its yield potential. Among agronomic inputs, irrigation and nutrients are the most important factors for boosting the yield, quality and economics of summer sesame. Therefore, the present investigation was undertaken to evaluate the effect of irrigation and nutrient management on quality and economics of summer sesame.

2. Materials and Methods

This field study was carried out during summer season of 2010 at Agronomy Farm, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharastra. The soil of the experimental plot was clay-loam (vertisol), slightly alkaline in reaction (pH 7.76), low in organic carbon, N and S, medium in P and moderately high in K. The FC and PWP were 31.45% and 16.24% respectively in 0-60 cm to soil layer and the BD in the same layer was 1.30 g cc^{-1}. The trial was conducted in split plot design with three replications on summer sesame var. AKT 101. The irrigation levels consisted of three moisture regimes (0.6, 0.8 and 1.0 IW/CPE) and three nutrient 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. Each plot was given equal quantity of irrigation water (907 litres) delivered by 1 inch water meter attached to the main water source. The depth of irrigation water was 60 mm and CPE was measured from USWB pan evaporimeter. 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.

The crude oil of sesame seed was determined by Suxhlet extraction method according to AOAC (2002) and from oil% oil yield (kg ha^{-1}) was worked out. 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).

3. Results and Discussion

3.1. Quality studies

3.1.1. Oil (%)

Data pertaining to oil % is given in Table 1 which indicated that oil % was not significantly affected by irrigation as well as nutrient levels. However, higher frequency of irrigation with 1.0 IW/CPE ratio recorded highest oil content of 49.50% followed by 0.8 and 0.6 IW/CPE ratio. Among the nutrient levels, 150% RDF contributed maximum oil% (49.82%) followed by 100% RDF (49.30%) and 50% RDF (48.63%). Application of sulphur significantly influenced the oil%. Sulphur 40 kg ha^{-1} recorded highest oil% (49.65) which was significantly superior over 20 kg S ha^{-1} (48.85%). Radhamani et al. (2001) and Maragatham et al. (2006) also reported the significant response of oil content of sesame to sulphur application.

3.1.2. Oil yield (kg ha^{-1})

Table 1: Quality and economics of summer sesame var. AKT 101 as affected by irrigation, nutrient and sulphur

Treatments	Oil (%)	Oil yield (kg ha^{-1})	Net monetary return (Rs. ha^{-1})	B:C ratio
Main plot (a) Irrigation levels				
0.6 IW/CPE ratio	48.76	184.33	12044	1.06
0.8 IW/CPE ratio	49.49	252.04	19581	1.72
1.0 IW/CPE ratio	49.50	252.07	18998	1.67
SEm±	0.32	4.43	571	-
CD (*p*=0.05)	NS	13.28	1713	-
(b) Nutrient levels				
50% RDF (12.5:12.5:0 kg NPK ha^{-1})	48.63	179.34	11088	0.97
100% RDF (25:25:0 kg NPK ha^{-1})	49.30	229.25	16837	1.48
150% RDF (37.5:37.5:0 kg NPK ha^{-1})	49.82	279.85	22698	1.99
SEm±	0.32	4.43	571	-
CD (*p*=0.05)	NS	13.28	1713	-
Sub plot Sulphur levels				
20 kg ha^{-1}	48.85	224.11	17075	1.50
40 kg ha^{-1}	49.65	234.85	16674	1.46
SEm±	0.17	2.19	283	--
CD (*p*=0.05)	0.51	6.51	NS	--

IW/CPE-Irrigation water:cumulative pan evaporation ratio; RDF-Recommended dose of fertilizer; NS-Non-significant

Data in Table 1 shows that oil yield of sesamum was minimum with irrigation at 0.6 IW:CPE ratio and increased with increase in the levels of irrigation. Scheduling of irrigation at 1.0 IW:CPE and irrigation at 0.8 IW:CPE were statistically at par with regard to oil yield and both of these treatments were significantly superior over 0.6 IW:CPE. This is in conformation with Dutta et al. (2000) who reported that increase in oil yield was due to increase in available soil moisture. On the other hand, there was significant increase in oil yield with successive increase in dose of nutrients. High nutrient level of 150% RDF recorded highest oil yield of 279.85 kg ha^{-1} and was significantly superior over low nutrient (50% RDF) and optimum nutrient level (100% RDF). Sulphur application, 40 kg ha^{-1} was significantly superior to produce highest oil yield (234.85 kg ha^{-1}) over 20 kg ha^{-1} (224.11 kg ha^{-1}). Tiwari et al. (2000) also reported that highest level of sulphur produced maximum oil yield ha^{-1} in sesame. The interaction effect of irrigation×nutrient was found only to be significant to oil yield ha^{-1}. Oil yield was highest with 0.8 IW/CPE and 150% RDF but was on par with 1.0 IW/CPE and 150% RDF and both of them were significantly superior over other treatment combinations (Table 2).

3.2. Economics

The maximum net return of ₹ 19581 ha^{-1} with B:C ratio of 1.72 was fetched at IW/CPE ratio of 0.8 but was at par with 1.0 IW/CPE ratio which gave a net return of ₹ 18998 ha^{-1} with B:C ratio of 1.67. High nutrient level (150% RDF) recorded highest net return of ₹ 22698 ha^{-1} with B:C ratio of 1.99 than 50% and 100% RDF. Between sulphur levels 20 kg ha^{-1} gave highest net return as well as B:C ratio over 40 kg ha^{-1} (Table 1). On the other hand, maximum net return of ₹ 27184 ha^{-1} was obtained when crop was irrigated with 0.8 IW/CPE along with 150% RDF but at the same time, the effect was on par with that of irrigation at 1.0 IW/CPE and 150% RDF which gave a net return of ₹ 25345 ha^{-1} (Table 2).

Table 2: Effect of irrigation× nutrient interaction on oil yield and net monetary return of summer sesame var. AKT 101

Treatments	Oil yield (kg ha^{-1})			Net monetary return (₹ ha^{-1})		
	50% RDF	100% RDF	150% RDF	50% RDF	100% RDF	150% RDF
0.6 IW/CPE	161.46	175.30	216.22	9655	10912	15565
0.8 IW/CPE	179.09	259.06	317.96	11110	20450	27184
1.0 IW/CPE	197.46	253.39	305.37	12499	19150	25345
SEm±		7.67			990	
CD (*p*=0.05)		23.00			2967	

IW/CPE-Irrigation water:cumulative pan evaporation ratio; RDF-Recommended dose of fertilizer; NS-Non-significant

4. Conclusion

Thus, it can be inferred that maximum oil yield from sesame can be harvested with irrigation at 0.8 IW/CPE ratio whereas, maximum profit can be gained with 37.5:37.5 kg NP ha^{-1} along with irrigation at 0.8 IW/CPE ratio during the summer season in Akola region of Maharastra, India.

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