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Potency of pre-emergence and post emergence herbicides on yield attributes and yield of Indian Mustard (*Brassica juncea* L.)

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Abstract: A field experiment was executed at the Crop Research Center (CRP) of Uttaranchal University, Dehradun, Uttarakhand during the rabi season of 2021–2022 to evaluate the potency of pre-emergence and post-emergence herbicides on yield attributes and yield of Indian mustard (*Brsassica juncea* L.). The trial included three replications of the Randomized Block Design and seven treatments viz., T_1 (Control), T_2 (Pemdimethalin @1%), T_3 (Pendimethalin @1.5%), T_4 (Pendimethalin 1% + hand weeding), T_5 (Glyphosate @1%), T_6 (Glyphosate @1.5%) and T_7 (Glyphosate @1% + hand weeding). The results indicated that T_6 (Glyphosate @1.5%) and T_7 (Glyphosate @1% + hand weeding) have the highest yield production than the treatments and also significant over T_1 (Control).

Index terms: Pendimethalin, glyphosate, yield.

INTRODUCTION:

Indian mustard (*Brassica juncea* L.) is one of the major plants utilised in India for the manufacture of rabi oil. Rapeseed and mustard are the most significant oil-seed crops that are safe to eat globally, following soybean and peanut. Oil content in mustard ranges from 30 per cent to 40 per cent. India's top states for growing mustard viz., Rajasthan with 46.06 per cent, Haryana with 12.60 per cent, Madhya Pradesh with 11.38 per cent%, Uttar Pradesh with 10.49 per cent and West Bengal with 7.81 per cent (Indian Horticulture Board,2019-20). Rajasthan with the highest production of 4202.39 tons covering 27 lakh hectares in area and productivity of 1240 kg/ha. Mustard may be grown in terrible soil with terrible control practices (**Ghosh *et al.*1993**) because of which weed infestation is excessive and it's miles one of the foremost reason of low productivity.

Crop germination is incredibly slow in the early stages. Therefore, weeds that emerge before the crop presents a serious challenge, ultimately leading to low yield, if no longer controlled. Early on, there is severe weed competition because the weeds outgrow the crops, which lowers crop yield. A yield loss takes place from 25 per cent to 30 per cent due to unchecked weed growth **(Upadhyay and Gogoi, 1993)**. Depending on the agro-climatic and ecological conditions, several weed management techniques are used. Since weed control techniques are very site-specific, it is essential to develop management technology that is more environmentally friendly and sustainable.

MATERIALS AND METHODS

A field experiment was executed at the Crop Research Center (CRP) of Uttaranchal University, Dehradun, Uttarakhand which is located 30º34' N latitude and 77º95' E longitude with an altitude of 640 m above the sea level. The experiment contained three replications of the random block design and seven treatments viz., T_1 (Control), T_2(Pendimethalon @1%), T_3 (Pendimethalin @1.5%), T_4 (Pendimethalin @1% + hand weeding), T_5 (Glyphosate @1%), T_6 (Glyphosate @1.5%) and T_7 (Glyphosate @1% + hand weeding). Seed rate was 5 kg/ha and Rh-74 was the variety used with 30 cm× 10 cm spacing. Average data on yield attributes and yield were recorded for the statistical analysis.

RESULTS AND DISCUSSION

Yield attributes and yield

Number of siliqua per plant: Table 1 contained information on the quantity of siliqua per plant under various treatments that was provided. There were 119.84 to 128.04 siliqua per plant, on average. The highest number of siliqua was achieved by T_6 (Glyphosate @1.5%) with 128.04 per plant followed by T_7 (Glyphosate @1% + hand weeding) with 126.96 per plant and T_5 (Glyphosate @1%) with 126.71 per plant. T_7 (Glyphosate @1% + hand weeding) and T_5 (Glyphosate @1%) were statistically *at par* to each other. The remaining treatments were found to be statistically significance to each other. The least number of siliqua was observed in T_1 (Control). In the present study during all different stages of experiment, treatment T_6 (Glyphosate @1.5%) recorded the maximum value of number of siliqua/plant, while the minimum was accomplished in T_1 (Control). Similar result was obtained by **Bijarnia *et al.* (2017)** and **Singh *et al.* (2020)**.

Table 1: Mean number of siliqua per plant, mean length of siliqua (cm), mean number of seeds per siliqua and mean 1000 seeds weight in mustard as impacted by various weed control treatments

Treatments	No. of siliqua per plant	Length of siliqua (cm)	No. of seeds per siliqua	1000 seeds weight (g)
T_1 (Control)	119.84	5.16	12.78	3.93
T_2 (Pendimethalin 1%)	123.67	6.18	15.35	4.11
T_3 (Pendimethalin 1.5%)	125.92	6.25	15.56	4.34
T_4 (Pendimethalin 1% + hand weeding)	124.35	6.14	14.94	4.31
T_5 (Glyphosate 1%)	126.71	6.42	16.81	4.41
T_6 (Glyphosate 1.5%)	128.04	6.56	17.87	5.43
T_7 (Glyphosate 1% + hand weeding)	126.96	6.46	17.46	4.38
S.Em±	0.12	0.18	0.26	0.22
CD(0.05)	0.63	0.77	0.92	0.84

Length of siliqua: Table 1 provided details on the length of siliqua (cm) under various treatments. Data on siliqua length per plant showed a range of 5.16 cm to 6.54 cm which the maximum length was achieved by T_6 (Glyphosate @1.5%) and the minimum length by T_1 (Control). The length of siliqua for the treatments; T_2 (Pendimethalin 1%), T_3 (Pendimethalin @1.5%), T_4 (Pendimethalin @1% + hand weeding), T_5 (Glyphosate @1%), T_6 (Glyphosate @1.5%) and T_7 (Glyphosate @1% + hand weeding) were 6.18cm, 6.25cm, 6.14cm, 6.42cm, 6.56cm and 6.46cm respectively. All the treatments were found to be statistically *at par* to each other. The findings of length of siliqua of mustard is close to that of **Yadav *et al.* (2017)** and **Singh *et al.* (2020)**.

Number of seeds per siliqua: Table 1 included information on number of seeds/siliqua under various treatments. Data on number of seeds/siliqua showed a range of 12.78 to 17.87. The maximum number of seeds were achieved by T_6 (Glyphosate @1.5%) with 17.87 seeds per siliqua followed by T_7 (Glyphosate @1% + hand weeding) with 17.46 seeds per siliqua which were also seen statistically at par to each other. T_2 (Pendimethalin @1%) and T_3 (Pendimethalin @1.5%) were also statistically *at par* to each other. The finding of number of seeds/siliqua of mustard is close to that of **Singh *et al.* (2020)** and **Brar & Gill (2021).**

1000 seeds weight: Table 1 contained data on 1000 seeds weight under various treatments. The 1000 seed-weight varies from 3.93 g to 5.43 g. The treatment T_6 (Glyphosate @1.5%) achieved the highest 1000 seed weight (5.43 g). The weight of 1000 seeds of the treatments T_2 (Pendimethalin 1%), T_3 (Pendimethalin @1.5%), T_4 (Pendimethalin @1% + hand weeding), T_5 (Glyphosate @1%), and T_7 (Glyphosate @1% + hand weeding) were 4.11g, 4.34g, 4.31g, 4.41g and 4.38g respectively, and were statistically *at par* to each other. The minimum weight of 1000 seeds was noted in T_1 (Control). The findings of 1000 seeds weight is similar to that of **Yadav *et al.* (2017)**, **Singh *et al.* (2020)** and **Brar & Gill (2021)**.

Seed yield: The data pertaining to seed yield influenced by weed management can be observed from Table 2. The range of the seed yield is 18.37 q/ha to 26.18 q/ha, and among all the treatments, T_6 (Glyphosate 1.5%) achieved the highest seed yield (26.18 q/ha), followed by T_7 (Glyphosate 1% + hand weeding), with 25.39 q/ha. Treaatments T_3 (Pendimethalin 1.5%) and T_4 (Pendimethalin 1% + hand weeding) were statistically *at par* to each other. The seed yield were significantly higher in all weed control treatments as compared to the treatment weedy check. It is due to the least competition of nutrients, space, moisture, thus providing opportunity for proper growth and development in comparison to weedy check. Similar outcomes were reported by **Gupta *et al.* (2019)** and **Pandey *et al.* (2019)**.

Table 2: Mean stover yield (q/ha), mean seed yield (q/ha), mean total biological yield (q/ha) and harvest index (%) as impacted by various weed control treatments

Treatments	Stover yield	Seed yield	Total biological yield	Harvest index(%)
T_1 (Control)	51.23	18.37	69.60	26.52
T_2 (Pendimethalin 1%)	53.48	20.86	74.34	28.06
T_3 (Pendimethalin 1.5%)	55.79	21.82	77.61	28.12
T_4 (Pendimethalin 1% + hand weeding)	53.81	21.27	75.08	28.33
T_5 (Glyphosate 1%)	57.28	23.84	81.12	29.39
T_6 (Glyphosate 1.5%)	58.69	26.18	84.87	30.84
T_7 (Glyphosate 1% + hand weeding)	56.54	25.39	81.93	30.97
S.Em±	0.34	0.18	0.48	0.25
CD(0.05)	1.05	0.77	1.23	0.89

Stover yield: The data regarding the stover yield are shown in Table 2. The stover yield varies from 51.23 q/ha to 58.69 q/ha. The highest stover yield was noted in T_6 (Glyphosate 1.5%) with a value of 58.69 q/ha, followed by 57.28 q/ha and 56.54 q/ha from the treatments T_5 (Glyphosate 1%) and T_7 (Glyphosate 1% + hand weeding), respectively. Stover yield at its lowest point was 51.23 ha^{-1} from the treatment T_1 (Control). All the treatments were found to be statistically significant. It is because there is less competition for nutrients, space, and moisture, which gives room for healthy growth and development compared to weedy check. Similar outcomes have been noted by **Gupta *et al*. (2019)** and **Pandey *et al*. (2019).**

Total biological yield: The data regarding the effect of different treatment on biological yield are shown in Table 2. Biological yield was effected significantly by various treatments. Among the treatments the significantly lowest biological yield was noted in T_1 (Control) with 69.60 q/ha. The maximum biological yield was noted in T_6 (Glyphosate @1.5%) with 84.87 q/ha. T_5 (Glyphosate @1%) and T_7 (Glyphosate @1% + hand weeding) with 81.12 q/ha and 81.93 q/ha respectively were statistically *at par* to each other. In comparison to the weedy check treatment, the total biological yield were significantly higher in all weed control regimens.

Harvest index (%): The data regarding the effect of different treatment on harvest index are shown in Table 2. Among the treatments the lowest harvest index was noted in T_1 (Control) with 26.52 per cent. The maximum harvest index was recorded in T_7 (Glyphosate @1% + hand weeding) with 30.97 per cent followed by T_6 (Glyphosate @1.5%) with 38.84 per cent which were statistically at par to each other. Treatnebts T_2 (Pendimethalin@1%), T_3 (Pendimethalin @1.5%) and T_4 (Pendimethalin @1% + hand weeding) were also seen statistically *at par* to each other. The harvest index was significantly higher in all weed control treatments as compared to the treatment weedy check. Similar results have been reported by **Pandey *et al.* (2019)** and **Singh *et al.* (2020)**.

CONCLUSION

The findings of this study show that different weed management strategies are essential. The experiment's findings allow us to draw the conclusion that the treatment with glyphosate 1.5% had the best yield production. The results are only indicative; further research is needed to reach a more reliable and conclusive conclusion.

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