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Research Article

EFFECT OF PRE AND POST EMERGENCE HERBICIDES ON WEED DYNAMICS, QUALITY AND NUTRIENT CONTENTOF SUMMER SESAME (*Sesamum indicum* L.)

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Abstract: The field experiment was carried out during summer season of 2017 at the Instructional Farm, Department of Agronomy, College of Agriculture, JAU, Junagadh. The experiment comprising 12 treatments was laid out in randomized block design with three replications. Besides, weed free condition, Two HW at 20 and 40 DAS, Quizalofop-ethyl 40 g/ha as post-emergence at 20 DAS fb 1 HW at 40 DAS and Pendimethalin 750 g/ha as pre-emergence fb 1HW at 30 DAS were found more effective in reducing the weed population up to harvest and resulted in less dry weight of weeds, lower weed index and higher weed control efficiency and significantly higher values ofprotein, oil, N, P and K content in crop.

Keywords: Andhra Pradesh Grameena Vikas Bank, Impact, Socio-Economic Status, Agriculture Development, Significant

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Introduction

Sesame (*Sesamum indicum* L.) popularly known as Til, Tilli, Gingelly etc. is an important oilseed crop and belongs to the family Pedaliaceae. Its oil content varies from 46 to 52%. Protein content in seed varies between 20 to 26%. The seeds are used in the preparation of baby foods considered as the best substitute for mother's milk to compensate the breast feeding. Further 100 grams of sesame seed provide 592 calories energy. Thus, sesame oil may be a substitute of "Ghee" for poor man. Sesame is quality food, nutrition, edible oil, bio-medicine and health care, all in one and is often called as the "queen of oilseeds". The international demand and market of sesame has witnessed significant growth in the recent past Sesame is grown in all seasons of the year and being a short duration crop, fits well into various cropping systems. Sesame is grown in an area of 7.54 million hectares with a production of 3.34 million tonnes in the world with a productivity of 0.44 tons/ha. In India, sesame is cultivated on 1.9 million hectares with a production of 0.77 million tonnes. The productivity of sesame was 0.41 tons/ha as compared to world average of 0.44 tons/ha in the year 2012-13 [1]. In 2012-13, Gujarat state reported 0.13million hectares with production of 0.06 million tonnes and productivity of 0.49 tons/ha among them summer sesame reported 3700 hectares with production of 1955 tonnes and productivity of 0.49 tons/ha [2]. The crop has a wide range of adaptability to different agro-climatic conditions prevailing in India. Gujarat, West Bengal, Rajasthan, Tamil Nadu, Andhra Pradesh, Madhya Pradesh and Maharashtra are major growing states in the country. The major sesame growing areas in Gujarat are Rajkot, Amreli, Bhavnagar, Bhuj, Jamnagar, Junagadh and Surendranagar. Severe weed competition is one of the major constraints in lower productivity of sesame. The competitional stress of weeds on crop for nutrients, water, light and space are mainly responsible for poor yield of sesame. Prevalence of high temperature with less relative humidity during the crop season coupled with slow plant growth particularly, during early growth stages favour luxuriant weed growth since seedling emergence causes about 50 - 75% reduction in seed yield of sesame [3]. The period from 15-30 DAS is the most critical period of crop-weed competition in sesame [4]. Pre and Post-emergence application of herbicides may lead to cost effective control of the weeds right from the start which otherwise may not be possible by manual weeding. Simultaneous emergence and rapid growth of weed lead to severe weed-crop competition for light, moisture, space and nutrients resulting in drastic reduction in yield particularly under warm weather conditions. Though, use of herbicide has revolutionized weed control and reduced the cost of production but unfortunately, until now majority of the farmers had been quite ignorant about the proper doses of herbicides, time of application, their economics and their integration with hand weeding. Therefore, the study is proposed to find out economically effective method of weed control for realising higher productivity and profitability of sesame under summer conditions.

Materials and Methods

The field experiment entitled "Effect of pre and post emergence herbicides on weed dynamics, quality and nutrient content of summer Sesame (*Sesamum indicum* L.)" was conducted during summer season of the year 2017. The soil of the experimental plot was clayey in texture and slightly alkaline in reaction with pH 7.9 and EC 0.33 dS/m. The soil was medium in available nitrogen (258 kg/ha), phosphorus (27.50 kg/ha) and potash (236 kg/ha). Twelve weed management treatments comprising of T1 (Alachlor 750 g/ha as pre-emergence fb 1HW at 30 DAS), T2 (Oxyfluorfen 180 g/ha as pre-emergence fb 1HW at 30 DAS), T3 (Pendimethalin 750 g/ha as pre-emergence fb 1HW at 30 DAS), T4 (Tank-mix Alachlor 375 g/ha + Oxyfluorfen 90 g/ha as pre-emergence), T5 (Tank-mix Alachlor 375 g/ha + Pendimethalin 375 g/ha as pre- emergence), T6 (Tank-mix Oxyfluorfen 90 g/ha + Pendimethalin 375 g/ha as pre- emergence), T7 (Quizalofop-ethyl 40 g/ha as post-emergence at 20 DAS fb 1 HW at 40 DAS), T8 (Propaquizafop 70 g/ha as post-emergence at 20 DAS fb 1 HW at 40 DAS), T9 (Pendimethalin 750 g/ha as pre-emergence fb Quizalofop-ethyl 40 g/ha as post-

Table-1 Effect of different weed management treatments on sedge, monocot and dicot weeds count per m^2 at harvest in summer sesame

Treatments	Sedge weed count	Monocot weed count	Dicot weed count	Total density of weeds
T_1	3.97(15.33)	4.13(16.66)	3.66(13.00)	6.73(45.00)
T_2	3.62(12.66)	4.05(16.00)	3.62(12.66)	6.45(41.33)
T_3	3.58(12.33)	3.56(12.33)	3.22(10.00)	5.88(34.66)
T_4	4.91(23.66)	5.00(24.66)	4.72(22.00)	8.40(70.33)
T_5	4.95(24.00)	5.00(24.66)	4.83(23.00)	8.48(71.66)
T_6	5.09(25.66)	4.90(23.66)	4.86(23.33)	8.55(72.66)
T_7	3.29(10.33)	3.27(10.33)	3.65(13.00)	5.83(33.66)
T_8	3.62(12.66)	4.06(16.00)	3.79(14.00)	6.56(42.66)
T_9	4.45(19.33)	4.24(17.66)	4.74(22.33)	7.73(59.33)
T_{10}	3.08(9.00)	3.41(11.33)	2.77(7.33)	5.30(27.66)
T_{11}	0.71(0.00)	00.71(0.00)	0.71(0.00)	0.71(0.00)
T_{12}	7.80(60.33)	7.45(55.33)	6.82(46.33)	12.73(162)
S.Em.±	0.17	0.26	0.28	0.33
CD at 5 %	0.5	0.76	0.83	0.96
CV %	7.22	10.88	12.35	8.16

Table-2 Effect of different weed management treatments on dry weight of weed, weed index, weed control efficiency and quality parameters of summer sesame.

Treatments	Dry weight of weed (kg/ha)	Weed index (%)	Weed control efficiency (%)	Protein content (%)	Oil content (%)
T_1	338	14.22	88.4	20.02	47.47
T_2	333.33	17.83	88.52	19.75	47.04
T_3	279.33	13.28	90.46	21.44	47.57
T_4	1406	39.86	51.88	19.43	47.04
T_5	1421.33	35.57	51.38	19.56	46.44
T_6	1417	39.26	51.42	19.24	46.4
T_7	213.67	9.85	92.66	22.3	47.97
T_8	330	13.92	88.66	20.13	47.9
T_9	784	17.87	59.43	19.74	47
T_{10}	203	6.58	93.01	22.4	48.47
T_{11}	0	-	100	23.31	48.97
T_{12}	2921.67	73.61	-	18.67	45.97
S.Em.±	43.09	-	-	0.94	1.99
CD at 5 %	126.4	-	-	2.77	NS
CV %	8.91	-	-	7.97	7.27

Table-3 Effect of different weed management treatments on N, P and K content of seed, stover and weed in summer sesame

Treatments	N content (%)			P content (%)			K content (%)		
	Seed	Stover	Weed	Seed	Stover	Weed	Seed	Stover	Weed
T_1	3.2	1.77	1.29	0.72	0.39	0.39	0.83	1.35	0.96
T_2	3.16	1.76	1.28	0.73	0.41	0.39	0.84	1.34	0.96
T_3	3.43	1.85	1.23	0.75	0.43	0.3	0.86	1.36	0.73
T_4	3.11	1.7	1.32	0.69	0.39	0.4	0.75	1.25	0.97
T_5	3.13	1.7	1.31	0.69	0.39	0.41	0.76	1.26	0.96
T_6	3.08	1.69	1.3	0.67	0.39	0.4	0.77	1.25	0.96
T_7	3.57	1.96	1.2	0.76	0.43	0.28	0.93	1.44	0.61
T_8	3.22	1.79	1.29	0.73	0.41	0.39	0.82	1.35	0.96
T_9	3.16	1.78	1.29	0.72	0.41	0.38	0.81	1.32	0.97
T_{10}	3.58	1.97	1.02	0.8	0.44	0.26	0.99	1.52	0.51
T_{11}	3.73	2.04	0	0.83	0.47	0	1.03	1.55	0
T_{12}	2.99	1.67	1.41	0.65	0.37	0.42	0.7	1.18	0.99
S.Em.±	0.15	0.08	0.07	0.03	0.02	0.01	0.03	0.06	0.03
CD at 5 %	0.44	0.24	0.2	0.09	0.05	0.04	0.1	0.17	0.1
CV %	7.97	7.86	10.12	7.03	7.04	7.01	7.15	7.35	7.05

emergence at 20 DAS), T10 (Two HW at 20 and 40 DAS), T11 (Weed free) and T12 (Unweeded check) were tried under randomized block design with three replications. The pre-emergence applications of herbicides were applied after sowing and post-emergence at 20 and 40 DAS using water 500 l ha-1. The improved variety 'G.Til-3' was sown at 30 cm X 10 cmby bullock drawn seed drill at third week of February. The fertilizer dose of 50-25-40 kg N-P_2O_5-K_2O/hain form of Urea, Diammonium Phosphate and murate of potash was applied to the crop just before sowing. Thinning operations were undertaken 15 days after sowing to maintain intra-row spacing of 10 cm.

Results and Discussion

Effect on Weed Parameters

Weed count at harvest

Different weed management treatments marked their significantly effects on monocot, dicot and sedge weeds at harvest. All the weed management treatments (T1 to T11) significantly reduced the monocot, dicot and sedge weeds compared to unweeded check (T12) at harvest (Table 4.8 to 4.10). Next to weed free (T11), significantly the lowest sedge, monocot and dicot weeds count per m^2 at harvest were recorded under the treatment T10 (Two HW at 20 and 40 DAS), which remained statistically at par with the treatment T3 (Pendimethalin 750 g/ha as pre-emergence fb 1HW at 30 DAS). At 30 DAS, treatmentT9 (Pendimethalin 750 g/ha as pre-emergence fb Quizalofop-ethyl 40 g/ha as post-emergence at 20 DAS) also gave significantly at par result. Treatment unweeded check (T12) recorded significantly the highest weed population at harvest owing to unrestricted weed growth. These results are in close accordance with those [5-9].

Dry weight of weed, Weed index, Weed control efficiency

A perusal of data (Table 2.) showed that the Dry weight of weeds, Weed index, Weed control efficiency and were significantly influenced by different weed management treatments. Except weed free (T11), significantly the lowest dry weight of weeds and weed index was observed under the treatment T10 (Two HW at 20 and 40 DAS), which remained statistically at par with the treatments T7

(Quizalofop-ethyl 40 g/ha as post-emergence at 20 DAS fb 1 HW at 40 DAS) and T3 (Pendimethalin 750 g/ha as pre-emergence fb 1HW at 30 DAS). Next to weed free (T11), significantly higher weed control efficiency was obtained under treatment T10 (2 HW at 20 and 40 DAS) followed by T7 (Quizalofop-ethyl 40 g/ha as post-emergence at 20 DAS fb 1 HW at 40 DAS) and T3 (Pendimethalin 750 g/ha as pre-emergence fb 1HW at 30 DAS) with WCE of 92.66 and 90.46 %.The lowest weed population observed under this treatment due to weed free condition maintained by hand weeding as when needed and early season control of weeds by application of pre emergence herbicides and at later stage by post emergence herbicide. In addition to this, dense crop canopy might have suppressed weed growth and ultimately less weed population. The findings are in conformity with those reported [10-14].

Effect on Quality Parameters

Protein content (%) and Oil content (%)

Significantly higher protein content in seed (Table 2) was recorded under treatment T11 (Weed free), but it was statistically at par with treatments T10(2 HW at 20 and 40 DAS), T7 (Quizalofop-ethyl 40 g/ha as post-emergence at 20 DAS fb 1 HW at 40 DAS) and T3 (Pendimethalin 750 g/ha as pre-emergence fb 1HW at 30 DAS). Treatments T12 (unweeded check) observed the lowest protein content in seed. This might have increased absorption of nitrogen and water by the crop and least by weeds which in turn enhanced assimilation of nitrogen leading to increased synthesis of amino acid. Similar, results are also reported by [15]. There were non significant differences observed in oil content (Table 2) by various weed management treatments. However, the highest percentage of oil content was observed under weed free (T11) condition.

Effect on Chemical Parameters

NPK content (%) in seed, stover and weed

The content of nutrients in seed, stover and weeds (Table 4.14 to 4.16), were significantly influenced by different weed management treatments. Significantly higher NPK content in seed and stover was recorded under treatment T11 (Weed free), but it was statistically at par with treatments T10 (Two HW at 20 and 40 DAS), T7 (Quizalofop-ethyl 40 g/ha as post-emergence at 20 DAS fb 1 HW at 40 DAS) and T3 (Pendimethalin 750 g/ha as pre-emergence fb 1HW at 30 DAS) in case of N content and P content, while in case of K content it gave at par result with treatments T10 (Two HW at 20 and 40 DAS) and T7 (Quizalofop-ethyl 40 g/ha as post-emergence at 20 DAS fb 1 HW at 40 DAS). Further, next to the weed free (T11), significantly the lowest NPK content in weed was recorded under the treatment T10 (Two HW at 20 and 40 DAS), which remained statistically at par with treatment T7 (Quizalofop-ethyl 40 g/ha as post-emergence at 20 DAS fb 1 HW at 40 DAS), while for P content it also gave at par result with treatment T3 (Pendimethalin 750 g/ha as pre-emergence fb 1HW at 30 DAS).

It can be explained in the light of the facts that treatments T11, T10,T7 andT3 controlled the weeds effectively, might be made more nutrients available to crop and consequently encouraged higher concentration of nutrients and more yield and thereby higher uptake of nutrients. These findings corroborate the reports of [16] and [17].

Conclusion

On the basis of the results of the field study, it can be concluded that more effective weed management and significantly higher values of quality parameters viz., protein, oil and nutrients content in crop in summer sesame under South Saurashtra Agro-climatic Zone can be achieved by adopting hand weeding at 20 and 40 days after sowing. However, integration of post-emergence application of Quizalofop-ethyl 40 g/ha or pre-emergence application of Pendimethalin 750 g/ha with one hand weeding can be employed where there is scarcity of labours. Under sufficient availability of labours, keep sesame crop weed free through hand weeding as and when required.

Application of research: To find out effective method of weed control for realising higher productivity and profitability of sesame under summer conditions.

Research Category: Weed Science, Agronomy.

Abbreviations:

N: Nitrogen, P : Phosphorus, K : Potash
K_2O : Potassium oxide, P_2O_5 : Phosphorus pentoxide
ha : Hectare
HW : Hand Weeding
fb : Followed by
m^2 : Square metre
RBD : Randomized Block Design
S.Em. : Standard Error of Mean
Std. : Standard
t : Tonne
IC : Inter cultivation

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Study area / Sample Collection: Junagadh district of Gujarat state

Cultivar / Variety: Summer Sesame - 'G. Til-3'

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
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