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IMPACT OF DIFFERENT HERBICIDES ON BROADLEAF WEEDS AND YIELD OF WHEAT

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ABSTRACT

Studies were carried out to evaluate the efficacy of different post emergence herbicides on weeds in wheat crop at Adaptive Research Farm, Karor (district Layyah), Thal Desert, Pakistan under irrigated conditions, during Rabi 2007-08. The experiment was laid out in Randomized Complete Block (RCB) design with three replications, with plot size of 20 x 5 m ^{2}. Three different herbicides were applied as post emergence viz: Buctril super 60 % EC, Starane-M and Logoran Extra with two different doses each viz: Buctril super 60 % EC @ 825 and 1125 ml ha^{-1}, Starane-M@ 750 and 875 ml ha^{-1} and Logoran Extra @250 and 315 g ha^{-1}. An untreated control was also included in the trial. All herbicides significantly decreased weed population over control and maximum grain yield (2300 kg ha^{-1}) was obtained where Buctril super 60 % EC was applied @ 825 ml ha^{-1}. It was however statistically at par with the grain yield of 2245 kg ha^{-1} where Starane-M was applied @875 ml ha^{-1}. All the herbicidal applications out yielded the control. It is thus recommended that Buctril- super and Starane-M may be applied @ 825 and 875 ml ha^{-1} for offering control of broad leaf weeds and increase grain yield of wheat.

Key words: Weed control, broadleaf weeds, *Triticum aestivum* L., herbicides.

INTRODUCTION

Wheat *(Triticum aestivum* L.) is an important staple food crop of Pakistan. During 2006-7, it was grown on an area of 8.578 million hectares with an annual production of 23.295 million tons and an average yield of 2.107 tons per hectare (MINFAL, 2009). Despite the use of costly inputs and improved cultural practices average yield of wheat is very low. The reasons for low yield are many, but one of the most serious and less noticeable, is the competition of weeds. Weeds compete with crop plants for nutrients, moisture, space, light and many other growth factors, which not only reduce crop yield but also

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deteriorate quality of farm produce and thereby reduce its market value (Qureshi, 1982).

It has been estimated that crop losses due to weed competition throughout the world as a whole, are greater than those resulting from combined effect of insect pests and diseases. Weeds may encourage the development of fungal diseases, provide shelter for pests of all kinds and act as host plants for parasitic nematodes. So there are several reasons for work on entirely elimination of weeds from crop environment. As a matter of fact, with rising costs of labour and power, use of herbicides will be the only acceptable method of weed control in future.

Weeds are one of the major constraints in wheat production as they reduce productivity due to competition (Zimdahl, 1980), allelopathy (Hussain, 1983), by providing habitats for pathogens and thus severing as alternate host for various insects and fungi and increase harvesting costs (Rao, 1983).

Wheat fields are generally infested with both dicot and monocot weeds. The major dicot weeds are: *Chenopodium album* (common lambsquartes), *Rumex dentatus* (curly dock), *Coronopus didymus* (swine cress), *Melilotus indica* (Indian sweetclover), *Fumaria indica* (Fumitory), *Cirsium arvense* (Canada thistle) and *Convolvulus arvensis* (field bindweed). However, Hussain *et al.* (2004) reported a different flora in Chitral.

Generally, weeds are managed manually. However, nowadays it has become difficult due to labour cost and unavailability of labour. Now a number of chemical weedicides are available that control weeds in wheat rather effectively. The weed control has been practiced since the time immemorial by manual labour and/or animal drawn implements, but these practices were laborious, tiresome and expensive due to increasing cost of labour. The growing mechanization of farm operations and over increasing labor wages has stimulated interest in the use of chemical weed control. Chemical weed control is the easiest and most successful alternative method. Reports are available on the efficacy of different herbicides in wheat (Khan *et. al.*, 1999; Khan *et al*., 2001; Khan, *et al*., 2002; Qureshi *et al*., 2002; Hassan *et al*., 2003). The herbicide use in Pakistan is not widely practiced as in the agriculturally advanced nations. The interest around the testing of graminicides (Walia et al., 1998; Ormeno and Diaz, 1998) indicates the problem posed by grasses whereas, the studies of Khan *et al.*, (2002) and Khalil *et al.* (2008) showed synergistic response on combined use of herbicides. In another studies researchers obtained an effective control of weeds in wheat through chemicals (Khan *et al*., 2003; Cheema and Akhtar, 2005).

Use of herbicides for control of broad leave weeds in wheat is common in Pakistan. But, the use of herbicides is not very common like elsewhere in Punjab. Therefore, present studies were initiated to find out the most economical and effective herbicide and its rate to control these dicot weeds in wheat.

MATERIALS AND METHODS

An experiment was laid out at Adaptive Research Farm, Karor (Layyah), and Pakistan during 2007-08, to study the effect of newly introduced herbicides against broad leave weeds. A basal dose of Nitrogen, phosphorus and potassium fertilizers were applied @ 128N-114P_2O_5–62 K_2O kg ha^{-1}. Nitrogen, phosphorus and Potassium were applied as Urea, SSP and K_2SO_4, respectively. Nitrogen fertilizer was applied in three splits; one-third Nitrogen & whole of Potassium & phosphorus were applied at the time of seedbed preparation and was thoroughly mixed into soil by ploughing and planking. The 2nd (1/3) of Nitrogen was applied at the time of 1st irrigation & 1/3rd at the time of 3rd irrigation. Canal water was used for irrigation.

All other cultural practices were kept according to Departmental recommendation, during the course of studies for all the treatments. The crop was harvested at maturity. The experiment was laid out in Randomized Complete Block Design having three Replications with a plot size of 20x5 m^2 and variety sown was As-2002. The detail of treatments applied is furnished in Table-1. The treatments were applied 40 days after sowing and the weed dynamics data were recorded 30 days after treatment.

The data were recorded on weed infestation and growth and yield parameters of wheat like number of weeds before and after spray of herbicides, plant height (cm), Spike length (cm), Spikelets per spike and yield (kg ha^{-1}). The data for each parameter were individually subjected to analysis of variance (ANOVA) and means were separated by using Duncan's Multiple Range (DMR) Test.

Table-1. Detail of post emergence herbicidal treatments used in wheat experiment.

Trade name	Common name	Dose ha^{-1}
Buctril- Super 60 % EC	bromoxynil +MCPA	825 ml
Buctril- Super 60 % EC	bromoxynil +MCPA	1125 ml
Starane-M	fluroxypyr +MCPA	750 ml
Starane-M	fluroxypyr +MCPA	875 ml
Logran –Extra	traisulfuran+terbutryn	250 g
Logran –Extra	traisulfuran+terbutryn	315 g
Weedy check		

RESULTS AND DISCUSSIONS

Number of weeds before spray

The perusal of data in Table-2 exhibit that the experiment was infested with several broad leaf weeds. The family Fabaceae predominated the other families having 4 species viz. *Lathyrus aphaca*, *Vicia tetrasperma*, *Rhynchosia capitata*, and *Trigonella monantha*. The family Polygpnaceae was represented by 2 species viz. *Emex spinosa* and *Rumex dentatus*. The other families were represented by single species each. Cheopodiaceae included *Chenopodium album*, while Asteraceae, Convolvulaceae and Fumariaceae were represented by *Cirsium arvense*, *Convolvulus arvensis* and *Fumaria indica*, respectively (Table-2). Data concerning number of weeds before spray m^{-2} showed non-significant differences among the different treatments (Table-3). Comparative study of the means showed that maximum number of weeds before spray (14.67 m^{-2}) were counted in Starane-M @ 750 ml ha^{-1} was going to be applied followed by Starane-M @ 750 ml ha^{-1} (14), as compared to T_1 (control) where least number of weeds before spray m^{-2} (13.33) were recorded. There was a random variability among the remaining treatments (Table-3).

Weed density (m^{-2})

Data concerning number of weeds after spray m^{-2} showed significant differences among the treatments under study (Table -3). Comparative study of the means showed that minimum number of weeds after spray (7.33 m^{-2}) were counted in T_2 where Buctril Super 60 % EC @ 825 ml ha^{-1} was applied, followed by T_5 (8.67 m^{-2}) where Starane -M was applied @ 875ml ha^{-1} as compared to control (14.00 m^{-2}). Statistically non-significant among themselves, the intermediate No. of weeds were recorded in treatments T_3 (Buctril

Super @ 1125 ml ha^{-1}, T_4 (Starane - M @ 750ml ha^{-1}), T_6 (Logran Extra @ 250 g ha^{-1}) and T_7 (Logran Extra @ 325 g ha^{-1}) having 11, 10, 10.67 and 10.67 weeds m^{-2}, respectively. These findings are in a great analogy with the previous work of Khan *et. al.*, 1999, Khan *et al*., 2001 Khan, *et al*., 2002, Qureshi *et al*., 2002 and Hassan *et al*., 2003. These researchers reported reduced number of weeds in wheat by using various herbicides. The reduced number of weeds in herbicidal treatments is attributed to the phytotoxic effect of herbicides on weeds.

Plant height (cm)

The analyses of data regarding plant height showed highly significant differences among the different treatments (Table-3). Comparative study of the means showed that maximum plant height (92.53 cm) was achieved in T_2 where Buctril Super 60 % EC @ 825 ml ha^{-1} was applied, followed by T_5 (Starane--M @ 875ml ha^{-1}) with 90.10 cm height, as compared to T_1 (control) where the least plant height (84.70 cm) was recorded. Treatment T_6 where Logran Extra was applied @ 250 g ha^{-1} was statistically at par with T_5 (Starane-M 875 ml ha^{-1}) with 88.37 cm plant height. Treatments T_4 (Starane-M 750 ml ha^{-1}, T_7 (Logran Extra @ 315 g ha^{-1}) and T_3 (Buctril Super @ 1125 ml ha^{-1}) were statistically at par with each other with 87.43, 87.17 and 86.53 cm plant height, respectively.

Spike length (cm)

Data concerning spike was analyzed statistically and showed non-significant differences among the means (Table-3). Comparative study of means showed that maximum spike length (9 cm) was achieved in T_2 where Buctril Super 60 % EC @ 825 ml ha^{-1} was applied, followed by T_3 (Buctril Super @ 1125 ml ha^{-1}) with 8.76 cm spike length. In treatment T6 where Logran Extra was applied @ 250 g ha^{-1} 8.76 cm spike length was recorded. Treatment T_4 (Starane-M @ 750 ml ha^{-1}) and T_7 (Logran Extra @ 315 g ha^{-1}) were numerically with each other with 8.7 and 8.6 cm spike length, respectively. Minimum spike length of 8.59 cm was recorded in T_5 (Starane M @ 875 ml ha^{-1}). In control were no weedicide was sprayed 8.6 cm plant height was recorded (Table-3). These findings are in contrast to Hassan *et al.* (2003) and Khan *et al.* (2003) who evaluated varying spike length of wheat treated with different herbicides.

Number of spikelets spike^{-1}

Data pertaining to number of Spikelets per Spike showed significant differences among the different herbicidal treatments contemplated (Table-3). Separation of means showed that maximum number of Spikelets per Spike (14.67) were achieved in T_7 where Logran Extra @ 315 g ha^{-1} was applied. It was however, statistically at par with T1 (control), T3 (Buctril Super @ 750 ml $ha^{-1)}$, T4 (Starane- M 750 ml ha^{-1}) and T_5 (Starane-M @ 875 ml ha^{-1}) producing 13.67 spikelets each $spike^{-1}$. The least No. of spikelets were produced by T2 (Buctril Super 60 % EC @ 825 ml ha^{-1} and T6 (Logran Extra @ 250 g ha^{-1}having 12.33 and 11.67 spikelets $spike^{-1}$, respectively. The data thus exhibit none of the herbicide was successful to overwhelm the control in producing spikelets rather the herbicides Buctril and Logran at the lower tested doses failed to produce spikelets even with the control (Table-3). Despite having significantly lesser No. of weeds as compared to control in all the herbicides and producing equal or lesser No. of spikelets implicates some adverse physiological effect of herbicides on wheat crops, which was not witnessed visually. These findings negate the earlier findings of Khan *et al.* (2001), Hassan *et al.* (2003), and Cheema and Akhtar (2005), who communicated the statistically significant impact of different herbicides in spikelet production in wheat.

Grain yield (kg ha^{-1})

The analysis of data concerning grain yield showed significant differences among the different treatments as presented in Table-3. Comparative study of the means showed that maximum grain yield (2300 kg ha^{-1}) was achieved in T_2 where Buctril Super 60 % EC @ 825 ml ha^{-1} was applied. It was however, statistically comparable with T_5 (Starane M @ 875 ml ha^{-1}) with grain yield of 2245 kg ha^{-1}. The later treatment was in turn statistically at par with the Treatment T_6 (Logran extra @ 250 g ha^{-1}) and T_4 (Starane- M @ 750 ml ha^{-1}) with grain yield of 2185 kg ha^{-1} and 2210 kg ha^{-1} respectively. Among the herbicides, least grain yield of 2160 kg $ha^{-1}$and 2155 kg $ha^{-1}$was obtained from treatments T_7 (Logran Extra @315g ha^{-1}) and T_3 (Buctril Super @ 1125ml ha^{-1}), respectively. These treatments were statistically at par with T4 Starane-M @ 750ml $ha^{-1,}$ which yielded 2210 kg ha^{-1}. Minimum grain yield of 1980 kg ha^{-1} was obtained from Control where no weedicide was applied (Table-3).

Mean increase of 13.91, 8.12, 10.40, 11.80, 9.38 and 8.33 % in grain yield was observed in T2, T3, T4, T5,T6 and T7, respectively, over control (Table-4). These inferences are in line with the earlier researches on wheat undertaken by shah *et al.* (1989), Khan *et al.* (2001, 2002, 2003), Hassan *et al.* (2003), Cheema and Akhtar (2005) and Khalil *et al.* (2008), who harvested increased grain yield of wheat with the application of different herbicides.

Table-2. Major broad leaf weeds infesting the field.

Botanical Name & Family	English Name	Local Name
Chenopodium album L. (Chenopodiaceae)	Common lamsquarters	Bathu
Cirsium arvense (L.) (Compositae/Asteraceae)	Canada thistle	Leh, Bhur bhur
Convolvulus arvensis L. (Convolvulaceae)	Field bindweed	Lehli, Baili Wanvehri
Emex spinosa (Polygonaceae)	Lesser jack	Trkandi, Kafar knda
Fumaria indica (Fumariacea}	Fumitory	Shahtra, Pitpapra
Lathyrus aphaca L. (Fabaceae)	Wild meadow peavine	Jangli matar, Matri
Rhynchosia capitata (Heyne ex Roth). DC. (Fabaceae)	*Caribbean snoutbean*	Maini
Rumex dentatus L. (Polygonacea)	Broadleaf dock, bitter dock,	Jangli palak
Trigonella monantha C.A. Meyer (Fabaceae)	Trefoil	Maini
Vicia tetrasperma L. (Fabaceae)	Four seeded vetch	Revavri

Table-3. Effect of different weedicides for the control of broad leaf weeds of wheat (*Triticum aestivum* L.)

Treatment	Treatments ml/g ha^{-1}	# of weeds m^{-2} before spray	# of weeds m^{-2} after spray	Plant height (cm)	Spike length (cm)	No. of Spikelets / spike	Grain Yield (kg ha^{-1})
T1	Control	13.33a	14.00a	84.70a	8.60a	13.67ab	1980d
T2	Buctril - Super 60 % EC @ 825	13.33a	7.333d	92.53d	9.00a	12.33bc	2300a
T3	Buctril Super 60 % EC @ 1125	13.67 a	11.00 b	86.53b	8.77a	13.67ab	2155c
T4	Starane-M @ 750ml ha^{-1}	14.67 a	10.00 b	87.43b	8.70a	13.67ab	2210 bc
T5	Starane-M @ 875	14.00 a	8.67c	90.10c	9.00a	13.67ab	2245 ab
T6	Logran Extra @ 250	13.67a	10.67b	88.37 b	8.77a	11.67c	2185bc
T7	Logran Extra @ 315	13.67a	10.67b	87.17b	8.60a	14.67a	2160c

Means in the columns followed by different letters are significantly different at 5% level of probability, using DMRT.

Table-4. %Increase in grain yield of different treatments over control.

Treatment	Treatments	Rate ml/g ha^{-1}	Yield (kg ha^{-1})	Additional yield (kg ha^{-1})	% Increase
T1	Control	0	1980d	-	-
T2	Buctril Super 60 % EC	825	2300a	320	13.91
T3	Buctril- Super 60 % EC	1125	2155c	115	8.12
T4	Starane-M	750	2210bc	230	10.40
T5	Starane-M	875	2245ab	265	11.80
T6	Logran Extra	250	2185bc	205	9.38
T7	Logran Extra	315	2160c	180	8.33

CONCLUSIONS

The data were collected on weed dynamics and growth and yield parameters of wheat like plant height (cm), Spike length (cm), Spikelets per spike and grain yield (kg ha^{-1}). The data exhibit that the best herbicides against broad leave weeds is Buctril Super 60 % EC @ 825 ml ha$^{-1,}$ as it out yielded all herbicides by producing 2300 kg ha^{-1} grain yield except T5 Starane-M @ 875 ml ha^{-1}, which produced grain yield to the tune of 2245 kg ha^{-1}.

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