

Original Research Article

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Effects of Herbicide against Yield Attributes and Yield in Transplanted Rice

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ABSTRACT

A field experiment was conducted during the *kharif* season 2019 at Instructional-cum-Research Farm, Raj Mohini Devi College of Agriculture & Research Station, Ambikapur (C.G.) to evaluate the “Effect of herbicide against complex weed flora in transplanted rice, under Northern hill zone of Chhattisgarh. The experiment was laid out in 10 treatments T₁ - Pretilachlor + Pyrazosulfuron (Ready mix) 769 g/ha as PE at 0-5 DAT, T₂ - Pretilachlor + Pyrazosulfuron (Ready mix) 922 g/ha as PE at 0-5 DAT, T₃ - Pretilachlor + Pyrazosulfuron (Ready mix) 615 g /ha as PE at 0-5 DAT, T₄ - Bensulfuron – methyl + Pretilachlor 660 g/ha as PE at 0-5 DAT, T₅ - Pyrazosulfuron – ethyl 15 g a.i / ha as PE at 0-5 DAT, T₆ - Penoxsulam 35 g a.i / ha as a POE at 20-25 DAT, T₇ - Bispyribac – Na – Salt 25 g a.i/ ha as a POE at 20-25 DAT, T₈ - Metsulfuron + Chlorimuron 4 g a.i. / ha as a POE at 12-15 DAT, T₉ - Mechanical Weeding at 20 & 40 DAT and T₁₀ - Weedy Check in RBD with three replications. The data indicated that significant higher growth parameter, yield attributes, yield and net return were obtained in mechanical weeding at 20 and 40 DAT, which was at par with treatment T₂ - Pretilachlor + Pyrazosulfuron (Ready mix) 922 g/ha as PE at 0-5 DAT, T₁ - Pretilachlor + Pyrazosulfuron (Ready mix) 769 g/ha, T₃ - Pretilachlor + Pyrazosulfuron (Ready mix) 615 g /ha and T₄ - Bensulfuron – methyl + Pretilachlor 660 g/ha. The economics analysis of yield also specified that treatment (T₉) mechanical weeding at 20 and 40 DAT recorded maximum net return and B:C ratio and which was at par with T₂ - Pretilachlor + Pyrazosulfuron (Ready mix) 922 g/ha as PE at 0-5 DAT, T₁ - Pretilachlor + Pyrazosulfuron (Ready mix) 769 g/ha, T₃ - Pretilachlor + Pyrazosulfuron (Ready mix) 615 g /ha and T₄ - Bensulfuron – methyl + Pretilachlor 660 g/ha but significantly superior over rest of the weed management treatments.

Keywords

Herbicides,
Transplanted rice,
Yield and Yield
attributes

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Introduction

In India rice crop occupies 44.0 million ha, and production of 110.15 million tonnes with productivity 2.55 tonnes ha. The rice plays a very vital role in the national food security. In India, rice is grown under three major ecosystem: rainfed uplands (16%), rainfed

lowlands (39%) and irrigated lands (45%) with a productivity of 0.87, 1.55, and 2.24 tonnes ha respectively. In Chhattisgarh during *Kharif* season rice is mainly grown under rainfed ecosystem and it is completely dependent on monsoon. Rice occupies an area of 3.68 million ha of total 5.9 million ha cultivated area with productivity of 2.02

tonnes ha. 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 compared to other state like Punjab (38.09 q/ha), Haryana (31.12 q/ha) and West Bengal (27.31 q/ha) (Anonymous, 2017). Severe weed infestation is a major biotic constraint for rice production. Uncontrolled weeds cause 10 - 80% reduction in grain yield and sometimes result in complete failure of crop. Manual weeding is a common practice in the state but it is less efficient and highly cost, labour intensive and often not done on time owing to adverse soil and weather conditions. So use of suitable herbicides provides more efficient and cost – effective control of weeds.

Materials and Methods

The experiment was conducted at Instructional-cum-Research Farm, Rajmohini Devi College of Agriculture and Research Station, Ambikapur (C.G.) during *kharif* 2019. The soil of the experimental field was sandy clay in texture with low available nitrogen (241 kg ha⁻¹), medium available phosphorous (12.7 kg ha⁻¹), high available potassium content (429.70 kg ha⁻¹).

An field experiment was performed in the basic of randomized block design with three replication for ten treatment including *viz.* Pretilachlor + Pyrazosulfuron (Ready- mix) @ 922 g/ha at (0-5 DAT), Pretilachlor + Pyrazosulfuron (Ready- mix) @ 769 g/ha at (0-5 DAT), Pretilachlor + Pyrazosulfuron (Ready- mix) @ 615g/ha at (0-5 DAT), Bensulfuron – methyl + Pretilachlor @ 660 g/ha at (0-5 DAT), Pyrazosulfuron – ethyl 15 g a.i / ha at (0-5 DAT), Penoxsulam @ 35 g a.i/ha at 20-25 DAT, Bispyribac – Na – Salt @ 25 g a.i/ha at 20-25 DAT, Metsulfuron + Chlorimuron @ 4g a.i./ha at 12-15 DAT, Mechanical weeding (20 and 40 DAT) and weedy check. The rice variety IR-64 was used

in the experiment. Rice was transplanted in August and harvested in November 2019. A uniform fertilizer dose of 120, 60, 40 kg N, P₂O₅ and K₂O ha⁻¹ was applied in the experimental field. All the recommended agronomic and plant protection measures were adopted to raise the crop. The data on weed density and dry weight were recorded at different growth stages of rice crop. These were subjected to square root transformation to normalize their distribution. Weed control efficiency (%) was computed using the values of dry weight of weeds. Grain yield of rice along with other yield attributing characters were recorded at harvest.

Results and Discussion

Effect on weeds

The experimental field was infested with all three categories of weeds under seven families. The total number of major species were fourteen, out of which *Echinochloa colona*, *Echinochloa crusgali*, *Cynodon dactylon*, *Leptochloa chinensis*, *Digitaria sanguinalis* among grasses, *Cyperus iria*, *Fimbristylis miliacea*, *Cyperus rotandus*, *Cyperus difformis* among sedges and *Eclipta alba*, *Commelina benghalensis*, *Eichhornia crassipes*, *Ludwigia parviflora*, *Ammania baccifera* among broad leaf weed were present in the transplanted rice field.

All weed management practices brought significant variation in density and dry weight of weeds. Mechanical weeding at 20 and 40 DAT recorded the lowest number (5.66, 6.12, and 5.53 no/ m²) as well as dry weight of grasses, sedges, broad leaved weeds (2.58, 3.99 and 4.50 g/m²) and highest weed control efficiency (81.61, 60.89 and 61.43 %) at 30,60 and 90 DAT respectively. Which was at par with Pretilachlor + Pyrazosulfuron (Ready mix) 922 g/ha as PE at 0-5 DAT fb - Pretilachlor + Pyrazosulfuron (Ready mix)

769 g /ha as PE at 0-5 DAT, Pretilachlor + Pyrazosulfuron (Ready mix) 615 g /ha as PE at 0-5 DAT and Bensulfuron – methyl + Pretilachlor 660 g/ ha as PE at 0-5 DAT. This result was similar to that of the experiment at findings of Yadav *et al.*, (2007). The lower weed density with that

treatment might be due to inherent ability of chemical to affect the cell division, cell growth and hampering the germination of weeds. Similar findings were reported by (Manhas *et al.*(2012), Kumar *et al.*, (2014), Duary *et al.*, (2015), Teja *et al.*, (2015).

Table.1 Effect of herbicides against weed density and dry weight on transplanted rice

Treatments	Total weed density/m ²			Total weed dry weight/m ²		
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
T₁ - Pretilachlor + Pyrazosulfuron (Ready mix) 769 g a.i / hac. as PE at 0-5 DAT	(8.58) 72.62	(10.13) 101.76	(8.22) 66.73	(3.49) 11.21	(4.86) 22.66	(5.37) 27.88
T₂ - Pretilachlor + Pyrazosulfuron (Ready mix) 922 g a.i / hac. as PE at 0-5 DAT	(8.05) 63.82	(9.39) 87.25	(7.98) 62.7	(3.22) 9.43	(4.55) 19.77	(5.15) 25.54
T₃ - Pretilachlor + Pyrazosulfuron (Ready mix) 615 g a.i / hac. as PE at 0-5 DAT	(9.24) 84.85	(10.89) 117.69	(9.36) 86.62	(3.82) 13.66	(5.01) 24.0	(5.62) 30.66
T₄ - Bensulfuron – methyl + Pretilachlor 660 g a.i / hac. as PE at 0-5 DAT	(9.63) 91.85	(11.57) 133.08	(9.87) 96.53	(3.87) 14.00	(5.29) 27.0	(5.68) 31.33
T₅ - Pyrazosulfuron – ethyl 15 g a.i / hac as PE at 0-5 DAT	(10.40) 107.21	(11.91) 140.94	(10.91) 118.2	(4.08) 15.66	(5.37) 27.88	(6.51) 41.33
T₆ - Penoxsulam 35 g a.i / hac. as a POE at 20-25 DAT	(12.12) 146.01	(13.32) 176.65	(11.78) 137.84	(4.88) 22.88	(5.85) 33.32	(6.67) 43.55
T₇ - Bispyribac – Na – Salt 25 g a.i/ hac as a POE at 20-25 DAT	(11.57) 133.06	(12.67) 159.58	(10.60) 111.42	(4.34) 17.88	(5.79) 32.55	(6.29) 38.66
T₈ - Metsulfuron + Chlorimuron 4 g a.i/ hac. as a POE at 12-15 DAT	(10.95) 119.02	(12.53) 156.17	(11.39) 128.88	(4.58) 19.99	(5.86) 33.44	(6.42) 40.32
T₉ - Mechanical Weeding at 20 & 40 DAT	(5.66) 31.06	(6.12) 36.57	(5.53) 29.63	(2.58) 5.66	(3.99) 14.99	(4.50) 19.32
T₁₀ - Weedy Check	(15.19) 229.87	(17.74) 313.75	(14.81) 218.5	(5.64) 30.85	(6.19) 38.33	(7.15) 50.10
SEm ±	1.27	1.70	1.36	0.34	0.56	0.39
CD (at 5%)	4.08	5.50	4.40	1.28	1.79	1.23

*Figures in parenthesis indicates the transformed value. $\sqrt{X + 1}$

Table.2 Effect of herbicides against weed control efficiency and weed index on transplanted rice

Treatments	Weed control efficiency (%)			Weed Index
	30 DAT	60 DAT	90 DAT	
T ₁ - Pretilachlor + Pyrazosulfuron (Ready mix) 769 g a.i /ha. as PE at 0-5 DAT	63.66	40.88	44.35	2.55
T ₂ - Pretilachlor + Pyrazosulfuron (Ready mix) 922 g a.i / ha. as PE at 0-5 DAT	69.43	48.42	49.02	1.42
T ₃ - Pretilachlor + Pyrazosulfuron (Ready mix) 615 g a.i /ha. as PE at 0-5 DAT	55.72	37.38	38.80	8.92
T ₄ - Bensulfuron – methyl + Pretilachlor 660 g a.i / ha. as PE at 0-5 DAT	54.61	29.55	37.46	9.18
T ₅ - Pyrazosulfuron – ethyl 15 g a.i / ha as PE at 0-5 DAT	49.23	27.26	17.50	21.42
T ₆ - Penoxsulam 35 g a.i / ha. as a POE at 20-25 DAT	25.83	13.07	13.07	29.08
T ₇ - Bispyribac – Na – Salt 25 g a.i/ ha as a POE at 20-25 DAT	42.04	15.07	22.83	26.02
T ₈ - Metsulfuron + Chlorimuron 4 g a.i/ ha. as a POE at 12-15 DAT	35.2	12.75	19.52	23.46
T ₉ - Mechanical Weeding at 20 & 40 DAT	81.65	60.89	61.43	-----
T ₁₀ - Weedy Check	---	---	---	31.63

Table.3 Effect of herbicide against yield attributes in transplanted rice

Treatments	Panicle length (cm)	Panicle weight (gm)	Grains per panicle (no.)
T ₁ - Pretilachlor + Pyrazosulfuron (Ready mix) 769 g /ha as PE at 0-5 DAT	18.33	2.4	99.33
T ₂ - Pretilachlor + Pyrazosulfuron (Ready mix) 922 g / ha as PE at 0-5 DAT	20	2.6	99.66
T ₃ - Pretilachlor + Pyrazosulfuron (Ready mix) 615 g /ha as PE at 0-5 DAT	18.33	2.33	98
T ₄ - Bensulfuron – methyl + Pretilachlor 660 g / ha as PE at 0-5 DAT	17.66	2.32	91.66
T ₅ - Pyrazosulfuron – ethyl 15 g a.i / ha as PE at 0-5 DAT	16.6	2.17	91.33
T ₆ - Penoxsulam 35 g a.i / ha as a POE at 20-25 DAT	16.33	2.04	78
T ₇ - Bispyribac – Na – Salt 25 g a.i/ ha as a POE at 20-25 DAT	16.4	2.04	82
T ₈ - Metsulfuron + Chlorimuron 4 g / ha as a POE at 12-15 DAT	16.5	2.12	84.33
T ₉ - Mechanical Weeding at 20 & 40 DAT	20.66	2.66	100
T ₁₀ - Weedy Check	15.4	1.78	75.66
SEm ±	1.31	0.11	3.05
CD (at 5%)	4.1	0.35	9.32

Table.4 Effect of herbicide against grain yield, straw yield, and harvest index in transplanted rice

Treatments	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index (%)
T ₁ - Pretilachlor + Pyrazosulfuron (Ready mix) 769 g /ha as PE at 0-5 DAT	63.66	79	44.62
T ₂ - Pretilachlor + Pyrazosulfuron (Ready mix) 922 g / ha as PE at 0-5 DAT	64.4	79.59	44.76
T ₃ - Pretilachlor + Pyrazosulfuron (Ready mix) 615 g /ha as PE at 0-5 DAT	59.5	78	43.26
T ₄ - Bensulfuron – methyl + Pretilachlor 660 g / ha as PE at 0-5 DAT	59.33	77.83	43.25
T ₅ - Pyrazosulfuron – ethyl 15 g a.i / ha as PE at 0-5 DAT	51.33	72.5	41.35
T ₆ - Penoxsulam 35 g a.i / ha as a POE at 20-25 DAT	46.33	67.66	40.65
T ₇ - Bispyribac – Na – Salt 25 g a.i/ ha as a POE at 20-25 DAT	48.33	71	40.95
T ₈ - Metsulfuron + Chlorimuron 4 g / ha as a POE at 12-15 DAT	50	72	41
T ₉ - Mechanical Weeding at 20 & 40 DAT	65.33	79.66	45
T ₁₀ - Weedy Check	44.66	64.5	40.6
SEm ±	2.05	2.33	0.74
CD (at 5%)	6.2	7.25	2.31

Table.5 Effect of herbicide against gross, return, net return and B: C ratio in transplanted rice

Treatments	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
T ₁ - Pretilachlor + Pyrazosulfuron (Ready mix) 769 g /ha as PE at 0-5 DAT	131343	88942	2.1
T ₂ - Pretilachlor + Pyrazosulfuron (Ready mix) 922 g / ha as PE at 0-5 DAT	132786	89635	2.08
T ₃ - Pretilachlor + Pyrazosulfuron (Ready mix) 615 g /ha as PE at 0-5 DAT	123592	81941	1.97
T ₄ - Bensulfuron – methyl + Pretilachlor 660 g / ha as PE at 0-5 DAT	123249	81773	1.97
T ₅ - Pyrazosulfuron – ethyl 15 g a.i / ha as PE at 0-5 DAT	107724	68550	1.75
T ₆ - Penoxsulam 35 g a.i / ha as a POE at 20-25 DAT	97621	56050	1.35
T ₇ - Bispyribac – Na – Salt 25 g a.i/ ha as a POE at 20-25 DAT	101920	61020	1.49
T ₈ - Metsulfuron + Chlorimuron 4 g / ha as a POE at 12-15 DAT	105150	65949	1.68
T ₉ - Mechanical Weeding at 20 & 40 DAT	134506	91230	2.11
T ₁₀ - Weedy Check	93960	56965	1.47
SEm ±	3675	3474	0.08
CD (at 5%)	11425	10403	0.24

Effect on crop

Mechanical weeding at 20 and 40 DAT registered the significantly highest value of plant fresh and dry weight, yield attributes viz., panicle length (20.66 cm), panicle weight (2.66 gm), grains panicle⁻¹ (100), highest grain (65.33 q/ha), straw yield (79.66 q/ha) and harvest index (45 %), net returns (9130 Rs/ha) and B:C (2.11) ratio and at par with Pretilachlor + Pyrazosulfuron (Ready mix) 922 g/ha as PE at 0-5 DAT fb - Pretilachlor + Pyrazosulfuron (Ready mix) 769 g /ha as PE at 0-5 DAT, Pretilachlor + Pyrazosulfuron (Ready mix) 615 g /ha as PE at 0-5 DAT, Bensulfuron – methyl + Pretilachlor 660 g/ ha as PE at 0-5 DAT. This might be due to increased production and translocation of photosynthesis to yield attributes to adequate availability of growth resources and less competition during the crucial phase of crop offered by weeds. These result are in conformity with Kumar *et al.*, (2014), Duary *et al.*, (2015), Teja *et al.*, (2015)

Mechanical weeding 20 and 40 DAT was found effective to control weeds in transplanted rice on the basis of vegetation analysis. However, based on economic analysis, mechanical weeding 20 and 40 DAT

could be adjudged as the best treatment for effective and economic weed management and obtained higher yield.

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