Doi: HTTPS://DOI.ORG/10.23910/2/2023.0504a

# Effect of Weed Management Practices on Nutrient Uptake and Economics of Mustard (*Brassica juncea*)

**Y. Yernaidu[1*], Y. S. Parameswari[1], M. Madhavi[2] and T. Ramprakash[3]**

[1,2]Dept. of Agronomy, College of Agriculture (Rajendranagar), [2]Dept. of Agronomy, Agricultural College (Aswaraopet), [3]Dept. of Soil Science and Agricultural Chemistry, AICRP on Weed management, Diamond Jubilee, Professor Jayashanker Telangana State Agriculture University, Rajendranagar, Hyderabad (500 030), India

**Corresponding Author**

Y. Yernaidu
*e-mail*: yernaiduyalla@gmail.com

**Article History**

Article ID: IJEP0504a
Received on 23rd November, 2022
Received in revised form on 26th January, 2023
Accepted in final form on 17th February, 2023

**Abstract**

A field experiment was conducted during *rabi* season (November to February, 2020–21) at College Farm, College of Agriculture, Rajendranagar, Hyderabad. The farm is geographically positioned at 17°19'16.4" North latitude and 78°24'43" East longitude and at an altitude of 542.3 m above the mean sea level. According to troll's climatic classification, it is categorized under semi-arid tropics (SAT). The experimental field was sandy loam texture with available nitrogen (223 kg ha$^{-1}$), available phosphorus (30.87 kg ha$^{-1}$) and potassium (375.72 kg ha$^{-1}$). Mustard variety NRCHB-101 was sown with seed rate of 4 kg ha$^{-1}$. The seeds were sown in solid rows 40 cm apart between rows and at a depth of 3–4 cm and covered with loose soil immediately after seeding. The experiment was laid out in randomized block design with twelve treatments and replicated thrice. The data was analyzed using standard statistical techniques. Among different weed management practices, higher nutrient uptake (59.57, 24.51, 52.46 kg ha$^{-1}$ ) by crop were observed under intercultivation and hand weeding at 15 and 30 DAS and it was on par with Oxadiargyl 6% EC 0.09 kg ha$^{-1}$ PE *fb* intercultivation at 30 DAS. Similarly higher gross and net returns (68933/- and 42952/-) were noticed with intercultivation and hand weeding at 15 and 30 DAS and it was on par with Oxadiargyl 6% EC 0.09 kg ha$^{-1}$PE *fb* intercultivation at 30 DAS. Higher B:C ratio was noticed under Oxadiargyl 6% EC 0.09 kg ha$^{-1}$ PE *fb* intercultivation at 30 DAS (2.96).

***Keywords:*** Mustard, oxydiargyl, weed, straw mulch, nutrient, net returns and profit

## 1. Introduction

Mustard is one of the most important crop adopted by the farmers in the North eastern hill region of India. This is a potential crop in winter (*rabi*) season due to its wider adaptability and suitability to exploit residual moisture. Rapeseed-mustard comprising eight different species are cultivated *viz*. Indian mustard (*Brassica juncea*), brown sarson (*Brassica campestris* var. brown sarson), yellow sarson (*Brassica campestris* var. yellow sarson), toria (*Brassica campestris* var. toria), gobhi sarson (*Brassica napus*), black mustard (*Brassica nigra*), karan rai (*Brassica carinata*) and rocket salad or taramira (*Eruca sativa*) are being cultivated in 53 countries spreading all over the globe (Raj et al., 2021, Tiwari et al., 2021). Indian mustard (*Brassica juncea*) alone occupies 7% of the total area among brassicas grown in India. It contributes 24.7% and 29.4%, respectively, to total area and production of oilseeds during 2019–20 (Anonymous, 2019). In India, mustard cultivated in 6.23 million hectares with a production of 9.34 mt and with a productivity of 1499 kg ha$^{-1}$ during 2019–20 (Anonymous, 2019–20). Major mustard growing states are Rajasthan, Punjab, Uttar Pradesh, Haryana, Gujarat, Assam. Non-traditional areas are Tamil Nadu, Andhra Pradesh, Telangana, Karnataka *etc.* The area under mustard in Telangana is 3000 hectares with a production 5000 tonnes. (Anonymous, 2019–20).

The oil content in mustard varies from 37–49% (Bhowmik et al., 2014). The oil is utilized for human consumption throughout the northern India for cooking purposes (Kuma, 2012, Singh and Kumar, 2020, Singh et al., 2022). It is used in the manufacture of greases. The seed is used as condiment. The leaves of young plants are used as green vegetables, as it supply sulphur and minerals in the diet. Oil cake is used as feed and manure (Chauhan et al., 2006, Singh, 2020).

In spite of being one of the leading oilseeds producing countries, India with its vast population, it is unable to meet the requirement for edible oils. India is spending valuable foreign exchange for importing edible oils to meet the demand. For bridging gap between demand and supply, productivity needs to be enhanced. Weeds are the major biotic stress in mustard production. Weed competition in

mustard is more serious during early stage because crop growth remains slow during the first 4–6 weeks after sowing (Adhikary and Ghosh, 2014, Sheoran, 2016, Gupta et al., 2018, Das et al., 2020, Sharma et al., 2021). However, during later stages it grows vigorously and has suppressing effect on weeds. Weeds compete with crop for water, nutrients and light which effect growth and development of crop. Hence, there is need to remove weeds in the early stage of crop growth to avoid competition on the reserve moisture. The most common weeds that grow in rapeseed mustard are *Avena ludoviciana, Phalaris minor, Chenopodium album, Rumex dentatus, Anagallis arvensis, Convolvulus arvensis* and *Cirsium arvensis* (Singh and Kumar, 2020, Singh, et al., 2020, Singh et al., 2021, Brar et al., 2021). The critical period of crop weed competition in mustard is 15–40 DAS and weeds cause about 25–50% of yield loss (Chandolia et al., 2010, Singh et al., 2013, Kaur et al., 2013, Singh et al., 2022). In mustard hand weeding and hand-pulling are the traditional practices. But increasing wages, scarcity of labour at peak periods and high-cost involvement compels need to depend other alternatives which are technically feasible and economically viable (Punia, 2014, Mahajan et al., 2018). Keeping this in view, the present experiment was carried out with the objective to study the weed management practices influenced on nutrient uptake by mustard crop and economics in mustard.

## 2. Materials and Methods

A field experiment was conducted during *rabi* season (November to February, 2020–21) at College Farm, College of Agriculture, Rajendranagar, Hyderabad. The farm is geographically positioned at 17°19'16.4" North latitude and 78°24'43" East longitude and at an altitude of 542.3 m above mean sea level. According to troll's climatic classification, it is categorized under semi-arid tropics (SAT). The experimental field was sandy loam texture. The initial soil status of the field is low in available nitrogen (223 kg $ha^{-1}$), high in available phosphorus (30.87 kg $ha^{-1}$) and medium in potassium (375.72 kg $ha^{-1}$). Mustard variety NRCHB-101 (90-110 days duration) was sown with seed rate of 4 kg $ha^{-1}$. The seeds were sown manually with spacing of 40×10 $cm^2$. The experiment was laid out in randomised block design with twelve treatments and replicated thrice viz.,$T_1$**:** Pendimethalin 30% EC 1.0 kg $ha^{-1}$PE *fb* Quizalofop ethyl 5% EC 0.05 kg $ha^{-1}$ PoE, $T_2$: Oxadiargyl 6% EC 0.09 kg $ha^{-1}$ PE *fb* Quizalofop ethyl 5% EC 0.05 kg $ha^{-1}$ PoE, $T_3$: Oxyfluorfen 23.5% EC 0.1 kg $ha^{-1}$ PE *fb* Quizalofop ethyl 5% EC 0.05 kg $ha^{-1}$ PoE, $T_4$: Pendimethalin 30% EC 1.0 kg $ha^{-1}$ PE *fb* straw mulch 5 t $ha^{-1}$, $T_5$: Oxadiargyl 6% EC 0.09 kg $ha^{-1}$ PE *fb* straw mulch 5 t $ha^{-1}$, $T_6$: Oxyfluorfen 23.5% EC 0.1 kg $ha^{-1}$ PE *fb* straw mulch 5 t $ha^{-1}$, $T_7$: Pendimethalin 30% EC 1.0 kg $ha^{-1}$PE *fb* intercultivation at 30 DAS, $T_8$: Oxadiargyl 6% EC 0.09 kg $ha^{-1}$ PE *fb* intercultivation at 30 DAS, $T_9$: Oxyfluorfen 23.5% EC 0.1 kg $ha^{-1}$PE *fb* intercultivation at 30 DAS, $T_{10}$: Intercultivation and hand weeding at 15 and 30 DAS (weed free), $T_{11}$: Intercultivation at 15 and 30 DAS, $T_{12}$: Unweeded control. Pre-emergence herbicides were applied within 24 hours after sowing. Post-emergence herbicide was sprayed at 2–3 leaf stage of weeds. Straw mulch was laid at 15 DAS. Intercultivation was done with push hoe at 15 and 30 DAS. Hand weeding was done at 15 and 30 DAS. The observations were -recorded on yield, nutrient uptake by crop and economics.

## 3. Results and Discussion

### *3.1. Effect on yield*

Higher seed (1483 kg $ha^{-1}$) and stover yield (3280 kg $ha^{-1}$) were recorded in the treatment where intercultivation and hand weeding was done at 15 and 30 DAS and it was on par with Oxadiargyl 6% EC 0.09 kg $ha^{-1}$ PE *fb* intercultivation at 30 DAS (1349 kg $ha^{-1}$ tseed and 3149 kg $ha^{-1}$ stover yields?). This treatment was on par with Oxyfluorfen 23.5% EC 0.1 kg $ha^{-1}$ PE *fb* intercultivation at 30 DAS, and Pendimethalin 30% EC 1.0 kg $ha^{-1}$PE *fb* intercultivation at 30 DAS. Effective control of weeds provided congenial environment for crop which resulted in higher yield attributes led to higher yield in mustard crop by using Oxadiargyl 6% EC 0.09 kg $ha^{-1}$ PE (Mankar, 2015).

### *3.2. Effect on nutrient uptake by mustard crop*

Different weed management practices had a significant impact on nutrient uptake by crop (Table 1). Higher nutrient uptake by crop (66.51, 28.22, 59.29 kg $ha^{-1}$ N, $P_2O_5$, $K_2O$) was observed under intercultivation and hand weeding at 15 and 30 DAS and it was on par with Oxadiargyl 6% EC 0.09 kg $ha^{-1}$PE *fb* intercultivation at 30 DAS (61.37, 25.78,54.21 kg $ha^{-1}$ N, $P_2O_5$, $K_2O$). This treatment was on par with Oxyfluorfen 23.5% EC 0.1 kg $ha^{-1}$ PE *fb* intercultivation at 30 DAS (59.57, 24.51, 52.46 kg $ha^{-1}$ N, $P_2O_5$, $K_2O$) and Pendimethalin 30% EC 1.0 kg $ha^{-1}$ PE *fb* intercultivation at 30 DAS (56.14, 24.05,51.03 kg $ha^{-1}$ N, $P_2O_5$, $K_2O$) . Weed free environment favoured higher plant height and dry matter production which resulted in higher nutrient uptake by mustard crop (Degra et al., 2017).

### *3.3. Effect on economics*

The results (Table 2) revealed that, maximum gross and net returns (68933/- and 42952/-) were recorded under intercultivation and hand weeding at 15 and 30 DAS and this treatment was followed by Oxadiargyl 6% EC 0.09 kg $ha^{-1}$ PE *fb* intercultivation at 30 DAS, Oxyfluorfen 23.5% EC 0.1 kg $ha^{-1}$ PE *fb* intercultivation at 30 DAS, Pendimethalin 30% EC 1.0 kg $ha^{-1}$ PE *fb* intercultivation at 30 DAS. But higher B:C ratio (2.96) was recorded with Oxadiargyl 6% EC 0.09 kg $ha^{-1}$ PE fb intercultivation at 30 DAS followed by Oxyfluorfen 23.5% EC 0.1 kg $ha^{-1}$ PE *fb* intercultivation at 30 DAS (2.91) due to lower cost of cultivation (₹ 21125/-) (Kalita et al., 2017).

Table 1: Yield and nutrient uptake (kg ha$^{-1}$) as influenced by integrated weed management practices in mustard

| Treatments | Seed yield (kg ha$^{-1}$) | Stover yield (kg ha$^{-1}$) | N uptake (kg ha$^{-1}$) | $P_2O_5$ uptake (kg ha$^{-1}$) | $K_2O$ uptake (kg ha$^{-1}$) |
|---|---|---|---|---|---|
| $T_1$ | 895 | 2596 | 41.70 | 16.81 | 37.94 |
| $T_2$ | 917 | 2668 | 42.97 | 17.17 | 38.50 |
| $T_3$ | 908 | 2634 | 42.14 | 16.88 | 38.24 |
| $T_4$ | 1084 | 2878 | 49.56 | 20.33 | 44.86 |
| $T_5$ | 1104 | 2938 | 49.90 | 21.14 | 45.56 |
| $T_6$ | 1092 | 2897 | 49.79 | 20.58 | 45.28 |
| $T_7$ | 1267 | 3098 | 56.14 | 24.05 | 51.03 |
| $T_8$ | 1349 | 3149 | 61.37 | 25.78 | 54.21 |
| $T_9$ | 1320 | 3115 | 59.57 | 24.51 | 52.46 |
| $T_{10}$ | 1483 | 3280 | 66.51 | 28.22 | 59.29 |
| $T_{11}$ | 1070 | 2799 | 49.32 | 20.16 | 43.92 |
| $T_{12}$ | 641 | 2413 | 33.43 | 13.52 | 29.78 |
| SEm± | 47.7 | 48.7 | 1.83 | 0.94 | 1.70 |
| LSD (*p*=0.05) | 140.0 | 142.8 | 5.50 | 2.80 | 5.10 |

$T_1$: Pendimethalin 30% EC 1.0 t ha$^{-1}$ PE fb Quizalofop ethyl 5% EC 0.05 t ha$^{-1}$ PoE; $T_2$: Oxadiargyl 6% EC 0.09 t ha$^{-1}$ PE fb Quizalofop ethyl % EC 0.05 t ha$^{-1}$ PoE; $T_3$: Oxyfluorfen 23.5% EC 0.1 t ha$^{-1}$ PE fb Quizalofop ethyl 5% EC 0.05 t ha$^{-1}$ PoE; $T_4$: Pendimethalin 30% EC 1.0 t ha$^{-1}$ PE fb straw mulch 5 t ha$^{-1}$; $T_5$: Oxadiargyl 6% EC 0.09 t ha$^{-1}$ PE fb straw mulch 5 t ha$^{-1}$; $T_6$: Oxyfluorfen at 23.5% EC 0.1 t ha$^{-1}$ PE fb straw mulch 5 t ha$^{-1}$; $T_7$: Pendimethalin 30% EC 1.0 t ha$^{-1}$ PE fb intercultivation at 30 DAS; $T_8$: Oxadiargyl 6% EC 0.09 t ha$^{-1}$ PE fb intercultivation at 30 DAS; $T_9$: Oxyfluorfen 23.5% EC 0.1 t ha$^{-1}$ PE fb intercultivation at 30 DAS; $T_{10}$: Intercultivation and hand weeding at 15 DAS and 30 DAS (weed free); $T_{11}$: Intercultivation at 15 and 30 DAS; $T_{12}$: Unweeded control

Table 2: Economics (₹ ha$^{-1}$) as influenced by integrated weed management practices in mustard

| Treatments | Cost (₹ ha$^{-1}$) of cultivation | Gross returns | Net returns | B:C ratio |
|---|---|---|---|---|
| $T_1$ | 21041 | 42201 | 21160 | 2.01 |
| $T_2$ | 21421 | 43246 | 21825 | 2.02 |
| $T_3$ | 21055 | 42856 | 21801 | 2.04 |
| $T_4$ | 24531 | 50875 | 26344 | 2.07 |
| $T_5$ | 24681 | 51820 | 27139 | 2.10 |
| $T_6$ | 24305 | 51234 | 26929 | 2.11 |
| $T_7$ | 21181 | 59163 | 37982 | 2.79 |
| $T_8$ | 21231 | 62874 | 41643 | 2.96 |
| $T_9$ | 21125 | 61555 | 40430 | 2.91 |
| $T_{10}$ | 25981 | 68933 | 42952 | 2.65 |
| $T_{11}$ | 23531 | 50162 | 26631 | 2.13 |
| $T_{12}$ | 19531 | 28806 | 11275 | 1.47 |
| SEm± | | 2137 | 837 | |
| LSD (*p*=0.05) | | 6353 | 2507 | |

## 4. Conclusion

On the basis of the above-mentioned findings, it may be inferred that, intercultivation and hand weeding at 15 and 30 DAS is excellent weed management practices. It was on par with oxadiargyl 6% EC 0.09 kg ha$^{-1}$ PE fb intercultivation at 30 DAS.

## 5. References

Adhikary, P., Ghosh, R.K., 2014. Integrated weed management strategies in black-gram-brinjal-mustard cropping sequence. Environment and Ecology 32(2A), 725–727.

Anonymous, 2019. Agricultural statistics at a glance. Department of Agriculture and Co-operation, Ministry of Agriculture & Farmers Welfare, Government of India.

Anonymous, 2019–20. Telangana open data portal.

Brar, A.S., Gill, H.K., 2021. Role of planting pattern and weed control methods on growth and yield of mustard: a review. The Pharma Innovation Journal 10(4),880.

Chandolia, P.C., Dadheech, R.C., Solanki, N.S., Mundra, L.S., 2010. Weed management in groundnut under varying crop geometry. Indian Journal of Weed Science 42(3–4), 235–237.

Chauhan, B.S., Gill, G., Preston, C., 2006. Influence of

environmental factors on seed germination and seedling emergence of Oriental mustard (*Sisymbrium orientale*). Indian Journal of Weed Science 54(6),1025–1031.

Das, T.K., Ghosh, S., Gupta, K., Sen, S., Behera, B., Raj, R., 2020. The weed Orobanche: species distribution, diversity, biology and management. Journal of Research in Weed Science 3(2), 162–180.

Degra, M.L., Pareek, B.L., Shivran R., Jat R.D., 2011. Integrated weed management in Indian mustard and its residual effect on succeeding fodder pearl millet. Indian Journal of Weed Science 43(1–2), 73–76.

Gupta, K.C., Kumar, S., Saxena, R., 2018. Effect of different weed control practices on yield and returns of mustard (*Brassica juncea* L.). Journal of Crop and Weed 14(1), 230–233.

Kalita, S., Mundra, S.L., Solanki, N.S., Sharma, N.K., 2017. Weed management and nitrogen application for improved yield of mustard. Indian Journal of Weed Science 49(1), 85–87.

Kaur, T., Walia, U.S., Bhullar, M.S., Kaur, R., 2013. Effect of weed management on weeds, growth and yield of toria. Indian Journal of Weed Science 45(4), 260–262.

Kumar, S., Kumar, A., Rana, S.S., Chander, N., Angiras, N.N., 2012. Integrated weed management in mustard. Indian Journal of Weed Science 44(3), 139–143.

Mahajan, G., Matloob, A., Walsh, M., Chauhan, B.S., 2018. Germination ecology of two Australian populations of African turnipweed (*Sisymbrium thellungii*). Indian Journal of Weed Science 66(6), 752–757.

Mankar, D.D., 2015. Study on effective weed management in Indian mustard (*Brassica juncea* L.). Journal of Oilseed Brassica 8(6), 279–288.

Punia, S.S., 2014. Biology and control measures of Orobanche. Indian Journal of Weed Science 46(1), 36–51.

Raj, P., Singh, G., Raj, R., Kumar, A., Pandey, D., Pal, R.K., 2021. Influence of integrated weed management on growth attributes and quality of Indian mustard (*Brassica juncea* L.). The Pharma Innovation Journal 10(4), 131–135.

Sharma, Y., Kaushik, M.K., 2021. Effect of varying date of sowing and weed management practices on yield of Indian Mustard (*Brassica juncea* (L.) Czern and Coss). The Pharma Innovation Journal 10(9), 229–231

Sheoran, P., Punia, S.S., Singh, S., Singh, D., 2016. Orobanche weed management in mustard: Opportunities, possibilities and limitations. Journal of Oilseed Brassica 1(2), 96–101.

Singh, A., Mahajan, G., Chauhan, B.S., 2022. Germination ecology of wild mustard (*Sinapis arvensis*) and its implications for weed management. Indian Journal of Weed Science 70(1), 103–111.

Singh, A., Mahajan, G., Chauhan, B.S., 2022. Germination ecology of wild mustard (Sinapis arvensis) and its implications for weed management. Indian Journal of Weed Science 70(1), 103–111.

Singh, A., Yadav, R.S., Anshuman, K., Kumar, A., Patel, V.K., Singh, A.P., Pratap, R., 2020. Effect of weed management practices on yield and economics in Indian mustard. Indian Journal of Weed Science 8(2), 1364–1367Singh, L., Kumar, S., 2020. Effect of integrated weed management on weed and growth attributing characters of mustard (*Brassica juncea* L.). Journal of Oilseed Brassica 11(1), 62–68.

Singh, R.K., Singh, R.P., Singh, M.K., 2013. Weed management in rapeseed-mustard. Agricultural Reviews 34(1).

Singh, S., Mahajan, G., Singh, R., Chauhan, B.S., 2021. Germination ecology of four African mustard populations in the eastern region of Australia. Indian Journal of Weed Science 69(4), 461–467.

Singh, S.P., Yadav, R.S., Godara, A.S., Bairwa, R.C., 2020. Screening of herbicides for broomrape (Orobanche) control in mustard. Indian Journal of Weed Science 52(1), 99–101.

Tiwari, R., Piskackova, T.A.R., Devkota, P., Mulvaney, M.J., Ferrell, J.A., Leon, R.G., 2021. Emergence patterns of winter and summer annual weeds in Ethiopian mustard (*Brassica carinata*) cropping system. Indian Journal of Weed Science 69(4), 446–453.