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Productivity and Economics of Mustard (*Brassica juncea*) Varieties as Influenced by Different Herbicide Levels

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Abstract
A field experiment on Productivity and economics of mustard (*Brassica juncea*) varieties as influenced by different fertility levels was conducted on the RMD College of Agriculture & Research Station, Ambikapur, during the *Rabi* season of 2012-2013. Soil of the experimental field was sandy loam in texture. 12 treatments with different herbicidal combination of weed management practices were study in randomized block design and 3 times replicated. weed control treatments Pendimethalin @ 1.0kg/ha PE, Glyphosate 50gm/ha alone after emergence of Orobanche, Trifluralin @ 1.5kg/ha PPI, Glyphosate 25gm/ha alone with 1% solution NH4SO4 at 40 DAS, Neem cake at 200kg/ha in furrow and Pendimethalin at 0.5kg/ha (PE) followed by 1 hoeing at 40 DAS, Neem cake at 200kg/ha in furrow followed by Imazethapyr 30gm/ha at 20DAS, Trifluralin @ 1.5kg/ha +Neem oil 1% PPI, soybean oil 2 drops/shoot after emergence of Orobanche, Application of 25% extra dose of phosphorus and phosphorus solubilizing bacteria, Trichoderma viride 2.5kg/ha as basal application, Farmers practice-1 hoeing at 40DAS and Weedy check. Gross monetary return is directly related to the value of produce in the market. Among the different weed control treatment, the lowest gross monetary return (Rs. 49050/ha) was recorded in neem cake at 200kg/ha in furrow followed by imazethapyr 30gm/ha at 20DAS. The lowest seed yield under neem cake at 200kg/hac in furrow followed by imazethapyr 30gm/ha at 20DAS was the reason for the lowest gross monetary return, were as it was highest (Rs. 66660/ha) in pendimethalin @ 1.0kg/ha (PE) followed by trifluralin @ 1.5kg/ha +neem oil 1% PPI (Rs. 64230/ha), neem cake at 200kg/ha in furrow and pendimethalin at 0.5kg/ha (PE) followed by 1 hoeing at 40 DAS (Rs. 63180/ha) and trifluralin @ 1.5kg/ha PPI (Rs. 60750/ha) due to maximum seed yield. In respect of net income per hectare, the pendimethalin @ 1.0kg/ha (PE) recorded highest net profit of Rs. 51355/ha followed by trifluralin @ 1.5kg/ha +neem oil 1% PPI, neem cake at 200kg/ha in furrow and pendimethalin at 0.5kg/ha (PE) followed by 1 hoeing at 40 DAS and trifluralin @ 1.5kg/ha PPI recorded net profit of Rs. 48428, Rs. 46297/ha and Rs. 45248, respectively. In case of B;C ratio, pendimethalin @ 1.0kg/ha (PE) and trifluralin @ 1.5kg/ha +neem oil 1% PPI recorded higher B:C ratio(Rs. 4.36 and 4.07) as compared to other Yadav *et al.* (1999a), Singh *et al.* (2000), Singh *et al.* (2001), Bazaya *et al.* (2004), Rana (2006) and Mitra (2011) has reported similar finding. The economics of inputs indicated that the benefit: cost ratio was highest under pendimethalin 1.0 kg a.i./ha (PE) (4.36) followed by trifluralin @

1.5kg/ha +neem oil 1% PPI (4.07) and glyphosate 50gm/ha alone after emergence of Orobanche(3.98), respectively. Net return was recorded highest in pendimethalin 1.0 kg a.i./ha (PE) (Rs. 51355/ha) followed by trifluralin @ 1.5kg/ha +neem oil 1% PPI (Rs. 48428/ha) and neem cake @ 200kg/ha in furrow and pendimethalin @ 0.5kg/ha (PE) followed by 1 hoeing at 40 DAS (Rs. 46297/ha).

Keywords: Productivity, economics, mustard, herbicide

INTRODUCTION:

Indian mustard [*Brassica juncea* (L.) *Czern & Cross*] is one of the oil seed crop of the state of Madhya Pradesh. The problem of low productivity continues to be a major issue for agricultural planners and researchers. The best way to increase the productivity of mustard is by improving crops. Weeds are regarded as one of the major negative factors of crop produce loss due to competition for nutrient, moisture, light and space which have been reported as high as 30-70% (Tiwari,1998).

Mustard crop is grown both in subtropical and temperate countries. India occupies the third position with regard to average production of rapeseed and mustard in the world. It is raised to 5.77 million hectares with an annual production of 6.59 million tonnes and average productivity of 1142 kg/ha in the country. In Madhya Pradesh rapeseed and mustard is grown in 791 thousand hectares area with annual production of 849 thousand tonnes and average productivity of 1075 kg/ha. But in Gwalior district it covers an area of 58.5 thousand hectares with annual production 75.9 thousand tonnes and average productivity of 1303 kg/ha (CLRS M.P., 2009-10). Many workers have stated that glyphosate at lower rates (82 g/ha) 30DAS provided excellent control of broomrape without any toxic effect on mustard crop, but it caused some toxicity at higher rates (123 g/ha) 60DAS to the crop. Other herbicides like fluchloralin and pendimethalin did not control this weed (Kumar, 2002).

The mustard crop is infested with grassy as well as broadleaf weeds. Weeds substantially reduce the productivity and production of mustard due to competition for various inputs. A wide ranging yield reduction in the crop on account of weeds is well documented. Therefore, there is a need to create an environment that is detrimental to weeds and favourable to crop. (Bhan 1992, Banga and Yadav, 2001 and Singh *et al.* 2001) even ranging from 20-70 % depending upon the type of weed flora, magnitude and duration of weed infestation (Tiwari and Kurchania 1993) Competition by weeds at initial stages is a major limiting factor to its productivity.

MATERIALS AND METHODS:

The field experiment was carried out during *Rabi* season of 2012-2013 at the Research farm, RMD College of Agriculture & Research Station, Ambikapur situated at 23018' N latitude and 83015' Elongitude and at altitude of 611 meter above mean sea level which represents the northern hills agro-climatic zone of Chhattisgarh. The soil of the experimental site was sandy loam in texture, acidic in reaction (pH 5.7), medium in organic carbon (0.56), available nitrogen

(234 kg ha-1), available phosphorus (8.4 kg ha-1) and available potassium (268 kg ha-1). The experiment was carried out in randomized block design (RBD) with 3 replications. The treatments contained of nine weed management practices. The treatment comprised of Pendimethalin @ 1.0kg/ha PE, Glyphosate 50gm/ha alone after emergence of Orobanche, Trifluralin @ 1.5kg/ha PPI, Glyphosate 25gm/ha alone with 1% solution NH4SO4 at 40 DAS, Neem cake at 200kg/ha in furrow and Pendimethalin at 0.5kg/ha (PE) followed by 1 hoeing at 40 DAS, Neem cake at 200kg/ha in furrow followed by Imazethapyr 30gm/ha at 20DAS, Trifluralin @ 1.5kg/ha +Neem oil 1% PPI, Soybean oil 2 drops / shoot after emergence of Orobanche, Application of 25% extra dose of phosphorus and phosphorus solubilizing bacteria, Trichoderma viride 2.5kg/ha as basal application, Farmers practice-1 hoeing at 40DAS and Weedy check. Data on weed population were recorded at 30, 60 days after sowing and at harvest. The observations of weed density and their dry matter were taken randomly from 0.25 m2quadrate from net plot area from each treatment. To calculate the weed control Data on weed density and dry weight was subjected to square root transformation before analysis.

RESULTS AND DISCUSSION:

Economics of treatment

Economics of the crop cultivation (Table 4.28) were studied and presented under the following

Total cost of cultivation

The cost of cultivation of Rs. 13940/ha was common for all the treatments. But the cost of weed control treatment varied from treatment to treatment. The highest cost of cultivation (Rs. 16883/ha) was incurred under neem cake at 200kg/ha in furrow and pendimethalin at 0.5kg/ha (PE) followed by 1 hoeing at 40 DAS, neem cake at 200kg/ha in furrow, imazethapyr 30gm/ha at 20DAS and trifluralin @ 1.5kg/ha +neem oil 1% PPI against the lowest cost of Rs. 13940/ha involved in weedy check.

Gross income

Data embodied in Table 3 revealed that all the weed control treatments gave more gross income over weedy check. The maximum gross income of Rs. 66660/ha was obtained with pendimethalin @ 1.0kg/ha (PE) treatment, which was higher than neem cake at 200kg/ha in furrow, imazethapyr 30gm/ha at 20DAS and weedy check. The treatment trifluralin @ 1.5kg/ha +neem oil 1% PPI, neem cake at 200kg/ha in furrow, pendimethalin at 0.5kg/ha (PE) and 1 hoeing at 40 DAS were the next higher gross income treatment.

Net income

Data encamped in Table 3 revealed that all the weed control treatment gave more net return over neem cake at 200kg/ha in furrow followed by imazethapyr 30gm/ha at 20DAS and weedy check. The maximum net return of Rs. 51355/ha was recorded pendimethalin @ 1.0kg/ha

(PE), which was higher than neem cake at 200kg/hac in furrow followed by imazethapyr 30gm/ha at 20DAS and weedy check. Trifluralin @ 1.5kg/ha +neem oil 1% PPI and neem cake at 200kg/ha in furrow and pendimethalin at 0.5kg/ha (PE) followed by 1 hoeing at 40 DAS were the next best treatments recording Rs. 48428 and Rs. 46297per hectare net income, respectively.

Benefit: cost ratio

All the weed control treatment except neem cake at 200kg/ha in furrow followed by imazethapyr 30gm/ha at 20DAS resulted more benefit:cost ratio compared with weedy check. The maximum benefit:cost ratio of 4.36 was recorded with the treatment pendimethalin @ 1.0kg/ha (PE) followed by trifluralin @ 1.5kg/ha +neem oil 1% PPI and glyphosate 50gm/ha alone after emergence of Orobanche while minimum with neem cake at 200kg/ha in furrow followed by imazethapyr 30gm/ha at 20DAS (2.99).

Discussion

Gross monetary return is directly related to the value of produce in the market. Among the different weed control treatment, the lowest gross monetary return (Rs. 49050/ha) was recorded in neem cake at 200kg/ha in furrow followed by imazethapyr 30gm/ha at 20DAS. The lowest seed yield under neem cake at 200kg/hac in furrow followed by imazethapyr 30gm/ha at 20DAS was the reason for the lowest gross monetary return, were as it was highest (Rs. 66660/ha) in pendimethalin @ 1.0kg/ha (PE) followed by trifluralin @ 1.5kg/ha +neem oil 1% PPI (Rs. 64230/ha), neem cake at 200kg/ha in furrow and pendimethalin at 0.5kg/ha (PE) followed by 1 hoeing at 40 DAS (Rs. 63180/ha) and trifluralin @ 1.5kg/ha PPI (Rs. 60750/ha) due to maximum seed yield.

In respect of net income per hectare, the pendimethalin @ 1.0kg/ha (PE) recorded highest net profit of Rs. 51355/ha followed by trifluralin @ 1.5kg/ha +neem oil 1% PPI, neem cake at 200kg/ha in furrow and pendimethalin at 0.5kg/ha (PE) followed by 1 hoeing at 40 DAS and trifluralin @ 1.5kg/ha PPI recorded net profit of Rs. 48428, Rs. 46297/ha and Rs. 45248, respectively. In case of B;C ratio, pendimethalin @ 1.0kg/ha (PE) and trifluralin @ 1.5kg/ha +neem oil 1% PPI recorded higher B:C ratio(Rs. 4.36 and 4.07) as compared to other Yadav *et al.* (1999a), Singh *et al.* (2000), Singh *et al.* (2001), Bazaya *et al.* (2004), Rana (2006) and Mitra (2011) has reported similar finding.

Conclusion

The economics of inputs indicated that the benefit: cost ratio was highest under pendimethalin 1.0 kg a.i./ha (PE) (4.36) followed by trifluralin @ 1.5kg/ha +neem oil 1% PPI (4.07) and glyphosate 50gm/ha alone after emergence of Orobanche(3.98), respectively. Net return was recorded highest in pendimethalin 1.0 kg a.i./ha (PE) (Rs. 51355/ha) followed by trifluralin @ 1.5kg/ha +neem oil 1% PPI (Rs. 48428/ha) and neem cake @ 200kg/ha in furrow and pendimethalin @ 0.5kg/ha (PE) followed by 1 hoeing at 40 DAS (Rs. 46297/ha).

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Table. 1. Cost of cultivation (ha) excluding treatment cost

S. No.	Particular of expenditure	Cost of cultivation (/ha)
Field preparation		
1	Ploughing by tracter @ 300/ hour for one ha time taking 2 hours	**600.00**
2	Two harrowing @ 250/ hour for one ha time taking one hour each harrowing	**250.00**
3	One levelling @ 250/ hour for one ha time taking one hour each harrowing	**250.00**
4	Layout, Ridge and channel making 4 labours @ 160/labour	**640.00**
5	Seed 5gk/ha @ 50/kg	**250.00**
6	Seed treatment carbendizain@ 100	**100.00**
7	Sowing 8 labour @ 160/labour	**1280.00**
8	Fertilizer cost (80:40:20:25 NPKS/ha) (a) Urea 174 kg/ha @ 285/ 50 kg (b) SSP 250 kg/ha @ 280/50 kg (c) M0P 60 kg/ha @ 415/50 kg	**2890.00**
9	2 Irrigation (one irrigation @350/ha)	**700.00**
10	Thinning 6 labour @ 160/labour	**960.00**

11	Rogar insecticide 1.5/ha @ 480/litre	**720.00**
12	Harvesting 15 labour @ 160/labour	**2400.00**
13	Transportation from field to threshing floor two trips @@ 150/trips	**300.00**
14	Threshing 10 labour @ 160/labour	**1600.00**
15	Miscellaneous	**1000.00**
	Total(in)	**13940.00**

Table.2. Treatment cost of cultivation (/ha) excluding treatment cost

S. No.	**Particular of expenditure**	**Cost of cultivation (/ha)**
1	Pendimethalin @ 1.0kg/ha @ 410/litre	1365.00
2	Glyphosate 50gm/ha @ 276/litre	34.00
3	Trifluralin @ 1.5kg/ha @ 500/litre	1562.00
4	Glyphosate 25gm/ha@ 350/litre and 1% solution NH4SO4	317.00
5	Neem cake at 200kg/ha@ 1050/quntal, Pendimethalin @ 0.50kg/ha @ 410/litre and1 hoeing 1 labour @ 160/labour	2943.00
6	Neem cake at 200kg/ha@ 1050/quntal and Imazethapyr 30gm/ha @ 1350/litre	2505.00
7	Trifluralin @ 1.5kg/ha @ 500/litre and Neem oil 1%	1862.00
8	Soybean oil @ 1.5kg/ha @ 100/litre	150.00
9	Application of 25%(10 kg/ha) extra dose of phosphorus @ 280/50 kg and phosphorus solubilizing bacteria	380.00
10	Trichoderma viride 2.5kg/han @ 50/250 gm	500.00
11	1 hoeing @ 160/labour	160.00

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Table.3. Economics of mustard as influenced by different weed control measures

S. No.	Treatment	**cost of cultivation (Rs./ha)**	**Treatment cost of cultivation (Rs./ha)**	**Total cost of cultivation (Rs./ha)**	**Seed yield (q/ha)**	**Gross income (Rs./ha)**	**Net income (Rs./ha)**	**B:C Ratio**
1	T1- Pendimethalin @ 1.0kg/ha PE	13940	1365	15305	22.22	66660	51355	4.36
2	T_2- Glyphosate 50gm/ha alone after emergence of Orobanche	13940	34	13974	18.51	55530	41556	3.98
3	T_3- Trifluralin @ 1.5kg/ha PPI	13940	1562	15502	20.25	60750	45248	3.92
4	T_4- Glyphosate 25gm/ha alone with 1% solution NH4SO4 at 40 DAS	13940	317	14257	18.63	55890	41633	3.93
5	T_5- Neem cake at 200kg/ha in furrow and Pendimethalin at 0.5kg/ha (PE) followed by 1 hoeing at 40 DAS	13940	2943	16883	21.06	63180	46297	3.75
6	T_6- Neem cake at 200kg/ha in furrow followed by Imazethapyr 30gm/ha at 20DAS	13940	2505	16445	16.35	49050	32605	2.99
7	T_7- Trifluralin @ 1.5kg/ha +Neem oil 1% PPI	13940	1862	15802	21.41	64230	48428	4.07
8	T_8- Soybean oil 2 drops / shoot after emergence of Orobanche	13940	150	14090	17.47	52410	38320	3.72
9	T_9- Application of 25% extra dose of phosphorus and phosphorus solubilizing bacteria	13940	380	14320	17.12	51360	37040	3.59
10	T_{10}- Trichoderma viride 2.5kg/ha as basal application	13940	500	14440	18.40	55200	40760	3.83
11	T_{11}- Farmers practice-1 hoeing at 40DAS	13940	160	14100	18.51	55530	41430	3.94
12	T_{12}- Weedy check	13940	00	13940	16.43	49290	35350	3.54