

ORIGINAL ARTICLE

Effect of Mechanical and Chemical Weed Control Measures On Yield Attributes, Quality, Weed Study And Economics Of Sesame (*Sesamum indicum* L.)

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ABSTRACT

The present investigation entitled "Effect of mechanical and chemical weed control measures on growth, yield and quality of sesame" (*Sesamum indicum* L.) was conducted at Agronomy farm, College of Agriculture, Dapoli, Dist. Ratnagiri (M.S.) during Rabi season of 2014-15. The trial was laid out in a randomized block design. There were ten treatments which were replicated thrice. The treatments mainly comprised of Pendimethalin PE (T_1), Pendimethalin PE with HW at 15 DAS (T_2), Pendimethalin PE with HW at 30 DAS (T_3), Pendimethalin PE with HW at 45 DAS (T_4), Quizalofop-ethyl PoE (T_5), Quizalofop-ethyl PoE with HW at 45 (T_6), HW at 30 DAS (T_7), HW with hoeing at 45 DAS (T_8), HW at 15, 30 and 45 DAS (T_9) and Weedy check (T_{10}). The sowing was done in the experimental plot on 10th November, 2014 by dibbling method at a distance of 30 cm in between the rows and plant to plant 15 cm. The other common package of practices was followed at time to time and periodical growth observations were recorded. Results revealed that, the treatments viz., HW at 15, 30 and 45 DAS (weed free), Pendimethalin PE with HW at 30DAS and Quizalofop-ethyl PoE with HW at 45DAS produced higher growth, yield attributes, grain and straw yield ($q\ ha^{-1}$) as compared to rest of the treatments under study. Nutrient uptake by weeds was significantly less under HW at 15, 30 and 45DAS, Pendimethalin PE with HW at 30DAS, Quizalofop-ethyl PoE with HW at 45DAS while, maximum in weedy check. The nutrient uptake by crop was significantly found to be more under treatment HW at 15, 30 and 45DAS, Pendimethalin PE with HW at 30DAS, Quizalofop-ethyl PoE with HW at 45DAS. This particular combination i.e. Pendimethalin PE with HW at 30DAS showed great promise in respect of enhancing highest net return (Rs.20,467) and B: C ratio (1.54). On the basis of results obtained during study, it can be concluded that the herbicides with one manual weeding gives better results as compared to use of herbicides alone. The treatment Pendimethalin PE with HW at 30DAS was found to be most effective and economical treatment in respect of growing sesame crop.

Received 19/02/2017

Revised 20/04/2017

Accepted 30/06/2017

How to cite this article:

Shehal Mane, H.M.Patil And U. V. Mahadkar. Effect Of Mechanical And Chemical Weed Control Measures On Yield Attributes, Quality, Weed Study And Economics Of Sesame (*Sesamum indicum* L.). Adv. Biores., Vol 8 [4] July 2017: 168-172.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is an important oilseed crop in India. About 45 percent of the area lies in the India. Area under sesame crop in India is 17.03 lakh ha and total production is 7.5 lakh tone. India is world's largest producer of the sesame accounting 35 percent of the total production, but its average productivity is extremely low (274 kg/ha) [1, 2]. Moreover, seeds are rich source of edible oil (48-55%) and protein (20-28%) consisting both methionine and tryptophan, vitamins (niacine) and minerals (Ca and P). Since sesame seed oil is cholesterol free, it is also used in health food industries. Seeds are used as fried and mixed with sugar and in several forms in sweet meats. Sesame is grown in world on 6.3 million hectares. Inadequate weed management appears to be one of the major constraints for such low productivity of sesame. The period from 15 to 30 days after sowing is the most critical period of crop weed competition in the sesame. Hand weeding is commonly practiced by the farmer but weeding is not

possible due to scarcity of the farm labour and cost of weeding operation. Chemical weed control is easier, time saving, and economical compared to hand weeding.

MATERIAL AND METHODS

The present investigation was conducted at Agronomy Farm, Dr. B. S. K.K.V., Dapoli Dist. Ratnagiri (M.S.) during *rabi* 2014. The soil of experimental plot was sandy clay loam in texture and slightly acidic in reaction with medium in organic carbon. It was medium in available nitrogen and low in available phosphorus and moderately high in available potassium. The experiment was laid out in randomized block design with three replications. The gross plot size was 4.2 x 3.6 m² and net plot sizes were varying according to the spacing such as 3.90 x 3.00 m². The seed of JLT-408 was used for sowing. It matures at 80-85 days and yields about 7-8 quintals per hectare. The variety is moderately resistant to phyllody. Sowing was done by opening small furrows of about 3 cm depth with the help of marker at a distance of 30cm between the lines and 15 cm between plants. The sesame seed was sown about 3 cm deep manually at the rate of 3 kg per hectare and covered with soil. The recommended full dose of fertilizers was applied to each plot at the time of sowing. Herbicides were applied as per the treatments. Pendimethalin was applied as pre-emergence (2-3 DAS) and Quizalofop-ethyl was applied as post emergence (20 DAS).

Treatment details:

Symbol	Treatments	Dose (Kg a.i. ha ⁻¹)	Time of Application
T ₁	Pendimethalin (PE)	0.75	2-3 DAS
T ₂	Pendimethalin (PE) + One hand weeding at 15 DAS	0.75	2-3 DAS
T ₃	Pendimethalin (PE) + One hand weeding at 30DAS	0.75	2-3 DAS
T ₄	Pendimethalin (PE) + One hand weeding at 45 DAS	0.75	2-3 DAS
T ₅	Quizalofop-ethyl (POE)	0.05	20 DAS
T ₆	Quizalofop-ethyl (POE) + One HW at 45 DAS	0.05	20DAS
T ₇	Hand weeding	-	30DAS
T ₈	Hand weeding +Hoeing	-	45 DAS
T ₉	Weed free check	-	HW at 15,30 and 45 DAS
T ₁₀	Weedy check	-	-

RESULTS AND DISCUSSION

Among different weed control treatments the weed count recorded periodically from the different treatments that, the grassy and broad leaf weeds were significantly less under treatment T₉ at 20, 40, 60, 80 and harvest followed by treatment T₃ and T₆ and which at par with each other and significantly better than the other treatments except T₉ at 80 DAS and at harvest. Weed free check (HW at 15, 30 and 45 DAS) was found to be significantly effective or reducing the weed density and dry weight of weeds, which had shown the effect on different growth parameters in terms of the height of the plant, number of leaves, number of branches and dry matter accumulation per plant by the plant as well as yield and yield attributing characters of crop followed by the pre-emergence application of herbicide with hand weeding. Which proved significantly better by controlling the grassy and BLWs in early stage of crop growth while later emerged weeds were controlled by hand weeding as compared to sole application of the herbicides. Similar findings were reported by Bhadauria *et al.*[3]. Similarly, Bhadauria *et al.*[4] and Sheoran *et al.*[5] reported same result. Treatment T₁₀ recorded significantly higher population of grassy and broad leaf weeds than the other weed control treatments. This was due to unrestricted weed growth.

Effect of different weed control measures: Grassy weed count (0.25 m²) in Sesame:

At 20, 40, 60, 80 DAS and at harvest treatment T₉ recorded significantly lowest weed population of grassy weeds which was found to be superior over rest of the other treatments and at harvest T₃ and T₆ were statistically at par with each and significantly superior over other treatments except T₉. Further, at 20, 40 DAS, treatments T₃, T₁ and T₂ were at par with each other. At 60, 80 DAS and at harvest treatment T₆ and T₇ were found to be at par with each other.

Table 1. Effect of different weed control treatments on yield attributes and quality of sesame at harvest

Treatment	No of capsule per plant	No of seeds per capsule	Wt of capsule in (gm)	Oil content in seed (%)	Yield (q ha ⁻¹)	
					Grain	Straw
T1:Pendimethalin (PE) @ 0.75 kg a.i/ha	39.07	42.40	7.15	50.20	3.28	6.58
T2:Pendimethalin (PE) @ 0.75 kg a.i./ha + one HW at 15 DAS	43.47	45	10.56	50.23	3.66	7.37
T3:Pendimethalin (PE) @ 0.75 kg a.i/ha+ one HW at 30 DAS	45.60	48.50	13.11	50.91	5.32	12.47
T4:Pendimethalin (PE) @ 0.75 kg a.i/ha+ one HW at 45 DAS	42.27	43.73	10.20	50.19	3.53	7.16
T5:Quizalofop-ethyl (POE) 0.05 kg ai/ha	34	40.97	7.03	50.17	3.22	6.46
T6:Quizalofop-ethyl (POE) 0.05 kg ai/ha + one HW at 45 DAS	45.33	46.50	13.60	50.90	5.29	12.39
T7: HW at 30 DAS	44.20	46.23	11.55	50.86	4.57	11.19
T8 : HW and Hoeing at 45 DAS	43.33	44.77	11.13	50.82	4.20	10.02
T9: weed free check	47.20	49.83	16.37	51.10	7.33	17.07
T10: Weedy check	20.13	34.40	4.49	50.16	2.49	4.25
S.E.±	0.45	0.40	0.17	0.03	0.10	0.12
CD at 5%	1.24	1.11	0.48	0.09	0.24	0.32

Table 2. Effect of different weed control treatments on weed study, Weed index, and WCE

Treatment	Grassy weed count (0.25 m ⁻²)	Broad leaved weed count (0.25 m ⁻²)	Dry matter accumulation by weed (q ha ⁻¹)	Oil content in seed (%)	Weed Study	
					Weed Index	WCE (%)
T1:Pendimethalin (PE) @ 0.75 kg a.i/ha	6.33 (2.61)	13.00 (2.14)	4.65	50.20	55.25	61.99
T2:Pendimethalin (PE) @ 0.75 kg a.i./ha + one HW at 15 DAS	7.33 (2.80)	11.6 (2.10)	4.38	50.23	50.06	64.21
T3:Pendimethalin (PE) @ 0.75 kg a.i/ha+ one HW at 30 DAS	5.33 (2.41)	9.33 (2.01)	3.28	50.91	27.42	73.16
T4:Pendimethalin (PE) @ 0.75 kg a.i/ha+ one HW at 45 DAS	7.00 (2.73)	12.33 (2.12)	5.02	50.19	51.84	58.99
T5:Quizalofop-ethyl (POE) 0.05 kg ai/ha	7.33 (2.79)	18.67 (2.24)	6.39	50.17	56.07	47.79
T6:Quizalofop-ethyl (POE) 0.05 kg ai/ha + one HW at 45 DAS	5.00 (2.34)	10.33 (2.04)	3.43	50.90	27.83	71.98
T7: HW at 30 DAS	6.00 (2.54)	11.33 (2.09)	4.16	50.86	37.65	66.01
T8 : HW and Hoeing at 45 DAS	6.67 (2.68)	14.33 (2.18)	5.25	50.82	42.70	57.13
T9: weed free check	4.33 (2.20)	6.33 (1.86)	2.10	51.10	--	81.32
T10: Weedy check	14.67 (3.89)	34.00 (2.61)	12.25	50.16	--	--
S.E.±	0.10	0.04	0.40	0.03		
CD at 5%	0.27	0.12	1.10	0.09		

(%) of sesame at harvest.

Table 3. Effect of different weed control treatments on economics of sesame at harvest

Treatment	Total cost (₹ha ⁻¹)	Gross income (₹ ha ⁻¹)	Net income (₹ha ⁻¹)	B:C Ratio
T ₁ :Pendimethalin (PE) @ 0.75 kg a.i/ha	34671	35406	735	1.02
T ₂ :Pendimethalin (PE) @ 0.75 kg a.i./ha + one HW at 15 DAS	37371	39535	2164	1.06
T ₃ :Pendimethalin (PE) @ 0.75 kg a.i/ha+ one HW at 30 DAS	37371	57730	20359	1.54
T ₄ :Pendimethalin (PE) @ 0.75 kg a.i/ha+ one HW at 45 DAS	37371	38139	768	1.02
T ₅ :Quizalofop-ethyl (POE) 0.05 kg ai/ha	34753	34779	26	1.00
T ₆ :Quizalofop-ethyl (POE) 0.05 kg ai/ha + one HW at 45 DAS	37633	57403	19770	1.52
T ₇ : HW at 30 DAS	36500	49663	13163	1.36
T ₈ : HW and Hoeing at 45 DAS	37140	45603	8463	1.22
T ₉ : weed free check	42140	76965	34825	1.82
T ₁₀ : Weedy check	32060	26782	-5277	0.83
S.E.±	34671	35406	735	1.02
CD at 5%	37371	39535	2164	1.06

Broad leaved weed count (0.25 m⁻²) and Square root transformation:

Data reveals that, all the weed control treatments were significantly superior over treatment T₁₀ in controlling broad leaved weeds during all the stages of observation. At 20 DAS treatment T₉ recorded lowest weed population, but it was at par with treatment T₂. At 40, 60 and 80 DAS, treatment T₉ recorded lowest number of broad leaved weeds, which was significantly superior than the other treatments. Treatment T₇, T₂ and T₃ were found to be at par with each other at 40 DAS and at 60 DAS, T₃, T₆ and T₇ were at par with each other. At 80 DAS and at harvest, treatments T₃, T₆, T₇ and T₂ were at par with each other while, treatment T₉ was significantly superior to other treatments. Treatment T₁₀ recorded highest number of weeds over other treatments.

Dry weight of grasses and broad leaved weeds (g 0.25 m²) :

Data pertaining to the mean dry weight of grasses, sedges and broad leaved weeds in sesame as affected by various treatments..All weed control measures recorded significantly less dry weight of weeds than treatment T₁₀. At 40 and 80 DAS, treatment T₉ recorded lowest dry weight of weed, and which is significantly superior than the other treatments. Treatments T₄ and T₆, T₁ and T₆ were found to be at par with each other at 40 DAS, however, at 80 DAS treatment T₃ and T₆ found to be at par with each other. Treatments T₂, T₇ and T₄ were found to be at par with each other at 80 DAS. At harvest, treatment T₉ recorded lowest dry weight of weeds, which was found to be significantly superior than the other treatments. Treatments T₃, T₆, T₇ and T₂ were found to be at par with each other.

Weed Index (%) : The data revealed that, Weed free check produced significantly higher grain and straw yield of sesame over all treatments including weedy check. However, among the different treatment combinations tried to find best treatment to bring effective control of weeds with increasing grain and straw yield, it was seen that the treatment T₃ (Pendimethalin (PE) @ 0.75 kg a.i/ha+ one HW at 30 DAS) recorded least weed index (27.42%) followed by treatment T₆ (Quizalofop-ethyl (POE) 0.05 kg ai/ha with one HW at 45 DAS) (27.83%).

Effect on weed growth and weed control efficiency (%) :

Among the different weed control treatments, the treatment T₉ significantly recorded minimum total dry weight of weeds at 40, 80 DAS and at harvest and recorded maximum weed control efficiency. At harvest treatment T₃, T₆ and T₇ found to be at par with each other. Weed free treatment significantly effective by reducing weed growth and dry weight of weeds at 40, 80 DAS and at harvest and recorded maximum weed control efficiency at harvest. Similar finding were observed by Bhadauria *et al.* [4], while treatment T₃ and T₆ were found to be at par with each other at harvest, recorded minimum weed growth and maximum weed control efficiency. This is due to control of weeds by the herbicide and removal of grasses

and broad leaf weeds by one hand weeding at 30 DAS. Similar result were reported by Bhadauria *et al.*[4] and Sheoran *et al.* [5].

Quality studies in Sesame: Oil content in seed:

In respect of quality aspects oil contain in seeds significantly influenced due to different weed control treatments. The oil contain in seeds increased significantly under treatment T₉ followed by treatment T₃ and T₆ found to be at par with each other. Treatment T₉ recorded highest oil contain in seeds this may be owing to least weed competition and thereby highest nutrient uptake which increase the oil contain in seeds. Treatment T₁₀ recorded significantly lowest oil contain seeds. Similar type of results were also reported by and Sheoran *et al.*[5].

Economics of the treatments:

Economics of the different weed control measures indicated that net profit as well as B: C ratio was higher under treatment T₉ as compared to other treatments. It was followed by treatment T₃ and T₆. Bhadauria *et al.* [3] reported that, different weed management treatments increases the net profit, highest net profit recorded in weed free treatment followed by post emergence application of herbicide with one HW at 30 DAS and lowest net profit recorded in weedy check plot due to poor performance of the sesame crop because of excessive weed competition. While, similar result recorded by Bhadauria *et al.*[3] and Sheoran *et al.*[5].

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