Comparative bio-efficacy of different weedicides and cultural practices against Grasses, Sedges and Broad-leaf weeds in Direct Seeded Rice

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ABSTRACT

Background: Direct seeded rice (DSR) requires less labor, tends to mature faster than transplanted crops hence less water requiring and gives better yields owing to the reason that the rice seedlings are not subjected to stresses such as being pulled from the soil and re-establishing fine rootlets. However, it encounters more competition from weeds as compared to transplanted rice.

Methods: A field experiment was conducted in clayey loam soil during Kharif season of 2016 at Rice Research Institute, Kala Shah Kaku, Lahore, Pakistan in a factorial randomized block design comprising of five treatment combinations of weedicides and cultural practices applied before and after seedling emergence at normal seed rate of 30 kg/ha in Direct Seeded Rice. Treatment combinations included one stale bed technique + spray of Bispyribac sodium at 22 DAS, One stale bed technique + spray of Glyphosate 15-20 days before seeding + Bispyribac Sodium at 22 DAS, Spray of pendimethalin as pre emergence + spray of Fenoxaprop-P-ethyl + Bispyribac sodium at 22 DAS, Spray of Bispyribac sodium + bensulfuraon at 22 and 40 DAS, Spray of pendimethalin as preemergence and Fenoxprop P Ethyl at 22 DAS and Bispyribac sodium at 40 DAS and control with no weedicide applied.

Results: Application of herbicides in different combinations and at different timings registered a significant variation in weed population over no herbicide treatment throughout the crop growth stages. Pre-emergence application of pendimethalin along with spray of Fenoxaprop-P-ethyl and Bispyribac sodium at 22 (days after sowing) DAS (T3) lowered down the weed population at maximum from 125/m^2 to 11.50/m^2 as compared to rest of the treatments. Likewise, After T3, Treatment T2 that included one stale bed technique with spray of Glyphosate 15-20 days before seeding and Bispyribac Sodium at 22 DAS decreased the weed density from 130.5/m^2 to 17.20/m^2 in the observed field areas.

Conclusion: Results of the experiment suggests that third treatment (T3) i.e. spraying Pendimethalin before seedling emergence along with spray of Fenoxaprop-P-ethyle and application of Bispyribac Sodium at 22nd day after sowing posed maximum inhibition of studied weeds. Pendimethalin had the inherent capacity to affect the cell division, cell growth, thus hampered the germination of weeds. As a second option, second treatment (T2) i.e. one stale bed

technique along with spray of Glyphosate 15-10 days before seeding and application of Bispyribac Sodium at 22nd day after sowing inhibited the weeds growth after T3.

Keywords: Direct seeded rice, Weed management, Weedicides, yield, yield attributes

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1. INTRODUCTION

Direct seeded rice (DSR) requires less labor, tends to mature faster than transplanted crops hence less water requiring and gives better yields owing to the reason that the rice seedlings are not subjected to stresses such as being pulled from the soil and re-establishing fine rootlets. However, it encounters more competition from weeds as compared to transplanted rice. Among all the weeds of DSR, *Leptochloa chinensis* and *Dactolactenum aegyptium* are the most devastating weeds. The productivity of direct seeded rice is higher but under field conditions it yields very low as weeds pose serious menace as compared with other rice ecosystem (Singh, 2002). This is because of aerobic soil condition, high temperature and dry tillage practices. With the introduction of short statured high yielding rice varieties with erectophylic leaves, the weed menace is becoming more acute. Highly competitive grassy weeds and sedges are tolerant to drought condition, thus predominant under the situations. Yield losses due to weed competition in direct seeded upland rice ranged from 15 to 90 percent (Mishra, 1997). The weed problem in DSR is very complex due to competitiveness and phasic emergence of weeds. Hence, an attempt has been made to devise the weed management strategy through integration of ecological, physical and chemical method of weed control under irrigated and rainfed upland rice eco-system.

Weed control is important to prevent losses in yield and production costs, and to preserve good grain quality. Specifically, weeds decrease yields by direct competition for sunlight, nutrients, and water thus increasing production costs e.g., higher labor or input costs, reduced grain quality and price.

2. MATERIALS AND METHODS

The experiment was conducted in clayey loam soil during Kharif season of 2016 at Rice Research Institute, Kala Shah Kaku, Pakistan. The soil of the experimental field was clayey loam.

The experiment was laid out in a factorial randomized block design with three replications. The five treatments combinations including control as check were:

(i) Stale bed technique + spray of Bispyribac sodium at 22 DAS
(ii) One stale bed technique + spray of Glyphosate 15-20 days before seeding + Bispyribac Sodium at 22 DAS
(iii) Spray of pendimethalin as pre emergence + spray of Fenoxaprop-P-ethyl + Bispyribac sodium at 22 DAS
(iv) Spray of Bispyribac sodium +bensulfuraon at 22 and 40 DAS
(v) Spray of pendimethalin as preemergence and Fenoxprop P Ethyl at 22 DAS and Bispyribac sodium at 40 DAS
(vi) Control

Stale seedbed technique is commonly used to reduce the weed seed bank in the soil. In this technique, weeds were allowed to emerge for at least 2 weeks. Tillage operations i.e. plow and harrow were performed on pre-levelled fields. Weed emergence is stimulate by light irrigation in order to maintain enough soil moisture to allow weeds to germinate. The high yielding rice variety, Super Basmati, was sown on 21st and 30th June during 2016 respectively with a row spacing of 25 cm and continuous seeding in rows. A total of 133 kg N, 85 kg P_2O_5 and 62 kg K_2O/ha were applied as basal. The rest N was applied as top dressing at 35 and 45 days of crop age. Crop growth rate was computed from the dry weight of 10 randomly selected plants from each plot. Leaf area index was calculated by using area weight relationship. The weed count and weed density were taken at 20, and 30 DAS and at harvest by using the quadrate method. During harvest, the yield attributes such as number of productive tillers, fertile grains/panicle and 1000-grain weight were recorded. After threshing, the grain and straw yield from each plot were recorded on perfect drying.

3. RESULTS AND DISCUSSION

Altogether different species of weeds belonging to grass family, sedges and broad leaved weeds were observed in the experimental site. The observed data results showed that weed population density were influenced significantly with different herbicides combinations before and after the herbicide treatments (Table 1). The same results were reported by Angiras and Sharma, 1998. Table 1 shows the overall densities of all the weeds altogether observed in the area before and after treatments.

Application of herbicides in different combinations along with and at different timings registered a significant variation in weed population over no herbicide treatment throughout the crop growth stages (Table 1). Pre-emergence application of pendimethalin along with spray of Fenoxaprop-P-ethyl and Bispyribac sodium at 22 (days after sowing) DAS (T3) lowered down the weed population from 125/m^2 to 11.50/m^2 as also depicted in table 1. Pendimethalin had the inherent capacity to affect the cell division, cell growth, thus hampered the germination of weeds. Similar findings were recorded by Pandey and Swarnakar, 1997 and Mutanal *et al*., 1997. Likewise,

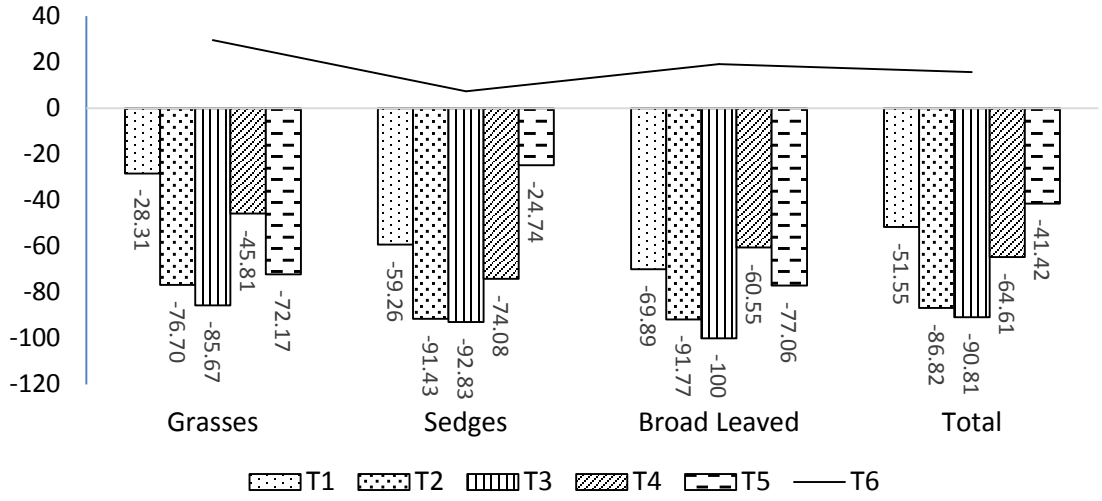
After T3, Treatment T2 that included One stale bed technique with spray of Glyphosate 15-20 days before seeding and Bispyribac Sodium at 22 DAS decreased the weed density from 130.5/m^2 to 17.20/m^2 in the observed field areas. It is in agreement with the findings of Savithri *et al*., 1994.

Likewise, T4 treatments including one spray of each of Bispyribac sodium and bensulfuraon at 22 and 40 DAS decreased weed population from 152.3 to 53.9 / ^{m2}, T1 One stale bed technique + spray of Bispyribac sodium at 22 DAS from 128.9 to 62.45 / ^{m2} while the minimum level of weed control was observed in case of treatment T5 that involved Spray of pendimethalin as preemergence and Fenoxprop P Ethyl at 22 DAS and Bispyribac sodium at 40 DAS. While in control where no herbicide was applied showed significant increase of weed densities from 148 to 171 /m^2 as shown in table 1.

Figure 1 shows the percentage reduction or increase in weed densities before and after the treatment applications in case of each herbicidal combination. It can be easily be comprehended from the figure that among all the treatments T3 showed the highest weed control, followed by T2, T5, T4 and T1 in case of each type of weeds under studies. In case of grasses, weed density decreased by 85.67% due to treatment T3 as compared to their respective densities before herbicidal treatments, T2 reduced by 76%, T5 by 72%, T4 by 45% and T1 by 28% whereas the control increased the weed grasses by 23% as depicted in figure 1. Likewise, in case of sedges, weed density decreased by 93% due to treatment T3 as compared to their respective densities before herbicidal treatments, T2 reduced by 91%, T4 by 74% T1 by 59%, and T5 by 24% whereas the control increased the weed grasses by 7% as depicted in figure 1.

In case of broad leaved weeds, weed density decreased by 100% due to treatment T3 as compared to their respective densities before herbicidal treatments, T2 reduced by 92%, T5 by 78% T1 by 70%, and T4 by 60% whereas the control increased the weed grasses by 19% as depicted in figure 1.

As a whole, cumulative weed density of all the weed types decreased by 91% due to treatment T3 as compared to their respective densities before herbicidal treatments, T2 reduced by 87%, T4 by 65% T1 by 52%, T5 by 41% whereas the control increased the weed grasses by 17% as depicted in figure 1. Results emphasizes that Treatment T3 reduced maximum weed spreading after treatment as compared to the rest of the treatment combinations. T2 treatments non-significantly differed from T3 in weed control percentage between pre and post treatment weed densities. While the rest of the treatments showed significantly lower level of suppression of weeds under observed fields.



T1 = One stale bed technique + spray of Bispyribac sodium at 22 DAS
T2 = One stale bed technique + spray of Glyphosate 15-20 days before seeding + Bispyribac Sodium at 22 DAS
T3 = Spray of pendimethalin as pre emergence + spray of Fenoxaprop-P-ethyl + Bispyribac sodium at 22 DAS
T4 = Spray of Bispyribac sodium +bensulfuraon at 22 and 40 DAS
T5 = Spray of pendimethalin as pre-emergence and Fenoxaprop-P-ethyl at 22 DAS and Bispyribac sodium at 40 DAS
T6 = control

Figure 1: Percentage decrease or increase in population densities of grasses, sedges and broad-lead weeds in Direct Seeded Rice (DSR) after each treatments.

5. CONCLUSION

Results of the experiment suggests that third treatment (T3) i.e. spraying Pendimethalin before seedling emergence along with spray of Fenoxaprop-P-ethyle and application of Bispyribac Sodium at 22nd day after sowing posed maximum inhibition of studied weeds. Pendimethalin had the inherent capacity to affect the cell division, cell growth, thus hampered the germination of weeds. As a second option, second treatment (T2) i.e. one stale bed technique along with spray of Glyphosate 15-10 days before seeding and application of Bispyribac Sodium at 22nd day after sowing inhibited the weeds growth after T3. Therefore, third treatment (T3) may be recommended to control and mitigate weeds of all the three types in DSR crop.

Table 1: Pre and post treatment weed densities of all the types of weeds

Treatments		Pre Treatment Weed Density				Post Treatment Weed Density			
		Grasses	Sedges	Broad-Leaved	Total	Grasses	Sedges	Broad-Leaved	Total
One stale bed technique + spray of Bispyribac sodium at 22 DAS	T1	38.50	71.80	18.60	128.90	27.60	29.25	5.60	62.45
One stale bed technique + spray of Glyphosate 15-20 days before seeding + Bispyribac Sodium at 22 DAS	T2	41.20	73.50	15.80	130.50	9.60	6.30	1.30	17.20
Spray of pendimethalin as pre emergence + spray of Fenoxaprop-P-ethyl + Bispyribac sodium at 22 DAS	T3	36.30	87.90	1.00	125.20	5.20	6.30	0.00	11.50
Spray of Bispyribac sodium +bensulfuraon at 22 and 40 DAS	T4	40.60	89.90	21.80	152.30	22.00	23.30	8.60	53.90
Spray of pendimethalin as pre-emergence and Fenoxaprop-P-ethyl at 22 DAS and Bispyribac sodium at 40 DAS	T5	34.50	86.90	10.90	132.30	9.60	65.40	2.50	77.50
Control	T6	48.90	86.50	13.00	148.40	63.40	92.80	15.50	171.70

Conflict of Interest

The authors declare that they have no conflict of interest.

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