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# Effect of integrated weed management on growth, yield and yield of *rabi* mustard (*Brassica junicea*. L) under sandy loam soil of Telangana

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**Abstract**
A field experiment was conducted at Agriculture Research Station, Karimnagar during *Rabi*, 2023-24 to evaluate the effects of integrated weed management practices on growth and yield of mustard. The experiment was laid out in randomized block design with three replications and ten treatments *viz.*, $T_1$ -Pendimethalin 30% EC @ 1.0 kg *a.i*/ha PE, $T_2$ -Oxyfluorfen 23.5% EC @ 0.1 kg *a.i*/ha PE, $T_3$ -Pendimethalin 30% EC @ 1.0 kg *a.i*/ha PE *fb* Propaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE, $T_4$ -Oxyfluorfen 23.5% EC @ 0.1 kg *a.i* $ha^{-1}$ PE *fb* Propaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE, $T_5$ -Pendimethalin 30% EC @ 1.0 kg *a.i.*/ha PE *fb* Power weeding at 30DAS, $T_6$ -Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30DAS, $T_7$ -Pendimethalin 30% EC @ 1.0 kg *a.i.*/ha PE *fb* Paddy straw mulch @ 5 t/ha at 20 DAS, $T_8$ -Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE *fb* Paddy straw mulch @ 5 t/ha at 20 DAS, $T_9$ -Weed free (HW at 20 and 40 DAS), $T_{10}$ -Weedy check. Based on the experimental results, it can be concluded that among various integrated weed control tactics, application of Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/haPE *fb* Power weeding at 30DAS and Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE *fb* Paddy straw mulch @ 5 t/ha at 20 DAS proved to be the most effective treatment in controlling weeds. This regime showed superior performance in growth, yield attributes and overall yield due to the high weed control efficiency and lower weed index.

**Keywords:** Mustard, integrated weed management, seed yield, weed control efficiency, weed index

## 1. Introduction
Mustard is important edible oil next to groundnut and used for cooking and also valued for vegetable, condiments, fodder. Mustard seeds are known for their rich nutritional content, which includes essential minerals (copper, calcium, and iron), vitamins (Vitamin C and B-complex) and bioactive compounds, including antioxidants and polyunsaturated fatty acids. Mustard seeds have an oil content ranging from 37 to 49% (Bhowmik *et al*., 2014) [1]. In addition to being used for cooking, mustard also has medicinal properties and is used as a remedy for ailments like stomach issues and skin diseases (Tian and Deng, 2020) [12].

Mustard production has jumped by 40% from 91.24 to 128.18 lakh tonnes in last 3 years. India is the third largest producer of rapeseed-mustard and contributes to around 11% of the world's total production. The area under cultivation has gone up from 6.70 million hectares in 2020-21 to 8.8 m ha in 2022-23. The productivity saw 11% increase from 1331 to 1447 kg $ha^{-1}$.In Telangana, mustard is being grown in several districts *viz*., Ranga Reddy, Khammam, Nizamabad, Adilabad, Jagtial and Karimnagar with an area of 3000 ha with a production of 4.78 million tonnes and productivity of 1594 kg $ha^{-1}$ (Indiastat, 2023) [4].

The critical period of crop weed competition in mustard is 15-40 DAS and weeds cause about 25-50% of yield loss (Yadav *et al*., 2017) [13] depending on weed flora, intensity and stage of the crop. The most common weeds affecting rapeseed-mustard fields include *Avena ludoviciana* (Wild oat), *Phalaris minor* (Canary grass), *Chenopodium album* (White goosefoot), *Rumex dentatus* (Toothed dock), *Anagallis arvensis* (Scarlet pimpernel), *Convolvulus arvensis* (Field bindweed), *Melilotus indica* (Indian sweet clover) and *Cirsium arvensis* (Creeping thistle). Effective management of these weed species is essential for ensuring healthy mustard crop growth and achieving optimal yields.

In mustard hand weeding is the traditional practice. But increasing labour wages, scarcity of labour at peak periods and high-cost involvement compels to depend on other alternatives which are technically feasible and economically viable weed management to get maximum yield. Keeping this in view, the present experiment was carried out with the objective to find out the effect of integrated weed management practices on growth and yield mustard

## 2. Materials and Methods

The experiment was carried out at Agriculture Research Station, Karimnagar, Telangana. The experimental site is geographically situated in the Northern Zone of Agro climatic zone of Telangana. The soil texture of the experimental site is sandy loam in texture with pH (7.6), E.C (0.23 ds m-1),organic carbon (0.52%),low in available N (268 kg ha-1), high in available Phosphorous (35 kg ha-1) and available potassium (318kg ha-1).The experiment comprised of ten different treatments and laid out in randomized block design with three replications. The treatments consist of $T_1$ -Pendimethalin 30% EC @ 1.0 kg *a.i*/ha PE, $T_2$ -Oxyfluorfen 23.5% EC @ 0.1 kg *a.i*/ha PE, $T_3$ - Pendimethalin 30% EC @ 1.0 kg *a.i*/ha PE *fb* Propaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE, $T_4$ - Oxyfluorfen 23.5% EC @ 0.1 kg *a.i* ha$^{-1}$ PE *fb* Propaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE, $T_5$ -Pendimethalin 30% EC @ 1.0 kg *a.i.*/ha PE *fb* Power weeding at 30DAS, $T_6$ -Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30DAS, $T_7$ -Pendimethalin 30% EC @ 1.0 kg *a.i.*/ha PE *fb* Paddy straw mulch @ 5 t/ha at 20 DAS, $T_8$ - Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE *fb* Paddy straw mulch @ 5 t/ha at 20 DAS, $T_9$ - Weed free (HW at 20 and 40 DAS), $T_{10}$ - Weedy check. The crop was sown at a spacing of 45x15cm.The recommended fertilizer dose was applied i.e 60:40:40 kg ha-1of N, P2O5 and K2O using urea, single super phosphate and murate of potash (MOP), respectively. All the recommended package of practices we followed. Pre-emergence herbicides were applied within in 48 hours after sowing. Post-emergence herbicide was sprayed at 2-3 leaf stage of weeds. Straw mulch was laid at 20 DAS. Intercultivation was done with power weeder at 30 DAS. Hand weeding was done at 20 and 40 DAS. The observations were recorded on weed dry weight, plant height, leaf area, dry matter production at 25, 50, 75 DAS and harvest. Yield attributes like number of siliquae plant$^{-1}$, length of siliqua, number of seeds siliqua$^{-1}$, seed yield and stalk yield were recorded at harvest in mustard. Weed control efficiency was calculated as the percentage reduction in weed dry matter in the treated plots.

$$\text{WCE}=\frac{\text{Dry weight of weeds in in unweeded control (g m}^{-2})\text{-Dry weight of weeds reatment plot (g m}^{-2})}{\text{Dry weight of weeds in unweeded control (gm}^{-2})}\times 100$$

Weed Index (%) is calculated as the percent reduction in yield caused by weeds as compared to weed free plots.

$$\text{Weed index (\%)}=\frac{X-Y}{X}\times 100$$

X= Yield from weed free or minimum weed competition plot (kg ha$^{-1}$)
Y= Yield from the treatment for which WI is to be worked out (kg ha$^{-1}$)

All recorded data from the study were subjected to statistical analysis using the analysis of variance technique for a randomized block design. Data on crop and weeds were analyzed using the analysis of variance (ANOVA) technique to evaluate the differences among treatments and the means were separated using the least significant difference (LSD) at the 5% level of significance.

## 3. Results and Discussion

### 3.1 Weed control efficiency (%)

The data on weed control efficiency (%) was obtained at 25, 50, 75 DAS and harvest. It was based on the total dry weight of weeds in the weedy check, and it differed significantly by various weed management strategies (Table1). At 25 DAS, all weed management practices produced significantly greater weed control efficiency than weedy check. Hand weeding twice at 20 and 40 days after sowing resulted in higher weed control efficiency (93.2%) than all other treatments. This might be due to lower dry weight of weeds due to its effective weed control. Among different integrated weed management treatments, maximum weed control efficiency was achieved by application of Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30 DAS (92.1%) and Oxyfluorfen 23.5% EC@ 0.1 kg*a.i.*/ha PE*fb* Paddy straw mulch@ 5 t/ha at 20 DAS (89.9%).
At 50 days after sowing (DAS), the highest weed control efficiency was observed with the treatment of hand weeding at 20 and 40 DAS (92.8%), followed closely by the application of Oxyfluorfen 23.5% EC at 0.1 kg a.i./ha pre-emergence (PE) followed by power weeding at 30 DAS (81.4%). This was followed by Oxyfluorfen 23.5% EC at 0.1 kg a.i./ha PE combined with paddy straw mulch at 5 t/ha applied at 20 DAS (77.9%). The increased weed control efficiency in these treatments is attributed to the reduction in both weed population and dry weight.
At 75 DAS, weed free treatment (Hand weeding at 20 and 40 days after sowing) resulted in a higher weed control efficiency (84.8%) which was closely followed by the application of Oxyfluorfen 23.5% EC at 0.1 kg a.i./ha PE followed by power weeding at30 DAS (78.6%). This was followed by Oxyfluorfen 23.5% EC at 0.1 kg a.i./ha PE combined with paddy straw mulch at 5 t/ha applied at 20 DAS (79.2%). Among all, weedy check reported the lowest weed control efficiency.
At harvest, all weed management practices observed a notably greater weed control efficacy compared to the weedy check. The hand weeding at 20 and 40 DAS (84.5%) recorded a considerably greater weed control efficiency among the various weed management practices which was closely followed Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30 DAS (80.6%) and Oxyfluorfen 23.5% EC@ 0.1 kg*a.i.*/ha PE*fb* Paddy straw mulch@ 5 t/ha at 20 DAS (80.3%). Increased weed control efficiency about treatments might be an outcome of a significant decrease in weed dry weight carried on by broad spectrum control of weeds and total weed suppression during the critical period of crop weed competition. It might be due to effective control of weeds led to reduced weed dry matter resulted in higher weed control efficiency (Singh and Kumar, 2020) [11].

### 3.2 Weed index

Integrated weed management practices significantly influenced the weed index (Table 1). The application of Oxyfluorfen 23.5%

EC at 0.1 kg a.i./ha as a PE followed by power weeding at 25-30 DAS achieved the lowest weed index (4.6%) among all integrated weed management treatments.This was closely followed by Oxyfluorfen 23.5% EC@ 0.1 kg*a.i.*/ha PE*fb* Paddy straw mulch@ 5 t/ha at 20 DAS (6.3%). A lower weed index in pre emergence application of Oxyfluorfen 23.5% EC at 0.1 kg a.i. $ha^{-1}$ followed by power weeding at 30 DAS or Paddy straw mulch@ 5 t/ha at 20 DAS indicates greater effectiveness in weed control. This results in favorable conditions for crop growth, leading to higher mustard seed yield compared to the weedy check treatment. These outcomes are similar to those observed by Yernaidu *et al*. (2021) [14].

**Table 1:** Weed control efficiency (%), Weed index (%) as influenced by integrated weed management practices in mustard

| Treatments | Weed control efficiency (%) | | | | Weed index (%) |
|---|---|---|---|---|---|
| | 25DAS | 50DAS | 75DAS | At Harvest | |
| $T_1$: Pendimethalin 30% EC @ 1.0 kg *a.i.*/ha PE | 51.3 | 45.5 | 55.5 | 53.8 | 43.6 |
| $T_2$: Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE | 57.2 | 50.5 | 67.1 | 56.4 | 33.7 |
| $T_3$: Pendimethalin 30% EC @ 1.0 kg a.i/ha PE fbPropaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE | 67.3 | 56.5 | 69.0 | 61.8 | 20.7 |
| $T_4$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i* ha PE fbPropaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE | 86.3 | 73.3 | 76.8 | 76.8 | 13.2 |
| $T_5$: Pendimethalin30% EC @ 1.0 kg *a.i.*/ha PE fb Power weeding at 30DAS | 85.1 | 68.6 | 74.9 | 71.4 | 14.3 |
| $T_6$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE fb Power weeding at 30DAS | 92.1 | 81.4 | 78.6 | 80.6 | 4.6 |
| $T_7$: Pendimethalin30% EC @ 1.0 kg *a.i.*/ha PE *fb* Paddy straw mulch@ 5 t/ha at 20 DAS | 73.8 | 61.4 | 72.2 | 72.6 | 13.9 |
| $T_8$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch @ 5 t/ha at 20 DAS | 89.9 | 77.9 | 79.2 | 80.3 | 6.3 |
| $T_9$: Weed free (hand weeding 20 and 40 DAS) | 93.2 | 92.8 | 84.8 | 84.5 | 0.0 |
| $T_{10}$: Weedy check | 0.0 | 0.0 | 0.0 | 0.0 | 57.5 |

### 3.3 Crop growth parameters

#### 3.3.1 Plant height (cm)

The height was gradually increased as the crop aged, reached its peak by the harvest stage. The most significant growth in plant height occurred during the early vegetative phase. Data presented in table 2 represents the influence of various weed management treatments on mustard plant height (cm) recorded at 25, 50 and 75 DAS and harvest. No significant difference was observed with plant height due to different treatments at 25 days after sowing during 2023-24.

At 50 DAS, there was significant difference observed among the integrated weed management treatments in terms of plant height. Significantly maximum plant height was recorded with hand weeding at 20 and 40 DAS (86.9cm) which was on par with Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30DAS (78.7 cm), Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch@ 5 t/ha at 20 DAS (78.3cm). Significantly lower plant height was recorded with weedy check (60.8cm).

At 75 DAS, there was significant difference observed among the integrated weed management treatments in terms of plant height. Significantly maximum plant height was recorded with hand weeding at 20 and 40 DAS (147.1cm) which was on par with Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30DAS (145.6 cm), Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch@ 5 t/ha at 20 DAS (139.1cm). Significantly lower plant height was recorded with weedy check (104.9 cm).

At harvest, there was significant difference observed among the integrated weed management treatments in terms of plant height. Significantly maximum plant height was recorded with hand weeding at 20 and 40 DAS (152.1cm) which was on par with Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30DAS (150.2 cm), Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch@ 5 t/ha at 20 DAS (144.5cm). Significantly lower plant height was recorded with weedy check (109.2 cm).

This increase in plant height might be due to effective control of weeds providing favorable conditions for crop and suppression of weed growth, creating a weed free environment that facilitated higher vegetative growth of the mustard plants. Similar results were also reported by Das (2016) [3] and Rani *et al*. (2016) [10].

**Table 2:** Plant height (cm) as influenced by integrated weed management practices in mustard

| Treatments | 25 DAS | 50 DAS | 75 DAS | At Harvest |
|---|---|---|---|---|
| $T_1$: Pendimethalin 30% EC @ 1.0 kg *a.i.*/ha PE | 19.4 | 67.6 | 124.5 | 128.2 |
| $T_2$: Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE | 19.5 | 68.4 | 129.8 | 134.1 |
| $T_3$: Pendimethalin 30% EC @ 1.0 kg a.i/ha PE fb Propaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE | 19.9 | 69.3 | 131.1 | 135.6 |
| $T_4$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i* ha PE fbPropaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE | 20.4 | 73.3 | 134.1 | 140.7 |
| $T_5$: Pendimethalin30% EC @ 1.0 kg *a.i.*/ha PE fb Power weeding at 30DAS | 20.3 | 72.4 | 133.7 | 139.3 |
| $T_6$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE fb Power weeding at 30DAS | 21.5 | 78.7 | 145.6 | 150.2 |
| $T_7$: Pendimethalin30% EC @ 1.0 kg *a.i.*/ha PE *fb* Paddy straw mulch@ 5 t/ha at 20 DAS | 20.0 | 71.9 | 132.5 | 138.3 |
| $T_8$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch @ 5 t/ha at 20 DAS | 21.3 | 78.3 | 139.1 | 144.5 |
| $T_9$: Weed free (hand weeding 20 and 40 DAS) | 22.8 | 86.9 | 147.1 | 152.1 |
| $T_{10}$: Weedy check | 18.5 | 60.8 | 104.9 | 109.2 |
| SE(m) ± | 1.2 | 4.2 | 4.3 | 4.1 |
| C.D (P=0.05) | NS | 12.6 | 12.9 | 12.2 |
| C.V (%) | 10.2 | 10.0 | 5.6 | 5.1 |

#### 3.3.2 Dry matter production (kgha$^{-1}$)

Data pertaining to the dry matter production of mustard revealed that dry matter production was significantly influenced by different weed management treatments at 50,75 DAS and harvest except at 25 DAS, where it was shown the non significance difference (Table 3).

Increase in average dry matter production of mustard was relatively slow up to 25DAS, there after it increased linearly till maturity. At 50 DAS significantly higher dry matter production was recorded with hand weeding at 20 and 40 DAS (1753 kg $ha^{-1}$) which was on par with Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30DAS (1702kg $ha^{-1}$), Oxyfluorfen

23.5% EC@ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch@ 5 t/ha at 20 DAS (1617 kg ha$^{-1}$). Significantly lower dry matter production was recorded with weedy check (1127 kg ha$^{-1}$).

At 75 DAS significantly higher dry matter production was recorded with hand weeding at 20 and 40 DAS (2879 kg ha$^{-1}$) which was on par with Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30DAS (2823 kg ha$^{-1}$), Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch@ 5 t/ha at 20 DAS (2710 kg ha$^{-1}$). Significantly lower dry matter production was recorded with weedy check (1644 kg ha$^{-1}$).

At harvest, significantly higher dry matter production was recorded with hand weeding at 20 and 40 DAS (3712kg ha$^{-1}$) which was on par with Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30DAS (3632 kg ha$^{-1}$), Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch@ 5 t/ha at 20 DAS (3502 kg ha$^{-1}$). Significantly lower dry matter production was recorded with weedy check (2009 kg ha$^{-1}$).

Efficient utilization of resources by the crop under less weed competition treatments resulted in higher dry matter production. Similar results were reported by (Bamboriya *et al*., 2017). The notable increase in dry matter production in the weed-controlled treatments was primarily due to improved crop nutrition, which was facilitated by reduced weed competition. This was evident from significantly lower weed density, reduced weed dry weight, and higher weed control efficiency. These results are consistent with the findings of Singh *et al.* (2020) [11] and Yernaidu *et al.* (2021) [14].

**Table 3:** Dry matter production (kg ha$^{-1}$) as influenced by integrated weed management practices in mustard

| Treatments | 25 DAS | 50 DAS | 75 DAS | At Harvest |
|---|---|---|---|---|
| $T_1$: Pendimethalin 30% EC @ 1.0 kg *a.i.*/ha PE | 242 | 1202 | 1841 | 2445 |
| $T_2$: Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE | 250 | 1229 | 2149 | 2774 |
| $T_3$: Pendimethalin 30% EC @ 1.0 kg a.i/ha PE fb Propaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE | 266 | 1321 | 2340 | 3015 |
| $T_4$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i* ha PE fbPropaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE | 297 | 1535 | 2659 | 3473 |
| $T_5$: Pendimethalin30% EC @ 1.0 kg *a.i.*/ha PE fb Power weeding at 30DAS | 290 | 1497 | 2586 | 3361 |
| $T_6$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE fb Power weeding at 30DAS | 317 | 1702 | 2823 | 3632 |
| $T_7$: Pendimethalin30% EC @ 1.0 kg *a.i.*/ha PE *fb* Paddy straw mulch@ 5 t/ha at 20 DAS | 268 | 1428 | 2586 | 3376 |
| $T_8$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch @ 5 t/ha at 20 DAS | 308 | 1617 | 2710 | 3502 |
| $T_9$: Weed free (hand weeding 20 and 40 DAS) | 339 | 1753 | 2879 | 3712 |
| $T_{10}$: Weedy check | 234 | 1127 | 1644 | 2009 |
| SE(m) ± | 23 | 79 | 129 | 163 |
| CD(p=0.05) | NS | 237 | 386 | 487 |
| C.V (%) | 14 | 10 | 9 | 9 |

### 3.4 Yield attributes

Significantly the highest number of siliquae plant$^{-1}$ was recorded with with hand weeding at 20 and 40 DAS (271) which was comparable with Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30DAS (255), Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch@ 5 t/ha at 20 DAS (244). Significantly lower number of siliquae plant$^{-1}$was recorded with weedy check (177). The increase in the number of siliqua plant$^{-1}$ might be due to low weed density during the critical period of crop-weed competition, which provided a favourable environment for crop growth (Kour *et al*., 2013) [6]. Weedy check ($T_{10}$) recorded the lowest number of siliquae plant$^{-1}$ (176.7) due to high weed density and increased dry matter during the peak period of crop growth, which suppressed crop growth and development.

The data on length of siliqua in mustard at harvest was significantly influenced by different integrated weed management practices (Table 4). Significantly more length of siliqua was recorded with hand weeding at 20 and 40 DAS (5.53) which was on par with Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30DAS (5.20), Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch@ 5 t/ha at 20 DAS (5.17). Significantly lower plant height was recorded with weedy check (4.0). Similar findings were noticed by Raj *et al* 2020 [9] in Mustard crop.

Number of seeds siliqua$^{-1}$ and test weight (g) in mustard was not significantly influenced by different weed management practices.

### 3.5 Seed Yield (kg ha$^{-1}$)

The data on grain yield of mustard in response to different integrated weed management treatments is presented in table 5. Significantly higher seed yield was recorded with hand weeding twice at 20 and 40 DAS (1318 kg ha$^{-1}$) which was comparable with Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30DAS (1258 kg ha$^{-1}$), Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch@ 5 t/ha at 20 DAS (1242 kg ha$^{-1}$).

Due to improved aeration and increased access to space, water, light and nutrients provided by the removal of weeds in between and within rows, the weed free plots showed significant growth. The best conditions for growth and development resulted in improved yield qualities and eventually, the highest yields. Significantly less seed yield was recorded with weedy check (558 kg ha$^{-1}$). The high levels of weed density in the unweeded control caused a decrease in grain yield due to severe competition from weeds. These observations are consistent with findings from several studies by Kalita *et al.* (2017) [7] and Yernaidu *et al.* (2021) [14].

### 3.6 Stalk yield (kg ha$^{-1}$)

The data on stalk yield of mustard in response to different integrated weed management treatments is presented in table 5. Significantly higher stalk yield was recorded with hand weeding twice at 20 and 40 DAS (3712 kg ha$^{-1}$) which was onpar with Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE *fb* Power weeding at 30DAS (3632 kg ha$^{-1}$), Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch@ 5 t/ha at 20 DAS (3502 kg ha$^{-1}$).This outcome might be due to maintaining a weed free environment throughout the critical stages of crop growth, which allows high uptake of nutrients by crop. Similar kind of results are confirmed by the findings of Chishi *et al* (2021) [2], Yernaidu*et al* (2021) [14].

**Table 4:** Yield attributes as influenced by integrated weed management practices in mustard

| Treatments | Number of siliquae Plant$^{-1}$ | Length of siliqua (cm) | Number of seeds siliqua$^{-1}$ | Test weight (g) |
|---|---|---|---|---|
| $T_1$: Pendimethalin 30% EC @ 1.0 kg *a.i.*/ha PE | 190 | 4.17 | 9.7 | 4.1 |
| $T_2$: Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE | 194 | 4.23 | 10.0 | 4.2 |
| $T_3$: Pendimethalin 30% EC @ 1.0 kg a.i/ha PE fb Propaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE | 206 | 4.37 | 10.2 | 4.4 |
| $T_4$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i* ha PE fbPropaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE | 228 | 4.77 | 11.7 | 4.6 |
| $T_5$: Pendimethalin30% EC @ 1.0 kg *a.i.*/ha PE fb Power weeding at 30DAS | 217 | 4.50 | 11.0 | 4.5 |
| $T_6$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE fb Power weeding at 30DAS | 255 | 5.20 | 12.3 | 4.8 |
| $T_7$: Pendimethalin30% EC @ 1.0 kg *a.i.*/ha PE *fb* Paddy straw mulch@ 5 t/ha at 20 DAS | 214 | 4.40 | 10.5 | 4.5 |
| $T_8$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch @ 5 t/ha at 20 DAS | 244 | 5.17 | 11.8 | 4.7 |
| $T_9$: Weed free (hand weeding 20 and 40 DAS) | 271 | 5.53 | 12.5 | 4.9 |
| $T_{10}$: Weedy check | 177 | 4.00 | 9.3 | 3.9 |
| SE (m) ± | 12 | 0.25 | 0.8 | 0.2 |
| CD(p=0.05) | 36 | 0.75 | NS | NS |
| C.V (%) | 10 | 9.38 | 12.5 | 9.1 |

**Table 5:** Seed yield (kg ha$^{-1}$) and Stalk yield (kg ha$^{-1}$) as influenced by integrated weed management practices in mustard

| Treatments | Seed Yield (kg ha$^{-1}$) | Stalk Yield (kg ha$^{-1}$) |
|---|---|---|
| $T_1$: Pendimethalin 30% EC @ 1.0 kg *a.i.*/ha PE | 743 | 2445 |
| $T_2$: Oxyfluorfen 23.5% EC@ 0.1 kg *a.i.*/ha PE | 873 | 2774 |
| $T_3$: Pendimethalin 30% EC @ 1.0 kg a.i/ha PE fb Propaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE | 1045 | 3015 |
| $T_4$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i* ha PE fbPropaquizafop 10% EC @ 0.0625 kg *a.i*/ha PoE | 1139 | 3473 |
| $T_5$: Pendimethalin30% EC @ 1.0 kg *a.i.*/ha PE fb Power weeding at 30DAS | 1130 | 3361 |
| $T_6$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE fb Power weeding at 30DAS | 1258 | 3632 |
| $T_7$: Pendimethalin30% EC @ 1.0 kg *a.i.*/ha PE *fb* Paddy straw mulch@ 5 t/ha at 20 DAS | 1135 | 3376 |
| $T_8$: Oxyfluorfen 23.5% EC @ 0.1 kg *a.i.*/ha PE*fb* Paddy straw mulch @ 5 t/ha at 20 DAS | 1242 | 3502 |
| $T_9$: Weed free (hand weeding 20 and 40 DAS) | 1318 | 3712 |
| $T_{10}$: Weedy check | 582 | 2009 |
| SE(m) ± | 59 | 163 |
| C.D (P=0.05) | 178 | 487 |
| C.V (%) | 10 | 9 |

## 4. Conclusion

Based on the findings, it may be inferred that hand weeding at 20 and 40 DAS was found to be suitable weed management practice which was comparable with Oxyfluorfen 23.5% EC@ 0.1kg *a.i.*/haPE fb Power weeding at 30DAS or Oxyfluorfen 23.5% EC @ 0.1 kg*a.i.*/ha PE*fb* Paddy straw mulch @ 5 t/ha at 20 DAS shows significantly higher weed control efficiency, lower weed index, higher growth and yield of mustard.

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