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STUDY OF VARIOUS HERBICIDES FOR WEED CONTROL IN WHEAT UNDER IRRIGATED CONDITIONS*

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ABSTRACT

A field experiment was conducted at Malakandher Farm, NWFP Agricultural University Peshawar during the rabi season 2004-2005. The experiment was laid out in randomized complete block (RCB) design with four replications. Six treatments were kept in each replication with five post-emergence herbicides including Topik 15 WP @ 0.04 kg, Puma super 75 EW @ 0.75 kg, Buctril super 60 EC @ 0.45 kg, Isoproturon 50 WP @ 1.0 kg, Aim 40 DF @ 0.02 kg a.i. ha^{-1} and a weedy check. The parameters found significantly affected were weed control efficiency (%), fresh weed biomass (kg ha^{-1}), number of tillers m^{-2}, 1000-grain weight (g) and grain yield (kg ha^{-1}). Statistically maximum weed control efficiency (85.4 %) and minimum fresh weed biomass (1015 kg ha^{-1}) was observed in plots treated with Isoproturon 50 WP followed by Buctril super 60 EC with values (77.3 %) and (1330 kg ha^{-1}) respectively as compared to the fresh weed biomass (3175 kg ha^{-1}) in the weedy check. Similarly number of tillers (253 m^{-2}), 1000-grain weight (38.9 g), biological yield (13500 kg ha^{-1}) and grain yield (3250 kg ha^{-1}) were maximum in Isoproturon 50 WP treatments followed by Buctril super 60 EC treatments with values (210 m^{-2}), (34.8 g), (11420 kg ha^{-1}) and (2883 kg ha^{-1}) respectively as compared to the weedy check (136 m^{-2}), (23.4 g), (9834 kg ha^{-1}) and (1834) respectively. The herbicide Isoproturon 50 WP @ 1.0 kg a.i. ha^{-1} followed by Buctril super 60 EC @ 0.45 kg a.i. ha^{-1} both applied as post emergence in wheat performed well in the entire weed and crop data parameters and showed effectively weed control in wheat.

Key words: Wheat, *Triticum aestivum*, seed rates, densities, chemicals, herbicides, weeds

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INTRODUCTION

Human beings practically attain all their food directly or indirectly from plants. Cereal crops belonging to Gramineae (Poaceae) family produce edible grains, which provide about one-half of man's food calories and a major portion of his nutrient requirements. Wheat (*Triticum aestivum* L.) is foremost among cereals and indeed among all crops, as a direct source of food for human beings. In Pakistan, its ranks first among the cereal crops and occupies about 66% of the annual food crop area, providing protein and caloric requirements to one third of the world population. Wheat is a staple food of 160 million Pakistanis’. It is the cheapest source of food for a great deal of population of the world, and supplies 73 percent of the calories and protein in the average diet (Heyne, 1987), principally in the form of chapattis, roati, nans, breads, cakes, biscuits, porridges, and other products.

During 2004-05, the area at the national level under wheat cultivation was 8.3580 million ha, with a production of 21.612 million tons. The area consisted of about 7.2206 million ha irrigated and 1.1374 million ha of non-irrigated land. At provincial level, in NWFP, the area under wheat cultivation was about 0.7486 million ha having 0.3133 m ha area irrigated and 0.4353 m ha rain-fed, giving a total production of 1.0911 m tons at 1458 kg ha^{-1} (MINFAL, 2005).

Weeds are one of the major problems in crop production. They compete with crop plants for light, moisture, nutrients and space. Weeds also increase harvesting costs, reduce quality of the produce, clog water ways, and increase fire hazards (Arnon,1972). It has been estimated that annual losses caused by weeds in Pakistan amount to Rs.1150 million; slightly higher than those caused by diseases (Haq, 1970). Agricultural experts have assessed that weeds caused 17-25% losses in wheat annually (Shahid, 1994). Therefore, it is, essential to control weeds in order to obtain maximum yield of wheat having good quality grain. Management of weeds has been practiced from time immemorial by manual labor or animal drawn implements. These methods, besides being laborious and tiresome, are expensive due to increasing cost of labor, draft animals and implements (Iqbal,1994), escalating costs have stimulated interest in the use of chemical weed control. But, the exclusive reliance on herbicides results in pollution of the environment and inter- and intra-specific shifts of weed flora.

Chemical control of weeds is being emphasized in modern agriculture (Taj *et al*. 1986). Malik *et al.* 1989b compared the effectiveness of 1.6 kg ha^{-1} Isoproturon with other herbicides on weeds in wheat and concluded that Isopoturan performed well among these herbicides. Improving wheat performance under irrigated conditions lead us study chemical weed control to find out the relative efficiency of chemical methods of weed control. Thus, chemical weed control has been proved to be relatively efficient, and economical in controlling the weeds (Majid and Hussain, 1983). Weed control has resulted in higher yield in wheat by increasing the number of tillers. As a matter of fact with rising costs of labour and power, the use of herbicides will be the only acceptable method of weed control in the future. Although, Topik and Puma super; the two grass killers have been proved effective against weeds of wheat yet, further information on weed control methods including herbicides is needed in the country to make a better choice of weed control methods for the farmers. To properly address the weed problem in wheat, there is a dire need of developing a package of weed control technology for the wheat growers of the country. In order to investigate the different weed control approaches in wheat this experiment was conducted at Malakandher Research Farm, NWFP Agricultural University, Peshawar with the objectives; to investigate the efficacy of different herbicides on weed control and determine the impact of weed control on wheat yield.

MATERIALS AND METHODS

The experiment entitled "Study of various herbicides for weed control in wheat under irrigated conditions" was conducted at Malakandher Research Farm, N.W.F.P. Agricultural University, Peshawar during the Rabi Season 2004-2005 using the wheat variety Ghaznavi-98. Wheat was sown on November, 2004. The experiment was laid out in a RCBD design with four replications. In each replication, there were six treatments each with size of 5m x 1.8m. Row to row distance was kept at 30 cm. All the herbicides were applied as post emergence as detailed in Table-1.

Table-1. Treatments used in the experiment.

Herbicides	Common names	Rate (kg a.i. ha^{-1})
Buctril super 60EC	bromoxynil+MCPA	0.45
Puma super 75EW	fenoxaprop-p-ethyl	0.75
Topik 15 WP	clodinafop-propargyl	0.04
Isoproturon 50 WP	isoproturon	1.00
Aim 40 DF	carfentrazone-ethyl	0.02
Weedy check	---	---

The herbicides were applied with the help of a knapsack sprayer 21 days after sowing when the crop was in the 5-6 leaf stage. The weed present at the time of application were *Avena fatua*, *Phalaris minor*, *Gallium aparine*, *Fumaria indica*, *Sinapis arvinse*, *Convolvulus arvensis*, *Melilotus indica and Cirsium arvense*. Most of the weeds mentioned above were in the seedling stage except *Cirsium arvense.*

To spray the herbicides successfully all the precautionary measures were adopted so as to avoid any misuse of the herbicides. The data were recorded on weed control efficiency (%), fresh weed biomass (kg ha^{-1}), number of tillers m^{-2}, thousand grains weight (g), biological yield (kg ha^{-1}) and grain yield (kg ha^{-1}).The data recorded for each parameter were individually subjected to the ANOVA technique by using MSTATC computer software. Means were separated by using Fisher's Protected LSD test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Weed control efficiency (%)

The analysis of the data showed that there were significant effects of different herbicides on weed control. The data regarding weed control efficiency is presented in Table-2. Comparison of the treatment means reflects that maximum weed control efficiency (85.4) was recorded where isoproturon 50 WP was sprayed followed by Buctril super 60 EC (77.3). This means that the Isoproturon 50 WP and Buctril super 60 EC have effectively controlled weeds that resulted in increased yield. The results are similar to those reported by Khan *et al.* (1999).

Fresh weed biomass (kg ha^{-1})

The statistical analysis of the data showed that there was significant effect of different herbicides on fresh weed biomass. The data regarding fresh weed biomass (Table-2) indicated that maximum fresh weed biomass (3175 kg ha^{-1}) was recorded in the weedy check plot while minimum fresh weed biomass (1015 kg ha^{-1}) was recorded in the isoproturon 50 WP followed by Buctril super 60 EC (1330 kg ha^{-1}). Analogous results were reported by Khan *et al*. (2003). They reported that herbicide applications decreased the fresh weed biomass as compared to the weedy check. These findings are also in conformity with those of Shahid (1994) who reported that broad-spectrum herbicides like Isoproturon 50 WP significantly reduced fresh weed biomass in he plots having both grassy as well as broad leaf weeds.

Number of tillers m^{-2}

Analysis of the data revealed that different herbicides had significant effect on the number of wheat tillers m^{-2} (Table-3). Comparison of the treatment means reflects that the maximum number of tillers m^{-2} (253) was recorded in plots treated with Isoproturon 50 WP. This was followed by Buctril super 60 EC herbicide (210). The minimum number of tillers m^{-2} was observed in weedy check (136). Baldha *et al*. (1998) who investigated that herbicides application significantly influenced the number of tillers m^{-2} concur with our results.

Thousand grain weight (g)

Herbicides use affected 1000 grain weight significantly. Data regarding the effect of different herbicides on 1000 grain weight are given in Table-3. Thousand grain weight was highest (38.9 g) in plots treated with Isoproturon 50 WP followed by Buctril super 60 EC (34.8 g). Smallest 1000 grain weight was recorded (23.4 g) from the weedy check. Similar results were reported by Hassan *et al.* (2003) who found that herbicides increased the 1000 grain weight significantly when compared with the weedy check.

Biological yield (kg ha^{-1})

Analysis of variance of the data exhibited that herbicides did not affect the biological yield. Table-4 shows the effect of different herbicides on the biological yield. The data indicated that maximum biological yield of (13500 kg ha^{-1}) was recorded in Isoproturon 50 WP and minimum (9834 kg ha^{-1}) was recorded in weedy check. These results are in conformity with those reported by Salarzai *et al*. (1999).

Grain yield (kg ha^{-1})

Analysis of variance of the data exhibited that herbicides had significant effect on the grain yield. The data regarding the effect of different herbicides on the grain yield in Table-4 showed that the maximum grain yield of 3250 kg ha^{-1} was observed in Isoproturon 50 WP treated plots. This was followed by Buctril super 60 EC (2883 kg ha^{-1}). Minimum grain yield of 1834 kg ha^{-1} was obtained in weedy check plots. The highest grain yield obtained in Isoproturon 50 WP treatment was perhaps due to its best control of weeds, while the lowest grain yield obtained in weedy check was probably due to more weed competition. These results are in conformity with those reported by Hassan *et al*. (2003). They reported that herbicidal treatments significantly increased grain yield in wheat.

CONCLUSION

Isoproturon 50 WP at 1.0 kg a.i. ha^{-1} proved to be the best herbicide in controlling *Avena fatua*, *Phalaris minor*, *Fumaria indica*, *Convolvulus arvensis, Melilotus indica and Cirsium arvense,* as there were problems with both grassy and broadleaf weeds in the experimental plots. Grain yield was excellent in Isoproturon 50 WP and Buctril super 60 EC at 0.45 kg active ingredient ha^{-1}.

Table-2. Weed control efficiency (%) and fresh weed biomass (kg ha^{-1}) as affected by different herbicide treatments in wheat.

Treatments	Weed control efficiency (%)	Fresh weed biomass (kg ha^{-1})
Buctril super 60 EC	77.0 a	1330 d
Puma super 75 EW	36.0 b	1525 c
Topik 15 WP	47. 0 b	1610 c
Isoproturon 50 WP	85.0 a	1015 e
Aim 40 DF	39.0 b	1775 b
Weedy check	---	3175 a*
LSD value at 5% α level	15.0	110

*Means sharing common letter in the respective category are not Significantly different by LSD Test at 5% level of probability

Table-3. Number of tillers m^{-2} and thousand grain weight (g) as affected by different herbicide treatments in wheat.

Treatments	Number of tillers m^{-2}	Thousand grains weight (g)
Buctril super 60 EC	210 b	34.8 b
Puma super 75 EW	187 c	32.0 d
Topik 15 WP	195 c	33.3 c
Isoproturon 50 WP	253 a*	38.9 a*
Aim 40 DF	169 d	30.3 e
Weedy check	136 e	23.4 f
LSD value at 5% α level	10.1	1.3

*Means followed by different letters in the respective column are significantly different at 0.05 ɑ level according to LSD test.

Table-4. Biological yield (kg ha^{-1}) and grain yield (kg ha^{-1}) as affected by different herbicide treatments in wheat.

Treatments	Biological yield (kg ha^{-1})	Grains yield (kg ha^{-1})
Buctril super 60 EC	11420	2883 b
Puma super 75 EW	10580	2358 c
Topik 15 WP	11080	2500 c
Isoproturon 50 WP	13500	3250 a*
Aim 40 DF	11330	2333 c
Weedy check	9834	1834 d
LSD value at 5% α level	NS	267

*Means followed by different letters in the respective column are significantly different at 0.05 ɑ level according to LSD test.

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