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PERFORMANCE OF DIRECT SEEDED RICE (*ORYZA SATIVA*) AND WEEDS UNDER DIFFERENT WEED CONTROL PRACTICES

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ABSTRACT

A field experiment was conducted at the College of Agriculture, JNKVV, Jabalpur during Kharif2022, to assess the efficacy of various weed control practices on direct-seeded rice (*Oryza sativa*) and weed populations. The study encompassed seven distinct treatments, with a focus on weed density and dry weight reduction for both monocot and dicot weed species. The most effective treatments in mitigating weed density and dry weight involved the pre-sowing application of glyphosate, supplemented by a single hand weeding event at 30 days after sowing (DAS). Additional treatments that demonstrated noteworthy weed control included hand weeding twice at 30 and 45 DAS, post-emergence application of bispyribac-sodium coupled with a single hand weeding event, post-emergence application of bispyribac-sodium alone, and pre-sowing glyphosate application in conjunction with a solitary hand weeding event at 30 DAS. These treatments yielded grain outputs of 3475, 3154, 2655, 2330, 2110, and 1870 kg/ha, respectively, in stark contrast to the meagre 1508 kg/ha grain yield in the weedy check plot. Regarding plant development and productivity, the treatment involving the pre-sowing application of glyphosate alongside one-hand weeding at 30 DAS displayed the most favourable outcomes. This treatment yielded the maximum plant height at 30 DAS (29.75 cm), at the time of harvest (72.00 cm), and the highest number of effective tillers, registering 825.00/m^2. Subsequently, the treatment involving hand weeding twice at 30 and 45 DAS also exhibited notable plant growth and tiller development characteristics.

Keywords: DSR, Glyphosate, Bispyribac-sodium, Weed density, Weed Dry weight.

Introduction

Rice (*Oryza sativa* L.), a member of the Poaceae family, stands as a fundamental dietary staple for a significant portion of the global population. India boasts the largest cultivated area for rice, covering 43.99 million hectares, and ranks as the second-largest producer worldwide, yielding 104.99 million tonnes in 2022 (FAO, 2022). Among cereals, rice holds a preeminent position globally, as underscored by Ashraf *et al*. (2006), and over 50% of the world's population relies on it for their daily sustenance (Chauhan and Johnson, 2011).Weeds dominate the crop habitat and lower the yield potential due to their high adaptability and rapid growth. Sunil *et al*. (2010) have documented that prolonged weed competition throughout the rice growing season in the context of Direct Seeded Rice (DSR) can lead to a substantial reduction in yield, potentially up to 80%. Thus, efficient weed control is crucial for successful production of DSR (Kumar *et al*. 2016). Weeds could be managed by hand weeding, through herbicides or by a combination of both. While, hand weeding represents a conventional weed control method employed by farmers, it proves to be labour-intensive and costly, primarily due to elevated labour

wages. In such circumstances, the utilization of appropriate herbicides emerges as the sole viable alternative to achieve enhanced productivity while minimizing cost implications. Integrated approach is much more efficient than the individual control methods.

Materials and Methods

A field experiment was conducted at the College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, during the Kharif season of 2022. The experiment encompassed seven distinct treatments, as detailed in Table 1. The experimental site featured clay loam soil with the following properties: 0.57% organic carbon content, pH of 7.1, and initial nutrient levels of 260.14 kg/ha of available nitrogen, 16.18 kg/ha of available phosphorus, and 305.10 kg/ha of available potassium. Rice variety JR206 was sown with a 20 cm row-to-row spacing on July 10, 2022, employing a seed rate of 70 kg/ha and was subsequently harvested on November 10, 2022. The recommended fertilizer regimen, consisting of 120 kg/ha of nitrogen, 40 kg/ha of phosphorus, and 60 kg/ha of potassium, was applied with half of the nitrogen (60 kg N/ha) administered as a basal dose at the time of sowing, while the remaining nitrogen was split into two equal portions, with 25% applied as a top dressing at the tillering stage (30 days after sowing) and the remaining 25% at the panicle initiation stage (60 days after sowing). Seven weed management practices were implemented in this study: T_1 - Pre-sowing application of glyphosate; T_2 - Pre-sowing application of glyphosate followed by one hand weeding at 30 days after sowing (DAS); T_3 - Post-emergence application of bispyribac-sodium salt; T_4 - Post-emergence application of bispyribac-sodium salt followed by one hand weeding at 45 DAS; T_5 - Single hand weeding at 30 DAS; T_6 - Hand weeding twice, at 30 and 45 DAS; T_7 -Weedy check. Glyphosate was applied before sowing the crop, while bispyribac-sodium was applied 20 days after sowing when the crop had reached the 3-4 leaf stage. These herbicides were administered using a knapsack sprayer with a water volume of 500 litres per hectare. Weed density was assessed using 0.25 m^2 quadrats at 30, 60, 90 DAS, and at harvest across all treatments, and subsequently converted into weed counts per square meter. The collected weeds were dried in an oven until a constant weight was achieved and were then quantified in grams per square meter using the appropriate formula. The data of total weed count and weed dry matter were subjected to a square root transformation to achieve normalization of their distribution, following the methodology outlined by Gomez and Gomez in 1984.

Results and Discussion

Effect on weeds

The experimental study involved the assessment of weed control in a field comprising *Echinochloa colona*, *Leptochloa chinensis*, *Fimbristylis miliacea*, *Cyperus rotundus*, and *Celosia argentia*. The application of glyphosate before sowing, in conjunction with a single hand weeding at 30 days after sowing (DAS), resulted in a significant reduction in both the density and dry weight of monocot and dicot weeds, as indicated in Table 1. Conversely, the effectiveness of bispyribac-sodium, when supplemented with one hand weeding at 45 DAS, was surpassed by the practice of hand weeding twice, at 30 and 45 DAS. This observed superiority is likely attributed to the comprehensive weed control achieved through the combined strategy of glyphosate application prior to crop sowing and manual weeding post-crop emergence.

At 30 days after sowing (DAS), the pre-sowing application of glyphosate in conjunction with a single hand weeding operation at 30 DAS exhibited comparable efficacy to the exclusive use of pre-sowing glyphosate application, resulting in superior weed control outcomes. This was primarily due to the effective suppression of weeds prior to crop sowing. Subsequently, at 45 DAS, a combination of post-emergence bispyribac-sodium application and a single hand weeding operation proved equally effective as the sole post-emergence bispyribac-sodium application in weed management. The performance of hand weeding twice, once at 30 DAS and again at 45 DAS, was also on par with exclusive hand weeding and significantly outperformed weedy-check plots in terms of weed control. At the time of harvest, the combined treatment of pre-sowing glyphosate application with a single hand weeding at 30 DAS, followed by hand weeding at both 30 and 45 DAS, led to a notable reduction in the density and dry weight of both monocot and dicot weeds. This surpassed the performance of post-emergence bispyribac-sodium application in isolation and the exclusive use of pre-sowing glyphosate with a single hand weeding at 30 DAS. Collectively, these findings indicate that the integrated approach of post-emergence bispyribac-sodium application with one hand weeding at 45 DAS, followed by post-emergence bispyribac-sodium application alone and pre-sowing glyphosate application with one hand weeding at 30 DAS, yielded superior weed control results when compared to weedy-check plots.This was due to the

fact that the less competition for moisture, light and nutrient uptake by thecrop plants. The higher assimilation of photosynthesis in weedicides treated plots may be the reason for higheryield. The result was in close conformity with those of Singh *et al.* (2003), Singh *et al*. (2006), Singh *et al*. (2007).

Tables 1 : Effect of weed control measure on density and dry weight of weed at harvest

Treatment	Weed density (No./$m^{2)}$				Weed dry weight(g/ m^2)			
	Monocot		Dicot		Monocot		Dicot	
	30 DAS	At harvest	30 DAS	At harvest	30 DAS	At harvest	30 DAS	At harvest
T_1	1.50 (2.75)	5.09 (25.5)	1.85 (2.9)	3.27 (10.25)	2.25 (4.56)	4.26 (17.56)	1.87 (3.00)	3.51 (11.75)
T_2	1.75 (2.50)	1.80 (2.75)	1.75 (2.56)	1.65 (2.50)	2.08 (3.76)	1.54 (1.87)	1.50 (1.75)	1.60 (2.06)
T_3	4.25 (17.56)	4.00 (15.50)	4.50 (19.75)	2.69 (6.75)	6.23 (39.31)	3.73 (13.56)	6.72 (45.65)	3.25 (10.06)
T_4	4.50 (19.75)	2.73 (7.00)	4.25 (17.56)	2.23 (4.50)	6.01 (38.56)	2.27 (4.56)	6.51 (41.75)	3.25 (10.06)
T_5	8.50 (72.75.)	4.60 (20.75)	8.00 (63.50)	2.82 (7.50)	9.53 (89.75)	4.00 (15.50)	10.76 (115.06)	3.24 (10.06)
T_6	8.25 (67.56)	1.93 (3.25)	7.75 (60.56)	1.73 (2.50)	10.25 (104.56)	1.65 (2.25)	11.25 (126.06)	1.80 (2.74)
T_7	9.75 (94.56)	8.42 (70.50)	8.25 (67.56)	6.02 (35.75)	11.23 (126.06)	9.00 (80.50)	12.26 (149.56)	5.24 (27.06)
CD (P=0.05)	**0.64**	**0.68**	**1.16**	**0.38**	**1.24**	**0.36**	**1.06**	**0.25**

Effect on rice:

The data analysis reveals notable variations in plant growth and yield outcomes among different weed control strategies in a crop study at 30 days after sowing (DAS) and at the time of harvest. At 30 DAS, the application of glyphosate prior to sowing, combined with a single hand weeding session, exhibited the highest plant height at 29.75 cm, closely followed by pre-sowing glyphosate application alone at 29.50 cm. However, at the time of harvest, the pre-sowing glyphosate application with one hand weeding session resulted in the maximum plant height of 72.00 cm, with hand weeding twice at 30 and 45 DAS reaching 68.25 cm. Thesefindings are similar to the findings of Teja *et al*. (2015).

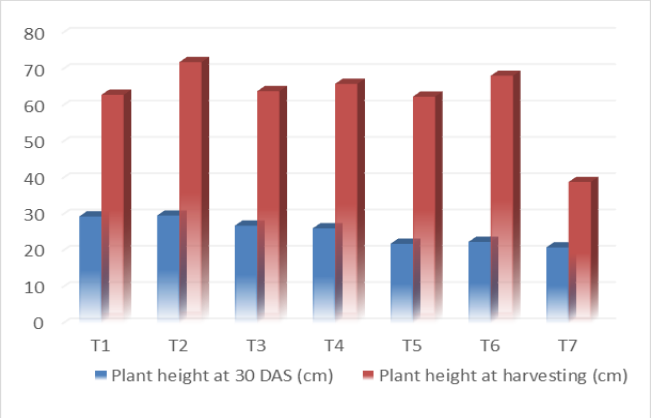

Fig. 1 Effect of various weed management practices on plant height of direct seeded rice at 30 DAS and at harvest

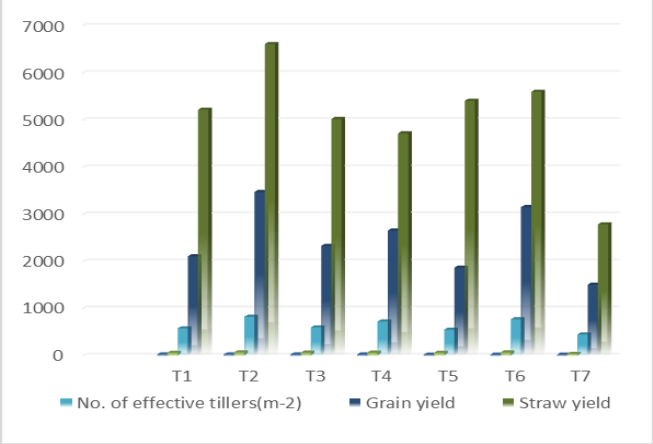

Fig. 2 : Effect of various weed management practices on No. of effective tillers, grain yield and straw yield of direct seeded rice

In terms of effective tillers per square meter, the pre-sowing glyphosate application along with one hand weeding at 30 DAS demonstrated the highest count at 825/m^2, followed closely by hand weeding twice at 30 and 45 DAS, with 772.50/m^2. These findings indicate a significant impact of different weed control practices on grain and straw yield compared to weedy check plots. Notably, the combination of pre-sowing glyphosate application and one-hand weeding at 30 DAS resulted in the highest grain yield at 3475 kg/ha and straw yield at 6615 kg/ha, surpassing other strategies, including hand weeding twice at 30 and 45 DAS, which achieved yields nearly double that of the weedy check plots. These findings are similar to the

findings of Gopinath *et al*. (2012), Karthika *et al*.(2019) and Manisankar *et al*. (2019).

Conclusion

The study highlights the importance of integrating chemical and manual weed control strategies to enhance the growth and yield of direct-seeded rice. The pre-sowing application of glyphosate followed by hand weeding at 30 DAS emerges as the most effective practice, offering substantial benefits in terms of both weed suppression and rice productivity. These findings provide valuable insights for developing effective weed management protocols to optimize rice yields in direct-seeded systems.

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