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## Effect of different weed management practices on growth and yield of direct-seeded rice in Krishna zone of Andhra Pradesh

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### Abstract

A field experiment was conducted during the *kharif* season of 2022 to determine the effects of various weed management practices on weed dynamics and productivity of dry direct-seeded rice at Agricultural College Farm, Bapatla. The experiment was laid out in a Randomized complete block design (RCBD) with six treatments and four replications. The lowest weed population, dry weight, highest percent weed control efficiency and productivity of rice were recorded by the hand weeding treatment. Among all the herbicidal treatments, the lowest weeds count, weeds dry weight and highest percent weed control efficiency and high productivity of rice were recorded under treatment PE Bensulfuron methyl 0.6% + Pretilachlor 6% @ 0.66 kg/ha fb PoE Bispyribac-Na 10% @ 25 g/ha at 20 DAS fb PoE Ethoxysulfuron 15% @ 18.8 g/ha + Fenoxaprop-P-Ethyl 6.7% @ 55 g/ha which can be recommended to the farmers.

**Keywords:** Direct seeded rice, weed population, weed control efficiency, grain yield

### Introduction

Over 60% of people on earth depend on rice (*Oryza sativa* L.) as their staple diet, and over 40% of them use it for energy. Approximately one third of all people on earth eat rice every day. A viable substitute resource-conserving technique in light of the impending shortage of agricultural resources is direct-seeded rice (DSR). However in DSR, the aerobic soil condition fosters weed growth, resulting in about 80% production losses. Weed population in season has a significant impact on DSR, suggesting that prompt and efficient weed control is critical to the success of DSR (Hasimi *et al.*, 2022) [3].

However, using a single pre- or post-emergence herbicides to control the varied weed flora found in DSR is extremely challenging. Pre-emergence (PE) herbicide application can also occasionally be difficult because of unusual soil moisture levels and weather conditions. Herbicide-resistant weeds are hard to control when a single herbicide or a combination of herbicides with similar modes of action is applied consistently. For this reason, post-emergence (PoE) applications of different herbicides with various modes of action may be helpful in DSR for effective, broad-spectrum weed control, hence postponing the emergence of herbicide resistance (Kujur *et al.*, 2018 and Yogananda *et al.*, 2019) [4, 9]. Therefore, the present experiment was conducted to find out the effective herbicides or herbicide mixtures for weed control in direct seeded rice.

### Materials and Methods

A field experiment was conducted during *kharif* season of 2022 in the Agricultural College Farm, Bapatla. The field is situated at an altitude of 5.49 m above mean sea level, 15° 54' North latitude, 80° 25' East longitude and about 8 km away from the Bay of Bengal in the Krishna Agro-climatic Zone of Andhra Pradesh state of India. The soil of the experimental field was sandy loam in texture. The experiment consisted of six treatments was laid out in randomized block design with four replications. The treatments were as follows: T<sub>1</sub>: PE Pretilachlor 50% @ 0.5 kg/ha fb PoE Triafamone 20% + Ethoxysulfuron 10% @ 33.6 g/ha at 20 DAS fb PoE

Metsulfuron Methyl 10% + Chlorimuron Ethyl 10% @ 4 g/ha at 40 DAS; T<sub>2</sub>: PE Bensulfuron methyl 0.6% + Pretilachlor 6% @ 0.66 kg/ha fb PoE Triafamone 20% + Ethoxysulfuron 10% @ 33.6 g/ha at 20 DAS fb PoE Metsulfuron Methyl 10% + Chlorimuron Ethyl 10% @ 4 g/ha at 40 DAS; T<sub>3</sub>: PE Pretilachlor 50% @ 0.5 kg/ha fb PoE Bispyribac-Na 10% @ 25 g/ha at 20 DAS fb PoE Ethoxysulfuron 15% @ 18.8 g/ha + Fenoxaprop-P-Ethyl 6.7% @ 55 g/ha; T<sub>4</sub>: PE Bensulfuron methyl 0.6% + Pretilachlor 6% @ 0.66 kg/ha fb PoE Bispyribac-Na 10% @ 25 g/ha at 20 DAS fb PoE Ethoxysulfuron 15% @ 18.8 g/ha + Fenoxaprop-P-Ethyl 6.7% @ 55 g/ha; T<sub>5</sub>: Three hand weeding's at 20, 40 and 60 DAS; T<sub>6</sub>: Weedy check. Recommended agronomic practices were followed for raising the rice crop. The rice variety BPT-5204 (Samba Mashuri) was used in the study. The herbicides were applied using knapsack sprayer with a spray volume of 500 l ha<sup>-1</sup>. Hand weeding was done manually with the hoe. Recommended dose of 120 kg N, 60 kg P<sub>2</sub>O<sub>5</sub> and 60 kg K<sub>2</sub>O ha<sup>-1</sup> was applied through urea, single super phosphate and muriate of potash respectively. One-third quantity of nitrogen and full amount of phosphorus and potassium was applied as basal. Rest two-third quantity of N was applied in two equal splits as top dressing *i.e.* one third of nitrogen was top dressed at active tillering stage and rest one-third of nitrogen was top dressed at panicle-initiation. The data on weed density and dry weight of different weed flora m<sup>-2</sup> were recorded at different growth stages of rice crop. These were subjected to square root transformation to normalize their distribution. Grain and straw yield of rice were recorded at harvest and statistically analyzed at 5% level of significance.

## Results and Discussion

### Weed density

Hand weeding treatments shown significantly lower weed density at 60 DAS over rest of the treatments. The primary cause of this is the timely removal of weed species. The significantly higher weed population was obtained in weedy check at 60 DAS which was significantly superior compared to rest of the treatments. It was mostly due to the unchecked growth of three different kinds of weeds which include grasses, sedges and broadleaved weeds (Dhaker *et al.*, 2022) [2]. Among the herbicide applied treatments, the minimum weed density of total weeds was recorded. under T<sub>4</sub>: PE Bensulfuron methyl 0.6% + Pretilachlor 6% @ 0.66 kg/ha fb PoE Bispyribac-Na 10% @ 25 g/ha at 20 DAS fb PoE Ethoxysulfuron 15% @ 18.8 g/ha + Fenoxaprop-P-Ethyl 6.7% @ 55 g/ha which was at par with PE Pretilachlor 50% @ 0.5 kg/ha fb; PoE Bispyribac-Na 10% @ 25 g/ha at 20 DAS fb; PoE Ethoxysulfuron 15% @ 18.8 g/ha + Fenoxaprop-P-Ethyl 6.7% @ 55 g/ha. This is may be due to the that some weeds may have died as a result of the herbicides application which affect cell division, cell growth, and competition between the weeds and crop. Herbicidal mixtures decreased the weed density compared to the either solo application of pre or post emergence herbicides. These results

are in conformity with the findings of Dangol *et al* (2020) [1].

### Weed dry weight

Among the all herbicidal treatments, the minimum weed dry weight (3.11 g m<sup>-2</sup>) was under T<sub>4</sub> (Bensulfuron methyl 0.6% + Pretilachlor 6% @ 0.66 kg/ha fb PoE Bispyribac-Na 10% @ 25 g/ha at 20 DAS fb PoE Ethoxysulfuron 15% @ 18.8 g/ha + Fenoxaprop-P-Ethyl 6.7% @ 55 g/ha) at 60 days after sowing (Table 1). The maximum dry weight (8.08 g m<sup>-2</sup>) of weed was obtained under T<sub>6</sub> (weedy check). Herbicides were integrated in a way that produced broad spectrum weed control over the other treatments. Pre-emergence herbicides controlled the weeds that emerged early, while post-emergence herbicides controlled the weeds that germinated later and produced the lowest weed population and weed dry weight. These results are in conformity with the findings of Nagargade *et al.* (2024) [6], Mishra, (2019) [5].

### Weed control efficiency (%)

Among herbicide applied treatments, the highest WCE was recorded (85.05%) under T<sub>4</sub> (Bensulfuron methyl 0.6% + Pretilachlor 6% @ 0.66 kg/ha fb PoE Bispyribac-Na 10% @ 25 g/ha at 20 DAS fb PoE Ethoxysulfuron 15% @ 18.8 g/ha + Fenoxaprop-P-Ethyl 6.7% @ 55 g/ha) whereas minimum WCE (70.89%) was obtained with treatment T<sub>1</sub>: PE Pretilachlor 50% @ 0.5 kg/ha fb PoE Triafamone 20% + Ethoxysulfuron 10% @ 33.6 g/ha at 20 DAS fb PoE Metsulfuron Methyl 10% + Chlorimuron Ethyl 10% @ 4 g/ha at 40 DAS. The sequential weed control treatments causes reduction in weed density and ensuing reduction in drymatter demonstrated a broad spectrum weed control efficiency. These findings were in conformity to those of Rao *et al.* (2019) [8].

### Grain yield, Straw yield and Harvest index

Among all the herbicide applied treatments, the significantly higher grain yield of (5.58 t ha<sup>-1</sup>) was produced with T<sub>4</sub> (PE Bensulfuron methyl 0.6% + Pretilachlor 6% @ 0.66 kg/ha fb PoE Bispyribac-Na 10% @ 25 g/ha at 20 DAS fb PoE Ethoxysulfuron 15% @ 18.8 g/ha + Fenoxaprop-P-Ethyl 6.7% @ 55 g/ha) which was at par with T<sub>5</sub>: Three hand weeding's at 20, 40 and 60 DAS). The increased grain yield in these treatments is because of improved yield characteristics, such as the number of productive tillers per square meter, the number of grains per panicle, and the test weight, combined with low weed density and higher WCE. This corroborates with the findings of Negalur *et al.*, (2017) [7], Dhaker *et al.*, (2022) [2]. The treatment T<sub>4</sub> obtained significantly higher straw yield of (6.27 t ha<sup>-1</sup>). The minimum straw yield was recorded in T<sub>6</sub> (Weedy check). Similar findings were observed by Yogananda *et al.*, (2019) [9]. The average harvest index in the experiment was 47.3%. It was not significantly influenced by weed management practices (Table 2).

**Table 1:** Effect of weed control treatments on total weed density, dry weight and weed control efficiency at 60 DAS in direct seeded rice

Treatments	Weed density (No. m <sup>-2</sup> )	Weed dry weight (g m <sup>-2</sup> )	Weed control efficiency (%)
T <sub>1</sub> : PE Pretilachlor 50% @ 0.5 kg/ha fb; PoE Triafamone 20% + Ethoxysulfuron 10% @ 33.6 g/ha at 20 DAS fb; PoE Metsulfuron Methyl 10% + Chlorimuron Ethyl 10% @ 4 g/ha at 40 DAS	13.63	4.39	70.89
T <sub>2</sub> : PE Bensulfuron methyl 0.6% + Pretilachlor 6% @ 0.66 kg/ha fb PoE Triafamone 20% + Ethoxysulfuron 10% @ 33.6 g/ha at 20 DAS fb; PoE Metsulfuron Methyl 10% + Chlorimuron Ethyl 10% @ 4 g/ha at 40 DAS.	12.23	4.14	73.40
T <sub>3</sub> : PE Pretilachlor 50% @ 0.5 kg/ha fb; PoE Bispyribac-Na 10% @ 25 g/ha at 20 DAS fb; PoE Ethoxysulfuron 15% @ 18.8 g/ha + Fenoxaprop-P-Ethyl 6.7% @ 55 g/ha	11.31	3.72	78.58

T <sub>4</sub> : PE Bensulfuron methyl 0.6% + Pretilachlor 6% @ 0.66 kg/ha fb; PoE Bispyribac-Na 10% @ 25 g/ha at 20 DAS fb; PoE Ethoxysulfuron 15% @ 18.8 g/ha + Fenoxaprop-P-Ethyl 6.7% @ 55 g/ha	9.33	3.11	85.05
T <sub>5</sub> : Three hand weeding at 20, 40 and 60 DAS	2.63	1.26	96.43
T <sub>6</sub> : Weedy check	20.08	8.08	0.00
CD (P=0.05)	1.39	0.67	7.36

**Table 2:** Effect of weed control treatments on grain yield, straw yield and harvest index of direct seeded rice

Treatments	Grain yield (kg ha <sup>-1</sup> )	Straw yield (kg ha <sup>-1</sup> )	Harvest index (%)
T <sub>1</sub> : PE Pretilachlor 50% @ 0.5 kg/ha fb; PoE Triafamone 20% + Ethoxysulfuron 10% @ 33.6 g/ha at 20 DAS fb; PoE Metsulfuron Methyl 10% + Chlorimuron Ethyl 10% @ 4 g/ha at 40 DAS	5028.99	5022.00	50.06
T <sub>2</sub> : PE Bensulfuron methyl 0.6% + Pretilachlor 6% @ 0.66 kg/ha fb PoE Triafamone 20% + Ethoxysulfuron 10% @ 33.6 g/ha at 20 DAS fb; PoE Metsulfuron Methyl 10% + Chlorimuron Ethyl 10% @ 4 g/ha at 40 DAS.	5159.70	5779.03	47.18
T <sub>3</sub> : PE Pretilachlor 50% @ 0.5 kg/ha fb; PoE Bispyribac-Na 10% @ 25 g/ha at 20 DAS fb; PoE Ethoxysulfuron 15% @ 18.8 g/ha + Fenoxaprop-P-Ethyl 6.7% @ 55 g/ha	5317.33	6065.72	46.55
T <sub>4</sub> : PE Bensulfuron methyl 0.6% + Pretilachlor 6% @ 0.66 kg/ha fb; PoE Bispyribac-Na 10% @ 25 g/ha at 20 DAS fb; PoE Ethoxysulfuron 15% @ 18.8 g/ha + Fenoxaprop-P-Ethyl 6.7% @ 55 g/ha	5589.43	6274.00	47.13
T <sub>5</sub> : Three hand weeding at 20, 40 and 60 DAS	5854.01	6877.29	45.98
T <sub>6</sub> : Weedy check	2782.93	3148.70	46.85
CD (P=0.05)	553.68	606.94	NS

### Conclusion

From the above findings, it can be stated that the Bensulfuron methyl + Pretilachlor can effectively manage different categories of weeds, especially of sedge and broad leaved weeds in direct sown rice. Post emergence application of Bispyribac-Na at 20 DAS followed by Ethoxysulfuron + Fenoxaprop-P-Ethyl at 40 DAS suppressed all the predominant weeds throughout crop growing season and recorded higher weed control efficiency and higher grain yield. Thus, combined application of Bensulfuron methyl 0.6% + Pretilachlor 6% @ 0.66 kg/ha as PE fb PoE Bispyribac-Na 10% @ 25 g/ha at 20 DAS fb PoE Ethoxysulfuron 15% @ 18.8 g/ha + Fenoxaprop-P-Ethyl 6.7% @ 55 g/ha may be recommended for broad spectrum weed management and higher paddy yield of *kharif* grown rice in the Krishna zone of Andhra Pradesh.

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