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Research Article

Effect of integrated weed management on growth and yield of paddy

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Abstract

Paddy is one of the imperative cereal crops of state Jharkhand and plays a crucial part in the economy. Paddy yield is drastically influenced by weeds infestation resulting decrease in output and productivity. The experiment was conducted at Chhotakipona village, Chitarpur Block, Ramgarh, Jharkhand during *kharif* season of 2018 using Randomised Block Design with 9 weed control methods T_1- Weedy check, T_2- Pretilachlore @ 0.75 kgha^{-1} as pre-emergence, T_3- Pretilachlore@0.75 kgha^{-1} + Bispyribac Na@25gha^{-1}, T_4- Pendimethalin @ 1 kgha^{-1} + 2,4-D @ 1.00 kgha^{-1} at 30 DAS, T_5- Pendimethalin @ 1 kgha^{-1} as pre-emergence + Bispyribac Na @ 25 gha^{-1}, T_6- Bispyribac Na @ 25 gha^{-1} as post-emergence at 20 DAS, T_7- Hand weeding at 20 DAS + Hoeing at 40 DAS, T_8- Two hand weeding at 20 & 40 DAS and T_9- weed free and replicated 3 times. The hand weeding and hoeing were carried out manually. Application of IWM (Integrated weed management) in paddy Pretilachlore@0.75 kgha^{-1} + Bispyribac Na@25gha^{-1} was recorded maximum yield attributes resulting in higher grain yield (4952 kgha^{-1}).

Keywords Jharkhand, paddy, yield attributes and yield and integrated weed management

Introduction

One of India's most significant food crops is paddy. It is responsible for feeding more than half of the world's populace. It is a staple food for the majority of people in Southeast Asia. The majority of the world's rice area and cultivation is in Asia. India, which has the world's principal paddy-growing territory, is second only to China in paddy production among paddy-growing countries [1-2]. However, India's productivity is far lower than that of Egypt, Japan, China, Vietnam, the United States, and Indonesia, as well as the global average. It accounts for a total of 42 percent of the country's food grains and 45 percent of the country's overall cereals [3]. India's total paddy area was 431.94 lakh hectares, and paddy production was 110.15 m. tones during 2017-18. The demand for paddy has increased as the country's population has grown [4-5]. Following that, many efforts were made to raise production and productivity in the country through various centrally supported programs, like high yield paddy varieties, Hybrid paddy, SRI method, sensitive to high fertilizer doses, and improved package of procedures. Production has expanded significantly, and the country is currently self-sufficient in paddy [6]. Jharkhand' is one of the central paddy-growing states. Kharif paddy is farmed in most state regions, whereas

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garma (summer) paddy is grown in others. In Jharkhand, paddy productivity averages 1411 kgha^{-1}, placing it in the low productivity category. Improving productivity is the key to increasing paddy production and contributing to the state's food sufficiency. Several studies have shown that using suggested rice technology results in higher yields and profitability for farmers. Paddy yields are now low and need to be significantly enhanced [7-8]. Weeds are the primary issue with direct-seeded wetland paddy because pre-germinated seeds and pre-existing weed seeds in the soil weed seed bank grow concurrently, creating competition for moisture, nutrients, and light [9]. The majority of smallholder farmers are unaware of using herbicides safely [10]. Less toxic herbicides pose low health hazards, are comparatively safer for the environment, and effectively control weeds are critical. Weeds are one of the most significant biological barriers to reaching rice output potential and also have a substantial impact on profitability [1-2, 5]. According to current weed management approaches, yield losses owing to weeds in rice are estimated to be over 10% worldwide [8]. The majority of newly developed herbicides are selective, targeting only one or two species of weeds. The present study is an effort to find suitable weed management practices for better yield and productivity of paddy under study areas.

Table 1. Yield attributes predisposed to various weed control methods

	Treatment	No. of panicles (/m^2)	No. of grains/panicles	Grain weight/plant (g)	Test weight (g)
T_1	Weedy check	262.33	130.40	33.67	17.56
T_2	Pretilachlore @0.75 kgha^{-1} as pre-emergence	303.00	147.76	43.67	20.89
T_3	Pretilachlore @0.75 kgha-1 as pre-emergence + Bispyribac Na @25gmha^{-1} as post-emergence at 20 DAS	353.00	156.73	51.00	23.67
T_4	Pendimethalin @1.0 kgha^{-1} as pre-emergence + Hand weeding at 20 DAS	326.33	150.11	45.00	21.89
T_5	Pendimethalin @1.0 kgha-1 as pre-emergence + Bispyribac Na @25gha^{-1} as post-emergence at 20 DAS	345.00	151.42	47.67	23.22
T_6	Bispyribac Na @25gha^{-1} as post-emergence at 20 DAS	339.67	151.06	45.67	22.56
T_7	Hand weeding at 20 DAS+ Hoeing at 20 DAS	285.33	141.12	36.00	19.73
T_8	Two hand weeding at 20 & 40 DAS respectively	300.67	144.35	41.33	20.56
T_9	Weed free check	399.00	158.28	54.00	24.11
	S Em±	**17.49**	**2.94**	**1.65**	**0.49**
	CD(P=0.05)	**64.04**	**10.78**	**6.04**	**1.80**

Methodology

The experiment was conducted at Chhotakipona village, Chitarpur Block, Ramgarh, Jharkhand during kharif season of 2018 in sandy-loam (sand 52%, silt 33% and clay 15%) in texture, acidic in reaction (pH 6.2), low available N 240 kgha^{-1}, available K 187 kgha^{-1}., low in organic carbon (4.2 gkg^{-1} soil), available P 19.00 kgha^{-1}. The experiment was laid out in Randomised Block Design with 9 weed control methods T_1- Weedy check, T_2- Pretilachlore @ 0.75 kgha-^{1} as pre-emergence, T_3- Pretilachlore@0.75 kgha^{-1} + Bispyribac Na@25gha^{-1}, T_4- Pendimethalin @ 1 kgha + 2,4-D @ 1.00 kgha^{-1} at 30 DAS, T_5- Pendimethalin @ 1 kgha^{-1} as pre-emergence + Bispyribac Na @ 25 gha^{-1}, T_6- Bispyribac Na @ 25 gha^{-1} as post-emergence at 20 DAS, T_7- Hand weeding at 20 DAS + Hoeing at 40 DAS, T_8- Two hand weeding at 20 & 40 DAS and T_9- weed free and replicated 3 times. The annual rainfall of about 1350 mm, of which 85% is received between mid-June to mid-September. A tractor-drawn disc plough was used to furrow the experimental plot, which was then harrowed and planked. Sowing was done by using a marker to open tiny furrows at 22.5 cm between the lines. Manual labourers sowed the seed 2 to 3 cm deep and covered it with earth. A seed rate of 100 kg ha^{-1} was utilized. The paddy crop was fertilized with 120-kilogram N, 60 kg P_2O_5, and 40 kg K_2O per hectare, respectively, in urea, DAP, and MOP. Half of the nitrogen was administered together with the complete doses of phosphorus and potassium at sowing time, and the other half of nitrogen was applied later. The gaps noticed in experiment plots were occupied by seedlings grown at a suitable time to maintain the optimal plant populace. The present study implicates the package of practices for minimizing weed infestation for higher productivity and yield of paddy.

Table 2. Yield (q/ha) of paddy as influenced by different weed control methods.

	Treatment	Grain yield (q/ha)	Straw yield (q/ha)
T_1	Weedy check	22.25	33.38
T2	Pretilachlore @0.75 kg ha^{-1} as pre-emergence	35.00	52.50
T3	Pretilachlore @0.75 kg ha^{-1} as pre-emergence + Bispyribac Na @25gha^{-1} as post-emergence at 20 DAS	49.52	74.28
T4	Pendimethalin @1.0 kg ha^{-1} as pre-emergence + Hand weeding at 20 DAS	38.42	57.63
T5	Pendimethalin @1.0 kg ha^{-1} as pre-emergence + Bispyribac Na @25gha^{-1} as post-emergence at 20 DAS	44.85	67.28
T6	Bispyribac Na @25gha^{-1} as post-emergence at 20 DAS	44.17	66.25
T7	Hand weeding at 20 DAS+ Hoeing at 20 DAS	30.35	51.13
T8	Two hand weeding at 20 & 40 DAS respectively	34.08	52.50
T9	Weed free check	53.17	79.75
	S Em±	1.58	2.47
	CD(P=0.05)	5.79	9.05

Results and Discussion

Yield attributes

Data presented in Table 1 shows paddy crop yield features such as number of panicles/m^2, number of grains/panicles, weight of grains/plant, and 1000 grain weight (g) as influenced by weed management strategies. Seed yield is controlled by various morphological and physiological characteristics of the plant that interact with the environment. Amongst these factors, numbers of panicles, number of grains per panicles, grain weight per plant, and 1000-grain weight, biological yield are the most crucial yield attributing characteristics of paddy. Among weed control methods, T_3 (ha^{-1} + Bispyribac Na@25gm ha^{-1}) was most effective and recorded 34.56, 20.19, 51.47, 34.79,122.56, and 122.53 percent higher numbers of panicles, the number of grains per panicles, grain weight per plant, and 1000-grain weight, respectively owing to improved regulation of weeds at perilous stages consequently providing the favorable atmosphere for enhanced growth and progression resulting into higher grain yield compared to weedy check, i.e., 262 /m^2, 130, 33.67 (g), 17.56 (g), respectively. The results were similar to the findings of several other researchers [3-6,9], who also reported the package of practices for weed controls for higher yields of paddy.

Yield (q/ha)

Data on yield by paddy as predisposed by weed control methods are presented in Table-2. Weed control methods influenced grain and straw yield of paddy significantly higher. Weed-free treatment recorded higher grain (53.17 qha^{-1}) and straw (79.75 qha^{-1}) yield than the weedy check. However, it was similar with T_3 (Pretilachlore@0.75 kg ha^{-1} + Bispyribac Na@25gha^{-1}). The weedy check treatment recorded significantly lower grain (22.25 qha^{-1}) and straw (33.38 qha^{-1}) yield compared to other treatments. Application of T_3 (Pretilachlore@0.75 $kgha^{-1}$ + Bispyribac Na@25gha^{-1}) recorded higher 122.56 and 122.53 % significantly grain and straw yield by paddy. The findings are in accordance with the findings of other researchers [3-6, 9], who reported that weed infestation is common problems in paddy cultivation and can be minimized using the package of practices for better yields.

Conclusion

The outcome of the current study concludes application of IWM (Integrated weed management) in paddy is an essential practice for a higher yield of paddy. The use of weedicide is one of the packages of practices resulting in maximum yield attributes and higher grain yield (4952 $kgha^{-1}$) and is also economically feasible. Hence, it is being recommended to farmers for a better outcome of paddy in Jharkhand.

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