

Bio-Efficacy of Different Graminicides and Their Effect on the Growth and Yield of Wheat Crop

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ABSTRACT

Field trials to study the efficacy of six different graminicides in wheat crop were carried out at Adaptive Research Farm, Sheikhpura Pakistan. The trials were laid out in Randomised Complete Block Design with three replications. The results revealed that Atlantus 3.6 WG @ 400 g ha⁻¹, Isoproturon 50 WP @ 2.0 kg ha⁻¹, Metribuzin 70 WP @ 247 g ha⁻¹, Topik 15 WP @ 247 g ha⁻¹, Puma super 75 EW @ 1.0 l ha⁻¹ and Affinity 50 WP @ 2.0 kg ha⁻¹ gave 100.00, 96.61, 86.84, 77.50, 77.14 and 63.26% control of *Phalaris minor* Retz., respectively and 100.00, 73.33, 78.57, 94.78, 95.00 and 82.60% control of *Avena fatua* L. The height of wheat was maximum (100.67 cm) and grains per spike were 41.230 when treated with Topik. Maximum number of tillers m⁻² (322.39), 1000-grains weight (33.33 g) and grain yield (4291.7 kg ha⁻¹) was observed in plots treated with Isoproturon.

Key Words: Bio-efficacy; Graminicides; Growth; Yield; Wheat

INTRODUCTION

Average yield of wheat (*Triticum aestivum* L.) in Pakistan is very low with an average of 1876 kg ha⁻¹, which is far below the level that could be achieved (GOP, 2001). Several factors contribute to this low yield but the weed infestation is a serious one. Weeds compete with the crop plants for light, nutrients, moisture, space and carbon dioxide. Weeds are reported to reduce crop yield, make less efficient use of land and labour, poor quality of products and more water management problems (Klingman & Ashton, 1982). Weeds reduce yield by 10-25% (Ahmad *et al.*, 1991). Allelopathic substances have been reported in many plant species including annual and perennial weeds. Many weeds are reported to serve as host for various diseases and pests.

Weeds are a serious problem in Pakistan's agriculture. Amongst the various agronomic practices involved in crop production, weed control plays an important role in increasing crop yield. Weeding through manual labour or animal drawn implements is not only laborious but it is quite expensive owing to the increased cost of labour and mechanization of farm operations.

Graminicides are effective and economical only if crop is infested with narrow leaved weeds. Therefore, there is need to introduce graminicides, which can provide effective control of specific types of weeds (Anderson, 1996). The present study was carried out to evaluate the effect of post emergence graminicides on yield and economics of wheat.

MATERIALS AND METHODS

Field trials were conducted at Adaptive Research Farm, Sheikhpura during Rabi seasons of 2002-03 and

2003-04. The soil was heavy loam with pH 8.4 and organic matter less than 0.5%.

Trials were laid out in Randomized Complete Block Design with 3 replications. The net plot size was 5x10m. Wheat cultivar Uqab-2000 was sown with hand drill, using seed rate 125 kg ha⁻¹. NPK fertilizers were applied at the rate of 128:114:62 kg ha⁻¹, respectively. Half of the N and full doses of P and K were applied at sowing time while the remaining half N was applied at first irrigation. Trial treatments comprised of Topik 15WP (Chlodinafop propergyle) @ 247 g ha⁻¹, Affinity 50WP (Carfentrazone-ethyl+Isoproturon) @ 2.0 kg ha⁻¹, Isoproturon 50WP @ 2.0 kg ha⁻¹, Puma super 75 EW (Fenoxaprop-p-Ethyl) @ 1.0 l ha⁻¹, Metribuzin 70 WP @ 247 g ha⁻¹, Atlantus 3.6 WG (Mesosulfuron-methyl, Iodosulfuron-methyl-sodium+Alkyl ether sulphate sodium-salt) @ 400 g ha⁻¹ and weedy check. All the weedicides were sprayed with "Solo" hand sprayer fitted with flood jet nozzle after first irrigation in "Wattar" (moisture at field capacity level) condition. Weed population from one square meter, randomly selected from individual plots was recorded before spray and 30 days after spray (75 Days After Sowing).

Data were recorded on various parameters and cumulative averages for the two years were subjected to statistical analysis in computer M stat C. Least Significant Difference Test at 5% probability level was employed to determine the differences among the treatment means (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

All the graminicides significantly controlled the *A. fatua* L. and *P. minor*. Topik and Puma super were statistically similar and the best ones in this regard (Table I).

While other treatments differed from one another in controlling *A. fatua* L and *P. minor* Retz. After 30 days of spray (75 DAS) mortality percentage of *A. fatua* and *P. minor* was 89.50 for Topik, 89.56 for Puma super, 86.56 for Isoproturon, 81.48 for Metribuzin, 100 for Atlantus and 72.63 for Affinity. Both the graminicides (Puma super and Topik) gave a good control of *A. fatua* L. but slightly weaker towards the control of *P. minor* Retz. at labeled rates. Table I also depicts that mortality percentage of *A. fatua* L. was 100.00, 95.00, 94.78, 82.60, 78.57 and 73.33 for Atlantus, Puma super, Topik, Affinity, Metribuzin and Isoproturon, respectively. Similar results were also reported by Singh *et al.* (1989), and Raffel and Fluh (1992). Similarly, mortality percentage of *P. minor* was 100.00, 96.61, 86.84, 77.50, 77.14 and 63.26 for Atlantus, Isoproturon, Metribuzin, Topik, Puma super and Affinity, respectively. It is also evident from Table I that there was 8.33% cumulative increase in *A. fatua* and *P. minor* population at second count i.e. 75 DAS in weedy check. Similarly, 9.80, 5.26% increase in population of *A. fatua*

and *P. minor*, respectively was also recorded in second count of weeds i.e. 75 DAS in the weedy check. These results are in conformity with the findings of Baldha *et al.* (1989).

Table II shows that all the graminicides displayed significantly better yield and yield components than weedy check. Topik gave the highest plant height (100.67 cm) and Atlantus suppressed the plant height (77.10 cm) at the labeled doses. Topik gave the highest number of productive tillers per meter square (315.00) over weedy check (258.00). (El-Hattab *et al.*, 2001) also had similar findings. Topik also gave the highest number of grains per spike (41.230) over weedy check (32.300). Isoproturon gave the highest 1000-grains weight (33.33 g) over weedy check (29.40 g). Increase in 1000-grain weight has also been reported by Ahmed *et al.* (1991). Isoproturon also gave more grain yield (4291.7 kg ha⁻¹) over weedy check (2450.0 kg ha⁻¹) which is in accordance with the findings of Gill and Walia (1989).

Economic analysis (Table III) shows that all the graminicides increased the yield over weedy check. Also all

Table I. Mortality percentage of *Avena fatua* L. and *phalaris minor* Retz.

Treatments	Weeds population before spray (45 DAS*)			Weeds population (30 days after spray)						
	<i>A. fatua</i>	<i>P. minor</i>	Total	<i>A. fatua</i>		<i>P. minor</i>		Total		
	No.	% mortality	No.	% mortality	No.	% mortality	No.	% mortality	No.	% mortality
Topik 15 WP	78	40	118	4	94.78	9	77.50	12	89.50	
Affinity 50 WP	46	49	95	8	82.60	18	63.26	26	72.63	
Isoproturon 50 WP	45	59	104	12	73.33	2	96.61	14	86.53	
Puma super 75EW	80	35	115	4	95.00	8	77.14	12	89.56	
Metribuzin 70 WP	70	38	108	15	78.57	5	86.84	20	81.48	
Atlantus 3.6WG	80	25	105	0	100.00	0	100	0	100	
Weedy check	82	38	120	90	-	40	-	130	-	

*Days after sowing

Table II. Effect of different graminicides on growth and yield of wheat

Treatments	Plant height (cm)	Tillers (m ²)	Grains per spike	1000-grains weight (g)	Yield (kg ha ⁻¹)
Topik	100.67a	315.00abc	41.230a	31.39e	4076.8abc
Affinity	90.50e	316.67ab	40.730ab	30.51de	3935.0abcd
Isoproturon	100.567ab	322.39a	39.94bcde	33.33a	4291.7a
Puma Super	99.467abc	314.78abcd	40.040abc	31.31b	4091.7a
Metribuzin	88.233f	300.00e	40.040abcd	30.59d	3675.0bcde
Atlantus	77.100g	273.45f	33.080f	29.76f	2691.7cdef
Weedy Check	95.367d	258.00g	32.300fg	29.40fg	2450.0fg
	LSD1.259	LSD 45.12	LSD 13.42	LSD 1.228	LSD 451.2

The means showing similar letters in the same column do not differ significantly from each other (p=0.05).

Table III. Economic Analysis of the Bio-efficacy of different graminicides and their effect on the growth and yield of wheat crop

Treatm-ents	Av.yield kg ha ⁻¹	Add.Yield kg ha ⁻¹	% inc.	Total Exp. Rs. ha ⁻¹	Total income Rs. ha ⁻¹	Net income Rs. ha ⁻¹	Add. Exp Rs. ha ⁻¹	Add. Income Rs ha ⁻¹	Marginal CBR
Topik	4076.8	1626.8	66.40	19890.25	30576.00	10085.75	1690.25	12201.00	1:7.22
Affinity	3935.0	1485.0	60.61	19663.75	29512.00	9248.25	1463.75	11137.00	1:7.61
Isoproturon	4291.7	1841.7	75.17	19981.28	32187.50	11806.22	1781.28	13812.50	1:7.75
Puma Super	4091.7	1641.7	67.01	19861.28	30687.75	10226.47	1661.28	12312.75	1:7.41
Metribuzin	3675.0	1225.0	50.00	19228.75	27562.50	7733.75	1028.75	9187.50	1:8.93
Atlantus	2691.7	241.7	9.87	18911.28	20187.75	676.47	711.28	1812.75	1:2.55
Weedy Check	2450.0	-	-	-	-	-	-	-	-

CBR = Cost Benefit Ratio

the graminicides caused an increase in net return over the weedy check. However, net return in case of Atlantus was minimum because it suppressed the plant height. The maximum marginal cost benefit ratio of 1:8.93 and 1:7.75 with additional income of Rs. 9187.50 and Rs. 13812.50 was recorded in crop treated with Metribuzin and Isoproturon, respectively.

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