Pak. j. life soc. sci. (2004), 2(1): 24-27

Pakistan Journal of Life and Social Sciences

Evaluation of Some Herbicides for the Control of Weeds in Wheat Crop

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Abstract

The study was conducted at Adaptive Research Farm, Gujranwala for two years (2000-01 and 2001-02) to evaluate the effect of Topic, Affinity, Isoproturon, Puma-S and Sencor on weed control, grain yield and yield components of wheat crop. All the herbicides provided good control of narrow leaf weeds and caused significant reduction in their density. Mortality of narrow leaf weeds ranged between 92.52 and 97.61%. Affinity, Isoproturon and Affinity provided good control of broad-leaf weeds resulting in 75.64 to 96.80 % mortality whereas Topik and Puma S had no effect on broad leaf weeds. Number of tillers m^{-2}, 1000-grain weight, number of grains $spike^{-1}$ and grain yield recorded in treated plots were significantly higher in treated plots as compared to untreated ones. Affinity gave the highest yield (4656.7 and 40.53 kg ha^{-1}) followed by Isoproturon (4583.30 and 3973.3 kg ha^{-1}) and Sencor (4493.3 and 3906.0 kg ha^{-1}) for the 2000-01 and 2001-02, respectively. On the basis of economic analysis Isoproturon was found to give the highest net return of Rs.8037 ha^{-1} followed by Affinity (Rs. 7862) and Sencor (Rs.7759.5).

Keywords: Wheat, Weed control, Herbicides, Yield components, Pakistan

Introduction

Weeds are one of the most important factors which adversely affect the yield of wheat crop. They compete with wheat plants for nutrients, moisture, light and other growth requirements. They reduce yields, lower the quality of the crop and increase the cost of harvesting, threshing and cleaning. Weed control is therefore an important component of management practices used to increase crop production. Chemical herbicides are most important tools in weed management to maintain yield and quality of crop. Various researchers have investigated the efficacy of different herbicides for control of weeds in wheat crop.

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A field experiment conducted by Malik *et al.* (2001) revealed that application of Isoproturon at 1.0 kg ha^{-1} provided significant control of *Phalaris minor*. Azad *et al.* (1997) also found that application of 0.75 kg Isoproturon ha^{-1} at 30-35days after sowing gave the best weed control. Similarly, Agrawal and Jain (1998) recorded the highest weed control by Isoproturon applied @1.5 kg ha^{-1} alone or in combination with 2, 4-D @ 0.5 kg ha^{-1}. Virender *et al.* (2001) applied different herbicides and recorded the highest weed control by the application of Isoproturon +2, 4-D (79.3%) and Metribuzin (79.2%) at 35 days after sowing. Herpal *et al.* (1999), however, revealed that a combination of Isoproturon and Metribuzine was the most effective herbicide treatment against *Phalaris minor*, providing 72% control of this weed.

Dingxu (2001) applied affinity and other herbicides at various growth stages of wheat and observed that affinity was the most effective herbicide in controlling weeds at 3 leaf stage. Studies of Tickes (2003) have shown that Puma Super provided good (92%) control of *Phalaris minor* and *Avena fatua* and icreased yield and yield components. Hussain *et al.* (2003) compared the performance of Affinity, Alkanak, Logran and Buctril-M and observed that all the herbicides decreased weed population and significantly increased the number of tillers m^{-2}, number of grains $spike^{-1}$, 1000- grain weight and grain yield in treated plots as compared to control. Fayed *et al.* (1998) applied different herbicides at 30 or 60 day after sowing of wheat and the results have shown that tralkoxydim and Puma Super applied at 30 days after sowing of wheat gave significant increase in wheat spikes m^{-2}, grains $spike^{-1}$, 1000 grain weight and grain yield as compared to control. The results of previous studies reported here indicate that efficiency of herbicides could be modified by the species of weeds, soil type, environmental conditions and experimental protocols. Weed flora of rice tract differs from other regions of the Punjab (Jalis *et al.*, 1986). Therefore, the present study was undertaken to evaluate the effectiveness of most commonly available herbicides under rice-wheat cropping system.

Materials and Methods

The study was conducted at Adaptive Research Farm, Gujranwala during Rabi, 2000-01 and 2001-02. Wheat variety Inqlab-91 was planted with 125 kg

seed rate ha-1. Fertilizer @ 128-114-62 kg NPK ha^{-1} was applied. All P and K+ I/3 N was applied at sowing time, 1/3 N at first irrigation and 1/3 at second irrigation. The herbicide treatments are listed as follows.

Topik 15 WP (clodinofop propargyle) @ 247 g. ha^{-1}(37.5 g a. i. ha^{-1})
Affinity 50WP (Isoproturon + Carfentrazone) @ 2 kg. ha^{-1} (1000 +15 g a. i. ha^{-1})
Isoproturon 50 WP @ 2 kg.ha^{-1} (1000 g a. i. ha^{-1}).
Puma Super 75 EW (Fenoxaprop-p-ethyl) @ 1.235 l.ha^{-1}(937.5 g a. i. ha^{-1})
Sencor 75 DF (Metribuzin) @ 247 g ha^{-1}(187.5 g a. i. ha^{-1})
Control

Insecticide trade name	Chemical name	Recommended dosage (l/ha.)
Topic 15 WP	Clodinofop propargyle	247 g
Affinity 50 WP	Isoproturon+ Carfentrazone	2 kg
Isoproturn 50WP	Isoproturon	2 kg
Puma Super 69 EW	Fenoxaprop-p-ethyle	1,235 l.
Sencor 75 DF	Metribuzin	247 g
Control	–	–

The experiment was laid out in randomized complete block design with three replications having 5 x 15 m plot sizes. The herbicides were sprayed at 4-6 leaf stage of weeds in moist field after first irrigation with hand operated knapsack sprayer in a spray volume of 250 l. ha^{-1}. Weed count was recorded before and 3 weeks after spray of herbicides from one meter square area randomly selected from each plot. The data on tiller count, number of grains $spike^{-1}$, 1000-grain weight and grain yield were recorded at harvesting. The data were statistically analyzed by Fisher's analysis of variance method and the treatment means were compared with LSD test at 5% level of significance. Economic analysis was carried out on the basis of extra income obtained from the enhanced yield by extra cost incurred for each treatment and prevailing market prices.

Results and Discussion

Major narrow leaf weed species recorded in the experimental plots were wild oats (*Avena fatua*) and dumbi sitti (*Phalaris minor*). The broadleaf weeds included common lambquarters (*Chenompodium album*), krund (*Chenopodium murale*), Shahtra (*Fumaria* indica), maina (*Medicago sativa*), Common vetch (*Vicia sativa*), senji (*Melilotus indica*) and lehli(*Convolvulus arvensis*).

Results of the study showing the effects of herbicide applications on weed control yield components and yield during rabi 2000-01 are presented in Table1. All herbicides provided good control of narrow leaf weeds, causing significant reduction in their density (2.67 to 6.33 weeds m^{-2}) as compared to untreated control (95.97 weeds m^{-2}). Mortality of these narrow leaf weeds varied from 92.52 to 97.61% following the application of herbicides. However, the efficiency of herbicides in controlling broad leaf weeds differed. Affinity, Isoproturon and Sencor provided good control of broad leaf weeds resulting in 97.61%, 87.75 %, and 80.68 % mortality, respectively. Topik and Puma-Super had no effect on broad leaf weeds.

Number of tillers m^{-2}, 1000-grain weight, number of grains $spike^{-1}$ increased significantly in herbicide treated plots as compared to untreated ones. Number of tillers differed among various herbicides as well as between treated and untreated plots. Affinity gave the highest number of tillers m^{-2}(440.67) followed by Isoproturon (434.33) and Sencor (426.33), which were statistically at par with each other but significantly higher than Topik (401.00) and Puma Super(399.0). The 1000-grain weight, and number of grains $spike^{-1}$ were the highest in the plots treated with Affinity (41.57 g and 46.33 g) but these results did not differ significantly from those of other herbicides. It appears that these two parameters are less sensitive as compared to the tillers per unit area and the population of broad leaf weeds recorded in our plots was too low to cause significant differences among these. .The increase in number of tillers, 1000-grain weight, number of grains $spike^{-1}$ may be attributed to better weed control and elimination of weed crop competition for nutrients, moisture and light and better utilization of available resources by the crop. These results agree with the findings of Fayed (1998), and Hussain *et al.* (2003) who recorded similar increase in these yield components in their weed control experiments.

Wheat grain yield recorded in treated plots was significantly higher than the untreated control. The highest yield was obtained from the plots treated with Affinity (4656.7 kg ha^{-1}) followed by Isoproturon (4583.3 kg ha^{-1}) and Sencor (4493.3) but the differences among these treatments were not significantly different. This was due to better control of narrow leaf and broad leaf weeds by these herbicides. Puma-Super and Topik registered lower yield (4283.3 and 4226.7 kg ha^{-1}, respectively) because they did not control narrow leaf weeds. These results agree with those of Hussain *et al.* (2003).

More or less similar results were recorded during 2001-02. All the herbicides except Topik and Puma Super (which controlled the narrow leaf weeds only) provided satisfactory control of narrow and broad leaf weeds. A significant increase in yield components i.e. number of tillers m^{-2}, 1000-grain weight, number of grains $spike^{-1}$ was recorded in treated plots over control. Again, this year the highest number of tillers m^{-2} (363.33), 1000-grain weight (38.27 g.), grains $spike^{-1}$ (42.67) and grain yield (4053.3 kg ha^{-2}) were observed with Affinity as compared to other treatments.

Table 1: Effect of herbicides on weed control, yield components and yield of wheat during rabi 2000-01

		Topic@247 g ha^{-1}	Affinity@ 2kg ha^{-1}	Isoproturon@ 2Kg ha^{-1}	Puma S.@ 1.235 L ha^{-1}	Sencor @247 kg ha^{-1}	Control	LSD
Weed density before spray	Narrow leaf	71.67*	83.67	74.67	99.00	84.67	82.33	-
	Broad leaf	11.33*	14.67	16.33	15.67	19.0	16.67	-
Weed density after spray	Narrow leaf	3.33 a	2.67 a	4.67	4.33	6.33	95.67 b	8.03
	Broad leaf	11.67 a	0.67 b	2.00 b	14.67 a	3.67 b	17.33 b	6.87
Mortality (%)	Narrow leaf	95.35	97.61	93.75	95.63	92.52	-	-
	Broad leaf	-	95.43	87.75	6.38	80.68	-	-
No. of tillers m^{-2}		401 b	440.67 a	434.33 a	399.00 b	426.33 a	329.33 c	23.31
No. of grains $spike^{-1}$		40.37 a	41.57 a	41.33 a	40.67 a	40.97 a	37.27 b	1.29
No. of grains $spike^{-1}$		44.33 a	46.33 a	45.67 a	44.00 a	45.33 a	37.67 b	5.85
Yield (kg ha^{-1})		4283.3 b	4656.7 a	4583.3 a	4226.7 b	4493.3 a	3303.0 c	146.71

* Non significant

Means sharing the same letter do not differ significantly

Table 2: Effect of herbicides on weed control, yield components and yield of wheat during rabi 2001-02

		Topic@247 g ha^{-1}	Affinity@ 2kg ha^{-1}	Isoproturon@ 2Kg ha^{-1}	Puma S.@ 1.235 L ha^{-1}	Sencor @247 kg ha^{-1}	Control	LSD
Weed density before spray	Narrow leaf	83.33 *	91.33	89.00	79.67	92.67	68.67	
	Broad leaf	13.67 *	17.0	15.0	18.67	13.67	21.00	
Weed density after spray	Narrow leaf	2.67 a	3.67 a	6.33 a	3.38 a	5.67 a	62.33	15.26
	Broad leaf	12.67 a	0.67 b	2.33 b	16.33 a	3.33 b	20.00 a	8.84
Mortality (%)	Narrow leaf	96.80	95.98	94.75	95.76	93.88	-	-
	Broad leaf	7.32	96.06	84.46	12.53	75.64	-	-
No. of tillers m^{-2}		316.67 b	363.33 a	357.00 a	321.67 b	351.33 a	264.67 c	21.86
No. of grains $spike^{-1}$		37.60 a	38.27 a	38.07 a	37.77 a	37.93 b	34.83 c	1.27
No. of grains $spike^{-1}$		41.33 a	42.67 a	42.33 a	41.0 a	42.00 a	33.67 b	4.13
Yield (kg ha^{-1})		3746.7 b	4053.3 a	3973.3 a	3706.7 b	3906.0 a	2910.0 c	154.53

* Non significant

Means sharing the same letter do not differ significantly

Table 3: Economics of weed control operations in wheat crop

Treatments	Yield* (kg ha^{-1})	Increase in yield over control (kg)	Profit calculated @ Rs. 7.5 kg^{-1}	Cost of insecticide and labour (Rs. ha^{-1})	Net profit (Rs. ha^{-1})
Topik 15WP @ 250 g ha^{1} (37.5 .g a i ha^{-1})	4015.0	908.3	6812.3	1275.0	5537.3
Affinity @ 2.0 kg ha^{-1} (1000+15 .g a i ha^{-1})	4355.0	1248.3	9362.3	1500.0	7862.3
Isoproturon @ 2.0 kg ha^{-1} (1000 .g a i ha^{-1})	4278.3	1171.6	8787.0	750.0	8037.0
Puma Super- @ 1.25 l. ha^{-1} (937.5 .g a i ha^{-1})	3966.7	860.0	6450.0	1187.5	5262.5
Sencor 40 EC @ 250 g ha^{-1} (137.5 .g a i ha^{-1})	4199.7	1093.0	8197.7	437.5	7759.5
Control.	3106.7	-	-	-	-

*Average of two year results

The economic analysis showed that all herbicide treatments were economical as compared to control (Table 3). Surprisingly, Isoproturon provided the highest net return (Rs. 8083) followed by Affinity (Rs 7862) and Sencor (7759.5). Puma super gave the lowest net return (Rs.5262.5)

Our findings lead to the conclusion that application of Puma super and Topik could provide good control of narrow leaf weeds but Affinity, Sencor and Isoproturon are recommended for adequate control of both narrow and broadleaf weeds under environmental conditions comparable to the ones considered in this experiment

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