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EFFECT OF HERBICIDES ON YIELD AND ECONOMICS OF MUSTARD (*Brassica juncea* L.)

P. G. Dodewar[1], P. C. Pagar[2] and B. Gouthami[3]

ABSTRACT

An experiment was carried out to study the effect of pre and post emergence herbicides on yield and economics of mustard at Agronomy Farm, College of Agriculture, Nagpur during *rabi* season of 2021-22. The experimental design was randomized block design (RBD). Ten treatments were tested with three replications on clayey and slightly alkaline soil. Results revealed that highest number of siliqua plant^{-1} (287.15), number of seeds siliqua^{-1} (15.67), seed yield (9.76 q ha^{-1}), straw yield (15.91 q ha^{-1}), net monetary return (37645) and B:C ratio (3.26) of mustard was obtained by the weed free check treatment. Among all herbicidal treatments, application of Pendimethalin 0.75 kg a.i. ha^{-1} PE fb Propaquizafop + Imazethapyr 60 g a.i. ha^{-1} at 35 DAS was found to be the most effective for higher number of siliqua plant^{-1} (268.46), number of seeds siliqua^{-1} (15.60), seed yield (8.84 q ha^{-1}) and straw yield (14.41 q ha^{-1}) of mustard which resulted in maximum net monetory returns (29527 ¹ ha^{-1}) and B:C ratio (2.50) followed by application of Pendimethalin 0.75 kg a.i. ha^{-1} PE fb 1 hoeing at 35 DAS with 27467 ¹ ha^{-1} net monetory returns and 2.47 B:C ratio. Manual weeding is common but it is expensive, labour-intensive and often not performed at critical stage due to adverse soil and weather conditions and paucity of labours so herbicidal weed management is a viable and wise decision for weed management.

(Key words: Mustard, yield, pendimethalin, imazethapyr, hoeing)

INTRODUCTION

Indian mustard (*Brassica juncea* L.) belongs to the family *Brassicaceae* (Syn. Cruciferae) is a *rabi* oil seed crop grown traditionally in the northern states of India like Uttar Pradesh, Gujarat, Punjab, Bihar, Madhya Pradesh, Rajasthan and West Bengal. However now a days, its cultivation is spreading to non traditional states like Maharashtra, Andhra Pradesh, Tamilnadu and Karnataka. It is mainly grown in poor soil with poor management practices (Ghosh *et al*., 1993) due to which weed infestation is high and it is one of the major cause of low productivity. Moreover, they increase production cost, decrease the quality of farm produce, reduce values of the land, and harbour insect, pest and plant disease organisms. Weeds cause 30-70% reduction in yield of Indian mustard (Pandey, 1980). The chemical method of weed control can be very effective in killing the weeds before their emergence as well as post emergence (Deshkari *et al.,* 2019). A limited number of herbicides have been tested against the weeds in mustard. These herbicides are applied as pre-emergence and can control weeds up to a limited period. Introduction of post emergence applied herbicides may prove a boon for effective weed control in growing stage of mustard crop. During recent past a number of broad spectrum herbicides have been launched which are capable of reducing competition for a longer period of time.

Recent investigations have vouched the importance of herbicide combinations in enhancing mustard productivity through wide spectrum weed control. Keeping in view the above facts, a field trial was carried out to investigate best herbicide combinations for control of complex weed flora in mustard (*Brassica juncea* L.)

MATERIALS AND METHODS

A field experiment entitled effect of pre and post emergence herbicides on yield and economics of mustard was conducted at Agronomy Section Farm, Collage of Agriculture, Nagpur (Maharashtra) during *rabi* season of 2021-22. The soil of experiment field was characterized as clayey in texture, having slightly alkaline pH, medium organic carbon status, low available nitrogen, medium available phosphorus and very high available potassium status. Mustard variety 'TAM-108-1' was sown on 23rd Nov. 2021. The crop was sown in rows 45 cm apart.

The experiment was laid out in randomised block design with ten treatments *viz.,* Weedy check (T_1), Weed free check (T_2), Pendimethalin 0.75 kg a.i. ha^{-1} PE fb Clodinafop 60 g a.i. ha^{-1} at 35 DAS (T_3), Pendimethalin 0.75 kg a.i. ha^{-1} PE fb Quizalofop 60 g a.i. ha^{-1} at 35 DAS (T_4), Pendimethalin 0.75 kg a.i. ha^{-1} PE fb Propaquizafop + Imazethapyr 60 g a.i. ha^{-1} at 35 DAS (T_5), Pendimethalin 0.75 kg a.i. ha^{-1} PE fb 1 hoeing at 35 DAS (T_6), Oxyfluorfen 150 g

1. P.G. Student, Agronomy Section, College of Agriculture, Nagpur, Maharashtra, 440 001, India (Corresponding author)
2. Asstt. Professor, Agronomy Section, College of Agriculture, Nagpur, Maharashtra, 440 001, India
3. Ph.D. Student, ICAR- Indian Agriculture Research Institute, New Delhi, 110 012, India

a.i. ha^{-1} PE fb Clodinafop 60 g a.i. ha^{-1} at 35 DAS (T_7), Oxyfluorfen 150 g a.i. ha^{-1} PE fb Quizalofop 60 g a.i. ha^{-1} at 35 DAS (T_8), Oxyfluorfen 150 g a.i. ha^{-1} PE fb Propaquizafop + Imazethapyr 60 g a.i. ha^{-1} at 35 DAS (T_9) and Oxyfluorfen 150 g a.i. ha^{-1} PE fb 1 hoeing at 35 DAS (T_{10}) replicated thrice. Spraying was done with the help of manually operated knapsack sprayer fitted with flat fan nozzle using 500 litres of water $hectare^{-1}$. Data on yield attributes *viz.,* number of siliqua $plant^{-1}$ and number of seeds $siliqua^{-1}$ were determined at harvest. Data regarding seed yield ha^{-1} and straw yield ha^{-1} were also recorded. The economics was worked out by estimating the cost of cultivation, monetary returns and B:C ratio. The data were statistically analysed by using statistical procedures and comparisons were made at 5% level of significance (Panse and Sukhatme, 1967). B:C ratio was calculated with following formula

$$\text{Benefit : Cost ratio} = \frac{\text{Gross monetary returns (Rs. ha}^{-1}\text{)}}{\text{Cost of cultivation (Rs. ha}^{-1}\text{)}}$$

RESULTS AND DISCUSSION

Effect on yield attributes

Number of siliqua $plant^{-1}$ (287.15) and number of seeds $siliqua^{-1}$ (15.67) were significantly higher with weed free check treatment (T_2). Among herbicidal treatments, application of Pendimethalin 0.75 kg a.i. ha^{-1} PE fb Propaquizafop + Imazethapyr 60 g a.i. ha^{-1} at 35 DAS (T_5) recorded higher yield attributing characters followed by treatment Pendimethalin 0.75 kg a.i. ha^{-1} PE fb 1 hoeing at 35 DAS (T_6) when compared with weedy check. The increase in yield attributing characters might be due to better suppression of weeds by herbicidal treatments which might have maintained greater availability of nutrients and moisture due to less removal by weeds. This might have increased nutrient and water uptake by crops leading to increase rate of various sinks. Gupta *et al.* (2018) found that two hand weedings at 25-30 and 40-45 days after sowing recorded maximum mean number of siliqua $plant^{-1}$ (153.7) and number of seeds $siliqua^{-1}$ (13) of mustard during both years of study which was statistically at par with 1 hand weeding and pre-emergence application of pendimethalin 38.7 CS. Sharma *et al*. (2015) reported that application of Pendimethalin @ 0.9 kg ha^{-1} as PE + imazethapyr @ 75 g ha^{-1} as PoE herbicides at 20 DAS resulted in significantly higher yield attributes and yield.

Effect on yield

Weed free check treatment (T_2) produced significantly higher seed yield (9.76 q ha^{-1}) and straw yield (15.91 q ha^{-1}) and was found at par with application of Pendimethalin 0.75 kg a.i. ha^{-1} PE fb Propaquizafop + Imazethapyr 60 g a.i. ha^{-1} at 35 DAS (T_5) and Pendimethalin 0.75 kg a.i. ha^{-1} PE fb 1 hoeing at 35 DAS (T_6) when compared with weedy check. Lowest seed yield and straw yield was recorded in control treatment i.e. weedy check. This might be due to more dry matter $plant^{-1}$ in mustard and lesser dry matter accumulation in weeds, in all the treatments, facilitating better crop growth, development and production of more seed and straw yields. Gupta *et al.* (2018) observed maximum seed and stover yield of mustard under one or two hand weeding closely followed by pre emergence application of pendimethalin 38.7 CS @ 0.75 kg ha^{-1} and pendimethalian 30 EC @ 0.75 kg ha^{-1} and they were statistically at par with each other and significantly superior over weedy check during both the years of experiment. Singh *et al*. (2018) found that weed free treatment recorded the highest yield followed by two hand weedings and pendimethalin + imazethapyr (pre-mix) @ 1.0 kg ha^{-1}.

Effect on economics

As regards economics, weed free check (T_2) recorded the highest GMR (54295 ¹ ha^{-1}), NMR (37645 ¹ ha^{-1}) and B:C ratio (3.26) followed by treatment application of Pendimethalin 0.75 kg a.i. ha^{-1} PE fb Propaquizafop + Imazethapyr 60 g a.i. ha^{-1} at 35 DAS (2.50) (T_5) and Pendimethalin 0.75 kg a.i. ha^{-1} PE fb 1 hoeing at 35 DAS (2.47) (T_6). The highest GMR, NMR and B:C ratio in weed management treatments might be due to higher grain yield of mustard which was attributed due to effective control of weeds by these treatments that had positive effect on crop growth and yield. Dixit *et al*. (2016) reported that economic evaluation of different weed control treatments showed maximum net return in weed free check followed by pre-emergence pendimethalin 1.0 kg ha^{-1} + post-emergence imazethapyr 75 g ha^{-1} at 20 DAS while maximum B:C ratio was observed in pre-emergence pendimethalin 1 kg ha^{-1} + post-emergence imazethapyr 75 g ha^{-1} at 20 DAS followed by post-emergence imazethapyr 75 g ha^{-1} at 20 DAS and post-emergence quizalofop-ethyl 50 g ha^{-1} at 20 DAS. Gupta *et al.* (2018) found that highest mean net monetary returns and B:C ratio were recorded under pre-emergence application of pendimethalin 38.7 CS closely followed by pendimethalin 30 EC and 1 HW. Mankar *et al.* (2013) reported that weed free treatment recorded higher GMR, NMR and B:C ratio in mustard. Singh *et al*. (2019) found that two hand weedings recorded the highest gross and net return and was followed by pendimethalin + imazethapyr (pre-mix) at 0.75 kg ha^{-1} (PE) and application of pendimethalin + imazethapyr at 0.75 kg ha^{-1} (PE) also gave the highest B:C ratio.

Based on experimental findings, it can be concluded that among the herbicidal treatments, application of Pendimethalin 0.75 kg a.i. ha^{-1} PE fb Propaquizafop + Imazethapyr 60 g a.i. ha^{-1} at 35 DAS (T_5) recorded higher the number of siliqua $plant^{-1}$, number of seeds $siliqua^{-1}$, seed yield and straw yield $hectare^{-1}$ and also maximum monetary returns, B:C ratio of mustard crop followed by treatment application of Pendimethalin 0.75 kg a.i. ha^{-1} PE fb 1 hoeing at 35 DAS (T_6). Manual weeding is common in the state but it is expensive, labour-intensive and often not performed at critical stage due adverse soil and weather conditions. Further, the operation has to be repeated and the paucity of labours, particularly during the peak period makes it further difficult. For overall management of weeds with greater profitability and sustainability, chemical weed management is a viable and wise decision for weed management.

Table 1. Yield attributes, yield and economics of mustard as influenced by different weed management practices

Treatments		No. of siliqua plant^{-1}	No. of seeds siliqua^{-1}	Yield		Economics		
				Seed yield (q ha^{-1})	Straw yield (q ha^{-1})	GMR (₹ha^{-1})	NMR (₹ha^{-1})	B:C ratio
T_1	Weedy check	186.12	13.13	4.35	7.09	24199	10549	1.77
T_2	Weed free check	287.15	15.67	9.76	15.91	54295	37645	3.26
T_3	Pendimethalin 0.75 kg a.i. ha^{-1} PE fb Clodinafop 60 g a.i. ha^{-1} at 35 DAS	234.67	15.13	6.89	11.23	38329	20679	2.17
T_4	Pendimethalin 0.75 kg a.i. ha^{-1} PE fb Quizalofop 60 g a.i. ha^{-1} at 35 DAS	230.27	15.00	6.86	11.19	38181	18031	1.89
T_5	Pendimethalin 0.75 kg a.i. ha^{-1} PE fb Propaquizafop + Imazethapyr 60 g a.i. ha^{-1} at 35 DAS	268.46	15.60	8.84	14.41	49177	29527	2.50
T_6	Pendimethalin 0.75 kg a.i. ha^{-1} PE fb 1 hoeing at 35 DAS	262.32	15.53	8.29	13.51	46117	27467	2.47
T_7	Oxyfluorfen 150 g a.i. ha^{-1} PE fb Clodinafop 60 g a.i. ha^{-1} at 35 DAS	228.85	14.93	6.21	10.12	34546	16771	1.94
T_8	Oxyfluorfen 150 g a.i. ha^{-1} PE fb Quizalofop 60 g a.i. ha^{-1} at 35 DAS	201.21	14.67	5.94	9.68	33044	13894	1.73
T_9	Oxyfluorfen 150 g a.i. ha^{-1} PE fb Propaquizafop + Imazethapyr 60 g a.i. ha^{-1} at 35 DAS	256.20	15.47	7.48	12.19	41611	21961	2.12
T_{10}	Oxyfluorfen 150 g a.i. ha^{-1} PE fb 1 hoeing at 35 DAS	242.18	15.20	7.43	12.11	41333	22558	2.20
	SE (m) ±	8.55	0.75	0.61	1.00	3421	3421	-
	CD at 5%	25.39	-	1.83	2.98	10164	10164	-

REFERENCES

Deshkari, S. M., P. C. Pagar, S. T. Dangore, V. P Babhulkar and H. S Mendhe, 2019. Effect of Weed management on growth, yield and economics of soybean. J. Soils and Crops. **29**(1) : 194-199.

Dixit, J. P., B. S. Kasana and Y. K. Singh, 2016. Evaluation of pre- and post-emergence herbicides in groundnut. Indian J. Weed Sci. **48**(4): 450-452.

Ghosh, D. C., B. N. Mitra and M. Pande, 1993. Weed control studies in mustard (*Brassica juncea*). Indian Soc. Weed Sci. **3**: 117-119.

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

Mankar, D. D., S. N. Mahajan, S. M. Panchbhai and S. M. Nawlakhe, 2013. Growth, yield attributes, yield oil, and economics of Indian mustard as influenced by the different herbicides. J. Soils and Crops. **23**(2): 387-391.

Pandey, J. 1980. Harvest high yield of ray (*Brassica juncea*) with herbicides and nitrogen in calcareous soil. Indian J. Weed Sci. **12**(2): 178-180.

Panse, V. G. and P. V. Sukhatme, 1967. Statistical methods for agriculture workers, ICAR, New Delhi.

Sharma, S., R. A. Jat and B. K. Sagarka, 2015. Effect of weed-management practices on weed dynamics, yield, and economics of groundnut (*Arachis hypogaea*) in black calcareous soil. Indian J. Agron. **60**(2): 312-317.

Singh, G., H. K. Virk and V. Khanna, 2018. Weed management in black gram [*Vigna mungo* (L.) Hepper] through sole and combined application of pre- and post- emergence herbicides. J. Crop and Weed. **14**(2): 162-167.

Singh, G., H. K. Virk and V. Khanna, 2019. Pre- and post-emergence herbicides effect on growth, nodulation and productivity of green gram. Indian J. Weed Sci. **51**(3): 257-261.

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