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INDIVIDUAL AND COMBINED EFFECT OF DIFFERENT HERBICIDES ON WEED CONTROL IN WHEAT

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ABSTRACT

A field study was conducted during 2006-07 at Cereal Crops Research Institute (CCRI) Pirsabak, Nowhshera, Pakistan to asses the individual and combined effect of different herbicides on weed control in wheat. The experiment was laid out in RCBD with 4 replications. The experiment comprised of 6 herbicides, hand weeding and a weedy check. The herbicidal treatments were the post-emergence application of Affinity 50 WDG (carnfentrazone ethyl + isoproturon) @ 0.016, Buctril super (bromoxynil octanovate + heptanovate ester) @ 1.23, Puma super 75 EW (fenoxaprop-p-ethyl) @ 0.94, Topik 15 WP (clodinafop propargyl) @ 0.04, Topik 15 WP + Buctril super 60 EC @ 0.04 +1.23, Puma super 75 EW + Buctril super 60 EC @ 0.94+ 1.23 kg a.i. ha^{-1}. Data were recorded on weed density m^{-2} before and after herbicides application, dry weed biomass (g m^{-2}), biological yield (t ha^{-1}) and grain yield (t ha^{-1}). For controlling weeds Affinity 50 WDG proved to be the best giving only 33 weeds m^{-2} and 14 g m^{-2} dry weed biomass as compared to 117

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weeds and 276 g m^{-2} dry weed biomass in weedy check plots. Maximum biological and grain yield of 13.70 and 4.18 t ha^{-1} was recorded in Affinity followed by hand weeded plot with 12.70 and 3.65 t ha^{-1}. The mixture of Buctril super + Puma super provided better results than their alone applications for biological and grain yield. Affinity 50WDG@0.016 kg a.i. ha^{-1} is thus, recommended as post emergence herbicide for the control of weeds in wheat crop.

Key words: *Triticum aestivum*, weed control, herbicide mixture.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops of Pakistan. It is the dietary requirement of the country. It ranks first as a staple food item in Pakistani diets. Despite all efforts done by scientists, the potential yields could not be attained. The gap between actual and the potential yield is due to many reasons; weed infestation is one of the most important reasons for lower yield. Weed management practices significantly affect total number of tillers, 1000 grain weight and harvest index (Young *et al.,* 1994; Norris 1982). Weeds compete with crop mainly for space, solar radiation, nutrients, water and carbon dioxide. Through competition weeds damage crop and cause reduction in yield of crop. Annual losses in wheat amount to more than Rs. 28 billion at the national level and Rs. 2 billion in N.W.F.P. (Hassan and Marwat, 2001).

Control of weeds is a basic requirement and major component of management in most production systems (Young *et al.,* 1994). Weed management has been practiced through manual labor or animal drawn implements, which were too much time consuming therefore chemical weed control was stimulated. The choice of best herbicide, proper time of application and proper dose is an important consideration for lucrative returns (Fayad *et al.*, 1998).

Application of herbicides 30 days after sowing was most effective in decreasing dry matter of weeds and increasing grain yield, while effectiveness of herbicide decreased with a delay in their application (Prasad, 1985). Diclofop-methyl applied alone and in combination with Isoproturon significantly increased the grain yield of wheat (Samara *et al.,* 1993). The mixture of Isoproturon + Buctril-M produced higher yield than their alone application (Khan *et al.,* 2001). Similar results were concluded by Shivay *et al.,* (1997) who communicated that the mixture of Tralcoxydim + Isoproturon produced higher yield than when these herbicides were used alone. Isoproturon and manual weeding were superior to metoxuron for weed control (Thakur and Singh, 1989). Combination of chemical, cultural and hand weed control methods is more effective in controlling weeds than their isolated application (Rao, 1983). The objective of this study was to evaluate the effect of different herbicides alone and in mixture on weed control in wheat.

MATERIALS AND METHODS

A field study was undertaken at Cereal Crops Research Institute (CCRI) Pirsabak, Nowshera, NWFP Pakistan during Rabi season 2006-07. The experiment was laid out in Randomized Complete Block Design (RCBD) with four replications. Eight treatments were assigned to each replication randomly. The size of each plot was 5 x 1.8 m^2. Each treatment had 6 rows 5 m long and 30 cm apart. Wheat variety Pirsabak 2005 was planted on 22nd November 2006. Fertilizer dose of 120-60-60 (NPK) kg ha^{-1} was applied during the trial. Nitrogen and Phosphorus were applied in the form of Urea and DAP while Potassium was applied in the form of SOP. Phosphorus, Potassium and half of nitrogen were applied prior to sowing while the remaining half N was applied with second irrigation. In total five irrigations were applied to the crop, first irrigation was applied 20 days after sowing while remaining irrigations were applied whenever needed. The experimental treatments were comprised of post emergence herbicides Affinity 50 WDG (carnfentrazone ethyl + isoproturon) @ 0.016, Buctril super (bromoxynil octanovate + heptanovate ester) @ 1.23, Puma super 75 EW (fenoxaprop-p-ethyl) @ 0.94, Topik 15 WP (clodinafop propargyl) @ 0.04, Topik 15 WP + Buctril super 60 EC (fenoxaprop-p-ethyl+ bromoxynil octanovate + heptanovate ester) @ 0.04 +1.23, Puma super 75 EW + Buctril super 60 EC (fenoxaprop-p-ethyl + bromoxynil octanovate + heptanovate ester) @ 0.94 + 1.23 kg a.i ha^{-1}, while hand weeding was performed three times in the respective treatment.

Post emergence herbicides were applied after the complete germination of crop and weeds after 1st irrigation when the crop was at 2, 3-leaf stage. The data were recorded on weed density m^{-2} before and after herbicides application, fresh and dry weed biomass (g m^{-2}) 30 days after treatment application and biological and grain yield (t ha^{-1}). Weeds were counted at two stages, first at 30 days after sowing before herbicide application i.e. 30 days after sowing and second 60 days after sowing, when the herbicides had shown their effects. Weeds were counted with the help of 1 m^2 quadrate thrown randomly in each treatment. Biological yield data were recorded by harvesting 3 central rows, bundled, dried, weighed and subsequently converted to t ha^{-1}. Such harvested bundles were threshed for recording grain yield data in t ha^{-1}.

The data collected were analyzed statistically using ANOVA technique with the help of MSTAT-C computer software and the significant means were separated by the least significant difference test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

An experiment comprising herbicides and hand weeding on wheat was carried out at Cereal Crops Research Institute Pirsabak, Nowshera. Data were recorded on weed density before and after herbicide application, dry weed biomass, biological yield and grain yield of wheat. The data are presented as under.

Weed density m^{-2} before herbicide application (30 days after sowing)

Statistical analysis of the data revealed that there were no significant differences among the treatments before the application of herbicides. All the treatments were statistically equal however the data exhibited that maximum numerical weed density m^{-2} (153) was recorded in Buctril super plot (Table-1). The total weeds density m^{-2} was almost the same across all the herbicidal treatments and the weedy check. Similar results were also provided by Shivay *et al.,* 1997, who reported that there were no significant differences among the weedy check and herbicidal plots before the application of herbicides.

Weed density m^{-2} 30 days after herbicides application

The statistical analysis of the data showed that there was significant effect of different herbicides on weed density m^{-2} after application. The minimum weed density m^{-2} (33) was recorded in Affinity 50 WDG treated plots, whereas the maximum weed density m^{-2} (117) was recorded in weedy check plots (Table-1). The density in the best treatment was however statistically at par with hand weeded (42 weeds m^{-2}) and the plot sprayed with the mixture of Buctril super and Puma super (46 weeds m^{-2}), while the Buctril super and Topik showed poor control when used alone with 94 and 82 weeds m^{-2}, respectively. These results are in conformity with Pandey and Singh (1994) and Khan *et al.* (2003) who reported that application of the tank mixed herbicides reduced broad and narrow leaf weeds to a varying degree sometimes approaching to 100% control. The variability in weeds population in different treatments can be attributed to the fact that some herbicides are more effective for weed control than the others. Similarly Hashim *et al.* (2002) reported that maximum weed density was recorded in weedy check plots in their herbicidal trial in wheat. Chhokar *et al.* (2007) also reported the similar results who concluded that the mixture of herbicides effectively controlled weed flora than weedy check in their herbicidal treatment in wheat. Mohammad *et al.* (2007) also confirmed these results who reported that satisfactory weed control was achieved through the mixture of herbicides.

Dry weed biomass g m^{-2} 30 days after herbicide application

Analysis of the data showed that there was a significant effect of different herbicides on dry weed biomass g m^{-2} after herbicide application. Minimum dry weed biomass (14 g m^{-2}) was recorded in Affinity 50 WDG treated plots followed by 23 g m^{-2} in hand weeded plots. Whereas the maximum dry weed biomass (88 g m^{-2}) was recorded in weedy check. Topik and Buctril super produced lesser dry weed biomass (23 g m^{-2}) than their alone application (33 g m^{-2}) respectively (Table-1). Similarly the mixture of Buctril super and Puma super also gave better results than their alone application. These results are in conformity with the work reported by Patel and Upandhyay (1990), Prasad and Singh (1995) and Azad *et al.* (1997), who reported that the combination of 2,4-D + Isoproturon reduced dry weed biomass. Muhammad *et al.* (2007) also provided the similar evidence that herbicides in mixture provide good control than their alone application and hence produce less weed biomass. Arif *et al.* (2004) also provided the same results in their herbicidal trial in wheat who reported that herbicidal treatments suppressed in weed biomass than the untreated plots.

Biological Yield (t ha^{-1})

Statistical analysis of the data exhibit that different herbicides had significant effect on the biological yield. The ANOVA indicated that maximum (13.70 t ha^{-1}) biological yield was produced by those plots which were treated with Affinity 50 WDG for weed control followed by hand weeded plots (12.70 t ha^{-1}) and the plots treated with the mixture of Buctril super and Puma super (12.60 t ha^{-1}) which indicated that the mixture of herbicides Buctril super + Puma super provided better results than their alon application (Table-1). These results are in agreement with the work of Panwar *et al.* (1995), Prasad and Singh (1995), Azad *et al.* (1997) and Marwat *et al.* (2003) who reported that post-emergence application of 2,4-D + Isoproturon was found to be the best treatment in reducing dry weed biomass and producing the highest straw and grain yield. Similar results were also provided by Hassan *et al.* (2003) who reported that the mixture of herbicides produced higher biological yield than weedy check plots. Cheema *et al.* (2006) also confirmed these findings who reported that maximum biological yield was recorded in those plots which were treated with the mixture of herbicides while minimum in the weedy check plots. Minimum biological yield (8.58 t ha^{-1}) was recorded in weedy check plots followed by plots sprayed with Buctril super alone (9.58 t ha^{-1}). Biological yield of the top scoring treatments is due to better weed control by the treatment under reference, which enabled the better utilization of the resources by the wheat crop. These results are also in accordance with the work of Baldha *et al.* (1988). They found that some herbicides are the best for increasing biological yield of wheat.

Grain yield (t ha^{-1})

The statistical analysis of the data indicates that the different herbicidal treatments had significant effect on the grain yield. Perusal of the ANOVA exhibited that the maximum grain yield was recorded in Affinity 50 WDG treated plots (4.18 t ha^{-1}) followed by hand weeded plots with 3.65 t ha^{-1} (Table-1). Minimum grain yield was recorded in weedy check plots (2.78 t ha^{-1}). Similar findings were reported by Ahmad *et al*. (1993), Singh and Singh (1996) and Subhan *et al.* (2003) who concluded that herbicide application and hand weeding increased grain yield of wheat as compared to weedy check. Shafi *et al.* (2004) also confirmed these findings who reported that maximum grain yield was produced by the plots which were treated with herbicides at tillering stage while minimum in weedy check plots. The mixture of Buctril super and Puma super provided better results than their alone application, in mixture they provided (3.33 t ha^{-1}) while Buctril super when applied alone (2.95 t ha^{-1}) and Puma super (3.10 t

ha^{-1}). Maximum grain yield was observed in Affinity 50 WDG treated plots, because it is more phytotoxic to both grassy and broad leaf weeds than other herbicide. Similar results were recorded by Punia *et al.* (1996) who concluded that herbicides if applied in combination provide better weed control and consequently higher yield. Panwar *et al.* (1995), Prasad and Singh (1995), Azad *et al.* (1997) and Marwat *et al.* (2003) who reported that post-emergence application of 2,4-D + Isoproturon was found to be the best treatment in reducing dry weed biomass and producing the highest straw and grain yield.

Table-1. Effect of different herbicidal treatment on weed density before and after application of herbicides, fresh and dry weed biomass and yield components of wheat.

Treatments	Weed density m^{-2} 30 DAS*	Weed density m^{-2} 30 DAT**	Dry weed biomass g m^{-2} 30 DAT**	Biological yield (t ha^{-1})	Grain yield (t ha^{-1})
Affinity 50 WDG	152	33 e	14 e	13.70 a	4.18 a
Buctril super 60 EC	153	94 b	33 c	9.58 de	2.95 c
Puma Super 75 EW	151	48 d	34 c	11.13 cd	3.10 bc
Topik 15 WP	152	82 bc	39 b	11.95 bc	3.15 bc
Topik 15 WP + Buctril Super 60 EC	152	81 c	23 d	11.98 bc	3.25 bc
Buctril Super 60 EC+ Puma Super 75 EW	149	46 d	33 c	12.60 bc	3.33 bc
Hand weeding	150	42 de	23 d	12.70 bc	3.65 ab
Weedy check	148	117 a	88 a	8.58 e	2.78 c

DAS* = Days after sowing
DAT** = Days after treatment
Mean not followed by the same letter (s) in the respective column are significantly different by LSD test at 5 % level of probability.

CONCLUSIONS

From the results of the experiments the following conclusions are drawn.

i. For effective and quicker weed control herbicides may be applied.
ii. Herbicides are useful tools for minimizing weed competition with the wheat crop for nutrients, light, space and water.
iii. Amongst herbicides the herbicide mixtures gave better results as compared with individually applied herbicides.

iv. Affinity 50 WDG and Hand weeding can increase the yield of wheat significantly.
v. Herbicides are the quicker source to control weeds however hand weeding is also a good tool to control weeds.

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