© 2022 *RELS*, **p-ISSN:** 0974-4908
Home page: http://rels.seplko.co.in
e-mail: rel_sci@yahoo.com
Res. Environ. Life Sci.,
15 (01) 04-06(2022)

Publication Info
Paper received: 17.11.21
Revised received: 07.01.22
Paper Accepted: 12.01.22
Category: Original Article

Evaluation of organic and inorganic sources of nutrients on productivity and economics of mustard

Abstract

A field experiment was carried out in Rabi season during the year 2020-21 at the research farm of Department of Agronomy, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, (M.P.) to study the economically feasibility ofintegrated weed management in mustard. Mustard variety RH-749 was sown at 6 november 2020 at the spacing of 30 × 10 cm with nine treatments were evaluated in Randomized Block Design with three replications with plot net sizes of 3.0 m × 2.60 m. Significantly lower values of weed parameters such as viz., monocot and dicot population, weed dry weight at 30, 60 and 90 DAS, and weed biomass at harvest were observed in the treatments T8 (weed free), which remain statistically at par with pendimethalin (PE) 1000 g/ha+ One hand weeding at 40 DAS (T3), HW & IC at 20 & 40 DAS (T4) and pendimethalin (PE) 1000 g/ha (T1), However, significantly higher values of monocot and dicot population at 30, 60 and 90 DAS under weedy check (T9). The economics point of view, maximum net return with pendimethalin (PE) 1000 g/ha (T1), followed by weed free, pendimethalin (PE) 1000 g/ha+ One hand weeding at 40 DAS, Quizalofopethyl (PoE) 50 g/ha at 30 DAS and Two hand weeding at 20 & 40 DAS, respectively. However, the minimum gross and net return was achieved with weedy check and the highest B:C of 3.21 was obtained with Quizalofopethyl (PoE) 50 g/ha at 30 DAS followed by oxyfluorfen (PE) 150 g/ha (3.14), clodinafop propargyl (PoE) 60 g/ha at 30 DAS (3.14), pendimethalin (PE) 1000 g/ha (3.13) and propaquizafop (PoE) 100 g/ha at 30 DAS (3.05), respectively. Whereas, the lowest B:C of 2.01 was obtained under weedy check.

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Keywords

Fertilizer, yield, Oil, Weed and Mustard

Introduction

Indian mustard *(Brassicajuncea* L.) is an important oilseed *Rabi* crop, its belong to *Brassicaceae***.** However rapeseed-mustard ranks first in terms of oil yield (ranging from 35-45%) among all oilseeds crops. Its seed contains 37 to 49 percent edible oil (Singh *et al*., 2009). Mustard seed in general, contains 30-33% oil, 17-25% protein, 8-10 % fibre, 6-10% moisture, and 10-12% extractable substances (Panday *et al*., 2013). Mustard is the third most important source of edible oil next to soybean and groundnut in India, and is grown in certain tropical and subtropical regions as a cold season crop (Shekhawat *et al*., 2012). In India it is grown in an area of 7.10 million hectares with an annual production of 7.98 million tones and having yield of 1281 kg ha^{-1} of seed. In Madhya Pradesh it is cultivated on an area of 0.77 m ha with production of 105 million tones and yield 1305 kg ha^{-1}, respectively (Agricultural statistics at a glance, 2019).With increasing population and improving purchasing power of the consumers, the demand of edible oil is further increasing at the rate of 4-6 per cent.

The maximum productivity of mustard depends upon the best utilization of resources and improved technology. Growing of crop without any weed competition is the major factor to achieve the best yield target. In Indian mustard weeds are recognized as one of the major detrimental factors responsible for lower yield. The lower yield of mustard is due to competition of weeds for nutrients, moisture, light and space was reported high (Buttar and Aulakh, 2003).Mustard is grown in winter season in India and about two thirds area under this crop is irrigated where in weed infestation causes considerable loss of yield. In Indian mustard weeds cause maximum damage in the initial 20-40 days (Bhan and Mishra, 1994). At later stages shading caused by plant height and broad spectrum leaves help in suppressing weed growth (Chakhaiyar and Ambasht, 1990).The effectiveness of herbicides largely depends upon the habitat, weed composition and density of weeds with pre-sowing or pre-emergence application of herbicides. The weeds can be controlled right from the germination stage resulting into a weed free environment from early stage of crop, but subsequent flushes of weeds that appear at

later stage of crop growth cannot be controlled effectively, under this situation, the integrated weed control method using herbicides in conjunction with manual weeding or intercultivation would provide more effective weed control and ultimately provide a favourable situation for crop growth. This situation calls for efforts to boost production and productivity of oilseeds in the country (Hegde, 2009).

Material and Methods

An investigation to study the economically feasibility of integrated weed management in mustard was carried out during the rabi season of 2020-21 at the Research Farm, College of Agriculture, R.V.S.K.V.V., Gwalior (M.P.). The area has typically sub-tropical climate with fairly cool and dry winter, hot and dry summer, and warm and moderately humid rainy season. The summers are hot and dry May and June is the hottest months with mean maximum temperature varying from 38.4°C to 47°C, respectively. December and January constitute the coolest months of the year mean minimum temperature 2.5°C to 4°C respectively. The mean annual rainfall ranges between 760 to 1060 mm distributed over a period of three months from the middle of June and the end of September. The soil was sandy clay in texture and slightly alkaline in reaction (7.67), low in available N (197 kg/ha), medium in available P (16.38 kg/ha) and medium in available K (287.2 kg/ha). A combination of 9 treatments, viz, Pendimethalin (PE) 1000 g/ha (T1), Oxyfluorfen (PE) 150 g/ha (T2), Pendimethalin (PE) 1000 g/ha+ One hand weeding at 40 DAS (T3), Hand weeding at 20 & 40 DAS (T4), Propaquizafop (PoE) 100 g/ha at 30 DAS (T5), Quizalofopethyl (PoE) 50 g/ha at 30 DAS (T6), Clodinafop propargyl (PoE) 60 g/ha at 30 DAS (T7), Weed free (As and when requires) (T8) and Weedy Check (T9), were tested in a randomized block design and replicated thrice. Mustard was sown at 30 *10 cm spacing on November, 6 in 2020. The recommended dose of fertilizers i.e. 80 kg N/ha, 40 kg P/ha and 20 kg K/ha was applied before sowing in the seed row zone. The nitrogen was applied through urea containing 46 per cent N. The half dose of nitrogen with full dose of P2O5 and K2O were given below the seed at the time of sowing as basal. The remaining half dose of nitrogen (40 kg/ha) was top-dressed after first irrigation. Crop was harvest on March, 5 in 2021.

Results and Discussion

Weed parameters: The removal of weeds at regular interval through manual weeding accounted for less count of weeds under weedfree (T_8). Similarly effective control of weeds by integration of herbicides with manual weeding and pre-emergence and post-emergence herbicides were responsible for lower weed intensity with application of Pendimethalin (PE) 1000 g/ha+ One hand weeding at 40 DAS (T_3).Further, dense crop canopy under these treatments might have suppressing effect on weeds. The unweeded control (T_9) had evidently the highest population of monocot and dicot weeds owing to uncontrolled condition (Table-1 and 2).

Dry weight of weeds was significantly influenced due to different weed management practices (Table-1). Besides weedfree (T_8), lower dry weight of weeds was observed under pendimethalin (PE) 1000 g/ha (T_1).This might be attributed to the effective control

Table - 1: Effect of different treatments on plant population of dicot weeds per square meter and weeds dry weight (g/m^2) in mustard

Tr. No.	Treatments	Plant population of dicot weeds/m^2			Weeds dry weight (g/m^2)		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T_1	Pendimethalin (PE) 1000 g/ha	5.69	7.00	8.33	5.17	5.17	4.50
T_2	Oxyfluorfen (PE) 150 g/ha	8.19	9.17	10.49	9.23	9.23	8.40
T_3	Pendimethalin (PE) 1000 g/ha+ One hand weeding at 40 DAS	4.43	5.67	7.00	3.35	3.35	2.67
T_4	Two hand weeding at 20 & 40 DAS	7.18	8.03	9.37	6.70	6.70	6.03
T_5	Propaquizafop (PoE) 100 g/ha at 30 DAS	11.50	12.83	14.18	12.44	12.18	11.17
T_6	Quizalofopethyl (PoE) 50 g/ha at 30 DAS	9.33	10.68	12.03	8.68	8.68	7.33
T_7	Clodinafop propargyl (PoE) 60 g/ha at 30 DAS.	11.78	13.60	14.30	11.48	11.42	10.41
T_8	Weed free (As & when requires)	1.44	1.21	1.35	1.15	1.20	1.10
T_9	Weedy Check	13.01	14.45	16.78	13.40	13.47	12.80
	SEm (±)	0.71	0.76	0.88	1.02	0.75	1.13
	C.D. (at 5%)	2.11	2.26	2.24	3.06	2.25	3.39

Table - 2: Weed control efficiency, weed index and weed biomass at harvest as influenced by weed management practices in mustard

Symbol	Treatments	Weed control efficiency(%)	Weed index (%)	Weed biomass at harvest
T_1	Pendimethalin (PE) 1000 g/ha	63.55	4.74	2.98
T_2	Oxyfluorfen (PE) 150 g/ha	34.66	13.11	5.91
T_3	Pendimethalin (PE) 1000 g/ha+ One hand weeding at 40 DAS	78.84	4.12	2.33
T_4	Two hand weeding at 20 & 40 DAS	52.02	7.39	4.57
T_5	Propaquizafop (PoE) 100 g/ha at 30 DAS	12.45	15.81	9.67
T_6	Quizalofopethyl (PoE) 50 g/ha at 30 DAS	41.39	10.39	5.67
T_7	Clodinafop propargyl (PoE) 60 g/ha at 30 DAS.	18.54	13.34	8.75
T_8	Weed free (As & when requires)	91.32	0.00	0.93
T_9	Weedy Check	0.00	99.69	11.13
	SEm (±)			1.01
	C.D. (at 5%)			3.03

Table -3: Economics of different weed management practices in mustard

Treatments	Total cost (Rs/ha)	Gross income (Rs/ha)	Net Income (Rs/ha)	B:C
Pendimethalin (PE) 1000 g/ha	29938	123554	93616	4.13
Oxyfluorfen (PE) 150 g/ha	28865	119470	90605	4.14
Pendimethalin (PE) 1000 g/ha+ One hand weeding at 40 DAS	31038	124000	92962	4.00
Two hand weeding at 20 & 40 DAS	31560	122533	90973	3.88
Propaquizafop (PoE) 100 g/ha at 30 DAS	28816	116838	88023	4.05
Quizalofopethyl (PoE) 50 g/ha at 30 DAS	28750	121165	92415	4.21
Clodinafop propargyl (PoE) 60 g/ha at 30 DAS.	28893	119723	90831	4.14
Weed free (As & when requires)	33210	125900	92690	3.79
Weedy Check	28260	85160	56900	3.01

Seed yield rate: 4425q/ha; Straw yield: 150q/ha

of weeds under these treatments, which reflected in less number of weeds and ultimately lower weed biomass. In addition to this, dense crop canopy might have suppressed weed growth and ultimately less biomass. The unweeded control (T_9) recorded significantly the highest dry weight of weeds owing to uncontrolled condition favoured luxurious weed growth leading to increased weed dry matter.

Effect on economics: The economics of different weed management treatments (Table-3) indicated that next to weedfree (T8), maximum net returns was accrued under pendimethalin (PE) 1000 g/ha (T1), followed weed free (T8), pendimethalin (PE) 1000 g/ha+ One hand weeding at 40 DAS (T3), Quizalofopethyl (PoE) 50 g/ha at 30 DAS (T6) and Two hand weeding at 20 and 40 DAS (T4). This might be due to effective and efficient control of weeds by pre-emergence and post-emergence herbicides under these treatments. The highest B:C ratio was recorded under quizalofopethyl (PoE) 50 g/ha at 30 DAS (T6), followed by oxyfluorfen (PE) 150 g/ha (T2), clodinafop propargyl (PoE) 60 g/ha at 30 DAS (T7), pendimethalin (PE) 1000 g/ha (T1) and propaquizafop (PoE) 100 g/ha at 30 DAS (T5), while minimum B:C ratio was obtained with weedy check (T9).

Based on the results of one year experimentation, It was concluded that higher economical production along with efficient weed management in rabi mustard can be achieved by weed free, pendimethalin (PE) 1000 g/ha+ One hand weeding at 40 DAS, pendimethalin 1.0 kg/ha (PE) and two hand weedings at 20 & 40 DAS according to availability of labors. However Clodinafop propargyl (PoE) 60g/ha at 30 DAS was found most remunerative.

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