Pak. J. Weed Sci. Res. 8(1-2):49-55, 2002

RESPONSE OF WHEAT VARIETIES TO SUBSTITUTED UREA HERBICIDES

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ABSTRACT

Field experiment was conducted to study the varietal response of two wheat varieties viz., Tatara and Ghaznavi-98 to six different types of substituted urea herbicides viz., Dicuran-MA 60 WP (Chlortoluron) @ 2.5 kg/ha, Arelon 50 S (Isoproturon) @ 2.0 lit/ha, Tribunil 70 WP (Methabenzthiazuron) @ 2.0 kg/ha, Dosanex 80 WP (Metoxuron) @ 1.5 kg/ha, Tolkan 50 WP (Isoproturon) @ 2.0 kg/ha, Graminon 50 FW (Isoproturon) @ 2.0 lit/ha in comparison with Buctril-M 40 EC (Bromoxynil+MCPA) @ 1.3 lit/ha, and a weedy check. Observations on weed density (Grassy and Broadleaf m^{-2}), weeds' dry weight (g), grain yield (kg ha^{-1}) and yield components of wheat varieties were recorded. Dicuran-MA 60 WP was the most effective herbicide in reducing the weeds' dry weight to 27 g m^{-2} compared to 106 g m^{-2} in the weedy check. Application of various herbicides did not affect the 1000-grain weight significantly. All the herbicides were effective in increasing grain yield compared to weedy check. Maximum grain yield of 5036 and 4990 kg ha^{-1} was obtained from plots treated with Tolkan and Tribunil, respectively, however, it was statistically at par with all other herbicides tested, but significantly higher than the weedy check. Ghaznavi-98 gave higher yield of 4884 Kg than Tatara (4355 Kg ha^{-1}).

Key words: Wheat, weed control, substituted urea herbicides.

INTRODUCTION

Wheat (*Triticum aestivum* L. em Thell) is the cereal of choice in most countries of the world enjoying unique position among cultivated crops. Firstly, it is grown on the area larger than the area of any other crop. Secondly, it provides more calories and proteins in the world diet than any other crop. Thirdly, the world trade in wheat exceeds trade in all others crops combined. In Pakistan, during 1999-2000, wheat was grown on an area of 8.30 million ha, with a production of 21 million tons. The area consists of about 6.898 million ha irrigated and 1.332 million ha of un-irrigated land. In NWFP, wheat is grown on an area of about 0.858 million ha. One-third of this area in NWFP is irrigated, while two-third is rainfed (Anonymous, 2000). The country, during the year under reference was not only self sufficient in wheat, but also a surplus of one million tons was available, which could not be exported and it was carried over to the current year due to which the market is cluttered despite lower yield due to unfavorable weather conditions during the wheat growing season. One of the prime reasons for the increased yield is introduction of

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very effective grass specific herbicides Puma Super and Topik which were feasible to be used due to increased support price of wheat.

Unfortunately, wheat yield ha^{-1} in Pakistan is very low and actual farm yield is about 30-35% of the potential yield. It is 50% of the mean yield realized in nations leading in wheat production, like China and Mexico (Anonymous, 1997). Weed interference is one of the important but less noticed constraints, contributing towards low yield of wheat in Pakistan.

It has been estimated that annual losses caused by weeds in Pakistan amount to Rs.1150 million which are little more than those caused by diseases (Haq, 1970), whereas weeds' losses in wheat alone have exceeded 25 billion during 1998 (Marwat, 1998). Agricultural experts have assessed that weeds cause 17-25% losses in wheat annually (Shad, 1987). Studies of Appleby *et al.*, 1976 exhibit that wheat yield proportionately declined as the Italian ryegrass densities increased. The percent reduction tended to be higher in tall than dwarf wheat cultivars. Later studies (Hashim and Radosevich, 1991) also quantified a proportionate decline in wheat yield with increasing Italian ryegrass densities. Carlson (1989) and Khan and Thill (1992) quantified the consequent decline in wheat grain yield as the *Avena fatua* density increased in the wheat fields. Although different reports are available on the efficacy of different herbicides in wheat (Mohibullah and Ali 1974; Gills and Walia, 1979; Makhdoom and Memon, 1982; Bhatia and Das, 1981; Balyan *et al.*, 1983; Riaz *et al.*, 1986; Khan *et al.*, 1999; Khan *et al.*, 2001), the herbicide use in Pakistan is not widely practiced as in the agriculturally advanced nations. Farmers have little orientation in herbicide use, however, they wish to have an effective and economical weed control package, including herbicide use. Appleby (1967) has cautioned the use of Buctril at later stages of growth and its use on perennial weeds due to its contact nature. Recent studies showed that herbicide treatments gave 87.2 to 90.3% weed control with a consequent 19.4 to 25.47% increase in grain yield. Since new products are being added to the arsenal of the chemical weaponry, therefore, this study was undertaken to determine the efficacy of different substituted urea and some other herbicides against weeds and to study the varietal response of wheat if any.

MATERIALS AND METHODS

These investigations were carried out at the experimental area of the Malakandher Farm, NWFP Agricultural University, Peshawar during the Rabi season of 1998-99. Two commercial wheat varieties viz., Tatara and Ghaznavi-98 were used as medium of experiment. Optimum dose of fertilizer nutrients was provided equally to all the treatments.

The experiment was laid out in a Randomized Complete Block Design with split-plot arrangement of the treatments with four replications in a sub-plot size of 5x3 m^2. Each replication consisted of two main-plots and each main-plot was further sub divided into eight sub-plots, out of which seven sub-plots were treated with the post-emergence herbicides and one sub-plot was kept un-treated (Table 1). In each sub-plot, wheat varieties were seeded on December 15, 1998 in 10 rows, 30 cm apart. The weeds were naturally occurring and were not seeded.

The herbicide treatments were applied as post-emergent at seedling stage (3-4 leaf stage). 27 days after emergence. Number of weeds per unit area (33 x 33 cm^2) at three random places per sub-plot was counted 35 days after the spray and subsequently converted into m^{-2}. The number m^{-2} was recorded separately for mono- and dicot weeds. Other parameters studied were plant height (cm), 1000-grain weight (g), weeds dry weight m^{-2} (g), grain yield (kg ha^{-1}). The data were analyzed statistically by the analysis of variance technique and the significant means were separated by LSD test at 5% alpha level (Gomez and Gomez, 1984).

Table 1. Detail of herbicidal treatments along with herbicide doses

Common name	Trade name	Rate (a.i. Kg ha^{-1})
Bromoxynil+MCPA	Buctril-M 40 EC	0.52
Chlortoluron+MCPA	Dicuran-MA 60 WP	1.50
Isoproturon	Arelon 50 S	1.00
Methabenzthiazuron	Tribunil 70 WP	1.40
Metoxuron	Dosanex 80 WP	1.20
Isoproturon	Tolkan 50 WP	1.00
Isoproturon	Graminon 50 FW	1.00
Weedy Check	-----	-----

Results and Discussion

Weeds Dry Weight m^{-2}: The main effect of cultivars and herbicides significantly affected the weeds dry weight, while the interaction of cultivars with herbicides was depicted as non-significant. The lesser weed biomass was recorded in Ghaznavi-98 (45.96 g) as compared to Tatara (Table 2), although the subsequent data show that the height of Tatara was higher as compared to the former cultivar. The competitive ability of Ghaznavi-98 may attributed to its earlier space capture and relative growth rate. All the seven herbicidal treatments lowered the dry weight of weeds as compared to un-weeded control (Table 3). Dicuran MA was the most effective and decreased the weeds dry weight to only 27.79 g m^{-2} followed by Graminon with 29.99 g as compared to 106.37 g of weedy check. These reductions were similar to those reported by Dhimon and Katron (1982). They reported that Arelon application decreased weeds dry weight by 44-79%.

Number of Grassy Weeds (m^{-2}): The differences between the cultivars and herbicides were evaluated as statistically significant, however, the interaction of cultivars with herbicides was detected as non-significant ($P>0.05$). The number of Grassy weeds was lower in Ghaznavi-98 (5.43 m^{-2}) as compared to Tatara (7.34 m^{-2}) [Table 2], which exhibits the competitive ability of the former genotype with the grassy weeds. The grassy weeds density decreased significantly with all herbicidal applications except Buctril-M, which was at par with weedy check (Table 3). It is logical that Buctril-M did not affect the number of Grassy weeds, as it is a selectively used against broad leaf weeds in wheat. The findings of Khan *et al.*, (2001) also validate our observations, who found comparable population of grasses with the weedy check when treated with broad leaf killers including Buctril-M.

Table 2. Weeds dry weight (g), number of Grassy and Broadleaf weeds (m^{-2}), 1000-grain weight of wheat (g), plant height (cm), and grain yield (kg ha^{-1}) as affected by two wheat varieties

Parameters	Tatara	Ghaznavi-98
Weeds dry weight (g)	51.61	45.96 *
Grassy weeds (m^{-2})	7.34	5.43 *
Broadleaf weeds (m^{-2})	10.20	7.40 ns
1000-grain weight (g)	38.10	32.38 *
Plant height (cm)	93.13	77.03 *
Grain yield (kg ha^{-1})	4344.63	4884.13 *

ns - Non-significant; * - Significant ; ** = Significant at alpha 0.01, using F-test.

Number of Broadleaf Weeds (m^{-2}): Variety by treatment (herbicide) interaction was significant for the number of Broadleaf weeds per plot. Highest number of 30.17 weeds m^{-2} was recorded in weedy check for Tatara followed by weedy check for Ghaznavi-98 with 15.75 weeds m^{-2}. Lowest number of Broadleaf weeds was recorded in Graminon (3.84 m^{-2}) treated plots of Tatara and Tolkan (4 m^{-2}) treated plots in Ghaznavi-98 (Table 4). These findings are in analogy of the work reported by Riaz *et al.*, (1988), Tanveer, *et al.*, (1999), and Khan, *et al.* (2001) who obtained a varying response of Broadleaf weeds to various herbicidal applications.

Thousand (1000)-grain Weight (g): The main effect cultivars for grain weight was statistically significant, while the herbicides and their interaction with the cultivars was evaluated as non-significant statistically. It shows that kernel weight is strictly under the genetic control and it is not largely affected by the agro-ecosystem. As shown in Table 1, 1000-grain weight was significantly higher in Tatara (38.1 g), as compared to Ghaznavi-98 (32.38 g). However, surprisingly grain yield per plot was higher in Ghaznavi-98, which may be due the superiority of the later in other yield components. The present results are in agreement with those of Taj, *et al.* (1986): who reported that 1000-grain weight was not significantly influenced by different herbicides.

Plant Height (cm): The main effects for cultivars and herbicides were significant statistically, while the interaction of cultivars with the herbicides was deciphered as non-significant for plant height. Plant height was significantly higher in Tatara (93.13 cm) than Ghaznavi-98 (77.03 cm) [Table 2] and it seems to be inherent characteristic of the varieties, as V X H interaction was non-significant. Among the herbicides, the highest plant height was recorded in control (88.85 cm). However, it was statistically at par with Tribunil (88.1 cm), Dosanex (86.15 cm) and Arelon (85.19 cm) [Table 3]. Lower and statistically comparable height was recorded in Tolkan (83.61 cm), Buctril-M (83.43 cm), Dicuran-MA (83.4 cm) and Graminon (82.11 cm). The height of these treatments was also statistically at par with Dosanex and Arelon (Table 3). These findings are however, at variance from Appleby, *et al.* (1976), who communicated the higher competitive ability of taller wheat cultivars in their studies.

Table 3. Efficacy of different herbicides on controlling weeds and their impact on wheat

Herbicides	Weeds dry weight (g m^{-2})	No. of Grassy weeds (m^{-2})	Plant height (cm)	Grain yield (kg ha^{-1})
Buctril-M 40 EC	48.67 b	13.96 a	84.43 b	4842 a
Dicuran-MA 60 WP	27.79 c	2.46 b	83.40 b	4434 a
Arelon 50 S	46.91 bc	5.09 b	85.19 ab	4804 a
Tribunil 70 WP	39.93 bc	3.67 b	88.10 a	4999 a
Dosanex 80 WP	56.59 b	3.67 b	86.15 ab	4728 a
Tolkan 50 WP	34.04 bc	3.30 b	83.61 b	5036 a
Graminon 50 FW	29.99 c	2.46 b	82.11 b	4921 a
Weedy Check	106.37 a	16.05 a	88.85 a	3166 b
$LSD_{0.05}$	25.11	3.94	4.37	1517

Means sharing a letter in common do not differ significantly using LSD test at alpha 0.05.

Table 4. Varieties X herbicides Interaction for No. of broadleaf weeds (m^{-2}) in wheat.

Herbicides	Varieties	
	Tatara	Ghaznavi-98
Buctril-M 40 EC	4.75 cd	6.09 cd
Dicuran-MA 60 WP	7.09 cd	8.84 cd
Arelon 50 S	8.51 cd	5.34 cd
Tribunil 70 WP	10.76 bc	8.17 cd
Dosanex 80 WP	10.26 bc	6.17 cd
Tolkan 50 WP	7.84 cd	4.00 d
Graminon 50 FW	3.84 d	4.84 cd
Weedy Check	30.17 a	15.75 b
$LSD_{0.05}$ for Varieties X Herbicide interaction	6.22	

Means sharing a letter in common do not differ significantly using LSD test at alpha 0.05

Grain Yield (kg ha^{-1}): The main effects were significant, while the interaction of the factors under study was non-significant statistically. As shown in (Table 2), Ghaznavi-98 gave significantly higher grain yield (4884.13) than Tatara (4344.63 kg ha^{-1}). All the herbicides were equally effective in increasing grain yield ha compared to weedy check (Table 3). Maximum yield of 5036 kg ha^{-1} was recorded in Tolkan treated plots. However, it was statistically comparable with all other herbicidal applications, but statistically higher than the weedy check. Our results are in agreement with those of Mohibullah and Ali (1974) who observed that Tribunil 70WP gave an increase of 26.1% in grain yield of wheat against control. Gills and Walia (1979) observed 36.7% increase in grain yield of wheat by using Arelon while Dhimon and Kairon (1982) stated that Arelon application increased grain yield of wheat by 23% over un-weeded control. Makhdoom and Memon (1982) found Dicuran-MA increasing grain yield by 58% in wheat crop. Recently, Tanveer *et al.* (1999) Khan, *et al.* (1999) and Khan, *et al.* (2001) have reported a significant increase in wheat grain yield due to varying herbicidal applications.

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