

Original Research Article

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Performance of Summer Sesame under Different Irrigation Scheduling and Nutrient Levels in Vidarbha Region

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ABSTRACT

Keywords

Summer Sesame,
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A field study targeted to advance effectual irrigation schedule with nutrient levels for elevated yield of summer sesame var. AKT 101, was conducted during 2012 and 2013 at Agronomy Farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The results revealed that all the growth characters, yield attributes were significantly elevated with irrigation scheduling at 1.0 IW/CPE followed by 0.8 IW/CPE. Fertilizer 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. Irrigation scheduling at 0.8 IW/CPE with 150 % RDF recorded significantly highest seed yield over rest of the combinations which was at par with 1.0 IW/CPE.

Introduction

Sesame (*Sesamum indicum* L.) is a prehistoric oilseed crop. The crop has early origins in East Africa and in India (Bedigian, 2003). Sesame is known as the king of oil seeds due to the high oil content (50% - 60%) of its seed (Toan *et al.*, 2010). 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). Its oil-cake is good feed for poultry, goat, sheep, fish and cattle (Khan *et al.*, 2009).

In India, during 2013-14, sesame was cultivated on 16.67 lakh ha area with annual

production of 6.75 lakh tons. Its average productivity (405 kg ha⁻¹) is below than that of the world (535 kg ha⁻¹), whereas, Maharashtra produced 0.70 lakh tons sesame from an area of 0.25 lakh hectare with the average productivity of 280 kg ha⁻¹ (Anonymous, 2014).

Sesame has fewer problems of pest and diseases in summer condition; it can be very well harvested. Due to low input required and high price of produce of Sesame, the crop is decidedly preferred by farmers. Hence, to realize its yield potential, its agronomic parameters need to be standardized region

wise. Irrigation, nutrient and seed rate are the key factors for boosting the yield, quality and economics of summer sesame. Therefore, the present investigation was undertaken to evaluate the impact of irrigation and nutrient levels on growth, yield and economics of Summer Sesame in Vidarbha region

Materials and Methods

A two year 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), however, it was good for 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 below seed in the soil as per treatment.

A half dose of N and full dose of P and S was applied at the time of sowing and the remaining half dose of N was applied in the rows at 30 days after sowing. 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). The net plot is converted in to quintal per hectare by using hectare factor.

Results and Discussion

Growth attributes

Pooled data exhibited in Table 1, remarked that all yield contributing characters under study were significantly influenced due to irrigation levels. Increasing trend was observed in all growth parameters as irrigation level increases. Irrigation scheduling at 1.0 IW/CPE ratio recorded significantly highest values for plant height (98.54 cm), leaves plant⁻¹ (65.63), branches plant⁻¹ (4.31) and dry matter production plant⁻¹ (32.72 g) over irrigation scheduling at 0.8 and 0.6 IW/CPE ratio. Building of tissues, carrying of biochemical and physiological activities within the plant body to express itself, water is dominantly essential. Hence, maintaining optimum soil water regime in all the physiological stages might be the reason for manifestation of higher growth and dry matter production. Similar results were perceived by Kashved *et al.*, (2010), Tripathy and Bastia, (2012) and Damadar *et al.*, (2015).

Significant effects of different RDF doses were observed on growth contributing characters. The growth parameters showed an increasing trend with increasing IW/CPE ratio from 0.6 to 1.0. Application of 150 % RDF obtained significantly highest plant height (97.79 cm), number of leaves plant⁻¹ (61.11), number of branches plant⁻¹ (4.06) and dry matter production plant⁻¹ (26.84 g) over 100 and 50 % RDF.

This may happen due to the availability of every nutrient in sufficient quantity which created the favorable situation for physiological processes, metabolic activities and nutrient uptake, have a positive effect on formation of new cells, optimum cell division and stem elongation. These results are in conformity with findings of Sarkar *et al.*,

(2010), Damdar *et al.*, (2015) and Jadhav *et al.*, (2015). Growth attributes were not significantly affected due to sulphur levels, whereas, higher values were recorded with the application of sulphur 40kg ha⁻¹. Significant Interaction effect between irrigation scheduling at 1.0 IW/CPE ratio and fertilizer dose with 150% was found than any other combination.

Yield attributes

Data on yield attributes in Table 2 revealed that irrigation scheduling at 1.0 IW/CPE ratio

recorded significantly maximum number of capsules plant⁻¹, test weight and seed yield plant⁻¹ than 0.6 IW/CPE ratio was being at par with 0.8 IW/CPE ratio. The increase in yield attributes might be due favorable plant water balance maintained through proper irrigation scheduling resulted in better maintenance of cell turgidity, consequently leading to better growth and beneficial effect on translocation of photosynthates toward sink viz., flowering, better capsule setting and seed filling. These results are in agreement with those obtained by Tripathy and Bastia (2012) and Damadar *et al.*, (2015).

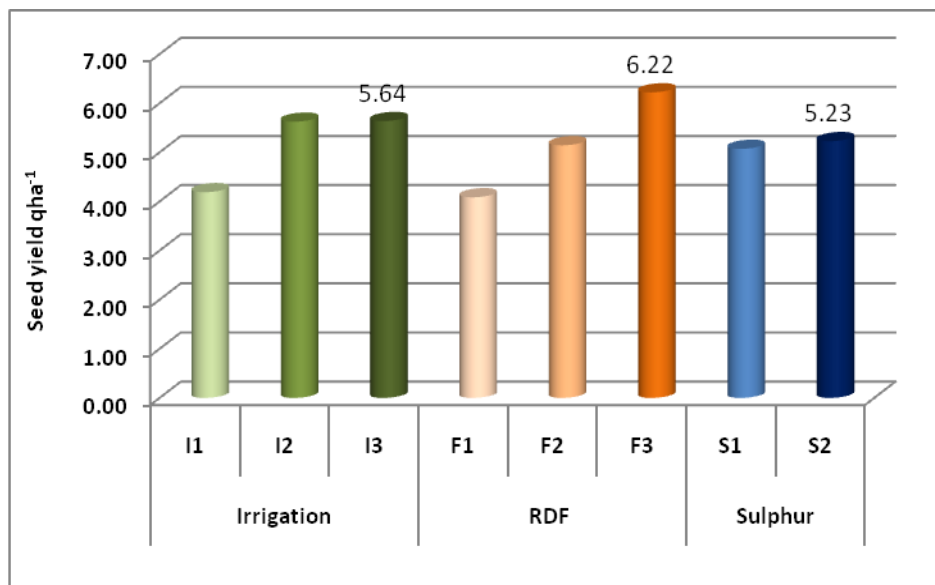
Table.1 Growth parameters, yields attributes and yield of summer Sesame as influenced by irrigation scheduling, nutrient and sulphur levels (Pooled)

Treatments	Plant height (cm)	Leaves plant ⁻¹	Branches plant ⁻¹	Dry matter plant ⁻¹ (g)	Capsules plant ⁻¹	Test weight (g)	Seed yield plant ⁻¹ (g)	Seed yield (q ha ⁻¹)	Stalk yield (q ha ⁻¹)
Main Plot									
A) Irrigation Scheduling									
I ₁ – 0.6 IW/CPE	81.03	44.84	2.87	13.52	34.95	1.96	1.62	4.19	39.94
I ₂ – 0.8 IW/CPE	93.04	55.33	3.24	18.57	54.12	2.32	2.32	5.62	59.39
I ₃ – 1.0 IW/CPE	98.54	65.63	4.31	32.72	55.72	2.57	2.40	5.64	82.13
SE (m) ±	1.15	1.21	0.08	0.44	0.936	0.064	0.045	0.097	2.421
CD @5%	3.43	3.64	0.23	1.31	2.805	0.191	0.135	0.292	7.256
B) Fertilizer management									
F ₁ – 50 % RDF	84.65	47.85	2.81	16.47	38.58	1.86	1.64	4.08	40.47
F ₂ – 100 % RDF	90.16	56.84	3.54	21.50	46.62	2.16	2.13	5.14	55.00
F ₃ – 150% RDF	97.79	61.11	4.06	26.84	59.59	2.82	2.56	6.22	86.00
SE (m) ±	1.15	1.21	0.08	0.44	0.936	0.064	0.045	0.097	2.421
CD @5%	3.43	3.64	0.23	1.31	2.805	0.191	0.135	0.292	7.256
Sub Plot									
C) Sulphur levels									
S ₁ – 20 kg S ha ⁻¹	90.45	54.94	3.38	21.12	46.93	2.16	2.07	5.07	59.28
S ₂ – 40 kg S ha ⁻¹	91.29	55.60	3.56	22.09	49.60	2.41	2.15	5.23	61.70
SE (m) ±	0.73	0.91	0.07	0.34	0.532	0.053	0.022	0.048	1.460
CD @5%	NS	NS	NS	NS	1.579	0.158	0.064	0.143	NS
C.V. %	5.35	9.32	9.46	8.57	8.22	11.83	9.03	8.02	16.97
Interactions									
Irrigation x Fertilizer (AxB)									
SE (m) ±	1.98	2.10	0.13	0.76	1.62	0.11	0.08	0.17	4.19
CD @5%	4.36	6.30	0.40	2.26	4.85	NS	0.23	0.51	12.57
Irrigation x Sulphur (AxC)									
SE (m) ±	1.26	1.58	0.128	0.59	0.92	0.09	0.04	0.08	2.53
CD @5%	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fertilizer x Sulphur (BxC)									
SE (m) ±	1.09	1.37	0.11	0.51	0.79	0.08	0.03	0.07	2.19
CD @5%	NS	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %	4.17	8.55	11.09	8.19	5.72	12.09	5.29	4.86	12.54

Table.2 Interaction effect of irrigation and RDF levels on seed yield (q ha⁻¹) of summer sesame (Pooled)

Irrigation Levels	RDF Levels		
	F ₁ (50 % RDF)	F ₂ (100 % RDF)	F ₃ (150 % RDF)
I ₁ – 0.6 IW/CPE	3.70	4.00	4.87
I ₂ – 0.8 IW/CPE	4.10	5.77	7.00
I ₃ – 1.0 IW/CPE	4.45	5.66	6.80
SE(m) ±	0.17		
CD @5%	0.51		

Fig.1 Effect of irrigation, RDF and sulphur levels on seed yield (q ha⁻¹) of summer sesame



Number of capsules plant⁻¹, test weight and seed yield plant⁻¹ were significantly increased as the RDF doses increased as 50, 100 and 150 %. Application of 150% RDF recorded significantly highest values for all yield attributes under study. This might be due to availability of sufficient quantity of nutrients when required which resulted in encouraged flowering, better capsule setting and seed filling. Damdar *et al.*, (2015) observed identical trend due to nitrogen application alone.

Significant effect of sulphur was recorded on yield attributes. Application of sulphur @ 40 kg ha⁻¹ recorded significantly higher number

of capsules plant⁻¹(49.60), test weight (2.41 g) and seed yield plant⁻¹ (2.15 g) than 20 kg ha⁻¹. Sonia Shilpi *et al.*, (2012) reported the same results with application of sulphur @ 40 kg ha⁻¹ than 20 and 0 kg ha⁻¹.

Yield studies

Irrigation, RDF and sulphur levels showed significant effect on seed and stalk yield of summer sesame var. AKT-101 (Fig. 1). Significantly highest seed yield (5.64 q ha⁻¹) was obtained with irrigation at 1.0 IW/CPE ratio which was 34.61 % greater than at 0.6 IW/CPE ratio, but found at par when applied at 0.8 IW/CPE ratio, whereas, stalk yield was

significantly increased with increase in irrigation levels. Highest stalk yield (82.13 q ha⁻¹) was observed with irrigation at 1.0 IW/CPE ratio which was near about double than yield obtained (39.94 q ha⁻¹) from irrigation at 0.6 IW/CPE ratio. This might be due to increase in the yield contributing attributes and dry matter production, as the plant gets required quantity of water at 1.0 IW/CPE ratio. These results are in agreement with those of Damdar *et al.*, (2015) and Jadhav *et al.*, (2015).

Linear increasing trend was observed in seed and stalk yield of sesame due to increase in RDF dose from 50 to 150 %. Significantly highest seed (6.22 q ha⁻¹) and stalk (86.00 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 stalk (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 oil yield of sesame were reported by Jadhav *et al.*, (2015), whereas, Prasanna kumara *et al.*, (2014), recorded negative response of sesame to increasing fertilizer levels in terms of seed and stalk yield. Higher dose of sulphur i.e. 40 kg ha⁻¹ significantly increase the seed yield by 3.09 % than the lower dose of 20 kg 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 Raja *et al.*, (2007) and Sonia Shilpi *et al.*, (2012). The stalk yield was not significantly influenced due to sulphur application.

Interaction effect of irrigation and RDF levels

Irrigation and RDF levels interacted significantly in respect of seed yield of

sesame (Table 2). 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 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 Damdar *et al.*, (2015) and Jadhav *et al.*, (2015).

It can be concluded from the present study that the maximum seed yield (7.00 q 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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