International Journal of Research in Agronomy 2024; 7(6): 86-89

E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; 7(6): 86-89
Received: 19-03-2024
Accepted: 24-04-2024

Ujjwal Agnihotri
M.Sc. Student, Department of Agronomy, FASAI, Rama University, Kanpur, Uttar Pradesh, India

Ravikesh Kumar Pal
Assistant Professor, Department of Agronomy, FASAI, Rama University, Kanpur, Uttar Pradesh, India

Durgesh Kumar Maurya
Assistant Professor, Department of Agronomy, FASAI, Rama University, Kanpur, Uttar Pradesh, India

Divya Yadav
M.Sc. Student, Department of Agronomy, FASAI, Rama University, Kanpur, Uttar Pradesh, India

Nisha Yadav
Research Scholar, Department of Agril. Extension Education, SVPUA&T, Meerut, Uttar Pradesh, India

Savita Singh
Research Scholar, Department of Agronomy, FASAI, Rama University, Kanpur, Uttar Pradesh, India

Corresponding Author:
Durgesh Kumar Maurya
Assistant Professor, Department of Agronomy, FASAI, Rama University, Kanpur, Uttar Pradesh, India

Effect of weed management practices on the performance of Indian mustard (*Brassica juncea* L.)

Ujjwal Agnihotri, Ravikesh Kumar Pal, Durgesh Kumar Maurya, Divya Yadav, Nisha Yadav and Savita Singh

DOI: https://doi.org/10.33545/2618060X.2024.v7.i6b.798

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 Effect of weed management practices on the performance of Indian mustard (*Brassica juncea* L.)". The soil was normal in pH of 7.64, electrical conductivity (EC) of 0.26 dSm^{-1}, organic carbon content of 0.44%, and available nutrients including nitrogen (N), phosphorus (P), and potassium (K) at levels of 215.60, 19.6, and 148.40 kg ha^{-1}, respectively. The experiment was laid out during Rabi season of 2023-24. The experiment consisted of 15 treatment combinations, was laid out in Randomized Block Design (RBD) with three replications.

Keywords: Herbicides, mustard, mulch

Introduction
Rapeseed is referred to locally as sarson, toria, and yellow toria, while mustard (*Brassica juncea* L.) 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, the oil is used for frying and cooking purposes and is consumed by humans. The entire seed is used as a condiment to flavor vegetables and curries, as well as to prepare pickles. In addition, mustard oil is utilized in the tanning, hair oil, medication, soap, and vegetable ghee preparation industries. Mustard seeds range in oil content from 37 to 49% (Bhowmik *et al*., 2014) [2]. Because it contains two essential fatty acids, linoleic and linolenic, and has the least amount of harmful saturated fatty acids of any edible oil, rapeseed-mustard oil that is available in India is superior nutritionally to many other edible oils. Erucic acid and glucosinolates are regarded as undesirable when present (Debnath *et al*. 2017) [3]. High in nutrients, the seeds have 38-57% erucic acid, 5-13% linolic acid, and 27% oleic acid. The leftover oil cake from extraction is used as manure and cattle feed, and it contains 5.1% N, 1.8% P2O5, and 1.1% K_2O. Because of its greater adaptability and ability to take advantage of residual moisture, this is a crop that could be grown during the winter (rabi) season (Mukherjee, 2010) [4].

After the United States, China, and Brazil, the edible oil industry in India is the fourth largest globally. India holds a significant position in the global edible oil market, contributing approximately 7% to production, 12% to consumption, and 20% to imports of edible oils between 2016 and 2017 (USDA 2018) [9]. According to Rana (2019) [5], the amount of edible oil imported in 2000-01 was 4.3 mt, costing approximately Rs. 4320 crores. In 2015-16, that amount increased to 15 mt, costing approximately Rs. 65000 crores. India holds a significant position as the world's third-largest producer of oilseeds, following China and Canada. Rapeseed and mustard occupied nearly 36.68 million hectares worldwide in 2017-18, with a total production of 70.42 million tonnes and a productivity of 1919 kg ha^{-1} (DRMR, 2018) [6]. In India, mustard is the second most important crop for edible oil seeds, right after groundnuts. It has a significant impact on the nation's oil seed economy. In India, the rapeseed-mustard acreage was 6.07 mha in 2017-18, yielding 7.92 mt of production and 1304 kg ha^{-1} of productivity (DRMR, 2018) [6]. The area under rapeseed-mustard in Uttar Pradesh, however, was only 0.90 mha in 2017-18, with 0.95 mt of production and a productivity of 1055 kg ha^{-1}. In contrast, Rajasthan had the highest area (2.12 mha) and production (2.45 mt) with a low productivity (1152 kg ha^{-1}), while Gujarat had the highest productivity (1373 kg ha^{-1}). 0.30 mt of production from 0.22 mha of area. The largest area (0.053 mha), production (0.077 mt), and productivity (1453 kg ha^{-1}) in U.P. were found in the Mathura district (SEA, 2018) [7]. The primary cause of the yield variations was the fact that over 70% of oilseeds are grown in drylands with rainfed conditions. Despite the fact that during the 1980s, the expansion of oilseed crops came at the expense of coarse grains and pulses. Thus, farmers were unable to find oilseed cultivation to be appealing (Rana 2018) [5].

Trianthema monogyna L., *Cyperus rotundus* L., *Cynodon dactylon* (L.) Pers., *Anagallis arvensis* L., *Melilotus indica* L., *Chenopodium murale* L., and other weeds are the most prevalent ones that grow in rapeseed mustard crops. Therefore, in order to prevent competition for reserve moisture, weeds must be removed in the early stages of crop growth. Timely weed management is critical to maximizing mustard yield potential. In mustard, weed control can be achieved through mechanical and cultural means that lower the benefit-cost ratio.

In rapeseed-mustard, the critical period of crop-weed competition is 15-40 days, and depending on the weed flora, its intensity, stage, nature, and duration of the crop-weed competition, weeds can cause an alarming decline in crop production ranging from 15-30% to a complete failure (Singh *et al*., 2017) [9]. Due to their harmful, poisonous, or injurious nature, weeds are a constant source of problems for crops' proper growth and development. Due to their competition for light, moisture, space, plant nutrients, and other environmental requirements, weeds impede crops' ability to grow normally (Verma *et al*., 2018) [11]. Weeds present a serious threat to crop husbandry because they deplete soil fertility and moisture, serve as a substitute host for insect pests, and may even pose a threat to crops that come after. Currently, 25 to 30 DAS of hand weeding is sufficient to control weeds in their early stages, but manual weed management has become expensive and time-consuming due to a lack of laborers and rising wages. Hand weeding proved to be ineffective and expensive compared to the use of selective herbicides (Yadav *et al*., 2005) [12]. However, as of right now, no herbicide is on the market that can effectively control diverse weed flora to the desired extent by itself. Therefore, there is a lot of room for growth in mustard productivity and oil yield through weed management.

Herbicides intended for pre-emergence are sprayed one or two days following crop sowing, but prior to crop emergence. Pre-emergence herbicide is the recommended method due to its higher efficacy and shorter application time. Through broad-spectrum weed control, the use of post-emergence herbicides alone or in combination may increase the window of opportunity for weed management (Chaurasiya *et al*. 2019) [14].

The word "mulch" is most likely derived from the German word "molsch," which means "soft to decay." This word seems to have referred to gardeners spreading straw and leaves over the ground as mulch (Jackson *et al*., 1955) [13]. Rainfed crops can be more productive when they are mulched with forest litter and/or crop residue (Mohiuddin 2011) [19]. In addition to lowering weed pressure (Qin *et al*. 2015) [21], reducing evaporation (Prasad *et al*. 2003) [20], increasing soil water retention capacity, and regulating soil temperature fluctuations (Lakshman *et al*. 2017) [18], mulching improves water use efficiency and crop yield. Crop productivity and vegetation dynamics have benefited from organic mulching (Bouyoucos, *et al*. 2009) [15]. Mulching also enhances soil quality by changing the soil's hydraulic conductivity, water-holding capacity, and resistance to root penetration, all of which have an impact on crop yield and growth. Additionally, organic mulches improve crop yield by adding soil organic matter and plant nutrients (Lyon *et al*. 2006) [17].

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 top layer of the soil can physically inhibit the emergence of seedlings or stop weed seeds from germinating, but it is ineffective against established perennial weeds. In addition to stopping weed germination, it also lowers soil temperature, requiring fewer irrigations (Dehnavi, 2018) [16]. To a degree of 30 to 85%, mulching reduced the growth of weeds; however, mulch composition greatly varies.

Other mechanical weed-control techniques are equally cost-effective and efficient. Before and after planting the crop, weeds are mechanically removed in India using a variety of hand tools and implements. These consist of the inter-row cultivator, disc plough, hand chisel (khurpi), hand hoe, wheel hoe, blade harrow, country plough (bakhar), and soil turning tools. Even though inter-row weeds are successfully controlled with these weeding tools, intra-row weeds still needed to be manually removed (Dehnavi, 2018) [16].

Materials and Methods

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 Effect of weed management practices on the performance of Indian mustard (*Brassica juncea* L.)".The soil was normal in pH of 7.64, electrical conductivity (EC) of 0.26 dSm^{-1}, organic carbon content of 0.44%, and available nutrients including nitrogen (N), phosphorus (P), and potassium (K) at levels of 215.60, 19.6, and 148.40 kg ha^{-1}, respectively. The experiment was laid out during Rabi season of 2023-24.The experiment consisted of 15 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}, at 20DAS, T_3 Pendimethalin (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 Isoproturon (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 Quizalofop-ethyl (POE) @ 60 g ha^{-1} at 20 DAS, T_9 Metribuzin (PE) @ 175 g ha^{-1} + Hand weeding at 40 DAS, T_{10} Quizalofop-ethyl (POE) @ 60 g ha^{-1} + Hand weeding at 40 DAS, T_{11}Metribuzin (PE) @ 175 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS, T_{12} Quizalofop-ethyl (POE) @ 60 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3 DAS, T_{13}Paddy straw mulch @ 10 t ha^{-1} at 2-3 DAS, T_{14} Hand weeding at 20 and 40 DAS, T_{15} Weedy check data were gathered on five plants chosen from each plot.

Results and Discussion

Yield contributing characters

Number of siliquae plant-1

The highest siliquae per plants 285.2 were recorded with application of 60 kg of sulfur per hectare, which was comparable to 40 kg. Sulfur ha^{-1}, 20 kg Sulfur ha^{-1}, and the lowest number of siliquae plants per plant (246.0) were noted in the absence of sulfur application.

The number of siliquae plant-1 markedebly was influenced by zinc levels. With 7.5 kg of zinc ha^{-1}, which was found to be significantly superior over control and on par with 5 kg and 2.5

kg of zinc ha^{-1}, the maximum number of siliquae plant-1 (282.49) was observed.

Length of siliqua

The application of 60 kg of sulfur per hectare was found to be on par with 40 kg of sulfur per hectare and significantly superior to 20 kg of sulfur per hectare and control. This resulted in the longest length of siliqua of mustard.

As each level of zinc increased, the length of the siliqua increased as well. In terms of siliqua length, 7.5 kg zinc ha^{-1} performed noticeably better than the control and on par with 2.5 and 5.0 kg zinc ha^{-1}.

Number of seeds siliqua^{-1}

When 60 kg of sulfur was applied per hectare, the number of siliqua-1 seeds increased to a maximum of 40 kg of sulfur per hectare, with 20 kg of sulfur per hectare being found to be superior and over control.

The maximum number of seeds siliqua-1 was recorded with 7.5 kg zinc ha^{-1}, which was found to be significantly superior over control and at par with 5 kg and 2.5 kg zinc ha^{-1}. The levels of zinc had an impact on the number of seeds siliqua-1 of the mustard mark.

Test weight (g)

The data clearly shows that test weight increased by up to 60 kg of sulfur per hectare annually. However, the amount of sulfur did not significantly affect the mustard's test weight.

In a similar vein, test weight was not significantly affected by zinc levels.

Yield (q ha^{-1})

Biological yield (q ha^{-1})

When 60 kg of sulfur was applied, the biological yield of mustard reached its maximum (90.24 q ha^{-1}), which was comparable to 40 kg of sulfur ha^{-1} and found to be significantly higher than both 20 kg of sulfur ha^{-1} and the control.

The biological yield of the mustard was influenced by the zinc levels. As the dosage of zinc increased to 7.5 kg zinc ha^{-1}, the data on the biological yield of mustard increased. With 7.5 kg zinc ha^{-1} being on par with 5 kg zinc ha^{-1} and found to be significantly superior over 2.5 kg zinc ha^{-1} and control, the biological yield of mustard was higher.

Seed yield (q ha^{-1})

The application of 60 kg of sulfur per hectare attained the highest seed yield of mustard, which was found to be significantly higher than 20 kg of sulfur per hectare and above control. This was on par with 40 kg of sulfur per hectare. The lowest seed yield (16.50q ha^{-1}) was observed in the absence of sulfur application.

The amount of zinc significantly affected the mustard's seed yield. As zinc dosages rose to 7.5 kg zinc hectare-1, data on mustard seed yield increased. With 7.5 kg zinc ha^{-1} being on par with 5 kg zinc ha^{-1} and found to be significantly superior over 2.5 kg zinc ha^{-1} and control, the mustard seed yield was higher.

Stover yield (q ha^{-1})

The application of 60 kg of sulfur ha^{-1} produced the highest stover yield of mustard (69.84 qha^{-1}), which was found to be significantly higher than 20 kg of sulfur ha^{-1} and the control. This yield was comparable to that of 40 kg of sulfur ha^{-1}.

Zinc levels had an impact on the mustard markebly's Stover yield. As zinc dosages rose to 7.5 kg zinc ha^{-1}, data on mustard stover yield increased. With 7.5 kg of zinc ha^{-1}, the Stover yield was found to be significantly higher than the control group's 2.5 kg ha^{-1} and comparable to that of 5 kg of zinc ha^{-1}.

Harvest index (%)

The data shows that the mustard harvest index increased by up to to 60 kg of sulfur per hectare ha^{-1}. The mustard harvest index was not significantly affected by the sulphur levels.

Likewise, the test weight of mustard was unaffected by zinc levels.

Table 1: Effect of sulphur and zinc levels on Number of silique plant^{-1} and Length of siliqua (cm) of mustard

Treatments	Number of silique plant^{-1}	Length of siliqua (cm)
Levels of sulphur (kg ha^{-1})		
0	246.0	6.30
20	268.0	6.70
40	281.2	7.25
60	285.2	7.35
SEm	6.17	0.13
CD (P=0.5)%	17.82	0.39
Levels of zinc (kg ha^{-1})		
0	251.00	6.41
2.5	269.00	6.87
5.0	278.00	7.10
7.5	282.49	7.21
SEm	6.17	0.13
CD (P=0.5)%	17.82	0.39

Table 2: Effect of sulphur and zinc levels on number of seeds siliqua^{-1} and test weight (g)

Treatments	No. of seeds siliqua^{-1}	Test weight (g)
Levels of sulphur (kg ha^{-1})		
0	11.20	3.22
20	12.40	4.05
40	13.00	4.25
60	13.20	4.30
SEm	0.25	0.10
CD (P=0.5)%	0.71	NS
Levels of zinc (kg ha^{-1})		
0	11.25	3.70
2.5	12.60	4.03
5.0	12.85	4.35
7.5	13.10	4.40
SEm	0.24	0.10
CD (P=0.5)%	0.71	NS

Table 3: Effect of sulphur and zinc levels on biological yield, seed yield, stover yield (q ha^{-1}) and harvest index

Treatments	Biological yield (q ha^{-1})	Seed yield (q ha^{-1})	Stover yield (q ha^{-1})	Harvest index (%)
Levels of sulphur (kg ha^{-1})				
0	74.64	16.50	58.19	22.10
20	81.96	18.20	63.76	22.22
40	88.81	19.90	68.91	22.42
60	90.24	20.40	69.84	22.60
SEm	1.70	0.36	1.53	0.54
CD (P=0.5)%	4.92	1.06	4.45	NS
Levels of zinc (kg ha^{-1})				
0	75.18	16.70	58.48	22.20
2.5	82.20	18.30	63.90	22.29
5.0	88.54	19.80	68.74	22.35
7.5	89.72	20.20	69.58	22.50
SEm	1.70	0.37	1.54	0.54
CD (P=0.5)%	4.92	1.06	4.45	NS

Conclusion

It was found that applying 40 kg of sulfur and 7.5 kg of zinc ha^{-1} would result in a good yield of Indian mustard. Maximum growth parameter values, yield, and oil content were also observed upon application of 60 kg ha^{-1} of sulfur and 7.5 kg ha^{-1} of zinc

References

1. Anonymous. Directorate of Economics and Statistics, Department of Agriculture and Cooperation (DAC). Annexure-3.1, p 163 and Annexure- 6. 1 p.169 on Mustard Crop Survey Report. 2018.
2. Bhowmik B, Mitra B, Bhadra K. Diversity of insect pollinators and their effect on the crop yield of *Brassica juncea* L., NPJ-93, from Southern West Bengal. Int J Recent Scientist Res. 2014;5(6):1207-1213.
3. Debnath A, Kole SC, Sukhim JM. Evaluation of the efficacy of different sulphur amendments and sulphur oxidizing bacteria in relation to its transformation in soil and yield of mustard (*Brassica juncea*). Res Crops. 2017;15(3):578-584.
4. Mukherjee D. Productivity, profitability and apparent nutrient balance under different crop sequence in mid-hill condition. Indian J Agric Sci. 2010;80(5):420-422.
5. Rana P, Sirothia P, Yadav Singh B. Effect of sulphur and zinc on yield and uptake of nutrients by mustard (*Brassica* spp. L.) under rainfed condition. Int J Chem Stud. 2019;6(6):871-874.
6. DRMR (Directorate of Rapeseed Mustard Research). Vision 2030, DRMR, Bhartpur, Rajasthan; c2018.
7. SEA (Solvent Extractors' Association of India): Publishers on March-2018.
8. Rana P, Sirothia P, Yadav, Singh B. Effect of sulphur and zinc on yield and uptake of nutrients by mustard (*Brassica* spp. L.) under rainfed condition International Journal of Chemical Studies. 2018;6(6):871-874.
9. Singh HC, Pandey G. Effect of sulphur and zinc on growth and yield of mustard (*Brassica juncea* L.). Adv Res J Crop Improv. 2017;8(2):199-202.
10. USDA. Oilseeds: world markets and trade. United States Department of Agriculture, Foreign Agricultural Service. 2018. Available at Usdagov / psdonline / circulars / oilseeds.
11. Verma V, Maurya CL, Tomar S, Singh RP. Effect of Different Levels of Zinc and Sulphur on Morpho-Physiological Parameters of Indian Mustard. Int J Curr Microbiol App Sci. 2018;7(7):2059-2073.
12. Yadav SS, Singh B, Singh S, Tikkoo A. Effect of levels and sources of P and S on growth and yield of Indian mustard (*Brassica juncea* L.) in light textured soils of Southern Haryana. Haryana J Agron. 2005;21(2):136-137.
13. Jackson ML. Soil chemical analysis. New Delhi: Prentice hall of India Pvt. Ltd; 1995. pp. 111-226.
14. Chaurasiya A, Singh S, Singh V, Singh N, Singh A. Effect of nitrogen and sulphur nutrition on interaction effect, quality parameters, nutrient content or uptake & economics of Indian mustard (*Brassica juncea* L.) in western UP. IJCS. 2019;7(1):787-791.
15. Bouyoucos GJ. Direction for making mechanical analysis of soil by hydrometer method. Soil Sci. 2009;42:225-228.
16. Chaoudhary SS, Godara PR, Singh N. Response of mustard to doses and sources of sulphur. Annual Plant Soil Res. 2018;5(2):234-236.
16. Dehnavi NM, Sanavy SAMM. Effects of withholding irrigation and foliar application of zinc and manganese on fatty acid composition and seed oil content in winter safflower. J Indian Soc Soil Sci. 2018;53(2):156-158.
17. Lyon TL, Buckman HD, Brady NC. The nature and properties of soil. 5th ed. New York: The Macmillan Company; c2006.
18. Lakshman K, Vyas AK, Shivakumar BG, Rana DS, Layek J, Munda S. Direct and residual effect of sulphur fertilization on growth, yield and quality of mustard in a soybean-mustard cropping system. Int J Curr Microbiol App Sci. 2017;6(5):1500-1512.
19. Mohiuddin M, Paul AK, Sutradhar GNN, Bhuiyan MSI, Zubair HM. Response of nitrogen and sulphur fertilizers on yield, yield components and protein content of oilseed mustard (*Brassica* spp.). Int J Bioresour Stress Manag. 2011;2(1):93-9.
20. Prasad K, Chaudhary HP, Uttam SK. Effect of nitrogen, phosphorus, sulphur and zinc on growth, yield attributes and yield of mustard under rainfed condition. Bhartiya Krishi Anusandhan Patrika. 2003;18(3/4):124-129.
21. Tang D, Qin B, Liu T. Document modeling with gated recurrent neural network for sentiment classification. InProceedings of the 2015 conference on empirical methods in natural language processing; c2015. p. 1422-1432.