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EFFICACY OF DIFFERENT POST EMERGENCE HERBICIDES AND THEIR APPLICATION METHODS IN CONTROLLING WEEDS IN WHEAT

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ABSTRACT

Studies were carried out to evaluate the effect of post-emergence herbicides and their application methods on weed control in wheat at the Agronomic Research Station, Bahawalpur during 2002-03 and 2003-04. Different herbicides such as, Isoproturon 500 WP @ 2 kg ha^{-1} (Sprayed, mixed with urea and broadcast, and mixed with sand and broadcast), Isoproturon 500 WP @ 2 kg ha^{-1} + Buctril M. @ 1 lit ha^{-1} (Sprayed), puma super 75 EW @ 1 lit ha^{-1} (Sprayed), puma super 75 EW @ 1 lit + Buctril M. @ 1 lit ha^{-1} (Sprayed) were applied as post emergent sprays including weedy control. All herbicides significantly decreased weed population over weedy control. Herbicides applied as sprays proved the best application method. Combination of grassy and broad leaf herbicides was better than their separate application for weed control in wheat. Weed control effectively increased the number of fertile tillers, grains spike^{-1}, 1000-grain weight and wheat grain yield.

Key words: Herbicide, application method, weed, *Triticum aestivum* L.

INTRODUCTION

Wheat *(Triticum aestivum* L.*)* the main food crop of Pakistan, is grown on an area of 8.463 million hectares with an annual production of 21.078 million tones and an average yield of 2.491 t ha^{-1} (Anonymous, 2002). This yield is lower than the potential yield. There are many causes of low yield but one of them, very serious and less attended is weed infestation. Weeds compete with the crop plants for nutrients, moisture, space, light and many other growth factors, which not only reduce crop yields but also deteriorate quality of the farm produce and thereby reduce its market value. Different researchers have reported varying about the weed losses in Pakistan. According to Qureshi (1982) weeds are responsible for 30% loss in wheat yield under normal conditions whereas, yield losses reported in wheat by Gill *et al.* (1979) are 15-5%. Hepworth (1979) and Shad (1987) reported that yield losses due to weeds were in between 17-25% and wheat grains loss was between 2.43 to 3.57 million tones annually. Improved weed control has resulted an impressive increase in the crop production. Weeding through manual labour or animal drawn implements is not only laborious but is also quite expensive owing to the increased cost of labour and higher prices of fuel and farm implements. Under such conditions, use of herbicides is an effective way to control the weeds at the proper time.

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.

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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 ratio 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 heavy 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. The present study was, therefore, undertaken with the objectives to determine the efficacy of different post-emergence herbicides and their application methods in controlling weeds and to detect their effect on the yield of wheat under Bahawalpur conditions.

MATERIALS AND MATHODS

The study on post-emergence herbicides in controlling weeds and yield and yield components was carried out at Agronomic Research Station, Bahawalpur. The trial was laid out in Randomized Complete Block Design with three replications with a plot size of 12 m x 8 m. The experiment comprised of seven treatments (Table-1.) Wheat variety Punjnad-01 was sown in lines 30 cm apart with single row hand drill in the 4^{th} week of November both the years, with a seeding rate of 150 kg ha^{-1}. Fertilizer dose of 125-100-50 (NPK) Kg ha^{-1} was applied during both the years (2002-03 and 2003-04). All the Phosphorus and Potash and half of Nitrogen was applied at sowing while remaining half of Nitrogen was applied with first Irrigation. Four irrigations were applied as needed. The herbicides were sprayed after first irrigation in moist condition, at 3-4 leaf stage of crop. A Knapsack hand sprayer fitted with T-Jet nozzle was used. Tank mixture of recommended dose of herbicides was made at the time of spray. All other cultural practices were kept normal and uniform for all the experimental units. Weed population of all weed species from one square meter was counted before herbicidal spray (Table-2). Data for weed density m^{-2} was recorded after 21 days of spray. Wheat yield and yield components viz number of fertile tillers m^{-2}, number of grain $spike^{-1}$ and 1000 grain weight data were recorded and analyzed statistically (Steel and Torrie, 1985).

Table-1. Various Post-emergence Herbicides and Their Application Methods

Treatment	Herbicide	Dose (kg/ L ha^{-1})	Methods
T_1	Isoproturon 500 WP	2	(Sprayed)
T_2	Isoproturon 500 WP	2	mixed with urea and broadcast)
T_3	Isoproturon 500 WP	2	(mixed with sand and broadcast)
T_4	Isoproturon 500 WP Buctril M. 40 EC	2 +1	(Sprayed)
T_5	Puma super 75 EW	1 + 1	(Sprayed)
T_6	Puma super 75 EW Buctril M. 40 EC	1	(Sprayed)
T_7	Weedy Control	------	---------

RESULTS AND DISCUSSION

Weed Density m^{-2}

The Data on weed density revealed that *Phalaris minor* Retz. had the maximum infestation of 73 and 75 % during the years 2002-03 and 2003-04 respectively. *Chenopodium album* L. and *Chenopodium murale* L. were the next obnoxious weeds infesting the crop 18 and 16% during the years 2002-03 and 2003-04 respectively (Table-2).

Table-2. Density of weed species infesting the wheat crop before spray

	Infestation (% age)		
Weed species	2002-03	2003-04	Mean
Phalaris minor Retz.	73	75	74
Chenopodium SP.	18	16	17
Convolvulus arvensis L.	5	5	5
Melilotus indica L.	4	4	4

Maximum weed count m^{-2} of 156 and 202 were recorded in weedy control followed by 21 and 27 plants in the plots where Puma super 75 EW @ 1 lit ha^{-1} was sprayed as it did not control broad leaf weeds like *Melilotus indica* L., *Convolvulus arvensis* and *Chenopodium* sp.. Whereas least number of weeds 2 to 5 were recorded when Puma super + Buctril M, Isoproturon + Buctril M were sprayed for broad spectrum weed control. Although Isoproturon is a broad spectrum herbicide yet it did not control *Convolvulus arvensis* L (Table-3). Among the application methods spray of herbicide proved to be the best application method as it thoroughly covered the weeds. (Table-3).

Table-3. Effect of different herbicides and their application methods on weed density 21 days after spray in wheat.

	Weed counts m^{-2}			
Treatment	**2002-03**	**2003-04**	**Mean**	**Mortality (%)**
T1 Isoproturon 500 WP sprayed	10 c	13 d	11 c	94
T2 Isoproturon 500 WP mixed with urea and broadcast	17 b	21 c	19 b	89
T3 Isoproturon mixed with sand and broadcast	20 b	24 b	22 b	88
T4 Isoproturon + Buctril M	3 d	5 d	4 d	98
T5 Puma super sprayed	21 b	27 b	24 b	87
T6 Puma super 75 EW + Buctril M. sprayed	2 d	4 d	3 d	98
T7 Weedy check	156 a	202 a	179 a	
LSD 0.05	4.6	5.7	5.3	

Any two means not sharing the same letter in a column differ significantly at 0.05 probability level.

Fertile Tillers m^{-2}

Maximum fertile tillers (476 m^{-2}) were recorded in the plots treated with Isoproturon + Buctril M. (T_4) Closely followed by Puma super + Buctril M. (T_6) treated plots having 472 fertile tillers m^{-2} whereas Puma super 75 EW treated plots had 470 tillers m^{-2}. Puma 'S' had effectively controlled the major weed *Phalaris minor* and reduced the competition of grassy weeds with wheat crop. Therefore, maximum fertile tillers resulted. All other herbicidal treatments were at par with each other. Minimum fertile tillers 375 m^{-2} were recorded in weedy control (Table-4).

Table-4. Effect of different herbicides and their application methods on fertile tillers of wheat.

Treatment	Fertile tillers m^{-2}		
	2002-03	2003-04	Mean
T1 Isoproturon 500 WP sprayed	467.0 bc	467 bc	467 b
T2 Isoproturon 500 WP mixed with urea and broadcast	462 c	464 c	463 b
T3 Isoproturon mixed with sand and broadcast	463 c	463 c	463 b
T4 Isoproturon + Buctril M	477 a	475 a	476 a
T5 Puma super sprayed	470 b	470 ab	470 ab
T6 Puma super 75 EW + Buctril M. sprayed	471 a	473 a	472 a
T7 Weedy check	375 d	375 d	375 c
$LSD_{0.05}$	6.22	6.0	6.0

Any two means not sharing the same letter in a column differ significantly at 0.05 probability level.

Number of Grains Spike^{-1}

Maximum Number of grains 55 spike^{-1} were obtained in the plots treated with Isoproturon + Buctril M. followed by Puma super + Buctril M. treated plots having 51 grains spike^{-1}. While there was no significant difference among the means of rest of the treatments. Least number of grains i.e. 43 grains spike^{-1} were obtained in weedy control (Table-5), indicating severe weed competition resulting a decreased number of grain spike^{-1} similar findings have been reported by Ahmad *et al.* (1991) and Cheema *et al.* (1988).

Table-5. Effect of different herbicides and their application methods on number of grains spike^{-1} of wheat.

Treatment	Number of grains spike^{-1}		
	2002-03	2003-04	Mean
T1 Isoproturon 500 WP sprayed	47 b	51 b	49 b
T2 Isoproturon 500 WP mixed with urea and broadcast	46 b	50 b	48 b
T3 Isoproturon mixed with sand and broadcast	46 b	50 b	48 b
T4 Isoproturon + Buctril M	53 a	57 a	55 a
T5 Puma super sprayed	47 b	49 b	48 b
T6 Puma super 75 EW + Buctril M. sprayed	49 a	53 a	51 a
T7 Weedy check	41 c	45 c	43 c
LSD 0.05	4.55	4.88	4.0

1000-Grain Weight

The maximum 1000-grain weight (39.74 g) was obtained in the plots treated with Puma Super + Buctril M. followed by Isoproturon + Buctril M. treated plots having 39.45g of 1000-Grain weight. While there was no significant difference among the means of other treatments. However, least grain weight of 35.48 g was obtained in weedy control, indicating that density of weed had depressed the 1000-grain weight in weedy control. Similar results have been reported by Ahmad *et al.* (1991), and Cheema *et al.* (1988).

Table-6. Effect of different herbicides and their application methods on 1000-grain weight of wheat.

Treatment	1000 Grain weight (g)		
	2002-03	2003-04	Mean
T1 Isoproturon 500 WP sprayed	36.95 b	38.78 b	37.86 b
T2 Isoproturon 500 WP mixed with urea and broadcast	36.54 b	39.40 b	37.97 b
T3 Isoproturon mixed with sand and broadcast	36.78 b	39.00 b	37.89 b
T4 Isoproturon + Buctril M	37.86 a	41.04 a	39.45 a
T5 Puma super sprayed	37.06 b	38.38 b	37.72 b
T6 Puma super 75 EW + Buctril M. sprayed	37.97 a	41.50 a	39.74 a
T7 Weedy check	34.66 c	36.30 c	35.48 c
LSD 0.05	1.26	1.34	0.89

Any two means not sharing the same letter in a column differ significantly at 0.05 probability level.

Grain Yield

All the herbicidal applications increased wheat yield over weedy control during both the years (Table-7). The increase was corresponding to their weed control spectrum attained with the applications of Isoproturon + Buctril M. and Puma super + Buctril M.

which controlled both grassy and broad leaf weeds. The yields increased with these treatments were correspondingly greater as compared to their alone application. Buctril M. controlled broadleaf weeds while Puma super controlled grassy weed only. Whereas, Isoproturon being a broad spectrum herbicide controlled both grassy and broadleaf weeds except *Convolvulus arvensis*. Hence, combination of grassy and broadleaf controlling herbicides was better than their application alone.

Table-7. Effect of different herbicides and their application methods on the grain yield of wheat.

Treatment	Grain yield kg ha^{-1}			% increase over control
	2002-03	2003-04	Mean	
T1 Isoproturon 500 WP sprayed	3863 b	3848 b	3856 d	26.0
T2 Isoproturon 500 WP mixed with urea and broadcast	3725 c	3750 c	3738 e	22.2
T3 Isoproturon mixed with sand and broadcast	3720 c	3790 c	3755 c	22.7
T4 Isoproturon + Buctril M	3943 a	3946 a	3945 a	28.9
T5 Puma super sprayed	3780 c	3860 b	3820 b	24.8
T6 Puma super 75 EW + Buctril M. sprayed	3958 a	3956 a	3957 a	29.3
T7 Weedy check	3050 d	3070 d	3060 d	
LSD 0.05	66.5	91.3	85.0	

Any two means not sharing the same letter in a column differ significantly at 0.05 probability level.

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