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Importance of weed control techniques for Indian mustard (*Brassica juncea*) and their yield and economic

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Abstract
A field experiment was conducted during rabi season of 2023-24 on loamy sand of in the rural area of Kanpur district of Mandhana, located 10 km from Kanpur in Uttar Pradesh to assess the importance of weed control techniques for Indian mustard (*Brassica juncea*) and their yield and economic. The soil was normal in pH of 7.64, electrical conductivity (EC) of 0.26 dSm^{-1}, organic carbon content of 0.40%, and available nutrients including nitrogen (N), phosphorus (P), and potassium (K) at levels of 216.0, 19.4, and 149.51 kg ha^{-1}, respectively. The experiment was laid out during Rabi season of 2023-24. The experiment consisted of 12 treatment combinations, was laid out in Randomized Block Design (RBD) with three replications.

Keywords: Herbicides, mustard, mulch

Introduction
In the region, rapeseed is referred to as sarson, toria, and yellow toria, while Indian mustard, or *Brassica juncea* (L.) Czern & Coss., is called rai, raya, laha, and raiya. Its tender, green plants are used to make a vegetable dish known as "Sarson ka Saag." In northern India, people use oil for cooking and frying in order to consume it. The entire seed is used as a condiment in pickle recipes, to enhance the flavor of curries and vegetable ghee, and to make hair oil, lubricating oil, medicines, and tanning products. Mustard seeds have an oil content that ranges from 37 to 49% (Bhowmik *et al*., 2014) [1].

Brassica juncea is a member of the Cruciferae (Brassicaceae) family. Presently, the family comprises 338 genera and 3709 species (Warwick *et al*., 2006) [2], and it is among the top ten economically significant plant families (Rich, 1991) [3].

Indian mustard is a common spice for seasoning food in addition to being a significant source of oil. According to Thiyam *et al*. (2006) [4], Indian mustard has the following nutritional value per 100 g (3.5): 4.51 g of carbohydrates, 1.41 g of sugar, 2.0 g of dietary fiber, 0.47 g of fat, and 2.56 g of protein. It is also a good source of phenolic antioxidants, such as sinapic acid and sinapine. Rapeseed is cultivated to produce biodiesel, vegetable oil for human consumption, and animal feed. In northern India, these crops are sown in the months of October and November because they require a cool growing season and consistent, moderate temperatures (Das *et al*., 2009) [5].

After the United States, China, and Brazil, the edible oil industry in India is the fourth largest in the world. India holds a significant position in the global edible oil market, accounting for approximately 7% of production, 12% of consumption, and 20% of imports during the 2016–17 period (USDA 2018). India holds a significant position as the world's third-largest producer of oilseeds, following China and Canada. In India, mustard is the second most important crop for edible oil seeds, right after groundnuts. Grown on 5.98 and 6.23 m ha in India, its productivity is 1410 and 1499 kg ha^{-1}, and its output is 8.43 and 9.34 mt. Nonetheless, the majority of the rapeseed-mustard production occurred in the states of Uttar Pradesh in the years 2017–18 and 2018–19, covering 0.68 and 0.75 mha with yields of 0.95 and 1.12 mt and yields of 1392 and

1483 kg ha^{-1}. As a result, it has a significant portion of our nation's mustard production (11.21 and 11.96%) and area (11.36 and 12.08%). Nevertheless, Gujarat had the highest area (0.22 and 0.20 mha), production (0.40 and 0.34 mt), productivity (1808 and 1745 kg ha^{-1}) and productivity of Gujarat (2.21 and 2.37 mha), and production (3.54 and 4.08 mt) [6]. In contrast, Rajasthan had the highest productivity (1602 and 1720 kg ha^{-1}).

The world's largest producers of oilseeds are brassica species, which are followed in size by sunflower (*Helianthus annuus* L.) and peanuts (*Arachis hypogaea* L.) (Shekhawat *et al*., 2012). The two most significant oilseed crops in the Indian subcontinent are rapeseed (*Brassica napus* L.) and Indian mustard (*Brassica juncea* L. Czern. & Coss.) (Saharan and Mehta, 2002) [8]. Its production is greatly aided by seven Indian states, including Gujarat, Rajasthan, Madhya Pradesh, Uttar Pradesh, Haryana, West Bengal, and Assam (Doddabhimappa *et al*., 2010) [9, 10].

A crop is sprayed with pre-emergence herbicide one or two days after it is sown. Pre-emergence herbicides are preferred more due to their longer half-lives and higher efficiency. Additionally, unlike manual weeding, it doesn't harm the crop plant mechanically. Furthermore, because the weeds are eliminated even within the row—a weed's tendency to escape mechanical control due to its morphological resemblance to the crop—the control is more successful. The type of weed flora infesting the crop, the time of application, the use of the ideal herbicide dose, and the appropriate nozzle—such as a flood jet or flat fan—all play a role in effective weed control. Broad-spectrum weed control can be achieved by using post-emergence herbicides alone or in combination (Choudhary *et al*. 2018) [11].

Mulch is a layer of materials kept or applied to the soil's surface that provides protection. Plastic mulch sheets, straw, leaves, and crop leftovers are among the materials used to make mulch. Mulching the soil's surface can physically suppress weed emergence or stop weed seeds from germinating, but it is ineffective against weeds that have already become established. It also moderates soil irrigations in addition to stopping weed germination (Dubey, 2018) [12]. Mulching can reduce weed growth by 30 to 85%, depending mainly on the type of mulch used (Choudhary *et al*. 2018) [11].

Materials and Methods

A field experiment was conducted during rabi season of 2022-23 on loamy sand of in the rural area of Kanpur district of Mandhana, located 10 km from Kanpur in Uttar Pradesh to assess the impact of levels of irrigation and nitrogen with & without mulch on growth, yield attributes, yield, field water use efficiency and economics of mustard. The soil was normal in pH of 7.64, electrical conductivity (EC) of 0.26 dSm^{-1}, organic carbon content of 0.40%, and available nutrients including nitrogen (N), phosphorus (P), and potassium (K) at levels of 216.0, 19.4, and 149.51 kg ha^{-1}, respectively. The experiment was laid out during Rabi season of 2023-24. The experiment consisted of 12 treatment combinations, was laid out in Randomized Block Design (RBD) with three replications. T_1 Pendimethalin (PE) @ 1000 g ha^{-1},T_2 Isoproturon (POE) @ 1000 g ha^{-1}, T_3Pendimethalin (PE) @ 1000 g ha^{-1} + Hand weeding at 40 DAS, T_4 Isoproturon (POE) @ 1000 g ha^{-1} + Hand weeding at 40 DAS, T_5 Pendimethalin (PE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS, T_6Isoproturon (POE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS, T_7 Metribuzin (PE) @ 175 g ha^{-1},T_8 Metribuzin (PE) @ 175 g ha^{-1} + Hand weeding at 40 DAS, T_9 Metribuzin (PE) @ 175 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS, T_{10} Paddy straw mulch @ 10 t ha^{-1} at 2-3 DAS, T_{11} Hand weeding at 20 and 40 DAS, T_{12}Weedy checkdata were gathered on five plants.

Results and Discussion

Growth Parameters

Taller plants (23.29 cm) were observed under two hand weeding (20 and 40 DAS) T_{11} herbicidal treatments. Nevertheless, the weedy check (T_{12}) had the shortest plant (21.26 cm). According to Upadhyay *et al*. (2012) [13] and Gupta *et al*. (2018) [14], the tallest plant height was measured under the T_{11} treatment during two hand weeding sessions on DAS 20 and 40, measuring 79.38 and 167.89 cm, respectively. This was significantly higher than the plant heights measured by T_8, T_3, T_4, T_7, T_1, T_2, and T_{12} at 60 DAS and harvest stage, and on par with T_{10}, T_9, T_5, and T_6 during the years. According to studies by Kumar *et al*. (2012) [15], Regar *et al*. (2007) [16], and Pandey *et al*. (2019) [17], the hand weeding treatment with paddy straw mulch @ 10 t ha^{-1} at 2- 3 DAS (T_{10}) and Metribuzin (PE) @ 175 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS (T_9) produced the tallest plants. However, at 60 DAS and during the harvest stage, the lowest plant heights (58.27 cm and 120.48 cm) were noted under weedy check (T_{12}).

In comparison to the weedy check, all weed management techniques produced noticeably more branches per plant. Under two hand weeding (20 and 40 DAS) T_{11} treatment, the maximum number of branches plant^{-1} (16.84) was observed. According to studies by Tetarwal *et al*. (2013) [18] and Gupta *et al*. (2018) [14], it was found to be statistically comparable to T_{10}, T_9, T_5, and T_6, and T_8, T_3, T_4, T_7, T_1, T_2, and T_{12} significantly superior to the other treatments [18, 13]. Notably, under the weedy check plot, the fewest number of branches, plant^{-1} (12.32), was found. The highest number of branches per plant (20.05) was noted during harvest under the two hand weeding (20 and 40 DAS) T_{11} treatments. Despite the fact that it was considerably better with T_8, T_3, T_4, T_7, T_1, T_2, and T_{12} treatments and statistically on par with T_{10}, T_9, T_5, and T_6. However, under weedy check plots, the notably lowest number of branches plant^{-1} (14.63) were observed.

With two hand weeding (20 and 40 DAS) T_{11} treatments, the maximum dry matter accumulation (1.84 g plant^{-1}) was observed; this was statistically comparable to T_{10}, T_9, T_5, and T_6 and significantly higher than the remaining treatments. However, under weedy check at 30 DAS (T_{12}) plots, the lowest value of dry matter accumulation (1.32 g plant^{-1}) was discovered. The two hand weeding (20 and 40 DAS) T_{11} treatments had the highest dry matter accumulation plant^{-1} (18.46 g plant^{-1}) among the labor-intensive practices treatments at 60 DAS; these results were statistically comparable to T_{10}, T_9, T_5, and T_6, and significantly better than the other treatments (Dubey, 2018, Pandey *et al*. 2019) [12, 17]. But in the weedy check during both years, the lowest dry matter accumulation plant^{-1} (11.75 and 12.47 g plant^{-1}) was discovered. According to studies by Sharma and Jain (2002) [19], Tetarwal *et al*. (2013) [18], and Pandey *et al*. (2019) [17], the highest values of dry matter accumulation (40.95 g plant^{-1}) at harvest with hand weeding at 20 and 40 DAS (T_{11}) were statistically comparable to T_{10}, T_9, T_5, and T_6 and significantly better than the remaining treatments. On the other hand, the weedy check had a significantly lower dry matter accumulation plant^{-1} value (26.14 g plant^{-1}).

Table 1: Effect of weed management practices on mustard plant height (cm)

Treatments	30 DAS	60 DAS	At harvest
T_1-Pendimethalin (PE) @ 1000 g ha^{-1}	21.68	67.08	140.18
T_2-Isoproturon (POE) @ 1000 g ha^{-1} at 20 DAS	21.38	64.87	135.29
T_3-Pendimethalin (PE) @ 1000 g ha^{-1} + Hand weeding at 40 DAS	22.08	68.65	143.88
T_4-Isoproturon (POE) @ 1000 g ha^{-1} + Hand weeding at 40 DAS	21.98	68.09	142.37
T_5-Pendimethalin (PE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS	22.87	74.97	157.98
T_6-Isoproturon (POE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS	22.68	73.98	155.46
T_7-Metribuzin (PE) @ 175 g ha^{-1}	21.86	67.57	141.28
T_8-Metribuzin (PE) @ 175 g ha^{-1} + Hand weeding at 40 DAS	22.17	69.77	146.49
T_9-Metribuzin (PE) @ 175 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS	23.03	76.28	160.87
T_{10}-Paddy straw mulch @ 10 t ha^{-1} at 2-3 DAS	23.18	78.19	165.09
T_{11}-Hand weeding at 20 and 40 DAS	23.29	79.38	167.89
T_{12}-Weedy check	21.26	58.27	120.48
SEM±	0.84	2.75	6.33
CD (P=0.05)	NS	8.06	18.57

Table 2: Effect of various weed management practices on number of branches plant^{-1} of mustard

Treatments	30 DAS	60 DAS	At harvest
T_1-Pendimethalin (PE) @ 1000 g ha^{-1}	2.41	14.23	16.84
T_2-Isoproturon (POE) @ 1000 g ha^{-1} at 20 DAS	2.35	13.74	16.33
T_3-Pendimethalin (PE) @ 1000 g ha^{-1} + Hand weeding at 40 DAS	2.49	14.53	17.35
T_4-Isoproturon (POE) @ 1000 g ha^{-1} + Hand weeding at 40 DAS	2.46	14.44	17.14
T_5-Pendimethalin (PE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS	2.61	15.83	18.20
T_6-Isoproturon (POE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS	2.59	15.65	17.85
T_7-Metribuzin (PE) @ 175 g ha^{-1}	2.44	14.47	17.03
T_8-Metribuzin (PE) @ 175 g ha^{-1} + Hand weeding at 40 DAS	2.51	14.83	17.54
T_9-Metribuzin (PE) @ 175 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS	2.63	16.14	19.24
T_{10}-Paddy straw mulch @ 10 t ha^{-1} at 2-3 DAS	2.68	16.55	19.63
T_{11}-Hand weeding at 20 and 40 DAS	2.73	16.84	20.05
T_{12}-Weedy check	2.29	12.32	14.63
SEM±	0.10	0.68	0.85
CD (P=0.05)	NS	2.00	2.49

Table 3: Effect of various weed management practices on dry matter accumulation plant^{-1}(g) at different growth stages of mustard

Treatments	30 DAS	60 DAS	At harvest
T_1-Pendimethalin (PE) @ 1000 g ha^{-1}	1.58	14.75	32.71
T_2-Isoproturon (POE) @ 1000 g ha^{-1} at 20 DAS	1.55	14.16	31.43
T_3-Pendimethalin (PE) @ 1000 g ha^{-1} + Hand weeding at 40 DAS	1.65	16.07	35.62
T_4-Isoproturon (POE) @ 1000 g ha^{-1} + Hand weeding at 40 DAS	1.61	15.64	34.70
T_5-Pendimethalin (PE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS	1.74	17.66	39.15
T_6-Isoproturon (POE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS	1.71	17.34	38.46
T_7-Metribuzin (PE) @ 175 g ha^{-1}	1.59	15.15	33.60
T_8-Metribuzin (PE) @ 175 g ha^{-1} + Hand weeding at 40 DAS	1.67	16.47	36.45
T_9-Metribuzin (PE) @ 175 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS	1.77	18.05	39.64
T_{10}-Paddy straw mulch @ 10 t ha^{-1} at 2-3 DAS	1.80	17.90	39.96
T_{11}-Hand weeding at 20 and 40 DAS	1.84	18.46	40.95
T_{12}-Weedy check	1.32	11.75	26.14
SEM±	0.04	0.62	0.86
CD (P=0.05)	0.14	1.84	2.54

Conclusion

The results showed that, when compared to weedy check at all stages, the various weed management techniques, such as two-hand weeding (20 and 40 DAS), worked best. The application of paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS also performed better than the other treatments.

References

1. Bamboriya SD, Kaushik MK, Bamboriya SD, Kumawat P. Effect of weed management on yield and nutrient uptake in mustard (*Brassica juncea*). J Appl Nat Sci. 2017;9(2):1107-1111.
2. Warwick SI, Francis A, Al-Shehbaz IA. Brassicaceae: species checklist and database on CD-Rom. Plant Syst Evol. 2006;259:249-258.
3. Rich TCG. Crucifers of Great Britain and Ireland. London: Botanical Society of the British Isles; c1991. p. 336.
4. Thiyam U, Stockmann H, Felde TZ, Schwarz K. Antioxidative effect of the main sinapic acid derivatives from rapeseed and mustard oil byproducts. Eur J Lipid Sci Technol. 2006;108:239-248.
5. Das R, Bhattacherjee C, Ghosh S. Preparation of mustard (*Brassica juncea* L.) protein isolate and recovery of phenolic compounds by ultrafiltration. Ind Eng Chem Res. 2009;48(10):4939-47.
6. Anonymous. Annual report Ministry of Agriculture; c2018-

19. p. 74.

7. Shekhawat RS, Kandpal BK, Chauhan JJ. Advance in agronomic management of Indian mustard (*Brassica juncea* L. Czern. & Coss.): an overview. Int J Agron. 2012;ID.408284:1-14.
8. Saharan G, Mehta N. Fungal diseases of rapeseed-mustard. Diseases of field crops. 2002;193-228.
9. Doddabhimappa R, Gangapur BG, Prakash PM, Salimath RL, Ravikumar, Rao MSL. Correlation and path analysis in Indian mustard (*Brassica juncea* L. Czern and Coss). Karnataka J Agric Sci. 2010;22(5):971-977.
10. Dutta I, Saha P, Das S. Efficient agrobacterium-mediated genetic transformation of oilseed mustard [*Brassica juncea* (L.) Czern] using leaf piece explants. *In Vitro* Cell Dev Biol Plant. 2008;44:401-411.
11. Choudhary VK, Kewat ML, Singh PK. New approaches of weed management in soybean. Indian Farming. 2018;68(11):68-72.
12. Dubey RP. Integrated weed management in vegetable crops. Indian Farming. 2018;68(11):80-82.
13. Upadhyay VB, Bharti V, Anay R. Bioefficacy of post-emergence herbicides in soybean. Indian J Weed Sci. 2012;44:261-263.
14. Gupta KC, Kumar S, Saxena R. Effect of different weed control practices on yield and returns of mustard (*Brassica juncea* L.). J Crop Weed. 2018;14(1):230-233.
15. Kumar S, Kumar A, Rana SS, Chander N, Angiras NN. Integrated weed management in mustard. Indian J Weed Sci. 2012;44(3):139-143.
16. Regar PL, Rao SS, Joshi NL. Effect of in-situ moisture-conservation practices on productivity of rainfed Indian mustard. Indian J Agron. 2007;52(3):148-150.
17. Pandey D, Singh G, Kumar R, Rao A, Kumar M, Kumar A. Effect of weed management practices on growth and yield of Indian mustard. J Pharmacogn Phytochem. 2019;8(4):3379-3383.
18. Tetarwal JP, Ram BMD, Tomar SS. Effect of moisture conservation and sulphur sources on productivity and water use efficiency of Indian mustard under rainfed conditions. Indian J Agron. 2013;58(2):231-236.
19. Sharma RP, Singh P, Maliwau PL. Effect of weed management and phosphorus levels on yield and quality of Indian mustard. J Agric Sci. 2002;72(8):461-463.