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PERFORMANCE OF DIFFERENT HERBICIDES IN WHEAT (*Triticum aestivum* L.) UNDER RAINFED CONDITIONS OF KOHAT, PAKISTAN*

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ABSTRACT

A field experiment was conducted at Barani Agriculture Research Station, Kohat during the rabi season 2003-2004. The experiment was sown in November, 2003, laid out in Randomized Complete Block (RCB) design replicated four times with a plot size of 5 x 1.5 m², having row-to-row distance of 25 cm. The experiment comprised of seven post-emergence herbicides i.e. Topik 15 WP (clodinafop propargyl) @ 0.3 kg a.i ha^{-1}, 2, 4-D 70 SL (2, 4-D) @ 1.7 L ha^{-1}, Buctril M 40 EC (bromoxynil + MCPA) @ 1.3 L ha^{-1}, Isoproturon 50 WP (Isoproturon) @ 2.0 kg a.i ha^{-1}, Aim 40 DF (chlorfluazuron) @ 0.1 kg a.i ha^{-1}, Logran extra 64 (triasulfuron + terbutryn) @ 0.3 kg a.i ha^{-1}, Puma Super 75 EW (fenoxaprop-P-ethyl) @ 1.3 L ha^{-1} and a weedy check. Maximum weeds density (142.25 m^{-2}) was recorded in weedy check plots while minimum weeds density (16.20 m^{-2}) was recorded in Buctril M 40 EC treated plots followed by 2,4-D 70 SL (27 m^{-2}) and Aim 40 DF (30.25m^{-2}). Similarly maximum grain yield (1970 kg ha^{-1}) was recorded in Buctril M 40 EC treated plots followed by 2,4-D 70 SL (1930 kg ha^{-1}) and minimum (1553 kg ha^{-1}) grain yield was recorded in weedy check plots. The cost-benefit ratio (CBR) was also the highest (1:10.71) in Buctril M 40 EC treated plots followed by 2,4-D 70 SL (1: 9.79). Moreover, plant height (cm), 1000 grain weight (g) and grain yield (kg ha^{-1}) were also the maximum in Buctril M 40 EC treated plots. Hence, the herbicide Buctril M 40 EC is recommended as post emergence herbicide @ 1.3 L ha^{-1} for weed control in wheat in Kohat.

Key words: *Triticum aestivum*, herbicides, weed control, Northwest Frontier Province.

INTRODUCTION

In irrigated and non-irrigated areas winter weeds are the main cause of the drastically reduced yield of cereals, especially wheat. It was concluded from an experiment that hand weeding and mixture of herbicides Puma super 75 EW and Buctril-M 40 EC showed better results for controlling winter weeds (Khan *et al.* 2005).

Chemical control of weeds, aiming at shifting the balance of the agro-ecosystem in favour of cultivated crop, which proved to be relatively efficient and economical in controlling the weeds. The efficacy of herbicides, however, depends more upon their

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formulation in addition to time, methods and rates of application (Majid *et al.* 1983). Application of Buctril-M decreased broadleaf weed population significantly and increased total number of tillers, number of grains spike^{-1}, 1000- grain weight and straw yield (Shah *et al.* 1985). Rastogi *et al.* (1984) and Iqbal *et al.* (1987) studied various substituted urea herbicides and found 51-62% decrease in weed population with a consequence increased in grain yield upto 3.5 tons ha-^{1}. Iqbal *et al.* (1987) obtained upto 92% increased in wheat grain yield with the use of different herbicides.

I At the national level, during 2004-05, the area under wheat cultivation was 8.358 million ha, with a production of 21.612 million tons. At provincial level, in NWFP, the area under wheat cultivation was about 0.749 million ha. One third of this area in NWFP is irrigated, while two third is rainfed giving a total production of 1.091 million tons at the rate of 1458 kg ha^{-1} (Anonymous, 2005).

With the advent of new short stature varieties, weeds competition has become even more severe. Weeds are a major problem and reduce the yield of wheat. Weeds reduce the crop yield, deteriorate the quality of farm produce and hence reduce the market value of wheat. Weed management increases the cost of production and thus it is necessary to device such methods which could reduce not only the cost of production but also save time and labor. Among the weed control methods, the chemical control is one of the recent origins, which is being emphasized in modern agriculture (Taj *et al.* 1986).

The objectives of the experiment were to study the effect of different herbicides on the prevailing weed flora and to quantify the effect of different herbicides on the yield and yield components of wheat.

MATERIALS AND METHODS

The study was conducted at Barani Agricultural Research Station, Kohat using wheat variety Kt-2000. The experiment was sown in November 2003 with a seed rate of 120 kg ha^{-1}, consisting of eight treatments replicated four times, using Randomized Complete Block (RCB) design. The size of each treatment was 5 x 1.5 m^2, consisting six rows, 25 cm apart and 5 m long. The treatments included were seven herbicides applied as post emergence and a weedy check.

Table-1. Detail of Treatments used in the experiment.

S. No.	Trade name	Common name	Rate (kg a.i. ha^{-1})
1.	Weedy check	---	---
2.	Puma Super 75 EW	fenoxaprop-p-ethyl	1.3
3	Topik 15 WP	clodinafop-propargyl	0.3
4.	Isoproturon 50 WP	isoproturon	2.0
5.	Logran extra 64 WG	terbutryn + triasulfuron	0.3.
6.	Aim 40 DF	chlorfluazuron	0.1
7.	2, 4-D 70 SL	2,4-D	1.7
8.	Buctril M 40 EC	bromoxynil + MCPA	1.3

All the herbicides mentioned in Table-1 were applied with the help of a knap sack sprayer. While spraying the herbicides, all the precautionary measures were kept in mind

to avoid any danger due to the misuse of the herbicides. The crop was harvested, after maturity when the grains were fully mature and the crop had senesced. In order to determine the effects of the aforesaid treatments, data were recorded on the weed density m^2 before application of herbicides, Weed density m^{-2} after 30 days of herbicides application, plant height at maturity (cm), spike length (cm), thousand grains weight (g), grain yield (kg ha^{-1}) and Cost-benefit ratio. The data recorded for each trait was subjected to ANOVA technique by using MSTATC computer software and means were separated by using Fisher's LSD test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Weed density m^{-2} before application of herbicides

Statistical analysis of the data showed that the weeds density (m^{-2}) was non-significant before the herbicides application Table-2. The data showed that the weeds were distributed randomly with a preponderance of broadleaf weeds. The weed density ranged between 125.25 and 211 m^{-2}, prior to the treatments application (Table-2). The weeds recorded were *Carthamus oxycantha, Cirsium arvense, Convolvulus arvensis, Medicago denticulata, Cyperus* sp., *Malcomia africana., Silybum marianum, Rumex crispus. Fumaria indica, Polygonum aviculare, Vicia sativa, Lathyrus* sp. *Setaria* sp., *Lolium rigidum, Avena fatua,* and *Phalaris minor.*

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

Statistical analysis of the data showed that there was significant effect of different herbicides on weed density m^{-2} after herbicides application (Table-2). The data regarding weeds density m^{-2} after herbicides application are presented in Table-2. The minimum weeds m^{-2} (16.20) were recorded in Buctril-M 40 EC treated plots whereas the maximum weeds m^{-2} (142.25) were recorded in the weedy check plots. The density in the best treatment was however statistically at par with 2, 4-D 70 SL (27 m^{-2}) and Aim 40 WP (30.25 m^{-2}). Since in the site of the experiment broadleaf weeds are more problematic, Buctril-M 40 EC and 2,4-D 70 SL gave an excellent control of infecting weeds. This means that the Buctril-M 40 EC has effectively controlled all the weeds, which ultimately increased the final yield. Analogous results were reported by Khan *et al.* (2002). They reported that herbicides application effectively controlled weeds

Plant height (cm)

The analysis of the data showed that different herbicidal treatments had significant effect on plant height (Table-2). The perusal of data in Table-2 revealed that the increased plant height (102.4 cm) was obtained in Buctril-M treated plots, followed by 2,4-D 70 SL (101.6 cm) and Isoproturon 50 WP (100.9 cm). Minimum was recorded from weedy check (90.31 cm) and Puma super (92.69 cm) treated plots. The reason for increased plant height in the Buctril-M40 EC plots is the best control of broad leaf weeds. These results are in agreement with the work of Jalis and Muhammad (1980). They concluded that application of herbicides increased plant height and other yield components.

Spike length (cm)

Statistical analysis revealed significant effect of different herbicides on spike length in wheat (Table-2). The effect of various herbicides on spike length are shown in Table-2. The highest (12.76 cm) spike length was obtained from 2,4-D 70 SL plots which was statistically at par with Buctril-M 40 EC and Logran extra 64 WG which produced 12 39 cm and 12.05 cm spike length, respectively. The perusal of data in Table-2 further revealed that the lowest spike length (11.52 and 11.55 cm) was obtained from Topik 15

WP treated plots and weedy check, respectively. As there was a problem of broad leaf weeds, therefore grass killer herbicides did not play important role in increasing the yield or yield components in wheat. These findings are in agreement with the work of Tanveer *et al.* (1999), and Khan *et al.* (1999). They reported that herbicide treated plots gave more spike length.

1000 grain weight (g)

Statistical analysis of the data revealed that herbicides had significant effect on thousand grain weight (Table-2). The highest (46.69 g) thousand grain weight was obtained from Buctril-M 40 EC treated plots followed by 2,4-D 70 SL (44.46 g) and Logran extra 64 WG (43.89 g) [Table-2]. The data in Table-2 further depicted that the lowest 1000 grain weight (41.467 g) was obtained from the weedy check plots followed by Aim 40 DF having only 41.50 g weight. All other herbicides showed similar effect on thousand grain weight. These results are in conformity with the work of Sohail (1993).

Grain Yield (kg ha^{-1})

Analysis of variance of the data exhibited that herbicides had significant effect on the grain yield of wheat (Table-2). The data indicated that maximum grain yield of (1970 kg ha^{-1}) was produced by those plots to which Buctril-M 40 EC was applied. It was however, statistically at par with 2,4-D 70 SL producing grain yield of 1930 (kg ha^{-1}) and Isoproturon 50 WP (1780 kg ha^{-1}). Minimum grain yield of 1553 kg ha^{-1} was however obtained in weedy check plots, which was statistically comparable with Puma super 75 EW (1630 kg ha^{-1}), Topik 15 WP (1695 kg ha^{-1}) and all the remaining herbicides. The highest grain yield obtained from Buctril-M 40 EC and other top scoring treatments was perhaps due to their best phototoxic effect on weeds, while the lowest grain yield obtained from weedy check plots was probably due to the weed competition with crop. As there was a preponderance of broad leaf weeds hence the grass killers failed to surpass the weedy check. Whereas the failure of Logran extra 64 WG and Isoproturon 50 WP is attributed to their weaker control of broadleaf weeds. Hence, it can be concluded from the findings of this experiment that Buctril-M 40 EC and 2,4-D 70 SL are the best choice for broad leaf weed control in wheat. Analogous results were reported by Punia *et al.* (1996) and Khan *et al.* (1999) who obtained higher yield with same herbicides as compared to weedy check.

Cost-Benefit ratio (CBR)

The cost-benefit ratio was found significant for different treatments. The data in Table-2 shows the cost-benefit ratios for different treatments. Maximum cost-benefit ratio was recorded for Buctril M 40 EC (1: 10.71) followed by 2, 4-D 70 SL treatments (1: 9.79.). The lowest cost-benefit ratio was recorded for the Topik 15 WP treatment (1:1). These values indicated that all the herbicidal treatments gave acceptable cost-benefit ratio as compared to the yield in the weedy check. The possible reason for the highest return of Buctril M 40 EC and 2,4-D 70 SL herbicides might be their lower cost and timely weed control as compared to other herbicides. Similar work has been reported by Pattanaik *et al.* (1996).

Table-2. Effect of different herbicides on weed density and different parameters of wheat.

Treatments	Density m^{-2} before application	Density m^{-2} 30 DAA*	Plant height (cm)	Spike length (cm)	1000 grains weight (g)	Grains yield (kg ha^{-1})	CBR
Weedy check	150.25	142.25 a*	90.31 c	11.55 c	41.46 c	1553 b	---
Puma Super 75 EW	150.50	80.25 b	92.69 c	11.98 bc	41.86 bc	1630 b	2.10
Topik 15 WP	158.25	90 50 b	97.50 abc	11.52 c	42.18 bc	1695 b	1 69
Isoproturon 50 WP	200.25	67.50 b	100.9 ab	11.85 bc	41.86 bc	1780 ab	3.97
Logran extra 64 WG	190.50	58.00 b	96 63 bc	12.05 abc	43.89 abc	1703 b	2.47
Aim 40DF	211.00	30.25 c	98.06 ab	11.66 bc	41.50 c	1723 b	2.87
2, 4 D 70 SL	190 50	27.00 c	101 6 ab	12.76 a*	44.46 ab	1930 a	9.79
Buctril M 40 EC	195.00	16.20 c	102.4 a*	12.39 ab	46.69 a*	1970 a*	10.71
LSD	NS	15.77	5 336	0 767	2 948	193 2	

*Means followed by different letters in the respective column are significantly different by $LSD_{0.05}$

* DAA = Days after application

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