Effect of Herbicides on Narrow Leaved Weeds and Yield of Wheat (*Triticum aestivum* L.)

M. Yasin, A. Tanveer, Z. Iqbal and A. Ali

***Abstract*—**This study was conducted to investigate the efficacy of five herbicides on narrow leaved weeds and growth and yield of wheat. An experiment was conducted at Agronomic Research Farm, University of Agriculture Faisalabad. The experiment was laid out in randomized complete block designee (RCBD) with three replications. Treatments studied were clodinafop (Topic-15 WG) at 37 g a.i. ha^{-1}, clodinafop (Topaz-15 WG) at 45 g a.i. ha^{-1}, fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1}, fenoxaprop-p-ethyl (Gramicide-6.9 EW) at 85 g a.i. ha^{-1}, fenoxaprop-p-ethyl (Chinlima-6.9 EW) at 85 g a.i. ha^{-1} and weedy check. Plots treated with fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1} produced relatively less weed biomass, more plant height, number of spike bearing tillers, number of grains per spike, 1000-grain weight and grain yield (4.20 t ha^{-1}).

***Keywords*—**clodinafop, fenoxaprop-p-ethyl, weeds, wheat

I. Introduction

WEEDS compete with crops for nutrients, light, space, moisture etc, causing reduction in wheat vigor, tillering, head size, and kernel weight [1]. Weeds also lower the market value of the produce and hence bring enormous economic losses to the growers [2]. Different methods of weed control include manual weeding, mechanical weeding, intercropping and use of herbicides [3]. Chemical weed control method is preferred over other weed control methods because it is quick, more effective and relatively cheaper [4]. Chemical weed control gave more (3974 kg ha^{-1}) grain yield as compared to hand weeding (3670 kg ha^{-1}), and more cost benefit ratio (1:2.88) [5]. Puma Super [fenoxaprop-P + fenchlorazole] was recommended to control *Avena fatua*, *Setaria spp.*, *Echinochloa crus-galli* and *Apera spica-venti* in winter wheat [6]-[7] tested different herbicides namely Irelon-50SC at 1.12, Puma Super-75EW at 0.85, Buctril-M-40EC at 0.72, Buctril M +Topic-15WP at 0.72 and 0.75, 2,4-D (powder) at 1.20 kg a.i. ha^{-1} against hand weeding and weedy check. The results revealed that all herbicides significantly decreased weed population. Puma Super 75 EW (1250 and 625 ml), Pujing 10 EC (1000 and 500 ml) and Brake 10 EC (1000 and 500 ml/ha) was studied for their optimum doses against weeds in wheat. Higher doses were tested for *Phalaris minor* and *Avena fatua* while lower doses were tested for *Avena* species only. Puma Super 75EW (1250 and 625 ml/ha) gave better weed mortality (52.2 and 86.2%) while relatively lower weed mortality (38 and 73.5%) was observed in Brake 10 EC over control (untreated) Puma Super 75E (1250 and 625 ml/ha) also gave more grain yield (20.8 and 81.3% over control 9.3 and 7.7% over Pujing 10EC and 3.8 and 16.74% over Brake 10EC). Higher concentration of Fenoxa formulation proved better for *Phalaris minor* and lower for *Avena* species in wheat crop [8]. The mixture of Buctril super + Puma super provided better results than their alone applications, for biological and grain yield [9].

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In view of the importance of narrow leaved weeds problem in wheat, this study was undertaken to investigate the effectiveness of different herbicides for controlling narrow leaved weeds in wheat crop. The objectives were, to find out most economical herbicides for controlling narrow leaved weeds and to study the response of wheat to the different herbicides under agro-climatic conditions of Faisalabad.

II. Materials and Methods

A field experiment was conducted to study the effect of different herbicides on narrow leaved weeds and yield of wheat. Experiment was conducted at Agronomic Research Farm, University of Agriculture, Faisalabad. The experiment was laid out in a randomized complete block design (RCBD) with three replications and a net plot size of 6 x 5 m. Wheat genotype “Wattan” was sown in 25 cm apart rows with a single row hand drill. Seed rate used was 125 kg ha^{-1}. Fertilizers were applied at 125 kg N and 100 kg P_2O_5 ha^{-1}. Urea and DAP were used as a source of N and P. Whole of P and half of N was applied as a basal dose while remaining half of N was applied at first irrigation by broadcost method. Experiment was comprised of these treatments were clodinafop (Topic-15 WG) at 37 g a.i. ha^{-1}, clodinafop (Topaz-15 WG) at 45 g a.i. ha^{-1}, fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1}, fenoxaprop-p-ethyl (Gramicide-6.9 EW) at 85 g a.i. ha^{-1}, fenoxaprop-p-ethyl (Chinlima-6.9 EW) at 85 g a.i. ha^{-1} and weedy check.

Herbicides were sprayed after 1^{st} irrigation in moist condition with a knapsack hand sprayer fitted with T-jet nozzle. The volume of spray was determined by calibration before spraying the herbicides. Data on weed count, weed biomass and number of spike bearing tillers was collected from an area of 1 m^2 selected at random from each experimental plot. Number of grains per spike, 1000-grains weight and grain yield was collected. Data obtained were analyzed statistically by using Fisher’s analysis of variance technique and treatment means were compared by using least significance difference (LSD) test at 0.05 probability level [10].

III. Results and Discussion

The common narrow leaved weeds present in wheat were *Phalaris minor* (Dumbi sitti), *Avena sativa* (Gangli jae) and *Cyperus rotandus* (Dela). The data on weed control was collected 25 days after spray. It can be noted from the data that all herbicides significantly affected the weed populations. Maximum (65.2 m^{-2}) numbers of weeds were found in weedy check (Table I). Among the herbicides minimum (4.2 m^{-2}) number of weeds were found in plot treated with fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1}, which was statistically at par with fenoxaprop-p-ethyl (Chinlima-6.9 EW) at 85 g a.i. ha^{-1} and fenoxaprop-p-ethyl (Gramicide-6.9 EW) at 85 g a.i. ha^{-1}. Fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1} gave maximum weed control percentage (92%). Similarly clodinafop (Topaz-15 WG) at 45 g a.i. ha^{-1} was also statistically at par with clodinafop (Topic-15 WG) at 37 g a.i. ha^{-1}. Minimum number of weeds in plots treated with different herbicides than in control (weedy check) could be due to mortality of weeds and toxicity of herbicides.

TABLE I
EFFECT OF HERBICIDES ON WEED COUNT, (25 DAYS AFTER SPRAY AND AT HARVEST) AND DRY WEIGHT AT HARVEST

Treatments	Weed count 25 days after spray(m^{-2})			Weed count at harvest (m^{-2})			Dry weight (g m^{-2})
	Total	*Phalaris minor*	*Avena fatua*	Total	*Phalaris minor*	*Avena fatua*	
Treat 1	12.3b	7.3bc	5.0b	6.3b	4.0bc	2.3b	3.3b
Treat 2	14.3b	9.3b	5.0b	7.6b	5.0b	2.6b	3.9b
Treat 3	4.2c	1.6d	2.6b	3.0c	1.0c	2.0b	0.8b
Treat 4	9.9c	3.3cd	6.3b	4.6bc	1.0c	3.6bc	2.1b
Treat 5	10.6bc	4.0cd	6.6b	4.6bc	2.3bc	2.3b	2.5b
Control	65.2a	31.6a	33.6a	19.3a	10.3a	9.0a	10.2a
LSD	7.98	4.67	5.92	5.99	3.81	2.77	3.23

Where Treat1= Clodinafop (Topic-15 WG) at 37 g a.i. ha^{-1}; Treat2=Clodinafop (Topaz-15 WG) at 45 g a.i. ha^{-1}; Treat3= Fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 ga.i. ha^{-1}; Treat4=Fenoxaprop-p-ethyl (Gramicide-6.9 EW) at 85 g a.i. ha^{-1}; Treat5=Fenoxaprop-p-ethyl (Chinlima-6.9 EW) at 85 g a.i. ha^{-1} ; Control=Weedy Check. Means sharing same letter in a column do not differ significantly at 5% probability level.

Maximum (31.6 m^{-2}) numbers of Phalaris minor were found in weedy check. Among herbicides minimum (1.6m^{-2}) number of *Phalaris minor* (994.8% control) were found in fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1}, which was statistically at par with fenoxaprop-p-ethyl (Chinlima-6.9 EW) at 85 g a.i. ha^{-1} and fenoxaprop-p-ethyl (Gramicide-6.9 EW) at 85 g a.i. ha^{-1}. Similarly, fenoxaprop-p-ethyl (Chinlima-6.9 EW) at 85 g a.i. ha^{-1}, fenoxaprop-p-ethyl (Gramicide-6.9 EW) at 85 g a.i. ha^{-1} and clodinafop (Topic-15 WG) at 37 g a.i. ha^{-1} were also statistically at par with one an other. Maximum (33.6m^{-2}) numbers of *A. fatua* plants were found in weedy check. Among herbicides, minimum (2.6 m^{-2}) numbers of *A. fatua* were found in plots treated with fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1} and gave maximum weed control percentage (92.1%). This treatment was statistically at par with all other herbicidal treatments. Variation in weed control percentage among different herbicides at varying rates was due to varying toxic effect of herbicides.The maximum (10.2 g m^{-2}) dry weight of weeds per unit area was recorded in weedy check. Among herbicides fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1} resulted in minimum (0.8 g m^{-2}) dry weight of weeds, which was statistically at par with other remaining treatments. More fresh weight of weeds resulted in weedy check plots. These results are in agreement with those of [11].

V. NUMBER OF SPIKE BEARING TILLERS (M^{-2})

All the herbicides had significant effect on number of spike bearing tillers. Among the herbicides maximum number of spike bearing tillers per unit area (258) were obtained with the application of fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1} (Table II), which was statistically at par with fenoxaprop-p-ethyl (Chinlima-6.9 EW) at 85 g a.i. ha^{-1} and fenoxaprop-p-ethyl (Gramicide-6.9 EW) at 85 g a.i. ha^{-1}. These were followed by clodinafop (Topic-15 WG) at 37 g a.i. ha^{-1}, which in turn was at par with clodinafop (Topaz-15 WG) at 45 g a.i. ha^{-1}. The significantly minimum numbers of spike bearing tillers (202) were recorded in weedy check.

Herbicide fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1} performed best because of effective weed control, minimum fresh and dry weight of weeds, which resulted in least competition. These results are in line with [12].

VI. NUMBER OF GRAINS PER SPIKE

Maximum number of grains per spike (41.02) was obtained by the application of fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1} (Table II). It was followed by the fenoxaprop-p-ethyl (Chinlima-6.9 EW) at 85 g a.i. ha^{-1}, which was statistically at par with fenoxaprop-p-ethyl (Gramicide-6.9 EW) at 85 g a.i. ha^{-1}. Weedy check gave minimum numbers of grains per spike (33.42).

Herbicide Fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1} performed best because of effective weed control and maximum utilization of environmental resources for growth and development. These results are in agreement with [13], who reported increase in number of grains per spike due to herbicides application.

VII. 1000 GRAIN WEIGHT (G)

Higher weight of 1000-grains (39.80 g) was obtained by applying fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1} (Table II), which was statistically at par with fenoxaprop-p-ethyl (Chinlima-6.9 EW) at 85 g a.i. ha^{-1} and fenoxaprop-p-ethyl (Gramicide-6.9 EW) at 85 g a.i. ha^{-1}. Similarly, fenoxaprop-p-ethyl (Chinlima-6.9 EW) at 85 g a.i. ha^{-1}, fenoxaprop-p-ethyl (Gramicide-6.9 EW) at 85 g a.i. ha^{-1} and clodinafop (Topic-15 WG) at 37 g a.i. ha^{-1} were statistically at par with one another. The minimum number of 1000-grains weight was recorded in weedy check (33.83 g). Herbicide fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1} performed best because of effective weed control; more photosynthetic rate and availability of assimilate for grain development. Results are in agreement with those of [14], who found that chlorotoluron at 2.5 kg ha^{-1} post-emergence application increased 1000-grain weight.

TABLE II
EFFECT OF HERBICIDES ON YIELD COMPONENTS AND YIELD OF WHEAT

Treatments	No. of spike bearing tillers(m^{-2})	No. of grains per spike	1000-grain weight(g)	Grain yield (t ha^{-1})
Treat 1	243b	37.9c	37.9bc	3.49c
Treat 2	241b	37.2c	37.2c	3.33c
Treat 3	258a	41.0a	39.8a	4.20a
Treat 4	249ab	39.1b	38.9ab	3.78b
Treat 5	251ab	39.8b	39.1ab	3.91b
Control	202c	33.4d	33.8d	2.27d
LSD value	11.62	1.00	1.60	0.25

Where Treat1= Clodinafop (Topic-15 WG) at 37 g a.i. ha^{-1}; Treat2=Clodinafop (Topaz-15 WG) at 45 g a.i. ha^{-1}; Treat3= Fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 ga.i. ha^{-1}; Treat4=Fenoxaprop-p-ethyl (Gramicide-6.9 EW) at 85 g a.i. ha^{-1}; Treat5=Fenoxaprop-p-ethyl (Chinlima-6.9 EW) at 85 g a.i. ha^{-1} ; Control=Weedy Check. Means sharing same letter in a column do not differ significantly at 5% probability level.

VIII. GRAIN YIELD (T HA^{-1})

The highest grain yield (4.203 t ha^{-1}) was obtained by application of fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1} (Table II), followed by fenoxaprop-p-ethyl (Chinlima-6.9 EW) at 85 g a.i. ha^{-1}, which was statistically at par with fenoxaprop-p-ethyl (Gramicide-6.9 EW) at 85 g a.i. ha^{-1}. Clodinafop (Topic-15 WG) at 37 g a.i. ha^{-1} was statistically at par with clodinafop (Topaz-15 WG) at 45 g a.i. ha^{-1}. Weedy check gave significantly minimum (2.27 t ha^{-1}) grain yield. Herbicide fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1} performed best because of highest values of yield components, such as number of spike bearing tillers (258 m^{-2}), number of grains per spike (41.04) and 1000-grains weight (39.80 g). These results are in agreement with those of [15]-[16]-[17]. They reported increase in grain yield due to maximum values obtained those of yield components by the application of herbicides in treated plots.

IX. CONCLUSION

Fenoxaprop-p-ethyl (Puma Super-75 EW) at 45 g a.i. ha^{-1} is the most economical herbicides for controlling narrow leaved weeds in wheat, under agro-climatic conditions of Faisalabad.

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