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Efficacy of Different Herbicides for Controlling Weeds in Wheat Crop at Different Times of Application – II

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Abstract: The effect of different herbicides applied at different timings viz. 30, 45 and 60 days after sowing (DAS) of wheat crop was studied for controlling weeds. Herbicidal treatments were Assert (Imazamethabenz-methyl) 0.30, isoproturon 1.12 kg alone and buctril-M (bromoxynil+MCPA) 0.72 kg+topik (clodinofop) 0.37 kg, logran (trisulfuron) 0.64 kg+topik (clodinofop) 0.37 kg, 2,4-D (2,4-D ester) 1.20 kg+topik (clodinofop) 0.37 kg and puma super (phenoxyprop-ethyle) 0.75 kg+2,4-D (2,4-D ester) 1.20 kg a.i. ha^{-1}. A weedy check was also included for comparison. The analysis of the data revealed significant differences among the times of application for biological yield and grain yield. Similarly significant differences were recorded for herbicidal treatments in traits like spikelets $spike^{-1}$, 1000 grains weight (g), biological yield (kg ha^{-1}) and grain yield (kg ha^{-1}). The interaction of the times of application and herbicides was significant for spikelets $spike^{-1}$ and for grain yield. Maximum number of spikelets $spike^{-1}$ and heavier 1000 grains weight was observed in plots treated with buctril-M+topik mixture, while minimum in weedy check plots. Biological and grain yield (kg ha^{-1}) were higher in plots treated with buctril-M+topik and logran extra+topik while lower biological and grain yield were in weedy check plots. Buctril-M+topik proved to be the most economical herbicides giving maximum return of Rs. 24631 ha^{-1}, if applied 45 DAS in wheat.

Key words: Efficacy, herbicides, weeds, wheat

Introduction

Wheat is the most important food crop of the world. The largest cropped area is devoted to wheat and the quantity produced is more than that of any other crop. In Pakistan, 37% of the cropped area is devoted to wheat, annually. The best quality wheat is produced in areas having a cold winter and comparatively warm spring or summer with moderate rainfall.

Although the environmental conditions are favourable and the high yielding varieties are available in the country yet we cannot achieve its potential yield. So many factors are responsible for low yield. Among these factors, infestation of weeds is a serious issue and requires immediate attention. The infested situations need the development of package of weed management technology, helpful to avoid wheat production losses Pakistan. The control of weeds is a basic requirement and major component of management in most production systems (Young *et al*., 1994; Norris, 1982; Triple, 1976).

Out of the factors contributing to low yield, presence of weeds in wheat fields is considered to be one of the most limiting factor. Weeds cause considerable yield loss amounting to 29.03% (Qureshi, 1982). Several reports address the importance of weed control at proper time in wheat. Rossarola *et al*. (1993) reported that application of herbicides resulted in increased grain yield at 2nd node stage.

In view of the importance of the problem from the national point of view, the research work was conducted to study the impact of different herbicides on different weeds and to know the response of crop to such herbicides in terms of tolerance, yield and yield components.

Materials and Methods

The research work was conducted at Malkandher Farm, NWFP Agricultural University, Peshawar during the rabi season 2000-01. The experiment was laid out as split plot in RCB design with three replications. In each replication, there were three main plots. Each main plot consisted of seven sub-plots having five meter length. The number of rows in each sub-plot was five, spaced at 30 cm. The time of herbicidal application were kept in main plots while the herbicidal treatments were assigned to the sub-plots. The seed was sown @ 120 kg ha^{-1} with the help of hand hoe. The detail of the treatments was as under:

- Times of herbicidal application (main plots)
- Thirty days after sowing (30 DAS)
- Forty five days after sowing (45 DAS)
- Sixty days after sowing (60 DAS)

B. Herbicidal treatments (sub-plots)

Trade name	Common name	Rate (kg ha^{-1} a.i.)
Buctril-M 40 EC	Bromoxynil+MCPA	0.72
+	+	+
Topik 15 WP	Clodinofop	0.37
Assert 30 SC	Imazamethabenz-methyl	0.30
Isoproturon 75 WP	Isoproturon	1.12
Logran extra 64 WG	Triasulfuron	0.64
+	+	+
Topik 15 WP	Clodinofop	0.37
2,4-D 72%	2,4-D ester	1.20
+	+	+
Topik 15 WP	Clodinofop	0.37
Puma super 75 EW	Fenoxyprop-ethyl	0.75
+	+	+
2,4-D 72%	2,4-D ester	1.20
Weedy check	------	------

All the herbicides were applied post-emergence and data were recorded on the following parameters, to determine the effect of aforesaid treatments.

Relative density (%), number of spikelets spike^{-1}, 1000 grains weight (g), biological yield (kg ha^{-1}), grain yield (kg ha^{-1}) and economics of weed control.

The data collected were subjected to statistical analysis, using MSTATC computer software and means were separated by using Fisher's protected LSD test (Steel and Torrie, 1980).

Results and Discussion

Relative density (%): Six weeks after herbicidal application, relative density of weed species was computed (Table 1). Statistical analysis of the data revealed that weed species were significantly affected by herbicidal treatments and their interactions. Highest relative density 22.91 and 21.16% were recorded for *Cyperus rotundus* and other weeds, respectively. While the lowest relative density (4.40%) was recorded for *Euphorbia helioscopia* followed by *Convolvulus arvensis* and *Ammi vis-naga* (6.06%) each. The highest relative density (28.41%) of *Cyperus rotundus* and other weeds (grasses, broadleaved and sedges) indicates that *Cyperus rotundus* is a perennial and other weeds were not successfully controlled with the herbicidal treatments. While the broadleaved, *Euphorbia helioscopia*, *Convolvulus arvensis* and *Ammi vis-naga* were controlled successfully. The data indicated that broadleaved weeds were controlled by broad spectrum herbicides. Herbicides and weed species interaction was also significantly different. Maximum density (28.41%) of *Cyperus rotundus* was recorded in buctril-M+topik mixture treated plots followed by 27.80% relative density of the same species in logran+topik treated plots as compared with 19.59% relative density in weedy check plots. The lowest relative density (1.21%) of *Convolvulus arvensis* was recorded in plots receiving buctril-M+topik mixture followed by isoproturon alone and buctril-M+topik mixture with relative densities of 2.41 and 2.62% of *Ammi vis-naga* and *Euphorbia helioscopia*, respectively. In weedy check plots the relative densities of these species were 7.32 and 6.26%, respectively.

Number of spikelets spike^{-1}: Statistical analysis of the data revealed that times of application had non-significant effect on number of spikelets per spike while different herbicidal treatments and their interactions with times of herbicidal application had significant effect on number of spikelets spike^{-1} (Table 2). Plots treated with buctril-M+topik had the highest number of spikelets spike^{-1} (17.92), while weedy check plots had the least spikelets spike^{-1} (13.21). In interaction of herbicides x application times, the highest number of spikelets spike^{-1} (18.33) were found in buctril-M+topik treated plots, treated 30 DAS. It was however, statistically at par with the application of the same herbicide at 45 DAS (19.20) or 60 DAS (17.23), while lowest spikelets were found in the weedy check plots at 60 DAS and it was statistically at par with isoproturon at 30 DAS, due to phytotoxicity (Table 2). These results are in conformity with the findings of Khan *et al.* (1999). They reported that spikelets spike^{-1} were affected with the use of herbicides.

1000-grains weight (g): Different herbicidal treatments significantly affected 1000 grains weight (Table 3). While the times of herbicidal application and interaction of times x herbicidal treatments did not affect the 1000 grains weight significantly. Highest 1000 grains weight (39.83 g) was recorded in buctril-M+topik treated plots followed by logran extra+topik, 2,4-D+topik and puma super treated plots with 38.36, 37.34 and 37.79 g. Lowest 1000 grains weight of 34.65 and 35.80 g were recorded in isoproturon treated and weedy check plots. In case of times of application, heaviest 1000 grains weight was recorded when herbicides were applied at 45 DAS while lightest 1000 grains weight was given by 30 DAS herbicidal application. In mutual interaction of herbicidesxtimes of application, the heaviest 1000 grains weight was recorded when buctril-M+topik was applied at 45 DAS followed by the same treatment applied at 30 DAS with 1000 grains weight of 40.67 and 40.23 g, respectively. Due to phytotoxicity, isoproturon produced the lightest 1000 grains weight of 33.87 g when applied 30 DAS followed by weedy check at 60 DAS with 1000 grains weight of 35.03 g. Similar results were also reported by Baldha *et al.* (1988). They reported that isoproturon showed phytotoxicity after 30 DAS. Increasing 1000 grains weight with the use of herbicides are the similar results reported by Marinkovic *et al.* (1997).

Table 1: Relative density of weeds as affected by herbicidal application

Herbicides	Weed species: *Avena fatua*	*Cyperus rotundus*	*Convolvulus arvensis*	*A. arvensis*	*C. arvense*	*Ammi vis-naga*	*Medicago denticulata*	*Euphorbia helioscopia*	*Others (grassy, broad leaved and sedges)*
Buctril-M 40 EC+ topik 15 WP	3.72s-w	28.41a	1.21w	5.30p-w	5.59p-w	4.22s-w	8.02m-v	2.62uv	25.31a-c
Assert 30 SC	10.67j-r	20.56c-g	9.00l-t	8.96l-t	8.77l-u	6.52o-w	14.79f-l	6.00p-w	17.52d-I
Isoproturon 75 WP	9.06l-t	24.20a-c	7.56m-v	6.78n-w	23.20a-d	2.41vw	12.93I-n	3.60t-w	20.84c-f
Logran extra 64 WG+topik 15 WP	3.58t-w	27.80ab	6.51o-w	7.17n-w	6.90n-w	5.08r-w	15.38f-k	3.94s-w	25.26a-c
2,4-D+topik 15 WP	3.42t-w	19.39c-h	7.36m-w	9.31k-t	11.30I-r	9.89k-s	12.80I-n	3.17t-w	22.67a-e
Puma super 75 EW+2,4-D	13.44h-m	20.46c-g	5.30p-w	10.96j-r	2.63uv	7.00n-w	11.52I-p	5.26q-w	22.11b-e
Weedy check	7.11n-w	19.59c-h	5.54p-w	12.72i-o	11.48I-q	7.32m-w	16.68e-j	6.26p-w	14.41g-l
Mean	7.29de	22.91a	6.06ef	8.74cd	9.98c	6.06ef	13.16b	4.40f	21.16a

LSD value at 5% level for weed species = 2.359 LSD value at 5% level for interaction = 6.241

Table 2: Spikelets spike^{-1} as affected by herbicidal applications at different times

Herbicides	Different times, Days after sowing (DAS): 30	45	60	Means
Buctril-M40 EC +Topik 15 WP	18.33a	18.20a	17.23ab	17.92a
Assert 30 SC	15.80cd	16.10bcd	15.53d	15.81b
Isoproturon75 WP	12.87ef	13.73e	15.87cd	14.16c
Logran extra 64 WG + Topik 15 WP	16.40bcd	16.53bcd	15.83cd	16.25b
2,4-D+Topik 15 WP	15.50d	15.87cd	15.93cd	15.77b
Puma super 75 EW + 2,4-D	16.13bcd	16.87bc	15.90cd	16.30b
Weedy check	13.70e	13.70e	12.23f	13.21d
Means	15.53a	15.86a	15.50a	

LSD value at 5% level for herbicides = 0.7090
LSD value at 5% level for interaction = 1.228

Table 3: 1000 grains weight (g) as affected by herbicidal application at different times

Herbicides	Different times, Days after sowing (DAS): 30	45	60	Means
Buctril-M40 EC +Topik 15 WP	40.23	40.67	38.60	39.83a
Assert 30 SC	35.83	38.30	36.60	36.91cd
Isoproturon 75 WP	33.87	35.17	34.90	34.65e
Logran extra 64 WG + Topik 15 WP	38.27	39.40	37.40	38.36b
2,4-D + Topik 15 WP	36.83	37.77	37.43	37.34bc
Puma super 75 EW + 2,4-D	37.97	38.87	36.23	37.69bc
Weedy check	35.47	36.90	35.03	35.80d
Means	36.92	38.15	36.60	

LSD value at 5% level for herbicides = 1.212
Means not followed by same letters are significantly different by using LSD test at 5% level of probability.

Biological yield (kg ha^{-1}): Analysis of the data showed that times of application and different herbicidal treatments significantly affected biological yield (Table 4). Herbicidal application, at 45 DAS produced highest biological yield of 8352 kg ha^{-1} followed by 60 DAS application, which produced 7845 kg ha^{-1}. The lowest biological yield (7428 kg ha^{-1}) was recorded when herbicides were applied at 30 DAS. Maximum biological yield of 9370 kg ha^{-1} was observed in buctril-M+topik

Table 4: Biological yield (kg ha^{-1}) of wheat as affected by herbicidal application at different times

Herbicides	Different times, Days after sowing (DAS): 30	45	60	Means
Buctril-M40 EC +Topik 15 WP	9644	9800	8666	9370a
Assert 30 SC	8000	8518	8348	8288bc
Isoproturon75 WP	4666	6866	7170	6234d
Logran extra 64 WG + Topik 15 WP	8703	9296	8607	8869ab
2,4-D + Topik 15 WP	8192	8666	7629	8162bc
Puma super 75 EW + 2,4-D	6711	8614	8274	7866c
Weedy check	6074	6703	6222	6333d
Means	7428b	8352a	7845ab	

LSD value at 5% level for application times = 588.4
LSD value at 5% level for herbicides = 747.2

Table 5: Grain yield (kg ha^{-1}) as affected by herbicidal application at different times

Herbicides	Different times, Days after sowing (DAS): 30	45	60	Means
Buctril-M40 EC +Topik 15 WP	3481b	3896a	2882cd	3420a
Assert 30 SC	1948g-k	2104g-I	1763I-l	1938c
Isoproturon75 WP	1007n	1452lm	1670j-m	1377d
Logran extra 64 WG +Topik 15 WP	2652c-e	2956c	2067g-j	2558b
2,4-D +Topik 15 WP	2193f-h	2348e-g	1800h-l	2114c
Puma super 75 EW +2,4-D	2515d-f	2807cd	2156f-I	2493b
Weedy check	1563k-m	1422lm	1318mn	1435d
Means	2194ab	2426a	1951b	

LSD value at 5% level for application times = 268.4
LSD value at 5% level for herbicides = 231.5
LSD value at 5% level for interaction = 400.9
Means not followed by same letters are significantly different by using LSD test at 5% level of probability.

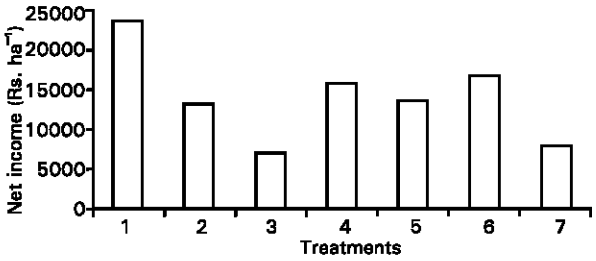

Fig. 1: Net income from different herbicides treated plots

treated plots. Significantly lowest biological yield of 6333 kg ha^{-1} was recorded in weedy check plots. Herbicides x times of application interaction was statistically non-significant however, buctril-M+topik when applied at 45 DAS, gave the maximum biological yield of 9800 kg ha^{-1}. The minimum biological yield (4666 kg ha^{-1}) was recorded in isoproturon treated plots at 30 DAS. Similar findings were also reported by Samar *et al.* (1993) and Porwal and Gupta (1987). They reported that different herbicides applied at 35 DAS reduced weed dry matter and increased grain and straw yield over control.

Grain yield (kg ha^{-1}): Statistical analysis of the data indicated that times of herbicidal application, different herbicidal treatments and their interactions had significant effect on the grain yield (Table 5). Herbicidal application at 45 DAS produced the highest grain yield (2426 kg ha^{-1}) followed by 30 DAS with grain yield of (2194 kg ha^{-1}). Lowest grain yield was recorded when herbicides were applied at 60 DAS. However, statistically it was similar to 30 DAS application. Highest grain yield (3420 kg ha^{-1}) was recorded in buctril-M+topik treated plots followed by logran+topik and puma super+2,4-D with grain yield of 2558 and 2493 kg ha^{-1}. Lowest grain yield of 1377 and 1435 kg ha^{-1} was recorded in isoproturon and weedy check plots, respectively. For interaction, maximum yield of 3896 kg ha^{-1} was recorded in treatments subjected to buctril-M+topik applied 45 DAS followed by the same herbicides when applied 30 DAS (3481 kg ha^{-1}). Minimum grain yield of 1007 and 12318 kg ha^{-1} was recorded in isoproturon and weedy check plots, respectively. Among the times of application, maximum grain yield (2426 kg ha^{-1}) was recorded when herbicides were applied 45 DAS followed by 30 DAS giving 2194 kg ha^{-1}. While minimum grain yield (1951 kg ha^{-1}) was observed at 60 DAS application. Similar results were reported by Holm *et al.* (2000). Who reported that herbicides applied at later times reduced wheat yield. The results are in agreement with the work reported by Montazeri (1994). Who reported that herbicide treatments increased the grain yield significantly.

Economics of weed control: Different herbicides were applied at three different times in wheat and it was concluded that maximum net profit of Rs. 24631 ha^{-1} was obtained from Buctril-M+topik treated plots when applied 45 days after sowing in wheat (Fig. 1).

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