



COMPARATIVE EFFICACY OF HERBICIDES ON YIELD AND YIELD COMPONENTS OF WHEAT (*Triticum aestivum* L.)

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ABSTRACT

To find out the comparative efficacy of herbicides on yield and yield components of wheat (*Triticum aestivum* L.) an experiment was conducted at Cereal Crops Research Institute (CCRI) Pirsabak, Nowshera during the winter season 2006-07. The experiment was comprised of 6 herbicides plus hand weeding and weedy check plots. 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 (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 treatments. The data were recorded on weed density m⁻² 30 days after treatment, number of tillers plant⁻¹, number of grains spike⁻¹, 1000 grain weight (g), biological yield (t ha⁻¹) and grain yield (t ha⁻¹). For effective weeds controlling Affinity 50 WDG proved to be the best treatment with minimum weed density after treatment 33 weeds m⁻² was observed in plots treated with Affinity 50 WDG while; maximum weed densities were recorded in weedy check plot with 117 weeds m⁻². Similarly the maximum grain yield of 4.072 t ha⁻¹ was recorded in Affinity plot followed by hand weeding plot and the plot sprayed with the mixture of Buctril super + Puma super with grain yield of 3.773 t ha⁻¹ and 3.483 t ha⁻¹, respectively. A minimum grain yield of 1.603 t ha⁻¹ was recorded in weedy check plots. Affinity was also proved to be effective in other parameters like spikes m⁻² (484), number of grains spike⁻¹ (52) and 1000 grain weight (36 g). In the light of this study the herbicide Affinity 50WDG followed by the mixture of Buctril super + Puma super provided better results for the control of weeds in the wheat crop.

Keywords: wheat, *Triticum aestivum*, weed control, herbicides, yield.

INTRODUCTION

Wheat (*Triticum aestivum* L) is a major cereal crop and is used as the major food source all over the world including Pakistan. It supplies about 73% of the calories and protein of the average diet. It is an annual, self pollinated and photo periodically long day plant. It belongs to family *poaceae*. The best soil for wheat is medium loam however it has adapted itself to varied climatic conditions all over the world. At present in Pakistan total area under wheat crop during 2006-07 was 8.4 million ha, out of which 7.3 million ha was irrigated and the rest 1.1 million ha was rainfed. Its total production in the country was 23.5 million tons. While in Khyber Pakhtunkhwa, the wheat was sown on area 0.75 million ha with 0.31 million ha irrigated and 0.44 million ha as rainfed. The total production of wheat from Khyber Pakhtunkhwa was 1.39 million tons (MINFAL, 2007).

Weeds are one of the biggest threats to agriculture production. They use the soil fertility, available moisture, nutrients, providing shelter for insect-pest and compete for space and sunlight with crop plants which result in yield reduction. According to the reports annual losses in wheat loss worth more than Rs. 28 billion at the national level and Rs. 2 billion in Khyber Pakhtunkhwa (Hassan and Marwat, 2001). Weeds reduce crop yield and deteriorate the quality of produce hence reduce the market value of wheat. (Taj *et al.*, 1986).

Management of weeds has been practiced since the time immemorial by manual labor or animal drawn implements. These methods were too much cumbersome and time consuming therefore chemical weed control was stimulated. However non-judicious use of herbicides can do harm rather than benefit in productivity if used improperly. The choice of best herbicide, proper time of application and proper dose of herbicide is the important consideration for lucrative returns (Fayad *et al.*, 1998). Combination of grassy and broad leaf herbicides was better than their separate application for weed control in wheat. (Cheema and Akhtar, 2005). Khan *et al.*, (2001) reported that highest grain yield was harvested from the plots treated with the mixture of Isoproturon + Buctril-M. Kumar *et al.*, (1997) find out that combined application of Tralcoxydim + Isoproturon produced significantly higher yield than their alone application. Similar results were concluded by Samara *et al.*, (1993) who reported that Diclofop-methyl applied alone and in combination with Isoproturon significantly increased the grain yield of wheat.

In view of the weeds problem in wheat crop, a study was conducted to investigate the comparative efficacy of herbicides alone and in combination in wheat crop.



MATERIALS AND METHODS

A field study was undertaken at Cereal Crops Research Institute (C.C.R.I) Pirsabak, Nowshera during Rabi season 2006-07. The experiment was laid out in Randomized Complete Block (RCB) design with four replications. Eight treatments were assigned to each replication randomly. The size of each plot was 5 x 1.8 m². Each treatment had 6 rows 5 m long and 30 cm apart. Wheat variety Pirsabak 2005 was planted on 22nd November 2006. The fertilizer dose of (NPK) 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 and Potassium was applied prior to sowing while half of the Nitrogen was applied prior and half of the remaining after germination 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 treatments. 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 while Hand weeding was applied three times throughout the trial with the help of hoe.

The data were recorded on weed density m⁻² 30 days after treatment, number of tillers plant⁻¹, grains spikes⁻¹, 1000 grain weight (g), biological yield (t ha⁻¹) and grain yield (t ha⁻¹). Weeds were counted 30 days after treatment, when the herbicides had shown their effects. Weeds were counted with the help of 1x1 m² quadrat thrown randomly through each treatment. In each treatment, ten representative plants were selected randomly and number of tillers plant⁻¹ was counted, then averages were calculated. To record the number of grains spike⁻¹, ten representative spikes were randomly selected in each treatment and the number of grains spike⁻¹ were counted in each spike and their average was recorded. For recording 1000-grain weight (g), the required number of kernels was randomly taken from each treatment, counted and then weighed with the help of electronic balance. Biological yield data were recorded by harvesting 3 central rows, bundled, dried and weighed then converted to t ha⁻¹ and Grain yield data were recorded by harvesting 3 central rows from each treatment, dried and threshed, weighed and the data were then converted to t ha⁻¹.

The data collected were analyzed statistically using the ANOVA technique with the help of MSTAT-C computer software and the significant means were

separated by the least significant difference test (Steel and Torie, 1980).

RESULTS AND DISCUSSIONS

Weed density m⁻² 30 days after treatment

The statistical analysis of the data showed that there was a 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. 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 with (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) who reported that application of the tank mixed herbicides reduced broad leaf and narrow leaf weeds to a varying degree sometimes approaching to 100%. 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 the maximum weed density was recorded in weedy check plots in their herbicidal trial in wheat. Chhokar *et al.*, (2007) also reported the same results who concluded that the mixture of herbicides effectively controlled weed flora than weedy check in their herbicidal treatment in wheat. Ashiq *et al.*, (2007) also confirmed these results who reported that satisfactory results of weed control were achieved through the mixture of herbicides.

Number of tillers plant⁻¹

Statistical analysis of the data showed that the number of tillers plant⁻¹ was significantly affected by various herbicidal treatments. The effects of various herbicides on the number of tillers plant⁻¹ showed that the highest (8) number of tillers plant⁻¹ were observed in Affinity 50 WDG treated plots followed by hand weeded plots with (7). The mixture of Buctril super + Puma super produced the highest number of tillers plant⁻¹ (7) than their alone application (5) tillers plant⁻¹. Similarly the mixture of Topik and Buctril super also produced more (6) tillers plant⁻¹ than their alone application. The lowest (4) number of tillers plant⁻¹ were obtained in weedy check plots while the highest (8) number of tillers plant⁻¹ were obtained from the plot treated with Affinity 50WDG perhaps due to the best phototoxic effect by it on the weeds. These results are in agreement with the work of Baldha *et al.*, (1992) who reported that there has been a significant increase in the number of tillers plant⁻¹ with the application of some herbicides in their studies. Cheema and Akhtar (2005) also reported the similar results that concluded that the mixture of herbicides increased the number of tillers plant⁻¹.



Number of grains spike⁻¹

Analysis of variances of the data showed that the application of different herbicidal treatments had a significant effect on the number of grains spike⁻¹. From the study of the data it was observed that the plots treated with Affinity 50 WDG had the highest (52) grains spike⁻¹, followed by hand weeded plot with 51 grains spike⁻¹. While the minimum (42) number of grains spike⁻¹ were recorded in weedy check plots followed by Topik treated plot along with 45 grains spike⁻¹ while Topik in combination with Buctril super produced a higher grains spike⁻¹ with 49, the reason for the increased number of grains spike⁻¹ is attributed to the effective weed control in those treatments and consequently wheat crop efficiently utilized all the available resources. Similar results were also reported by Arif *et al.*, (2004) who reported that higher numbers of grains were produced by herbicidal treated plots as compared with weedy check plots.

1000 grain weight (g)

The analysis of the data showed that the different treatments significantly affected 1000 grain weight. The data in (Table-1) exhibited that the highest 1000 grain weight (36 g) was obtained in the Affinity 50 WDG treated plots followed by hand weeded plots (33 g). The lowest 1000 grain weight (29 g) was recorded in weedy check plots followed by the plot sprayed with Buctril super alone with 30 g while Buctril super in combination with Puma super provided better results and produced higher 1000 grain weight than their individual application (32 g). Similarly the mixture of Topik + Buctril super produced higher 1000 grain weight (32) than their individual application (30 g) each. The increased grain weight is attributed to the availability of resources to the wheat crop. These results are corroborated with the results of Hassan *et al.*, (2003) who concluded that maximum 1000 grain weight was recorded in those plots which were treated with the mixture of herbicides while minimum in weedy check plots. Marwat *et al.*, (2005) have also reported the similar results who reported that herbicide treated plots given higher 1000 grain weight than the weedy check plots.

Biological yield (t ha⁻¹)

Statistical analysis of the data exhibit that different herbicides had a 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 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 alone application. These results were in agreement 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 a higher biological yield than weedy check plots. Cheema *et al.*, (2006) also confirmed the same results who reported that maximum biological yield was recorded in those plots which were treated with the mixture of herbicides while minimum in 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 crop scoring treatments is due to the better weed control of the treatment under reference, which enabled the better utilization of the resources by the wheat crop. These results are in accordance with the work of Balaha *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 a 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. 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. Similarly Shafi *et al.*, (2004) also confirmed the same results 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 given (2.95 t ha⁻¹) and Puma super with (3.10 t ha⁻¹). Maximum grain yield was observed in Affinity 50 WDG treated plots, because it is more toxic 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 as a result high 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 treatments on weed density, yield and yield components of wheat.

Treatments	Weed density m ⁻² 30 DAT*	Number of tillers plant ⁻¹	Grains spike ⁻¹	1000 Grain weight (g)	Biological yield (t ha ⁻¹)	Grain yield (t ha ⁻¹)
Affinity 50 WDG	33 e	8 a	52 a	36 a	13.70 a	4.18 a
Buctril super 60 EC	94 b	6 c	50 ab	30 bc	9.58 de	2.95 c
Puma super 75 EW	48 d	4 e	51 ab	31 bc	11.13 cd	3.10 bc
Topik 15 WP	82 bc	5 d	45 bc	30 bc	11.95 bc	3.15 bc
Topik 15 WP + Buctril super 60 EC	81 c	6 c	49 ab	32 bc	11.98 bc	3.25 bc
Buctril super 60 EC + Puma super 75 EW	46 d	7 b	50 ab	32 bc	12.60 bc	3.33 bc
Hand weeding	42 de	7 b	51 ab	33 ab	12.70 bc	3.65 ab
Weedy check	117 a	4 e	42 c	29 c	8.58 e	2.78 c
LSD	12.29	0.7425	6.11	3.786	2.236	0.565

Means not followed by the same letters are significantly different by LSD test at 5 % level of probability.

DAT* = Days after treatment

CONCLUSIONS

- Amongst herbicides the herbicide Affinity 50 WDG gave better results as compared with individually applied herbicides.
- The mixture of herbicides Buctril super + Puma super and Buctril super + Topik provided better results than their individual effect.
- Affinity 50 WDG and mixture of Buctril super + Puma super can increase the yield of wheat significantly.
- Herbicides are the quickest source to control weeds however hand weeding is also a good tool to control weeds.

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