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Response of various weed management practices on growth and yield of mustard (*Brassica juncea* L.)

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Abstract

A study titled “Effect of weed management practices on growth and yield of mustard (*Brassica juncea* L.)” was led during the *Rabi* season of 2022–23 at the Instructional Farm-1, School of Agriculture, GIET University, Gandhi Institute of Engineering and Technology, Gunupur, Odisha. The soil type of the research plot was sandy loam and soil pH was 6.4, organic carbon content of 5.2%, and available nitrogen (N), phosphorus (P₂O₅), and potassium (K₂O) levels of 120, 6.5, and 108.5 kg/ha, respectively. The design of experiment was RDB (randomized block design) with three replications and eight treatments. The results indicated that among the herbicide treatments, oxyfluorfen 23.5EC @ 0.05 kg/ha at 0-2DAS + one HW at 40DAS (T₅), showed the best performance in terms of higher growth parameters, reduced weed population, dry matter accumulation, and improved yield characteristics. This was closely followed by treatment T₄ (Pendimethalin 30EC @ 0.75 kg a.i./ha at 0-2 DAS + one HW at 40 DAS). Furthermore, T₅ (Oxyfluorfen 23.5EC @ 0.05 kg a.i./ha at 0-2 DAS) also achieved the highest B:C ratio, while the weedy check (T₈) had the lowest. Therefore, the study concluded that the most effective weed control method in mustard was the application of oxyfluorfen 23.5EC @ 0.05 kg /ha at 0-2 DAS + one HW at 40 DAS (T₅).

Keywords: Herbicides, mustard, weed flora, weed management, weed index

Introduction

Mustard (*Brassica juncea* L.) is considered as the second most vital oilseed crop in India, after groundnut, out of seven edible oilseeds. The seeds are used as a condiment. Young mustard plant leaves are commonly utilized as green veggies. provides sulphur and minerals in the diet (Yernaïdu *et al.*, 2022) ^[2]. In India, mustard covers an area of 6.8mha with an average production of 9.1 million tonnes and average yield of 1.34 t/ha (chishi *et al.*, 2021) ^[1]. Rapeseed mustard is grown on 145.36 thousand hectares in Odisha, producing 61.63 thousand tonnes and yielding 424kg/ha (Odisha AGRISTAT 2013-14), which is significantly less than the national average. (Mandi *et al.*, 2020) ^[3]. The oil content of mustard and rapeseed varies between 37 and 49%. The oil and seed are used as seasonings in the preparation of vegetables, curries, and pickles, as well as hair oil, in medications, and in the manufacture of grease. Mustard oil cake is regarded as the best animal feed and organic manure (Patel *et al.*, 2020) ^[4]. Weeds have a devastating effect on crop output, producing yield failure in mustard that can range from 15 to 30 percent. Weeds fight for water, space, light, and nutrients with crop plants. In addition to reducing produce quality and posing different health and environmental problems, it reduces seed output by 35-60% or more, depending on the weed population, types of weed and time duration of infestations (Singh *et al.*, 2024) ^[5]. In Indian mustard crop- weed competition is more significant mostly in its seedling stages because crop growth during the winter season is slow for the initial 4-6 (WAS) weeks after sowing. However, at later stages, it grows strongly and suppresses weeds (Saranya *et al.*, 2022) ^[6].

Materials and Methods

During the *Rabi* season of 2022, a field experiment was carried out on the "response of weed control practices on growth parameters and yield attributes of mustard (*Brassica juncea* L.) in instructional farm-I, School of Agriculture, GIET University, “Gunupur.”

The soil at the experimental site was sandy loam with a texture of 6.4 pH, 5.2% organic carbon, 120 kg/ha available nitrogen, 6.5 kg/ha phosphorus and 108.5 kg/ha potassium. Three replications with eight treatments each were used in the experiment's randomised block design layout. T1: Pendimethalin 30EC @0.75 kg a.i/ha at 0-2DAS; T2: Oxyfluorfen 23.5EC@0.05 kg a.i/ha at 0-2DAS; T3: Quizalofop-p-ethyl 10%EC @0.05 kg a.i/ha at 15-20DAS; T4: Pendimethalin 30EC @0.75 kg a.i/ha at 0-2DAS + oneHW at 40DAS; T5: Oxyfluorfen 23.5EC @0.05 kg a.i/ha at 0-2DAS + one HW at 40DAS; T6: Quizalofop- p-ethyl 10%EC @0.05 kg a.i/ha at 15-20DAS + one HW at 40 DAS T7: Weed free; T8: Weedy check. The depth of sowing was 3-4 cm and with a row -row spacing of 40 cm and plant-plant maintained 10 cm on 17th October, 2022. The fertilizers were applied in accordance with the required dose of 70:50:50 kg of N, P₂O₅, and K₂O per ha. Weed density and dry weight were recorded and normalized using the square root transformation ($\sqrt{x+5}$). Yield and yield attributes were recorded when the crop was harvested. Crop was harvested on February 2, 2023. Gross returns were determined using mustard seed yield and market price at time of marketing. The net returns per ha

were determined by subtracting the cultivation cost per ha from the gross returns per ha. The (B:C ratio) benefit cost ratio was estimated by using the following formula.

$$B:C \text{ ratio} = \frac{\text{Gross returns}}{\text{Cost of production}}$$

Results and Discussion

Effect on growth

Treatment T5 (oxyfluorfen 23.5EC @ 0.05 kg a.i/ha at 0-2DAS + one HW at 40DAS) resulted in significantly higher plant height (174.27 cm), maximum number of branches per plant (17.14) and plant dry weight of 4210 kg ha⁻¹, number of leaves plant⁻¹ (24.43) and LAI which was at par with T₁, T₄ and T₃ and the lowest was recorded with weedy check (T₈). Well crop growth might be due to comparatively competition-free conditions, which increase nutrient availability, light interception, soil moisture efficiency and space under reduced inter-plant competition. These factors ultimately lead to higher carbohydrate synthesis and the production of more dry matter accumulation per plant.

Table.1: Response of various weed management practices on yield attributes and yield

Treatments	No. of siliqua plant ⁻¹	No. of seeds siliqua ⁻¹	Test weight (g)	Seed yield (kg ha ⁻¹)	Stover yield (kg ha ⁻¹)	Harvest index (%)
T1(Pendimethalin 30EC @0.75 kg a.i/ha at 0-2DAS)	100.33	10.35	3.85	1056	1600	39.8
T2(Oxyfluorfen 23.5EC @0.05 kg a.i/ha at 0-2DAS)	104.67	13.20	3.97	1123	2012	35.8
T3(Quizalofop-p-ethyl 10%EC @0.05 kg a.i/ha at 15-20DAS)	99.00	9.80	3.96	1044	2023	34.0
T4(Pendimethalin 30EC @0.75 kg a.i/ha at 0-2DAS + one HW at 40DAS)	104.67	11.53	4.04	1131	2131	34.7
T5(Oxyfluorfen 23.5EC @0.05 kg a.i/ha at 0-2DAS + one HW at 40DAS)	108.33	14.23	4.20	1156	3061	27.4
T6(Quizalofop-p-ethyl 10%EC @ 0.05 kg a.i/ha at 15-20DAS+ one HW at 40 DAS)	102.67	10.31	4.02	1126	2054	35.4
T7(Weed free)	103.67	14.60	4.55	1212	3094	28.1
T8(Weedy check)	73.00	9.47	3.87	909	1229	42.5
S.Em(±)	6.42	0.35	0.13	42.37	108.78	-
CD at 5%	19.47	1.08	0.42	128.49	329.90	-

Among all the herbicidal treatments oxyfluorfen 23.5EC @ 0.05 kg a.i/ha at 0- 2DAS + one HW at 40DAS (T5) recorded with the greater number of siliqua plant⁻¹ (108.33), seeds siliqua⁻¹ (14.23) which was statistically at par with T2, T4 and maximum test weight (4.20 g). and the lowest value was recorded from un weeded control plot. Besides herbicidal treatments, T7 (i.e weed free) recorded with highest seed yield (1212 kg ha⁻¹) and stover yield (3094 kg ha⁻¹).

Among various herbicidal treatments T5 (oxyfluorfen 23.5EC @

0.05 kg a.i/ha at 0- 2DAS + one HW at 40DAS) reported with highest seed yield (1156 kg ha⁻¹), stover yield (3061 kg ha⁻¹) and harvest index (27.4%) which might be due to improved growth parameters such as height of plant, number of branches per plant and plant dry weight, leading to higher yields and less competition. and the lowest yield was recorded with un weeded control or weedy check. Chatterjee and Singh (2018)^[8] reported the same results.

Table 2: Response of various weed management practices on economics of mustard

Treatments	Cost of cultivation (Rs. ha ⁻¹)	Gross return (Rs. ha ⁻¹)	Net return (Rs. ha ⁻¹)	Return / rupee invested
T1(Pendimethalin 30EC @0.75 kg a.i/ha at 0-2DAS)	45589	61262	15673	1.34
T2(Oxyfluorfen 23.5EC @0.05 kg a.i/ha at 0-2DAS)	44324	65771	21447	1.48
T3(Quizalofop-p-ethyl 10%EC @0.05 kg a.i/ha at 15- 20DAS)	44414	61448	17034	1.38
T4(Pendimethalin 30EC @0.75 kg a.i/ha at 0-2DAS + one HW at 40DAS)	46369	66467	20098	1.43
T5(Oxyfluorfen 23.5EC @0.05 kg a.i/ha at 0-2DAS + one HW at 40DAS)	45364	69720	24356	1.54
T6(Quizalofop-p-ethyl 10%EC @ 0.05 kg a.i/ha at 15- 20DAS+ one HW at 40 DAS)	45714	66020	20306	1.44
T7(Weed free)	51444	72829	21385	1.42
T8(Weedy check)	42344	52472	10128	1.24

The highest gross and net returns were achieved with oxyfluorfen 23.5EC @0.05 kg a.i/ha at 0- 2DAS + one HW at 40DAS (T5) which was followed by pendimethalin 30EC @0.75 kg a.i/ha at 0-2DAS + one HW at 40DAS (T4) (Table 2) and

oxyfluorfen 23.5EC @0.05 kg a.i/ha at 0- 2DAS + one HW at 40DAS resulted in a greater B:C ratio due to the increased expense of cultivation and hand weeding.

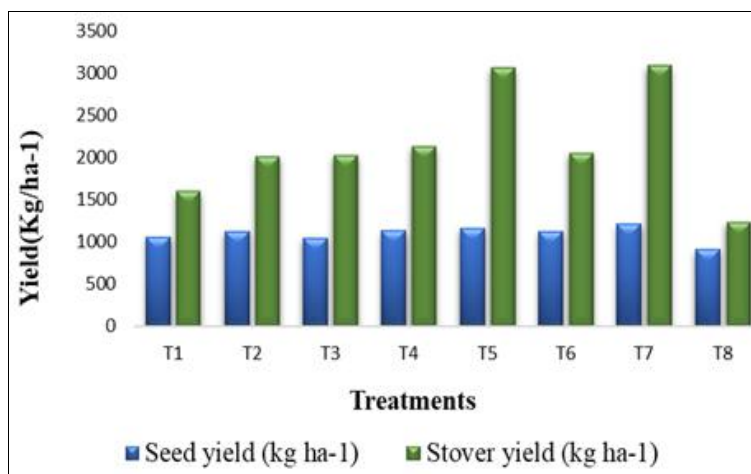


Fig 1: Effect of weed management on yield (kg ha⁻¹)

The pre-emergence application of oxyfluorfen 23.5EC @0.05 kg a.i/ha at 0-2DAS + one HW at 40DAS proved effective against weeds as it recorded highest seed yield of 1156 kg ha⁻¹ and stover yield of 3061 kg ha⁻¹.

Conclusion

It was concluded that among all the herbicidal treatments, application of oxyfluorfen 23.5 EC @0.05 kg a.i/ha at 0-2DAS + one HW at 40DAS (T₅) was recorded with the higher growth parameters, yield attributes and yield, which was followed by T₄: Pendimethalin 30EC @0.75 kg a.i/ha at 0-2DAS + one HW at 40DAS.

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