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STUDY OF DIFFERENT CHEMICALS FOR WEED MANAGEMENT IN TWO WHEAT VARIETIES IN CHITRAL*

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ABSTRACT

A field experiment was carried out at ARS Chitral during 2005-06 on two wheat varieties, Nowshera-96 and Fakhr-i-Sarhad in a split plot design. The varieties were assigned to the main plots and the herbicides along with a weedy check to the subplots. The herbicides were Buctril super 60EC @ 0.45 kg, Topik 15WP @ 0.04 kg, Puma super 75EW @ 0.75 kg and Isoproturon 50WP @ 1 kg a.i. ha^{-1}. Statistically maximum weed control efficiency (72%) and minimum weed biomass (99.5 kg ha^{-1}) was observed in Buctril super 60EC followed by Isoproturon 50WP (64.5 %) and (159 kg ha^{-1}) as compared to the biomass in weedy check (1146 kg ha^{-1}). Similarly, number of tillers (413 m^{-2}), thousand grains weight (40.2 g), biological yield (9685 kg ha^{-1}) and grain yield (2896 kg ha^{-1}) were maximum in Buctril super 60 EC followed by Isoproturon 50WP with values (373 m^{-2}), (39.3 g), (8725 kg ha^{-1}) and (2673 kg ha^{-1}), respectively as compared to weedy check (301 m^{-2}), (36.3 g), (7138 kg ha^{-1}) and (1584 kg ha^{-1}), respectively. Furthermore, the variety Nowshera-96 alone as well as its interaction effect with herbicides was better in performance than Fakhr-i-Sarhad in all the weed and crop parameters studied.

Key words: Wheat, herbicides, varieties, weed control and Chitral.

INTRODUCTION

Pakistan is an agricultural country and agriculture employs 50% of the total labor force at the national level. Wheat ranks first among the cereal crops in Pakistan and occupies about 66% of annual food

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crop area providing protein and caloric requirements to the population. Wheat is a staple food of 165 million Pakistanis. It is the cheapest source of food for great deal of population of the world, and supplies 73 percent of the calories and protein in the average diet (Heyne, 1987). 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 un-irrigated land. At provincial level, in NWFP, the area under wheat cultivation was about 0.7486 million ha having 0.3133 m ha area as irrigated and 0.4353 m ha is rain-fed, giving a total production of 1.0911 m tons @ 1458 kg ha^{-1} (MINFAL, 2005).

Annual losses in wheat amount to more than 28 b at national level (Hassan and Marwat, 2001). The annual losses to wheat crop in NWFP on monetary basis amount to Rs. 2 billions (Marwat, 2002). These figures warrant an efficient control of weeds. The control of weeds is basic requirement and major component of management in the production system (Young *et al.* 1996). A gloomy situation is seen further that the twin menace of water logging and salinity is devouring our irrigated land like termites. Out of 37 m ha total irrigated area, 10.6 m ha area is already subject to water logging and salinity. The growth rate of population is around 3% annually and there is continuous and gradual increase in per capita use of wheat and its products. The horizontal increase is almost impossible because the cultivated area is already squeezing and we have the only option to harness the potential yield of even the existing wheat varieties. Weeds are one of the major problems in wheat crop production. They compete with the crop for light, moisture, nutrients and space. The objectives of the experiments were to evolve the management package by isolating the most economical herbicide for weed control in wheat at higher altitudes and also to study the effect of two wheat varieties on weed management and grain yield.

MATERIALS AND METHODS

A field experiment was conducted to study the efficacy of different herbicides for weed management in two varieties of wheat at Agriculture Research Station, Chitral, Pakistan. The experiment was laid out in a randomized complete block (RCB) design with split plot arrangement having three replications. The varieties (Fakhr-i-Sarhad and Nowshera-96) were allotted to main plots and herbicides (Buctril super 60EC @ 0.45 kg, Topik 15WP @ 0.04 kg, Puma super 75EW @ 0.75 kg and Isoproturon 50WP @ 1 kg a.i. ha^{-1}) along with weedy check were allotted to the subplots. The size of each experimental unit

was kept 5 m x 1.8 m having 6 rows; each row five meter long and 30 cm apart from the adjacent one.

The data were recorded on weed control efficiency, weed fresh biomass (kg ha^{-1}), number of tillers m^{-2}, thousand grain weight (g), biological yield (kg ha^{-1}) and grain yield (kg ha^{-1}) of wheat. The data recorded for each parameter were individually subjected to the ANOVA technique by using MSTATC computer software and the means were separated by using Fisher's Protected LSD test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The herbicides and their interactions with varieties had a significant effect on the entire crop and weed parameters. However, the varieties alone had a non-significant impact.

Weed control efficiency (%)

The data in Table-1 indicated significantly maximum weed control efficiency (72%) noted in Buctril super 60EC treatments. Comparatively better weed control efficiency (51%) was recorded in Nowshera-96, though the varietal effect was non significant. On the other hand, the interaction effect was significant; with the best weed control efficiency (74%) observed in Buctril super treatment on variety Nowshera-96, followed by the same herbicide treatment (70%) in Fakhr-i-Sarhad. The least weed control efficiency was observed in Topik 15WP treated plots regardless of the varieties. Khan *et al*. (2002) and Bahraini *et al.* (1999) reported that herbicides application effectively controlled weeds. These findings are also in conformity with those of Shahid (1994), who reported that herbicides significantly reduced weed density.

Table-1. Weed control efficiency (%) as affected by herbicides and varieties

Herbicides	Varieties		Herbicide means
	Nowshera-96	Fakhr-i-Sarhad	
Puma super 75EW	60 b*	57 bc	58.5 bc
Buctril super 60 EC	74 a	70 a	72.0 a
Isoproturon 50 WP	67 ab	62 b	64.5 b
Topik 15 WP	51 c	49 c	50.0 c
Weedy check	0 d	0 d	0 d
Varieties means	51	48	

$LSD_{0.05}$ for herbicides = 6.8; $LSD_{0.05}$ for interaction = 7.5

*Means sharing a letter in common in the respective category do not differ significantly by LSD Test at 5% level of probability

Weed biomass (kg ha^{-1})

Table-2 demonstrated a significantly highest weed biomass (1146 kg ha^{-1}) recorded in weedy check and minimum biomass (100 kg ha^{-1}) observed in Buctril super 60EC treated plots, which was at par with Isoproturon 50WP (159 kg ha^{-1}). Even though non significant, the variety Nowshera-96 lowered weed biomass (418 kg ha^{-1}) as compared to Fakhr-i-sarhad (441 kg ha^{-1}). However, the interaction effect was significant, and significantly reduced weed biomass (94 kg ha^{-1}) was noticed in Nowshera-96 plots treated with Buctril super 60EC in comparison with the control plots. This could be attributed to the fact that the experimental plots were mainly infested with broadleaf weeds that were successfully minimized by Buctril super 60EC application. Herbicides application significantly declined weed biomass as compared to weedy control (Bahraini *et al.* 1999; Khan *et al*. 2002; Shahid 1994). Whereas Korres and Froud-Williams. (1997) performed similar work on varieties selection for weed suppression.

Table-2. Weed biomass (kg ha^{-1}) as affected by different herbicides and varieties.

Herbicides	Varieties		Herbicide means
	Nowshera-96	Fakhr-i-Sarhad	
Puma super 75EW	332 bc*	333 bc	332.5 b
Buctril super 60 EC	94 c	105 c	99.5 c
Isoproturon 50 WP	161 c	157 c	159.0 c
Topik 15 WP	401 b	420 b	410.5 b
Weedy check	1101 a	1191 a	1146.0 a
Varieties means	418	441	

$LSD_{0.05}$ for herbicides = 113; $LSD_{0.05}$ for interaction = 182

*Means sharing a letter in common in the respective category do not differ significantly by LSD Test at 5% level of probability.

Number of tillers m^{-2}

Among the herbicides, maximum (412 tillers m^{-2}) were recorded in Buctril super 60EC treatments while minimum (301 tillers m^{-2}) were documented in weedy check plots. Whereas the number of tillers (336 m^{-2}) observed in Nowshera-96, though non significant statistically, was higher than that in Fakhr-i-Sarhad, among the varieties. For the interaction of varieties with herbicides, maximum (429 tillers m^{-2}) were noticed in Nowshera-96 x Buctril super 60EC and minimum (292 m^{-2}) in Fakhr-i-Sarhad x weedy check. Nowshera-96 responded more positively to the best weed control by Buctril super 60EC, triggering the number of tillers to jump up, as compared to that in control plots. Therefore, the number of tillers m^{-2} can be significantly influenced by the application of herbicides (Marwat *et al.* 2003; Tunio *et al.* 2004).

Table-3. Number of tillers m^{-2} as affected by different herbicides and varieties.

Herbicides	Varieties		Herbicide Means
	Nowshera-96	Fakhr-i-Sarhad	
Puma super 75EW	340 cd*	321 cd	330.5 c
Buctril super 60 EC	429 a	397 ab	413.0 a
Isoproturon 50 WP	385 b	361 bc	373.0 b
Topik 15 WP	322 cd	308 d	315.0 cd
Weedy check	310 d	292 d	301.0 d
Varieties means	357	336	

$LSD_{0.05}$ for herbicides = 29; $LSD_{0.05}$ for interaction = 41

*Means sharing a letter in common in the respective category do not differ significantly by LSD Test at 5% level of probability.

Thousand grain weight (g)

The influence of herbicides and their interaction with varieties on 1000-grain weight was significant while the impact of varieties alone was insignificant. Thus the highest 1000-grain weight (40.2 g) was observed in Buctril super 60EC, however it was at par with Isoproturon 50WP (39.3 g) while the lowest (36.3 g) was noted in weedy check (Table-4). For the interaction effect, maximum 1000-grain weight (40.9 g) was recorded in Nowshera-96 treated with Buctril super 60EC whereas minimum 1000-grain weight (35.7 g) was documented in control plots. In fact when the interspecific competition is reduced the photosynthate assimilation is enhanced which improves the performance of the plants for grain filling eventually increasing the 1000-grain weight. Marwat *et al.* (2003), Hassan *et al*. (2003) and Baldha *et al.* (1998) reported that herbicides application increased 1000-grain weight significantly when compared with the weedy check.

Table-4. 1000 grains weight (g) as affected by different herbicides and varieties.

Herbicides	Varieties		Herbicide means
	Nowshera-96	Fakhr-i-Sarhad	
Puma super 75EW	39.2 bc*	37.8 cd	38.5 b
Buctril super 60 EC	40.9 a	39.5 ab	40.2 a
Isoproturon 50 WP	37.8 cd	38.7 bc	39.3 ab
Topik 15 WP	38.6 bc	37.4 cd	38.0 b
Weedy check	37.0 d	35.7 d	36.3 c
Varieties means	39.1	37.8	

$LSD_{0.05}$ for herbicides = 1.3; $LSD_{0.05}$ for interaction = 1.5

*Means sharing a letter in common in the respective category do not differ significantly by LSD Test at 5% level of probability

Biological yield (kg ha^{-1})

The analysis of the data showed that the differences among the herbicides were significant. It is evident from Table 5 that the highest biological yield (9685 kg ha^{-1}) was obtained in Buctril super 60EC treated plots and lowest (7138 kg ha^{-1}) secured in weedy control. Among the varieties, a biological yield of 8351 kg ha^{-1} was produced by Nowshera-96 which was better than that of Fakhr-i-Sarhad (8010 kg ha^{-1}), though the results were non significant statistically. As far as the interaction impact of the herbicides and varieties is concerned, the best biological yield (10004 kg ha^{-1}) was attained by Nowshera-96 plots treated with Buctril super 60EC; while minimum biological yield (6999 kg ha^{-1}) was gained in Fakhr-i-Sarhad under weedy check plots. The biological yield of the crop depends on the vegetative and reproductive growth. Therefore, with increase in number of tillers and thousand grain weight, the ultimate biological yield improves accordingly. The previous similar research endeavors by Marwat *et al.* (2003), Hassan *et al.* (2003), Fayed *et al.* (1998), and Baldha *et al.*. (1998) support these results.

Table-5. Biological yield (kg ha^{-1}) as affected by different herbicides and varieties

Herbicides	Varieties		Herbicide means
	Nowshera-96	Fakhr-i-Sarhad	
Puma super 75EW	7955 cd*	7577 de	7766 c
Buctril super 60 EC	10004 a	9367 ab	9685 a
Isoproturon 50 WP	8755 bc	8695 bc	8725 b
Topik 15 WP	7766 cd	7411 de	7588 d
Weedy check	7277 de	6999 e	7138 d
Varieties means	8351	8010	

$LSD_{0.05}$ for herbicides = 851; $LSD_{0.05}$ for interaction = 955

*Means sharing a letter in common in the respective category do not differ significantly by LSD Test at 5% level of probability

Grain yield (kg ha^{-1})

The most crucial parameter in any research endeavor concerning crops is the grain yield. In this experiment, the impact of the herbicides and their interaction on grain yield was significant whereas the varieties alone had no significant effect on the grain yield of wheat crop. The data in Table 6 revealed that among the herbicides alone, the highest grain yield (2896 kg ha^{-1}) was secured in Buctril super 60EC treated plots, however it was statistically similar to Isoproturon 50WP (2673 kg ha^{-1}) while lowest grain yield (1584 kg ha^{-1}) was achieved in the weedy check plots. For the effect of varieties alone, though non-significant, the grain yield (2387kg ha^{-1}) recorded in Nowshera-96 was better than the grain yield of 2263 kg ha^{-1} as

obtained in Fakhr-i-Sarhad plots. As concerns the interaction of herbicides with varieties, maximum grain yield (2986 kg ha^{-1}) was produced by Nowshera-96 treated with Buctril super 60EC as compared to the minimum value (1542 kg ha^{-1}) obtained in Fakhr-i-Sarhad x weedy check. The grain yield increased accordingly with increase in the number of tillers as well as 1000-grain weight which was the result of impressive weed control that diminished the interspecific competition between crop and weed plants. Therefore, the herbicidal treatments can significantly increase grain yield in wheat regardless of the variety used (Hassan *et al.* 2003) which support the results. Moreover, the findings conveyed by Marwat *et al.* (2003), Tunio *et al.* (2004), Baldha *et al.* (1998), Fayed *et al.* (1998), and Korres and Froud-Williams. (1997) were similar to these results.

Table-6. Grain yield (kg ha^{-1}) as affected by different herbicides and varieties.

Herbicides	Varieties		Herbicide means
	Nowshera-96	Fakhr-i-Sarhad	
Puma super 75EW	2472 c*	2335 cd	2403 b
Buctril super 60 EC	2986 a	2806 ab	2896 a
Isoproturon 50 WP	2736 ab	2613 bc	2673 a
Topik 15 WP	2115 de	2017 e	2066 c
Weedy check	1625 f	1542 f	1584 d
Varieties means	2387	2263	

$LSD_{0.05}$ for herbicides = 252; $LSD_{0.05}$ for interaction = 308

*Means sharing a letter in common in the respective category do not differ significantly by LSD Test at 5% level of probability

CONCLUSIONS AND RECOMMENDATIONS

In light of the results, the herbicide Buctril super 60EC at rate 0.45 kg a.i. ha^{-1}, and the variety Nowshera-96 both resulted in desirable yields. In the same way, the best interaction effect was displayed by Buctril super 60EC x Nowshera-96, bringing about best weeds control and grain yield. Therefore, for the climatic conditions of Chitral, the herbicide Buctril super 60EC at rate 0.45 kg a.i. ha^{-1} as post emergence and the variety Nowshera-96 are the best combination as an effective weed management strategy for suitable grain yields in wheat crop.

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