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PERFORMANCE OF DIFFERENT HERBICIDES IN WHEAT UNDER IRRIGATED CONDITIONS OF SOUTHERN PUNJAB, PAKISTAN

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ABSTRACT

A field study was conducted to investigate the performance of different herbicides for controlling weeds in wheat and their effect on the grain yield of wheat variety Manthar-2003 at Agronomic Research Station, Bahawalpur, Pakistan during the year 2004-05. The treatment included the broad spectrum herbicides viz. Isoproturon 50WP 2.0 kg ha^{-1}, Sencor 70WP @ 250 g ha^{-1}, Puma Super 75 FW @ 1.25 L ha^{-1} + Buctril Super 60EC @ 750 ml ha^{-1} (tank mixed), grass selective herbicides Puma Super 75 EW @ 1.25 L ha^{-1} and Topik 15 WP @ 250 g ha^{-1} , dicot selective herbicide Buctril super 60 EC @ 750 ml ha^{-1} and mechanical control i.e hoeing twice at Ist and 2nd irrigations were compared with the weedy check. Puma Super 75 EW + Buctril Super 60 EC applied 40 days after sowing gave 98% control of both grassy and broad leaf weeds followed by isoproturon applied after first irrigation in wet condition gave 95% weed control as compared to the weedy check.. As a result of excellent weed control, the maximum grain yield of 3990 Kg ha^{-1} was recorded from the Puma Super 75 EW @ 1.25L ha^{-1} + Buctril Super 60EC @ 750 ml ha^{-1} followed by Isoproturon @ 2 kg ha^{-1} having statistically at par grain yield of 3973 kg ha^{-1}. Although Puma Super 75 EW + Buctril Super produced the maximum grain yield yet Isoproturon has given maximum benefit: cost ratio 582% and proved to be the most economical herbicide for weed control in wheat. The weedy check produced the lowest statistical grain yield of 3393 kg ha^{-1} as compared to the herbicides and mechanical (hoeing twice) treatments included in the experiment. It is concluded from the study that all the treatments resulted in the statistically significant weed control and enhanced the grain yield over the weedy check.

Key Word *Triticum aestivum,* chemical control, hand weeding

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the staple food crop of Pakistan. During 2004-5 it was grown on an area of 8.216 million ha^{-1} with an annual production of 19.500 million tons of grain giving and average yield of 2.373 tons ha^{-1} (Anonymous, 2005), which is much below the harvested potential of our existing varieties. In Pakistan it is estimated that annual losses caused by weeds may be more than 10 billion rupees (Ahmad, 1992). Because of high competitive ability and high reproductive potential of weeds it is imperative to check their infestation. Weeds compete with the crop plants for nutrients, moisture, space and light. Shad (1987) reported that yield losses due to weed are in proximity of 17-25 percent which in terms of wheat grain comes to about 2.43 to 3.57 million tons annually. Chemical weed control enables farmers to obtain higher yields per unit area with an over all lower production cost. Herbicide are

a quick tool to control dense weed populations. Selective herbicides reduce the need for hand weeding. The effectiveness of herbicides is affected by time, rate and method of application.

Khan et al. (1987) reported that at the sites where *Phalaris minor* and *Avena fatua*were problem, substituted urea herbicides proved better weed control economically. Cheema et al. (1988) observed that post emergence application of Isoproturon @ 2 kg ha^{-1} or chlorotoluron +MCPA @ 2.5 kg ha^{-1} in wheat field heavily infested with *Phalaris minor* resulted in the highest grain yield and with cost benefit ration of 1:4.26 and 1:3.84 respectively, as against 1:2.24 for pendimethalin (pre-emergence). It was further reported that the increase in yield in the former two treatments was due to more number of spikes, grains $spike^{-1}$ and heavier grain weight.

Ahmad et al. (1991) while evaluating 5 post-emergence herbicides alone at recommended doses and in combination with DMA-6 for weed control in wheat concluded that herbicide application suppressed weed population effectively. Dosanex + DMA-6 and Arelon provided the best weed control. However, Dicuran M.A. 60 WP + DMA-6 produced the maximum grain yield. DMA-6 alone and in combination with Dicuran M.A.60 WP was more economical than all other herbicidal treatments. Prasad (1985) reported that Isoproturon, Tribunil 70WP and 2,4-D were the most effective in decreasing dry weight of weeds and increasing grain yields. Bhagat and Jain (1985) revealed that 2,4-D and hand weeding decreased the population and dry weight of weeds significantly. Dicuran MA 60WP, Buctril M. 40EC applied to wheat crop and hand weeding resulted in more grain yield than unweeded check. Chemical weed control was more economical than conventional method (Cheema et al.1988a&b). The present study was therefore, undertaken with the objectives to determine the efficacy of different postemergence herbicides as compared to hand weeding in controlling weeds and to detect their effect on the yield of wheat under Bahawalpur conditions.

MATERIALS AND METHODS

The study on post-emergence herbicides in controlling weeds and their effect on yield and yield components was carried out at Agronomic Research Station, Bahawalpur during Rabi 2004-05. The trial was laid out in Randomized Complete Block Design with three replications with plot size of 5x3 m^2. The experiment comprised of 8 treatments (Table-1). Wheat variety Manthar-03 was sown in lines 30 cm apart with single row hand drill in the 4^{th}week of November, 2004 with a seeding rate of 150 kg ha^{-1}. Fertilizer dose of 125-100-50 (NPK) kg ha^{-1} was applied. All the phosphorus and potash and half of nitrogen was applied at sowing while remaining half of Nitrogen was applied with Ist irrigation. Four irrigations were applied as needed. The herbicides were sprayed according to schedule given in Table-1 at 30 and 40 days after sowing. A knap sack hand sprayer fitted with T-get nozzle was used. Tank mixture of recommended dose of herbicides was used at the time of spray. All other cultural practices were kept at the recommended level and uniform for all the experimental units. Weed density of all weed species from one Square meter was counted before herbicidal spray. Data for weed density m^{-2} was recorded 21 days after spray. Wheat yield and yield components viz No. of fertile tillers m^{-2}, No. of grains $spike^{-1}$ and 1000-grain weight were recorded and analyzed

statistically (Steel and Torrie 1980) and treatment means were tested by least significant difference test at 5% probability level.

RESULTS AND DISCUSSION

Weed Density m^{-2}

The data on weed density revealed that *Phalaris minor* Retz. a grass weed had the maximum weed density of 65 to 80 plants m^{-2} and *Chenopodium album* had 30 to 51 plants m^{-2} (Table-2) while rest of the weeds were of minor importance. Maximum weed count 125 $m^{-2}$was recorded in weedy control followed by 65 and 44 plants in the plots where Buctril Super 60EC @ 750 ml ha^{-1} and Puma Super @ 1250 ml ha^{-1} were sprayed. As Buctril super did not control *Phalaris minor* while Puma Super did not control broad leaf weeds whereas least number of weeds 3 to 6 were recorded when Puma Super + Buctril Super and Isoproturon were sprayed for broad spectrum weed control.

Fertile Tillers m^{-2}

Maximum fertile tillers 318 m^{-2} were recorded in the plots treated with Puma Super + Buctril Super followed by Isoporturon having 315 fertile tillers m^{-2} as both were broad spectrum hence they controlled the weeds very effectively and resulted in maximum fertile tillers m^{-2}. (Table-3). Minimum fertile tillers 270 m^{-2} were recorded in weedy control.

Number of Grains Spike $^{-1}$

Maximum number of grain 42 $spike^{-1}$ were obtained in the plots treated with Puma Super + Buctril Super followed by Isoproturon and hand weeding treatments having 40 grains $spike^{-1}$ while there was no significant difference among the means of rest of the treatments. Least number of grains i.e.32 grains $spike^{-1}$ were obtained in weedy control (Table-3) indicating severe weed competition resulting in a decreased number of grains $spike^{-1}$ similar findings have been reported by Ahmad et al. (1991).

1000-Grain Weight g

The maximum 1000-grain weight 32.15 and 31.5 was obtained in the plots treated with Puma Super + Buctril Super and hand weeding treatments while there was no significant difference among the means of other treatments. However, least grain weight of 26.40 g was obtained in weedy control indicating that density of weed had depressed the 1000-grains weight in weedy control. Similar results have been reported by Ahmad et al. (1991) and Cheema et al. (1988).

Grain Yield kg ha^{-1}

All the herbicidal applications increased wheat yield over weedy control. The increase was corresponding to the weed control spectrum attained with the application of Puma Super + Buctril Super and Isoproturon which controlled both grassy and broad leaf weeds. The yields increased with these treatments were correspondingly greater as compared to their application alone. While minimum yield was obtained in weedy check. These findings are in a great analogy with the previous work of

Ahmad et al. (1991) and Cheema et al. (1988a&b) who obtained enhanced wheat yields with the application of herbicides.

ECONOMIC ANALYSIS

Economic analysis of different weed control treatments revealed that weed control in wheat by the use of herbicides gave more economic return as compared to hand weeding (Table 4) the highest benefit cost ratio of 582 % was recorded for Isoproturon 50WP @ 2Lit. ha^{-1} and proved to be the most economical herbicide for weed control of wheat. It is thus concluded that use of chemical control of weed is more economical than hand weeding which gave cost benefit ratio of 161% only.

TABLE-1. Different post- Emergence Herbicidal Treatments

Treatment	Herbicide	Dose	Application days after sowing
T1	Puma-Super 75EW	1.25 L ha^{-1}	40
T2	Topik 15WP	0.25 kg ha^{-1}	40
T3	Buctril Super 60Ec	0.75 L ha^{-1}	30
T4	Isoproturon 50WP	2 L ha^{-1}	30
T5	Sencor 70WP	0.25 kg ha^{-1}	30
T6	Puma -S + Buctril-S	1.25 L+0.75 L ha^{-1}	40
T7	Hand weeding	Twice	25and 45 DAS*
T8	Weedy check		

* DAS = Days after sowing.

TABLE-2. Mortality % age of Different post-em. Herbicides and Hand weeding on Weed Species

TABLE- 3. Effect of Different Herbicides on wheat Grain Yield and Yield Components.

Treatment	Herbicide	No.of fertile tillers m^{-2}	No. of grains $spike^{-1}$	1000-grain weight g	Yield kg ha^{-1}
T1	Puma-Super 75EW	300 b	37 b	29.50 b	3820 c *
T2	Topik 15WP	298 b	36 b	30.50 b	3720 d
T3	Buctril super 60Ec	282 c	38 b	28.00 c	3627 e
T4	Isoproturon 50WP	315a	40 a	29.9 b	3973 a
T5	Sencor 70WP	295 b	37 b	28.9 bc	3720 d
T6	Puma -S + Buctril- S	318 a	42 a	31.5 a	3990 a
T7	Hand weeding	295 b	40 a	32.15 a	3933 b
T8	Weedy check	270 d	32 c	26.40 d	3393 f
	CD1	6.25	2.10	1.59	39.30

* Any treatment means in the respective column not sharing a letter in common differ significantly by LSD at 5% level of probability.

TABLE-4. Economic Analysis of Wheat as Affected by Different Weed Control Practices during Rabi, 2004-05

TREATMENT	T1	T2	T3	T4	T5	T6	T7	T8
Grain: Experimental yield (kg ha^{-1})	3820	3720	3627	3973	3720	3990	3933	3393
Farmer yield (Adjusted after paying harvesting charges @ 300	3138	3048	2964	3276	3048	3291	3240	2754

kg ha^{-1} and 10% threshing charges) Grains (Rs)	31380	30480	29640	32760	30480	32910	32400	27540
Straw yield (Rs ha^{-1})	3820	3720	3627	3973	3720	3990	3933	3393
Field price (Rs).	35200	43200	33267	36733	34200	36900	36338	30933
Variable weed control cost.								
(i) Labour for 2-hoeings	-	-	-	-	-	-	2600	-
(ii) Herbicide	1000	1000	625	600	300	1625	-	-
(iii) Labour for spraying (2men/ha)	200	200	200	200	200	200	-	-
(iv) Rent of sprayer	50	50	50	50	50	50	-	-
Total variable cost	1250	1250	875	850	550	1875	2600	-
Net benefit (Rs)	33950	32950	32392	35883	33650	35025	33738	30933
Net gain over Control treatment (Rs.)	3017	2017	1459	4950	2717	4092	2805	-
Benefit: cost ratio (%)	241	161	167	582	494	218	108	-

Labour charges for spray= 2 man days =Rs 200, manual hoeing =13 Man days ha^{-1} 1man day =Rs100, Price of wheat grain =Rs 10 kg^{-1}, Straw cost =Rs 100 $quintal^{-1}$.

Prevailing market prices of herbicides:

Puma Super 75EW = Rs. 1000 ha^{-1}) Topik 15WP @ 0.25 kg ha^{-1} = Rs 1000 ha^{-1} Buctril Super 60Ec @ 0.75 L ha^{-1} =Rs.625 ha^{-1} Isoproturon 50WP @ 2 L ha^{-1} = Rs. 600 ha^{-1} Sencor 70WP@ 0.25 kg ha^{-1} = Rs.300 ha^{-1}

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