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## Effect of different weed management practices on growth and yield of summer sesame (*Sesamum indicum*. L)

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**Abstract**

A field experiment was carried out to evaluate the effect of different weed management practices on growth and yield of summer sesame (*Sesamum indicum*. L) during summer season of 2018 at Agricultural Farm of Palli Siksha Bhavana, Visva-Bharati, Sriniketan, West Bengal. Eight weed management treatments namely- pendimethalin 750 g/ha at 1 DAS, butachlor 1000 g/ha at 3 DAS, pendimethalin 750 g/ha at 1 DAS fb 1 HW at 30 DAS, butachlor 1000 g/ha at 3 DAS fb 1 HW at 30 DAS, HW at 15 DAS, HW at 15 and 30 DAS, weed free check and weedy check were laid out in Randomized Block Design with three replications. The result revealed that integration of pendimethalin and butachlor each with one HW at 30 DAS recorded higher growth attributes, yield and yield components than their sole application. Although pendimethalin and butachlor fb one HW at 30 DAS registered higher gross return (₹82,687/ha and ₹76,405/ha, respectively) and net return (₹56,825/ha and ₹51,067/ha, respectively) but the return per rupee invested was higher in their sole application (3.27 and 3.20, respectively). Based on overall performance, sole application of pendimethalin 750 g/ha at 1 DAS and butachlor 1000 g/ha at 3 DAS may be considered as promising cost-effective herbicides for improvement on seed yield in summer sesame.

**Keywords:** Butachlor, herbicide, pendimethalin, sesame, weed management

**Introduction**

The oilseed sector occupies an important place in the Indian economy. It contributed about 15 % of the gross cropped area and accounting for nearly 5 % of gross national product and 7 % of edible oil consumption (Anonymous, 2009) [1]. In India the total area, production and productivity under oilseed crops is 24.65 million ha, 31.31 million tonnes and 1229 kg/ha, respectively (DES, 2018) [4]. Gujarat is the leading sesame producing state contributing 22.3% of total production followed by West Bengal (19.2%). Sesame (*Sesamum indicum* L.), commonly known as til belongs to the family *Pedaliaceae*. India ranks first both in area and production of sesame in the world. Sesame is quality food, nutrition, edible oil, bio-medicine and health care, all in one and is often called as the 'queen of oilseeds'.

Sesame is grown throughout the year and being a short duration crop, fits well into various cropping systems. Now sesame cultivation is gaining popularity as a summer (pre-kharif) irrigated crop during warm and humid months in the many parts of the country due to less infestation of pests and diseases as well as higher yield and monetary returns. It can be cultivated in all seasons in the sub-tropical plains of West Bengal. Though the country ranks first in area and production of sesame in the world, the productivity of sesame is the lowest in the world due to its cultivation in marginal and sub marginal soils under rainfed situation with poor agronomic management practices (Bhadauria, 2012) [2]. Among the several constraints in sesame production, weed infestation is one of the major factors limiting the yield of sesame. Weeds cause enormous stress at the initial growth stages that affects the economic yield of sesame. (Channappagoudar *et al.*, 2008) [3]. In most of the areas sesame crop is heavily infested by weeds and thereby resulting in heavy yield loss ranging from 16-68% in sesame (Duary and Hazra, 2013) [5]. The period from 15-30 DAS is the most critical period of crop-weed competition in sesame (Venkatakrishan and Gnanamurthy, 1998a) [14].

Therefore, weed management is essential in sesame to minimise the losses caused by weeds. Weeds can be effectively managed by preventive, cultural, mechanical, chemical and

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biological methods. Mechanical weed control is often difficult during the initial stage of the crop where conventional methods like manual weeding is most commonly practised by the farmers to control weeds in sesame. But it is labour intensive, expensive and not feasible under all situations due to non-availability of labour during peak periods of agricultural operations. However chemical method is more favourable and effective due to their quick action, selectivity and cost effectiveness. Thus, an alternative weed control involving combination of both the cultural practices and use of chemical herbicides could be a more time saving, economical and an efficient approach to control weeds at an early period of crop-weed competition and to keep the weed population below threshold level.

### Materials and Methods

The experiment was conducted during pre-kharif season of 2018 at Agricultural Farm of Palli Siksha Bhavana, Visva-Bharati, Sriniketan, West Bengal to study the effect of different weed management practices on growth and yield of

summer sesame (*Sesamum indicum*. L). The predominant weed flora observed in sesame field were *Digitaria sanguinalis*, *Echinochloa colona*, *Cynodon dactylon*, *Cyperus iria*, *Cyperus rotundus*, *Eclipta alba*, *Trianthema portulacastrum* and *Spilanthes acmella*. The experiment was carried out in randomized block complete design consisting eight weed management treatments namely-Pendimethalin 750 g/ha at 1 DAS, Butachlor 1000 g/ha at 3 DAS, Pendimethalin 750 g/ha at 1 DAS fb 1 HW at 30 DAS, Butachlor 1000 g/ha at 3 DAS fb 1 HW at 30 DAS, HW at 15 DAS, HW at 15 and 30 DAS, Weed Free Check and Weedy Check. The study area was situated at about 23°39' N latitude and 87°42'E longitude with an average altitude of 58.90 m above the mean sea level under sub-humid, semi-arid region of West Bengal. The long term average minimum weekly temperature ranged from 19.84 °C in March to 26.65 °C in June; while the maximum temperature varied from 35.46 °C in March to 35.82 °C in June and the area receives rainfall of 191.6 mm during the cropping season i.e. March to June (Figure 1).

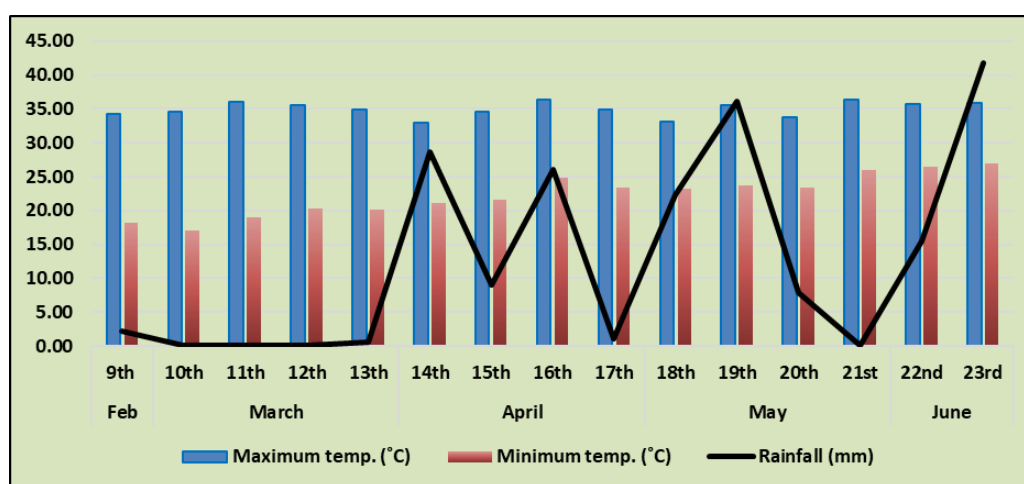


Fig 1: Weekly variation in temperature (°C) and rainfall (mm) during cropping season at experimental field

The sesame cultivar Rama was grown with seed rate of 5-6 kg /ha and fertilizer dose of 80:40:40 kg N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O /ha was applied to crop during the experiment. Observations was taken on growth and yield attributes like plant height (cm), no. of branches/plant, crop growth (g/m<sup>2</sup>/day), no. of capsule/plant, no. of seeds/capsule, seed yield (kg/ha) and stick yield (kg/ha), harvest index (HI) % as well as economics of sesame cultivation. The soil was sandy loam (*Ultisol*) in texture having pH 5.82, organic carbon 0.37 %, available N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O 262, 21.11, 152 kg /ha respectively. The details of herbicides used in the experiment are mentioned below-

#### Pendimethalin 30 EC

Pendimethalin [N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamide] is a dinitroaniline group of herbicide used as selective, pre-emergence application to control most annual grasses and certain broadleaved weeds. It inhibits root and shoot growth. It controls the weed population and prevents weeds from emerging, particularly during the crucial development phase of the crop. Its primary mode of action is to prevent plant cell division and elongation in susceptible species.

#### Butachlor 50 EC

Butachlor [N-(butoxymethyl)-2-chloro-N-(2,6-diethylphenyl)acetamide] is a pre-emergence herbicide, applied in several

crops like groundnut, sesame, potato, soybean and other pulses. It is very effective against annual grass weeds like *Echinochloa sp.*, *Digitaria sanguinalis* and certain sedges. It is selective, systemic herbicide, absorbed primarily by the germinating shoots and secondarily by the roots with translocation throughout the plant, giving higher concentration in vegetative parts than in reproductive parts. It inhibits cell division by blocking protein synthesis.

### Results and Discussion

#### Effect on crop growth

Among the weed management treatments, pendimethalin 750 g/ha at 1 DAS fb 1 HW at 30 DAS attained the highest plant height at every observation followed by butachlor 1000 g/ha at 3 DAS fb 1 HW at 30 DAS (Table 1). Pendimethalin 750 g/ha at 1 DAS and butachlor 1000 g/ha at 3 DAS also recorded higher plant height. This might be due to the greater broad spectrum weed controlling ability of these two herbicides which resulted in better utilization of growth resources leading to increase in plant height. The results are in conformity with the findings of Subramanyam *et al.* (2016)<sup>[12]</sup>. Hand weeding twice also recorded higher plant height due to removal of weeds manually two times. Similar results were reported by Singh *et al.* (2018)<sup>[11]</sup>.

Application of pendimethalin and butachlor either sole or integrated increased the number of branches/plant as they

maintained broad spectrum weeds from the beginning of crop growth, utilizing growth resources efficiently leading to higher number of branches. The results were in conformity with the results of Jha and Monika Soni (2013) [7]. Pendimethalin and butachlor maintained higher CGR from the beginning of crop growth due to their greater efficacy of weed control, thus utilized natural resources more efficiently. Sumathi *et al.* (2010) [13] reported similar findings. At 30

DAS, due to hand weeding most of the weeds were removed, that facilitated better environment to the crop for utilization of more growth resources which resulted higher dry matter accumulation, ultimately leading to higher CGR. Hand weeding twice reduced the weed population that in turn increased growth attributes, helped the crop to accumulate higher dry matter which gave higher CGR.

**Table 1:** Effect of weed management practices on different growth stages of sesame cultivation

Treatments	Plant height(cm)				Number of branches/ plant			CGR (g/m <sup>2</sup> /day)	
	25 DAS	50 DAS	75 DAS	At Harvest	50 DAS	75 DAS	At Harvest	25-50 DAS	50-75 DAS
Pendimethalin 750 g/ha at 1 DAS	14.13	104.20	131.53	133.40	7.33	7.67	7.73	5.50	15.85
Butachlor 1000 g/ha at 3 DAS	13.74	101.20	130.20	131.73	6.60	6.73	6.80	5.44	15.58
Pendimethalin 750 g/ha at 1 DAS fb 1 HW at 30 DAS	14.97	109.07	137.47	139.40	8.60	9.07	9.13	5.76	16.67
Butachlor 1000 g/ha at 3 DAS fb1 HW at 30 DAS	14.05	107.33	135.27	137.27	8.07	8.27	8.33	5.66	16.64
HW at 15 DAS	13.79	101.30	126.13	127.73	6.00	6.20	6.60	4.81	14.48
HW at 15& 30 DAS	14.31	102.47	130.73	129.40	6.33	6.60	6.67	5.37	15.52
Weed Free Check	16.13	112.53	139.80	141.53	8.87	9.27	9.33	6.25	16.70
Weedy Check	12.21	75.87	98.20	99.20	4.67	5.00	5.13	2.76	14.04
S.Em(±)	0.59	4.40	5.33	5.35	0.41	0.36	0.39	0.24	0.59
CD at 5%	NS	13.34	16.17	16.21	1.24	1.07	1.16	0.73	1.80
CV(%)	7.26	7.49	7.17	7.13	10.02	8.42	8.94	8.09	6.56

### Effect on yield attributes and yield

The effect of herbicides on yield attributes and yield of summer sesame was found significant (Table 2). The application of pendimethalin 750 g/ha at 1 DAS as pre-emergence fb 1 HW at 30 DAS and butachlor 1000 g/ha at 3 DAS as pre-emergence fb 1 HW at 30 DAS showed the similar effect in increasing the yield attributes like number of capsules/plant, no. of seeds/capsule; seed and stick yield of summer sesame and were significantly superior over control i.e. weedy check (490 kg/ha). Pendimethalin and butachlor effectively controlled grassy weeds and BLWs, provided desirable level of broad spectrum weed management

facilitating favourable environment of plant growth resulting the highest number of capsules/plant. Similar results were reported by Duary *et al.*, (2011) [6] and Duary and Hazra, (2013) [5]. Moreover, the competition between sesame and weed was minimum with these above mentioned herbicides, which helped promoting growth attributes, efficient translocation of photosynthates from source to sink as a result of more utilization of growth resources and partitioning dry matter towards seed formation. The results are in conformity with the findings of Yadav *et al.* (2002) [15], Zubair *et al.* (2011) [16].

**Table 2:** Effect of weed management practices on yield attributes of sesame cultivation

Treatments	No. of capsules/plant	No. of seeds/capsule	Test weight (g)	Seed Yield (kg/ha)	Stick Yield (kg/ha)	Harvest Index (%)
Pendimethalin 750 g/ha at 1 DAS	73.47	66.67	2.57	1100.00	2733.33	28.60
Butachlor 1000 g/ha at 3 DAS	68.47	63.44	2.53	1050.00	2676.67	28.12
Pendimethalin 750 g/ha at 1 DAS fb 1 HW at 30 DAS	78.60	74.56	2.67	1300.00	2900.00	31.00
Butachlor 1000 g/ha at 3 DAS fb1 HW at 30 DAS	75.80	71.00	2.62	1200.00	2833.34	29.81
HW at 15 DAS	61.00	57.33	2.48	761.67	2100.33	26.55
HW at 15& 30 DAS	64.27	60.67	2.50	990.00	2666.67	27.07
Weed Free Check	79.40	79.22	2.69	1440.67	3046.67	32.14
Weedy Check	48.40	50.67	2.29	490.00	1500.00	24.71
S.Em(±)	3.58	2.85	0.08	65.79	105.30	0.87
CD at 5%	10.85	8.64	NS	199.55	319.40	2.64
CV(%)	9.02	7.53	5.38	10.94	7.13	5.29

However higher seed yield of summer sesame (1300 kg/ha) was observed with the application of pendimethalin 750 g/ha at 1 DAS as pre emergence fb 1 HW at 30 DAS. It might be due to reduced crop-weed competition, increased plant attributes and yield components. These results were in agreement with those of Punia *et al.* (2001) [10]. Sole application of pendimethalin also recorded higher seed yield than hand weeding due to its efficacy to control broad spectrum weeds from the very beginning of crop growth ultimately leading to higher seed yield of sesame. Similar results were reported by Mane *et al.* (2017) [8]. The harvest index (HI) was also found higher under different herbicidal application treatments in comparison to control.

### Economics

The economics of summer sesame cultivation data (Table 2) revealed that pendimethalin and butachlor when integrated with one hand weeding at 30 DAS recorded higher net return ((₹56,825/ha and ₹51,067/ha, respectively) due to their higher seed yield (1300 kg/ha and 1200 kg/ha, respectively) and lower cost of cultivation (₹16,400 and ₹16,924 less than weed free check, respectively) but registered lower return/rupee invested (3.20 and 3.02, respectively) than their sole application (3.27 and 3.20, respectively) due to the cost of manual weeding in the former two treatments. Mruthul *et al.* (2015) [9] also reported similar findings.

**Table 3:** Effect of weed management practices on economics of sesame cultivation

Treatments	Cost of cultivation (₹/ha)	Gross return (₹/ha)	Net return (₹/ha)	Return per rupee invested
Pendimethalin 750 g/ha at 1 DAS	21462	70106	48644	3.27
Butachlor 1000 g/ha at 3 DAS	20938	66953	46015	3.20
Pendimethalin 750 g/ha at 1 DAS fb 1 HW at 30 DAS	25862	82687	56825	3.20
Butachlor 1000 g/ha at 3 DAS fb 1 HW at 30 DAS	25338	76405	51067	3.02
HW at 15 DAS	24662	48647	23985	1.97
HW at 15& 30 DAS	29062	63198	34136	2.17
Weed Free Check	42262	91551	49289	2.17
Weedy Check	20262	31270	11108	1.55
S.Em(±)	-	3925.05	3925.05	0.17
CD at 5%	-	11905.41	11905.41	0.51
CV(%)	-	10.24	16.94	11.52

### Conclusion

The present experiment was conducted to evaluate the effectiveness of herbicides having various modes of action and their impact on growth and yield of summer sesame. Among the tested herbicides pendimethalin 30 EC, butachlor 50 EC may be considered as the best herbicides and cost-effective for weed management in summer sesame. Therefore, those herbicides could be recommended in the study area and other areas with similar agro-climatic conditions and weed community. Further research is required to develop strategies having minimum effective dosages of herbicides which could be most economic and ecologically sound weed management approach for cultivation of summer sesame.

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