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Integrated weed management in summer sesame

R.K. Mathukia*, B.K. Sagarka and C.N. Jadav
Department of Agronomy, Junagadh Agricultural University, Junagadh, Gujarat 362 001

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ABSTRACT

A field experiment was conducted during 2010 to 2012 at Junagadh (Gujarat) to study the integrated weed management in sesame. Pendimethalin as pre-emergence, while imazethapyr and quizalofop-ethyl as post-emergence were tested alone and in integration with hand weeding and interculturing. The quizalofop-ethyl 40 g/ha as post-emergence (20-25 DAS) + HW and IC (45 DAS) and pendimethalin 450 g/ha as pre-emergence + HW and IC (30 DAS) were found equally effective to the weed free check in controlling weeds and improving growth and yield attributes and ultimately seed yield (1.21 and 1.16 t/ha) and stalk yield (2.01 and 1.85 t/ha) of sesame. These treatments also recorded higher net returns (` 44,066 and 42,242/ha) and B:C ratio (3.58 and 3.54), therefore, these integrated weed management practices could become effective and economical under south Saurashtra agro-climatic conditions of Gujarat.

Key words: Hand weeding, Imazethapyr, Intercultivation, Pendimethalin, Quizalofop, Weed flora

Sesame (*Sesamum indicum* L.), commonly known as '*til*', is one of the important edible oilseeds cultivated in India. India is the major producer of this crop in the world and occupies well over 36% of the total acreage and contributes about 25% of the total output. In Gujarat, sesame is cultivated in about 2.89 lakh hectares area with an annual production of about 1.27 lakh tonnes of seeds and productivity of 438 kg/ha (DOA 2011). Sesame is grown in almost all the districts as a *Kharif* and semi-*Rabi* crop. Now sesame cultivation has also gained popularity as a summer irrigated crop in the state due to less infestation of pests and diseases as well as higher yield and monetary returns. Initial slow growth of sesame seedlings makes itself poor competitor with more vigorous weeds. Scanty scientific information is available regarding weed management in summer sesame especially for south Saurashtra region of Gujarat, hence, present experiment was undertaken to find out appropriate weed management practices for summer sesame.

MATERIALS AND METHODS

A field experiment was conducted at Weed Control Research Scheme, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh (Gujarat) during summer seasons of 2010 to 2012. The soil of the experimental plot was clayey in texture and slightly alkaline in reaction (pH 7.8 and EC 0.34 dS/m) as well as low in available nitrogen (239 kg/ha), available phosphorus (24.4 kg/ha) and medium in available potash (236 kg/ha). The experiment comprising of 12 treatments, *viz*. pendimethalin 450 g/ha as pre-emergence, pendimethalin 450 g/ha pre-emergence + HW and IC (30 DAS), imazethapyr 75 g/ha as post-emergence (20-25 DAS), imazethapyr 37.5 g/ha as post-emergence (20-25 DAS) + HW and IC (45 DAS), imazethapyr 75 g/ha as post-emergence (20-25 DAS) + HW and IC (45 DAS), quizalofop-ethyl 40 g/ha as post-emergence (20-25 DAS), quizalofop-ethyl 20 g/ha as post-emergence (20-25 DAS) + HW and IC (45 DAS), quizalofop-ethyl 40 g/ha as post-emergence (20-25 DAS) + HW and IC (45 DAS), HW and IC (20 DAS), HW and IC twice (20 and 40 DAS), weed-free check, and weedy check was laid out in randomized block design with three replications.

The sesame variety *'Gujarat Til 2'* was sown at 45 cm row spacing. The crop was fertilized with 50-11-0 kg NPK/ha as basal. The pre-emergence herbicides were applied to soil on next day of sowing, while post-emergence spray was done at 20-25 DAS according to soil moisture condition. The spray volume for pre- and post-emergent herbicide application was 500 L/ha. Inter-culturing (IC) was carried out in inter-row space through bullock drawn implement simultaneously with hand weeding (HW). The crop was raised as per the recommended package of practices.

RESULTS AND DISCUSSION

The weed flora of experimental field mainly comprised of *Cyperus rotundus*, *Echinocloa colona*, *Cynodon dactylon*, *Digitaria sanguinalis*, *Digera arvensis*, *Trianthema portulacastrum* and *Physalis minima*.

Effect on crop

Various weed management practices significantly influenced growth and yield attributes of sesame (Table 1). Significantly the highest plant

***Corresponding author:** rkmathukia@jau.in

height, number of branches per plant, number of capsules per plant and test weight were recorded under the weed-free check, however it remained at par with quizalofop-ethyl 40 g/ha as post-emergence + HW and IC, pendimethalin 450 g/ha as pre-emergence + HW and IC, HW and IC twice, quizalofop-ethyl 20 g/ha as post-emergence + HW and IC and imazethapyr 75 g/ha as post-emergence + HW and IC in respect of plant height, with quizalofop-ethyl 40 g/ha as post-emergence + HW and IC and pendimethalin 450 g/ha as pre-emergence + HW and IC in respect of number of branches per plant and test weight and with quizalofop-ethyl 40 g/ha as post-emergence + HW and IC, pendimethalin 450 g/ha as pre-emergence + HW and IC, HW and IC twice, and imazethapyr 75 g/ha as post-emergence + HW and IC in respect of number of capsules per plant. Whereas, significantly the lowest values of these growth and yield attributes were registered under the weedy check. Periodical removal of weeds by hand weeding and inter-culturing or herbicide application supplemented with weeding and inter-culturing suppressed weeds, which in turn provided better weed free environment to the crop during critical period for growth and development. Baskaran and Solaimalai (2002) also reported similar results.

Different weed management treatments significantly influenced the seed yield of sesame during individual years and in pooled results. The weed-free check yielded by producing significantly the highest seed yield of 1.36, 1.44, 1.33 and 1.38 t/ha during 2010, 2011, 2012 and in pooled results, respectively. The next best treatments in this regard were quizalofop-ethyl 40 g/ha as post-emergence + HW and IC, pendimethalin 450 g/ha as pre-emergence + HW and IC and HW and IC twice. Significantly the lowest seed yield (0.39, 0.30, 0.27 and 0.32 t/ha) was observed under the unweeded control during all the three years and in pooled results. The yield increased with weed-free, quizalofop-ethyl 40 g/ha as post-emergence + HW and IC, pendimethalin 450 g/ha as pre-emergence + HW and IC and HW and IC twice over the unweeded control was to the tune of 329, 278, 264 and 243%, respectively.

The highest stalk yield of 2.03, 2.18, 2.21 and 2.14 t/ha was recorded under the weed-free check in 2010, 2011, 2012 and in pooled results, respectively, however it remained at par with quizalofop-ethyl 40 g/ha as post-emergence + HW and IC, pendimethalin 450 g/ha as pre-emergence + HW and IC and HW and IC twice in 2010, with quizalofop-ethyl 40 g/ha as post-emergence + HW and IC and pendimethalin 450 g/ha as pre-emergence + HW and IC in 2011 and with quizalofop-ethyl 40 g/ha as post-emergence + HW and IC in 2012 and pooled results. Efficient control of weeds and improved growth and yield attributes under these treatments might have reflected in increased seed and stalk yields. Whereas, significantly the lowest stalk yield of 0.64, 0.89, 0.52 and 0.68 t/ha was registered under the weedy check in individual years and pooled results, respectively. These results were in conformity with findings of Punia *et al.* (2001) and Gnanavel and Anbhazhagan (2006).

Effect on weeds

The data (Table 2) indicated that different weed management treatments exerted significant effect on dry weight of weeds during 2010, 2011, 2012 and in pooled results. All the weed management treatments including weed-free treatment significantly reduced dry weight of weeds over the unweeded control. During all the individual years and in pooled results, the weed-free recorded significantly the lowest weed dry weight (0.17, 0.03, 0.02 and 0.07 t/ha), which was statistically at par with quizalofop-ethyl 40 g/ha as post-emergence + HW and IC, pendimethalin 450 g/ha

Table 1. Effect of integrated weed management on growth, yield attributes and yield of sesame

Treatment	Dose (g/ha)	Plant height (cm)	Branc-hes per plant	100-seed weight (g)	Seed yield (t/ha)				Stalk yield (t/ha)			
					2010	2011	2012	Pooled	2010	2011	2012	Pooled
Pendimethalin	450	50.6	2.20	4.93	0.68	0.72	0.54	0.64	1.05	1.17	0.89	1.04
Pendimethalin + HW and IC	450	62.5	2.87	5.70	1.14	1.21	1.16	1.17	1.77	1.90	1.88	1.85
Imazethapyr	75	53.4	2.40	4.84	0.70	0.78	0.65	0.71	1.12	1.28	1.07	1.16
Imazethapyr + HW and IC	37.5	46.0	1.93	4.40	0.44	0.51	0.40	0.45	0.71	0.90	0.70	0.76
Imazethapyr + HW and IC	75	58.1	2.73	5.31	0.89	0.95	0.86	0.90	1.49	1.55	1.39	1.48
Quizalofop	40	56.7	2.47	5.05	0.72	0.82	0.66	0.74	1.25	1.43	1.17	1.28
Quizalofop + HW and IC	20	58.3	2.60	5.16	0.76	0.84	0.71	0.77	1.39	1.47	1.24	1.37
Quizalofop + HW and IC	40	62.7	3.13	5.75	1.18	1.22	1.24	1.21	1.95	2.04	2.05	2.01
HW and IC		47.3	2.20	4.63	0.47	0.57	0.51	0.52	0.73	1.15	1.00	0.96
HW and IC twice		62.5	2.80	5.31	1.05	1.16	1.09	1.10	1.72	1.86	1.76	1.78
Weed-free		63.9	3.27	5.92	1.36	1.44	1.33	1.38	2.03	2.18	2.21	2.14
Weedy		45.8	1.87	4.15	0.39	0.30	0.27	0.32	0.64	0.89	0.52	0.68
LSD (P=0.05)		5.9	0.35	0.53	0.17	0.20	0.17	0.10	0.31	0.27	0.27	0.16

Table 2. Effect of integrated weed management on weed parameters and economics

Treatment	Dose (g/ha)	Weed dry weight (t/ha)				Weed density (no./m^2)*	WCE (%)	WI (%)	Net returns (x10^3 `/ha)	B:C
		2010	2011	2012	Pooled					
Pendimethalin	450	1.72	2.03	1.96	1.91	9.27 (86)	77	54	16.98	2.10
Pendimethalin + HW and IC	450	0.41	0.26	0.33	0.33	6.84 (47)	159	15	42.24	3.54
Imazethapyr	75	1.60	1.84	1.65	1.70	8.55 (73)	88	49	19.58	2.21
Imazethapyr + HW and IC	37.5	2.39	2.64	2.70	2.58	10.8 (117)	41	68	6.02	1.36
Imazethapyr + HW and IC	75	1.08	1.08	1.19	1.12	7.41 (55)	118	35	28.00	2.61
Quizalofop	40	1.37	1.12	1.03	1.17	7.76 (61)	115	47	21.22	2.34
Quizalofop + HW and IC	20	1.21	1.66	1.68	1.52	8.29 (69)	97	45	22.41	2.35
Quizalofop + HW and IC	40	0.28	0.29	0.25	0.27	6.11 (37)	162	12	44.07	3.58
HW and IC	-	2.01	2.41	2.63	2.35	9.85 (97)	53	63	10.20	1.64
HW and IC twice	-	0.47	0.50	0.52	0.50	7.22 (53)	151	20	38.40	3.25
Weed-free	-	0.17	0.03	0.02	0.07	3.50 (12)	173	0	49.93	3.56
Weedy	-	3.08	3.42	3.60	3.37	12.7 (163)	0	78	1.61	1.11
LSD (P=0.05)		0.39	0.41	0.43	0.23	1.68	-	-	-	-

*The data were subjected to $\sqrt{x+0.5}$ transformation and values in parentheses are original

as pre-emergence + HW and IC and HW and IC twice in 2010, with quizalofop-ethyl 40 g/ha as post-emergence+ HW and IC and pendimethalin 450 g/ha as pre-emergence + HW and IC in 2011 and 2012, and with quizalofop-ethyl 40 g/ha as post-emergence + HW and IC in pooled results. Whereas, the unweeded control recorded the highest dry weight of weeds.

Pooled over three years, significantly the lowest weed density (12 per m^2) was observed under the weed-free check, followed by quizalofop-ethyl 40 g/ha as post-emergence + HW and IC, pendimethalin 450 g/ha as pre-emergence + HW and IC and HW and IC twice, which have weed density of 37, 47 and 53 per/m^2, respectively. On the other hand, significantly the highest weed density (163 per m^2) was recorded under the weedy check. Mean data of weed control efficiency (WCE) and weed index (WI) given in Table-2 showed that the weed-free check recorded the highest WCE of 173%, followed by treatments, *viz*. quizalofop-ethyl at 40 g/ha as post-emergence + HW and IC, pendimethalin 450 g/ha as pre-emergence + HW and IC and HW and IC twice by recording WCE of 162, 159 and 151%, respectively. Similarly, treatments *viz*., quizalofop-ethyl 40 g/ha as post-emergence + HW and IC, pendimethalin 450 g/ha as pre-emergence + HW and IC and HW and IC twice recorded lower WI of 12, 15 and 20%, respectively. The results corroborate the findings of Sukhadia *et al*. (2004) and Gnanavel and Anbhazhagan (2006).

Economics

The weed-free check recorded maximum net returns of ` 49,927/ha, followed by quizalofop-ethyl 40 g/ha as post-emergence + HW and IC and pendimethalin 450 g/ha as pre-emergence + HW and IC, which gave net returns of ` 44,066 and 42,242/ha, respectiviely.

The maximum B:C ratio of 3.58 was accrued with quizalofop-ethyl 40 g/ha as post-emergence + HW and IC, closely followed by the weed free check and pendimethalin 450 g/ha as pre-emergence + HW and IC by recording B:C ratio of 3.56 and 3.54, respectively. Parasuraman and Rajagopal (1998) also reported analogous results.

It was concluded that effective control of weeds in summer sesame along with higher yield could be achieved by hand weeding and inter-culturing as and when required or application of quizalofop-ethyl 40 g/ha as post-emergence at 20-25 DAS + HW and IC at 45 DAS or pendimethalin 450 g/ha as pre-emergence + HW and IC at 30 DAS under south Saurashtra agro-climatic conditions of Gujarat.

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