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Manisha Uraon
Student of M.Sc. (Ag.) Dept. of Agronomy, IGKV, Raipur, Chhattisgarh, India

GK Shrivastava
Scientist of Agronomy Dept. of Agronomy, IGKV, Raipur, Chhattisgarh, India

Correspondence
Manisha Uraon
Student of M.Sc. (Ag.) Dept. of Agronomy, IGKV, Raipur, Chhattisgarh, India

Studies on efficacy of pre-mix penoxsulam + pendimethalin on economics of direct seeded rice

Manisha Uraon and GK Shrivastava

Abstract
The present investigation entitled "Sudies on efficacy of pre- mix penoxsulam + pendimethalin on weed growth, yield and economics of direct seeded rice" was carried out at Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur during *kharif* season of 2015. The soil of experimental field was sandy loam in texture (*Inceptisols*), neutral in pH and has 0.44 % organic carban, low nitrogen, medium phosphorus and high potassium content. Experiment was laid out in Randomized Block Design (RBD) with three replications. The treatments consisted of fourteen different weed management treatments viz, T_1 Penoxsulam + Pendimethalin (10+240 g/l) SE @ 20 + 480 g a.i. ha^{-1}, T_2 Penoxsulam + Pendimethalin (10+240 g/l) SE @ 22.5 + 540 g a.i. ha^{-1}, T_3 Penoxsulam + Pendimethalin (10+240 g/l) SE @ 25 + 600 g a.i. ha^{-1}, T_4 Penoxsulam + Treatment Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha^{-1} (T_4) fetched the maximum net return (Rs 46914.13 ha^{-1}) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 100 + 2400 g a.i. ha^{-1} (T_5) (Rs 45753.13 ha^{-1}) and Penoxsulam 24% SC @ 25 g a.i. ha^{-1} (T_8) (Rs 43905.13 ha^{-1}). While, the highest B:C ratio (2.05) was noted under the application of Penoxsulam 24% SC @ 25 g a.i. ha^{-1} (T_8) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha^{-1} (T_4) (2.00) and Hand weeding at 20 & 35 DAS (T_{13}) (1.57). (10+240 g/l) SE @ 50 + 1200 g a.i. ha^{-1}, T_5 Penoxsulam + Pendimethalin (10+240 g/l) SE @ 100 + 2400 g a.i. ha^{-1}, T_6 Penoxsulam 24% SC 20 g a.i. ha^{-1}, T_7 Penoxsulam 24% SC @ 22.5 g a.i. ha^{-1}, T_8 Penoxsulam 24% SC @ 25 g a.i. ha^{-1}, T_9 Pendimethalin 30% EC @ 540 g a.i. ha^{-1}, T_{10} Pendimethalin 30% EC @ 600 g a.i. ha^{-1}, T_{11} Pendimethalin 30% EC @ 1000 g a.i. ha^{-1}, T_{12} Pendimethalin 30% EC @ 1500 g a.i. ha^{-1}, T_{13} hand weeding at 20 and 35 DAS and T_{14} untreated check. Rice The rice variety MTU-1010 was tested under different combinations of herbicide and maintining the recommended nutrient (N:P:K) doses of 100:50:30 kg ha^{-1}. Rice seed was direct seeded on June 27th, 2015 with a spacing of 20 x 10 cm and harvesting was done on October 29th, 2015.
Treatment Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha^{-1} (T_4) fetched the maximum net return (Rs 46914.13 ha^{-1}) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 100 + 2400 g a.i. ha^{-1} (T_5) (Rs 45753.13 ha^{-1}) and Penoxsulam 24% SC @ 25 g a.i. ha^{-1} (T_8) (Rs 43905.13 ha^{-1}). While, the highest B:C ratio (2.05) was noted under the application of Penoxsulam 24% SC @ 25 g a.i. ha^{-1} (T_8) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha^{-1} (T_4) (2.00) and Hand weeding at 20 & 35 DAS (T_{13}) (1.57).

Keywords: penoxsulam and pendimethalin

Introduction
Rice (*Oryza sativa* L.) is the monocot plant belonging to genus *Oryza* under tribe Oryzeae in grass family poaceae. The genus consists of 26 species, of which 24 are wild and two i.e. *Oryza sativa* and *Oryza glaberrima* are cultivated. *Oryza sativa* is grown worldwide, while *Oryza glaberrima* is grown in parts of West Africa. The plant, which needs both wormth and moisture to grow, measures 2-6 feet tall and has long, flat, pointy leaves and stalk- bearing flowers which produce the grain known as rice. Rice is rich in genetic diversity, with thousands of varieties grown throughout the world.
Rice is the backbone of the Indian agriculture being the main source of livelihood for more than 150 million rural households. In India, total rice crop area is 41.85 m ha and production is 133.29 m t and average productivity is 3.12 t ha^{-1}. It occupies about 23.3 per cent of the food grain production and 55 per cent of cereal production. The rice plays a very vital role in the national food security. In India, rice is grown under three major ecosystems: rainfed uplands (16%), irrigated lands (45%) and rainfed low lands (39%), with a productivity of 0.87, 2.24 and 1.55 t ha^{-1}, respectively (Anonymous, 2015a) [1].
Chhattisgarh state is popularly known as "rice bowl of India" because maximum area is covered under rice during *kharif* and contribute major share in national rice production. The state is completely dependent on monsoon with an annual rainfall 1200-1600 mm. It has geographical area of 13.51 m ha of which 5.9 m ha area is under cultivation. Rice occupies an area of 3.68 mha with productivity of 20.20 q ha^{-1}.

In Chhattisgarh, rice is mainly grown under rainfed ecosystem, which covers about 74, 97 and 95 per cent cropped area of Chhattisgarh plain, Bastar plateau and Northern hill zones, respectively. Chhattisgarh state contributes 5.26 per cent of the total rice production of the country. However, the production and productivity of rice per unit area is very low (Anonymous, 2015b) [2].

Now-a-days herbicides are gaining popularity because of their selectiveness and effectiveness. With the development of crop production technology in the recent years, lower doses of new herbicides have came forward which are being claimed to be more effective against broad spectrum weeds. Since Chhattisgarh is having vast area under rice crop which is the principle *kharif* season crop in all the three agro-climate zone. Certain districts in rice tracts have huge consumption of herbicides to control broad spectrum weeds. Researcher are testing new herbicide combination with lower doses to control the weeds at different critical stages which may reduce the quantity of herbicidal dose besides enhancing productivity. Therefore, there is a need to evaluate the suitability of these new herbicides combination under agro-climatic condition of Chhattisgarh plain.

Material and Methods

Economics (Rs)

Cost of cultivation for each treatment was worked out separately gross return (Rs ha^{-1}) was obtained by converting the harvest in to monetary terms at the prevailing market rate during the course of investigation. Net return was obtained by deducting cost of cultivation from gross return. The benefit: cost ratio was calculated with the help of following formula.

$$\text{Benefit cost ratio} = \frac{\text{Gross return (Rs)}}{\text{Total cost of cultivation}}$$

Results and Discussion

1. Economics

The data on cost of cultivation, gross return, net return and benefit cost ratio from rice as affected by different weed management treatments are presented in Table 1 and Appendix IV & V. The highest cost of cultivation was recorded under treatment hand weeding at 20 and 35 DAS (T_{13}) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 100 + 2400 g a.i. ha^{-1} (T_5) and Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha^{-1} (T_4) and minimum was noted under untreated check (T_{14}). The highest gross return was obtained under treatment Penoxsulam + Pendimethalin (10+240 g/l) SE @ 100 + 2400 g a.i. ha^{-1} (T_5) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha^{-1} (T_4) and hand weeding at 20 and 35 DAS (T_{13}) and lowest gross return was noted under Untreated check (T_{14}). The highest net return was noted under Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha^{-1} (T_4) followed Penoxsulam + Pendimethalin (10+240 g/l) SE @ 100 + 2400 g a.i. ha^{-1} (T_5) and Penoxsulam 24% SC 25 g a.i. ha^{-1} (T_8) and lowest under Untreated check (T_{14}). The benefit cost ratio was recoded highest under treatment application of Penoxsulam 24% SC @ 25 g a.i. ha^{-1} (T_8) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha^{-1} (T_4) and Penoxsulam + Pendimethalin (10+240 g/l) SE @ 100 + 2400 g a.i. ha^{-1} (T_5).

Table 1: Economics of direct seeded rice as influenced by combination of herbicides

	Treatment	Dosage		Time of application DAS	Total Cost of Cultivation (Rs ha^{-1})	Gross Return (Rs ha^{-1})	Net Return (Rs ha^{-1})	B:C Ratio
		g a.i. ha^{-1}	Formulation (ml ha^{-1})					
T_1	Penoxsulam + Pendimethalin (10+240 g/l) SE	20+480	2000	7	21932.27	51570	29637.73	2.35
T_2	Penoxsulam + Pendimethalin (10+240 g/l) SE	22.5+540	2250	7	22060.07	55815	33754.93	2.53
T_3	Penoxsulam + Pendimethalin (10+240 g/l) SE	25+600	2500	7	22187.87	57975	35787.13	2.61
T_4	Penoxsulam + Pendimethalin (10+240 g/l) SE	50+1200	5000	7	23465.87	70380	46914.13	3.00
T_5	Penoxsulam + Pendimethalin (10+240 g/l) SE	100+2400	10000	7	26021.87	71775	45753.13	2.76
T_6	Penoxsulam 24% SC	20	83.33	7	21293.87	48570	27276.13	2.28
T_7	Penoxsulam 24% SC	22.5	93.75	7	21341.87	61545	40203.13	2.88
T_8	Penoxsulam 24% SC	25	104.17	7	21389.87	65295	43905.13	3.05
T_9	Pendemethalin 30% EC	540	1800	7	21628.07	30000	8371.93	1.39
T_{10}	Pendemethalin 30% EC	600	2000	7	21707.87	34515	12807.13	1.59
T_{11}	Pendemethalin 30% EC	1000	3333.33	7	22239.87	54045	31805.13	2.43
T_{12}	Pendemethalin 30% EC	1500	5000	7	22904.87	52110	29205.13	2.28
T_{13}	Hand weeding	NA	NA	20 & 35	26309.87	67740	41430.13	2.57
T_{14}	Untreated check	-	-	-	20909.87	10830	-10079.9	0.52

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