Pak. J. Weed Sci. Res. 11(3-4): 103 - 108, 2005

CHEMICAL WEED MANAGEMENT IN WHEAT AT HIGHER ALTITUDES-I*

Khan Bahadar Marwat[1], Zahid Hussain[1], Muhammad Saeed[1], Bakhtiar Gul[1] and Sahib Noor[2]

ABSTRACT

To evaluate the effect of different herbicides for controlling weeds in wheat cultivar Fakhr-i-Sarhad, an experiment was conducted at Agriculture Research Station, Chitral during rabi season 2003–04, using randomized complete block design with four replications. The crop was sown during November, 2003 comprised of seven herbicides and a weedy check. The herbicides used were terbutryn + triasulfuron @ 0.16 kg, 2,4-dichlorophenoxyacetic acid @ 0.7 kg, fenoxaprop-P-ethyl @ 0.93 kg, clodinafop @ 0.05 kg, bromoxynil + MCPA @ 0.49 kg, carfentrazon-ethyl @ 0.02 kg and isoproturon @ 1.0 kg a.i ha^{-1}. Isoproturon revealed the best performance with maximum weed kill efficiency (48.26%) and minimum fresh weed biomass (433.3 kg ha^{-1}) as compared to weedy check (6 %) and (1102 kg ha^{-1}), respectively. Similarly, the spike length (8.34 cm), number of tillers (427 m^{-2}), number of grains spike^{-1} (38.0), thousand grains weight (39.85 g), biological yield (8475 kg ha^{-1}), grain yield (2530 kg ha^{-1}) and harvest index (31.3 %) were the highest in isoproturon treatments as compared to weedy check having (7.64 cm), (356 m^{-2}), (34.1), (37.12 g), (6858 kg ha^{-1}), (1913 kg ha^{-1}) and (27 %), respectively.

Key words: Wheat, weed control, herbicides.

INTRODUCTION

The low wheat yield on per unit area beside many other factors could also be attributed to serious weed infestation in the crop. Weed losses are upto 30% in wheat production (Khan and Noor, 1995). In Pakistan during 2002-03, total area under wheat crop was 8.034 million hectares, with grain production of 19.183 million tons. During the same year, total area in NWFP was 0.732 million hectares with production of 1.064 million tons (Anonymous, 2003).

Weeds not only reduce the crop yields, but also deteriorate quality and market value of the farm produce. Chemical weed control is being emphasized in modern agriculture (Taj *et al.* 1986). Annual losses in wheat crop amount to more than 28 billions at national level and two billions in NWFP (Hassan and Marwat, 2001). During past few years integrated efforts in our country were fortunately successful by achieving self-sufficiency in food but were also in position to export. The major interventions resulting a boost in wheat production were the balanced use of fertilizers and irrigation, certified

1 Department of Weed Science, NWFP Agricultural University, Peshawar – Pakistan

2 Department of Entomology, Agricultural Research Station, Serai Naurang, Bannu – Pakistan.

* The research was funded by PSF Project on "Management of Weeds in wheat in NWFP"

seed of the cultivars having yield potential and introduction of Isoproturon 50 WP, Topik 15 WP and Puma super 75 EW for effective control of grassy weeds particularly wild oats and little seed canary grass. Still there exists a gap between the yield potential and the gain. The major constraints are pure seed, fertilizers, irrigation water and the most challenging one is the weed competition.

Crop losses due to weed competition throughout the world as a whole, are greater than those resulting from the combined effect of insects and diseases. Weeds may encourage the development of diseases, provide shelter and acts as an alternate host for pests. As a matter of fact, with the rising costs of labor and power, the judicial use of herbicides is the only acceptable way for effective weed management in future. The infested situations need the development of package of weed management technology, helpful to minimize the weed competition losses in our country. Weed control is the basic requirement and major component of the production system (Young *et al.* 1996).

To cope with the rapid increase in population, the scientists have to develop technology to divert the resources from weeds towards the wheat crop. Conventional methods of weed control are weather dependent, laborious and costly. 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 higher yield in wheat (Khan *et al.*, 2003). Therefore, an experiment was designed to find out the most effective, economical and environment friendly herbicide for controlling weed flora in wheat crop in Chitral area.

MATERIALS AND METHODS

The experiment was conducted at Agriculture Research Station, Chitral using wheat cultivar Fakhr-i-Sarhad, sown in a Randomized Complete Block Design with four replications and eight treatments. Each treatment size was 5 m x 1.5 m, consisting of five rows each 5 m long and 30 cm apart. The treatments consist of seven herbicides and a weedy check. All the herbicides were applied as post-emergence. The detail of the treatments is given Table-1. The data were recorded on weed kill efficiency (%), Fresh weed biomass (kg ha^{-1}), plant height at maturity (cm), spike length (cm), number of tillers m^{-2}, number of grains $spike^{-1}$, thousand grains weight (g), biological yield (kg ha^{-1}), grain yield (kg ha^{-1}) and harvest index (%). All the data were individually subjected to the ANOVA technique by using MSTATC computer software and means were separated by using LSD test according to Steel and Torrie (1980).

Table 1. Detail of treatments used in wheat in Chitral during 2003-04

S. No.	Trade name	Common name	Rate (kg a.i. ha^{-1})
1	Logran extra 64 WG	terbutryn + triasulfuron	0.16
2.	2, 4-D 70 SL	2,4-dichlorophenoxyacetic acid	0.70
3.	Puma Super 75 EW	fenoxaprop-p-ethyl	0.93
4.	Topik 15 WP	Clodinafop	0.04
5.	Buctril M 40 EC	bromoxynil + MCPA	0.49
6.	Aim 40 DF	Carfentrazon-ethyl	0.02
7.	Isoproturon 50 WP	Isoproturon	1.00
8.	Weedy check	-	-

RESULTS AND DISCUSSION

Weed Kill Efficiency (%)

Results showed that weed kill efficiency data was significant ($P \leq 0.05$). Maximum weed kill efficiency (48.3%) was recorded in Isoproturon 50 WP treatments compared to the weedy check (Table 1). It was found statistically at par with Topik 15 WP and Puma super 75 EW ranged from 42.0 to 34.9%. This indicated that the Isoproturon 50 WP had effectively controlled the weeds, which ultimately increased the yield. Pandey and Singh (1994) also reported that Isoproturon @ 1.0 kg ha^{-1} was most effective against the grassy weeds and gave satisfactory control of broadleaved weeds as well.

Fresh Weed Biomass (kg ha^{-1})

Herbicidal treatments have shown significant effect ($P \leq 0.05$) on weed biomass. Table-2 indicated that minimum and statistically at par weed biomass ranged from 433.3 to 466.7 kg ha^{-1} was found in plots treated with Isoproturon 50 WP, Puma super 75 EW and Topik 15 WP. However, Isoproturon 50 WP showed the lowest weed biomass, while maximum weed biomass (1102 kg ha^{-1}) was obtained in the weedy check. The difference in the weed biomass in different treatments can be attributed to phytotoxic effect of different herbicides. These results are in analogy with the findings of Khan *et al.* (2003) and Pandey and Singh (1994).

Plant height at maturity (cm)

All the treatments showed non-significant effect on plant height (Table-2). However, weedy check plots possessed the tallest plants (76.4 cm) while the crop treated with Logran extra 64 WG has the minimum plant height (72.4 cm). The competition of the wheat plants with weeds in weedy check forced the crop plants to rise higher than their normal height. Similar results have been reported by Khalil *et al.* (2000) who stated that there was non-significant increase in the plant height with the application of herbicides.

Spike length (cm)

Results indicated that herbicides had non-significant effect on spike length (Table-2). However, maximum spike length (8.34 cm) was recorded in Isoproturon 50 WP treated crop, while minimum spike length (7.64 cm) was observed in weedy check. The maximum spike length recorded in Isoproturon 50 WP treatments may be due to effective weed control while the minimum spike length recorded in weedy check will be due to the weed crop competition for nutrients.

Number of spikes m^{-2}

The data for number of spikes m^{-2} was also found non-significant. However, data presented in Table-2, revealed that maximum number of spikes m^{-2} (427) were recorded in plots treated with Isoproturon 50 WP, while minimum number of spikes m^{-2} (356) were counted in the weedy check. The possible reason for increase in number of spikes m^{-2} by Isoproturon 50 WP may be the effective weed control, which increased nutrients availability to the crop. The results are supported by Khan *et al.* (2003).

Number of grains $spike^{-1}$

Number of grains $spike^{-1}$ was also non-significantly affected by various herbicidal treatments. However, highest number of grains $spike^{-1}$ (38.0) obtained in Isoproturon 50 WP treatments and the lowest number of grains $spike^{-1}$ (34.1) were found in weedy check (Table-3). The lowest number of grains $spike^{-1}$ obtained in weedy check was probably due to the weed crop competition, which might have greatly reduced the flow of nutrients towards the grains in spikes. These results are in line with Marwat *et al.* (2003) who reported that number of grains $spike^{-1}$ can be increased with chemical weed control.

Table-2. Weed kill efficiency, weed biomass, plant height, spike length and number of spikes as affected by different herbicides in wheat during 2003-04.

Treatments	Weed kill efficiency (%)	Weed biomass (kg ha^{-1})	Plant height (cm)	Spike length (cm)	Number of spikes m^{-2}
Logran extra 64 WG	33.5 bc*	791.7 b	72.4	8.17	375
2, 4-D 70 SL	30.4 bc	908.3 ab	73.2	8.18	371
Puma Super 75 EW	34.9 abc	435.0 c	76.0	8.08	398
Topik 15 WP	42.0 ab	466.7 c	74.5	8.18	395
Buctril M 40 EC	25.9 c	785.0 b	74.2	7.99	399
Aim 40 DF	36.8 abc	778.3 b	74.9	7.94	408
Isoproturon 50 WP	48.3 a	433.3 c	75.6	8.34	427
Weedy check	6.0 d	1102.0 a	76.4	7.64	356
LSD value at α 0.05	13.8	270.7	N.S.	N.S	N.S.

* Means followed by a common letter in the respective column do not differ by LSD

1000-Grain weight (g)

Results indicated that herbicides had non-significant effect on 1000-grain weight Data given in Table-3 regarding 1000-grain weight manifested that Isoproturon 50 WP treatment gave the highest (39.85 g), while weedy check exhibited the lowest (37.12 g) 1000-grain weight. These results are similar to those reported by Khalil *et al.* (2000)

Biological yield (kg ha^{-1})

Herbicides had significant ($P<0.05$) effect on biological yield (Tale-3). Maximum and statistically at par biological yield 8475 and 8383 kg ha^{-1} was obtained in Isoproturon 50 WP and Puma super 75 EW However, these were statistically at par with Logan extra 64 WG, Topik 15 WP, Buctril M 40 EC and Aim 40 DF with mean values of 7925, 7825, 7483 and 7383 kg ha^{-1}, respectively. Minimum biological yield (6858 kg ha^{-1}) was obtained in the weedy check. Similar results have been reported by Pandey and Singh (1994) and Khan *et al.* (2003).

Grain yield (kg ha^{-1})

Analysis of variance of the data depicted that different herbicides had significant (P≤0.05) effect on grain yield. Table-3 showed that maximum grain yield 2530 kg ha^{-1} was recorded in Isoproturon 50 WP. It was statistically at par with Puma super 75 EW (2485 kg ha^{-1}), Logran extra 64 WG (2473 kg ha^{-1}), Topik 15 WP (2402 kg ha^{-1}) and Aim 40 DF (2182 kg ha^{-1}). Minimum grain yield 1913 kg ha^{-1} was obtained in weedy check. The best performance of Isoproturon 50 WP can be attributed to the best control of weeds and due to which weed competition was reduced and cause increased flow of nutrients towards the grains and ultimately the grain yield was increased. The results are supported by Pandey and Singh (1994) and Khan *et al.* (2003). Similar results have also promulgated by Marwat *et al.* (2003).

Harvest index (%)

Analysis of the data exhibited that herbicides had significant (P≤0.05) effect on the harvest index (Table-3). Maximum and statistically at par harvest index 31.3 and 30.7% was recorded in Isoproturon 50 WP and Topik 15 WP, respectively. However these were statistically comparable with Puma super 75 EW, Logran extra 64 WG, Aim 40 DF and Buctril-M 40 EC with values, 30.2, 29.5, 29.2 and 28.8%, respectively. Minimum harvest index (27 %) was calculated in the weedy check. The data is supported by the results of Marwat *et al.* (2003).

Table-3. Number of grains spike^{-1}, 1000-grains weight, biological yield, grain yield and harvest index as affected by different herbicides in wheat during 2003-04.

Treatments	No. of grains spike^{-1}	1000-grains weight (g)	Biological yield (kg ha^{-1})	Grain yield (kg ha^{-1})	Harvest index (%)
Logran extra 64WG	36.5	38.74	7925 ab	2473 ab*	29.5 abc
2, 4-D 70 SL	37.4	38.77	6892 b	1975 cd	27.6 bc
Puma Super 75 EW	36.2	38.98	8383 a	2485 ab	30.2 ab
Topik 15 WP	36.7	38.08	7825 ab	2402 abc	30.7 a
Buctril M 40 EC	37.1	37.85	7483 ab	2025 bcd	28.8 abc
Aim 40 DF	36.7	38.47	7383 ab	2182 abcd	29.2 abc
Isoproturon 50 WP	38.0	39.85	8475 a	2530 a	31.3 a
Weedy check	34.1	37.12	6858 b	1913 d	27.1 c
LSD at α 0.05	NS	NS	1392	460	2.74

* Means followed by a common letter in the respective column do not differ by LSD $_{0.05}$

CONCLUSIONS

The problem weeds were identified in a survey before conducting the experiment which included both the grassy and broad leaf weeds. Thus an herbicide like Isoproturon 50 WP, that could kill both grassy and broad leaf weeds, was included among the herbicide treatments. Isoproturon 50 WP effectively controlled weeds and revealed maximum grain yield. This means that the most effective weed control leads to the highest yield. In the light of our results, the herbicide Isoproturon 50 WP is the best herbicide at the rate of 1.0 kg a.i. ha^{-1} used as post-emergence to control weeds in wheat and to increase the crop yield in Chitral area.

REFERENCES CITED

Anonymous. 2003. Agriculture Statistics of Pakistan. Ministry of Food, Agriculture and Livestock (MINFAL), Islamabad.

Hassan, G. and K. B. Marwat. 2001. Integrated weed management in agricultural crops. National workshop on technologies for sustainable agriculture, Sep. 24-26, 2001, NIAB, Faisal abad Pakistan.

Khalil, S.K., A.Z. Khan, S. Paigham, A.R. Baloch and M.F. Malik. 2000. Herbicides and row spacing effect on leaf characteristics and grains per spike of wheat. Sarhad J. Agric. 16(1): 13-17.

Khan, M. and H. Noor. 1995. Weeds of wheat crop and their control. Division of Com. Services. NWFP Agric. Univ. Peshawar.

Khan, M. H., G. Hassan, N. Khan and M.A. Khan. 2003. Efficacy of different herbicides for controlling broadleaf weeds in wheat. Asian J. Plant Sci. 2(3): 254-256.

Majid, A. and M.R. Hussain. 1983. Studies on chemical weed control in wheat. J. Agric. Res. 21(4): 17-171.

Marwat, M.I., H.K. Ahmad, K.B. Marwat and G. Hassan. 2003. Integrated weed management in wheat-II. Pak. J. Weed Sci. Res. 9(1-2): 23:31.

Pandey, J. and R.P. Singh. 1994. Effect of sulphonyl urea herbicides on weed control in wheat (*Triticum aestivum*). Indian J. Agron. 39 (4): 565-568.

Steel, R.G.D. and J.H. Torrie. 1980. Principles and procedures of statistics. McGraw Hill Book Co., Inc. New York. pp. 481.

Taj, F.H., A. Khattak and T. Jan. 1986. Chemical weed control in wheat. Sarhad J. Agric. (2): 15-21.

Young, F.L., A.G. Ogg, D.L. Young and R.I. Papendick. 1996. Weed management for crop production in the northwest wheat (*Triticum aestivum*) region. Weed Sci. 44 (2):429-36.