



Research Article

Comparative Efficacy of Weedicides for Control of Broad Leaf Weeds in Wheat (*Triticum aestivum* L.) Crop under Thal Irrigated Areas

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Abstract

The experiments were carried out to evaluate the comparative efficacy of different post-emergence weedicides on weeds in wheat crop at Adaptive Research Farm Karor, Distt. Layyah and at farmer's field a.i. Chak No. 116/TDA, tehsil Karor, Distt. Layyah during Rabi crop season 2022-23 under irrigated conditions. The experiments were laid out in randomized complete block design (RBCD) with three replications. Four different herbicides were applied as post-emergence treatments viz. Buctril Super 60 % EC (Bromoxynil + MCPA) @ 1125 ml ha⁻¹, Bromoxynil 40 % EC @ 1250 ml ha⁻¹, Findus Extra 60 WG (Mesosulfuron-Methyl + Iodosulfuron-Methyl-Sodium) @ 240 g ha⁻¹ and Clean wave (Imino Pyralid + Fluroxyber) @ 800 ml ha⁻¹. An untreated control was also included in the trials. All herbicides decrease the weeds population over control up to nine days in both locations and maximum grain yield 4533.35 kg ha⁻¹ and 4635.50 kg ha⁻¹ were produced in Adaptive Research Farm Karor, and at farmer's field a.i. Chak No. 116/TDA, Tehsil Karor, Distt Layyah respectively, where Buctril Super 60 % EC (Bromoxynil + MCPA) @ 1125 ml ha⁻¹ was applied. Therefore, it is recommended that Buctril Super 60 % EC (Bromoxynil + MCPA) may be applied @ 1125 ml ha⁻¹ for offering the control of broad leaves weeds and increase grain yield of wheat.

Keywords: Arid zone; Broad leaves weeds, Pakistan; Punjab; *Triticum aestivum*; Weeds



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Introduction

Wheat (*Triticum aestivum*) belongs to family Poaceae is an important cereal crop grown as

food grain in the whole world. The grain contains 60-80 percent carbohydrates, 8-15 percent protein, 1.5-2.0 percent fat, 1.5-2.0 percent inorganic ions and vitamin (B-complex & E) in small amounts (Schellenberger, 1969). In Pakistan, during Rabi 2022-23, wheat was grown on an area of 9043 thousands hectares with an annual total production of 3056 thousand tones (FAO, 2021).

Despite the use of costly inputs and modern cultural practices, the average yield of wheat is very low. The reasons for low per acre yield are many, but one of the most serious problem and less noticeable, is the competition of weeds. Weeds compete with crop plants for water, nutrients, moisture, space, light and many other growth factors, which not only reduce crop yield but also deteriorate quality of farm produce and thereby reduce its market value (Qureshi, 1982).

It has been estimated that yield losses due to weed competition through the world as a whole, are greater than those resulting from combined effect of insect pests and diseases. Weeds may encourage the development of various fungal diseases, provide shelter for all kinds of pests and act as host plants for parasitic nematodes. So, there are several reasons to work on complete eradication of weeds from crop environment. As a matter of fact, with rising costs of labour, equipment's and power, weedicides will be the only effective method of weed control in future. Weeds are one of the major constraints in wheat production as they reduce productivity due to competition (Zimdahl, 2007), their allelopathic effects (Hussain, 1983), and source of habitats for various diseases and insect pests that results in increase harvesting costs (Rao, 1983).

Wheat fields are generally infested with both dicot and monocot weeds. The major dicot weeds are; *Chenopodium album* (Bathu), *Rumex dentatus* (Jungli Palak), *Cronopus didymus* (Jungli Halon), *Melilotus indica* (Senji), *Fumaria indica* (Shahtra), *Chenopodium murale* (Krund), *Cirsium arvense* (Leh) and *Convolvulus arvensis* (Lehli) S. however, (Hussain *et al.*, 2003) reported a different flora in Chitral. Weed population continue to persist in agriculture fields despite repeated application of weed control practices and pose a recurrent and ubiquitous threat to agricultural productivity (Riaz *et al.*, 2009). Weeds are plants of native value those compete for space water, nutrients and carbon dioxide thus limiting the availability of basic requirement of economic crop and decrease grain yield up to 20-40%. (Oad *et al.*, 2007). Yield losses from 5% to 100% have been reported in different crops of different areas depending upon the weed density, frequency, type and intensity of competition for growth/yield components (Ashiq *et al.*, 2003). The losses due to weeds have also been estimated from 13% to 14.6%, 20% to 21% in South Asia while 8% to 9.5% in USA (Zimdahl, 2007) furthermore, weeds also increase harvesting cost reduce quality of product and increase fire hazards (Bajwa *et al.*, 2015).

Generally, weeds are managed manually. However, now-a-days it has become difficult due to labour cost and unavailability of labour. Now a number of chemical herbicides are available that control weeds in wheat rather effectively. The weed control has been practiced since the time immemorial by manual labor and 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 labour 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 comparative efficacy of different herbicides in wheat (Khan *et al.*, 1999; Khan *et al.*, 2002; Khan *et al.*, 2001; Qureshi *et al.*, 2002; Hassan *et al.*, 2003). The herbicide use in Pakistan is not widely practiced as in the agriculturally advanced nation. The interest around the testing of graminicides (Walia *et al.*, 1998) that indicates the problem posed by grasses whereas, the studies of Khan *et al.* (2001) and Khalil *et al.* (2008) showed synergistic response on combined use of weedicides. In another studies researchers obtained an effective control of weeds in wheat through herbicides (Khan *et al.*, 2003; Cheema and Akhtar, 2005). Use of herbicides for control of broad leaves weeds in wheat is common in Pakistan. But the use of weedicide is not very common like elsewhere in Punjab. Therefore, present studies were carried out to find out the most economical and effective herbicide to control these broad leaf weeds in wheat.

Methodology

Experimental site

The experiments were conducted at Adaptive Research Farm Karor, and at farmer's field Chak No.116/TDA, Tehsil Karor, Distt Layyah during Rabi crop season 2022-23 to study the effect of different herbicides against broad leaf weeds in wheat crop under arid areas.

Experimental design

Wheat variety Fakhare Bhakkar planted in 2nd week of November in 25 cm apart rows. The experiments were laid out in Randomized Complete Block Design (RCBD) having three replications with a plot size of 20 m x 5 m.

Experimental treatments

The experiments consist of four treatments. Different herbicides were applied as post-emergence treatments viz. Buctril Super 60 % EC (bromoxynil + MCPA) @ 1125 ml ha⁻¹, Bromoxynil @1250 ml ha⁻¹, Findus Extra60 WG (Mesosulfuron-Methyl + Iodosulfuron-Methyl-Sodium) @ 240 g ha⁻¹ and Clean Wave (Imino Pyralid + Fluroxyber) @ 800 ml ha⁻¹. An untreated control was also included in the trials. A basal dose of Nitrogen, Phosphorus and Potassium were applied as urea, DAP and K₂SO₄ respectively. Nitrogen fertilizer was applied in three splits. One third nitrogen and whole of potassium and phosphorus were applied at the time of seed bed preparation and was thoroughly mixed within to the soil by ploughing and planking. The 2nd (1/3rd) of nitrogen was applied at the time of 1st irrigation and last 1/3rd at the time of third irrigation, canal water was used for irrigation. All other agronomic practices were kept uniform and according to departmental recommendation during the period of studies for all the treatments.

Data collection

The crop was harvested at maturity stage. Standard procedure were adapted for recording the data of weeds before and after weedicides application, growth and yield parameters like plant height at maturity (cm), total number of tillers (m⁻²), Average spike length (cm), Number of spiklets per spike, 1000 grains weight (g), grain yield (kg ha⁻¹). 20 tillers were selected at random from each plot and height was recorded by meter rod. Total numbers of fertile tillers were taken at random from each plot from 1 m² area and then average was recorded. The grains separated by thrashing manually to know the grain yield of each plot and then converted into kg ha⁻¹.

Statistical analysis

Data collected were analyzed statistically using the Fisher analysis of variance techniques and treatments means were compared for significance by using LSD Test at 0.05 (Steel and Torrie, 1980).

Results

Average number of weeds before 24 hours spray

The perusal of data exhibits that the both experiments were infested with several broad leaf weeds. The data pertaining no of weeds m^2 before spray at Adaptive Research Farm Karor showed (Table-1) non significantly difference among different treatments. The comparative study of means showed that maximum number of weeds m^2 (13.70) before spray were counted in T3 where Bromoxynil 40 % EC @ 1250 ml ha^{-1} was going to be applied which is statistically at par with treatments T2 (13.65), T4 (13.50) and T5 (13.10) where Buctril Super 60 % EC (Bromoxynil + MCPA) @ 1125 ml ha^{-1} , Findus Extra 60 WG (Mesosulfuron-Methyl + Iodosulfuron-Methyl-Sodium) @ 240 g ha^{-1} and Clean wave (Imino Pyralid + Fluroxyber) @ 800 ml ha^{-1} were applied respectively. The mean number of weeds (13.40) before spray was recorded in T1 (control plot). While the data regarding the number of weeds/ m^2 before spray, the similar trend of result was observed in farmers' field i.e. Chak No. 116/TDA, Tehsil Karor, Distt. Layyah (Table-11) as that of AR Farm, Karor (Table 1).

Table 2 presents the results of the correlation analysis conducted on egg weight and specific gravity. The findings revealed that the maximum egg weight was observed in the Chmbar taluka, while the lowest was found in Jhando Mari. Interestingly, our study found that all eggs had lower weights compared to the average egg weight of 52.50 g suggested by (Exwal *et al.*, 2020). It is therefore suggested that Aseel chicken have ability to produce heavy egg weight as well as chicks.

Average number of weeds after 7 days spray

All the weedicides reduce the weed population as compared to control (check plot). The average number of weeds m^2 showed non-significantly differences among different herbicidal treatments in both locations (Table 1, 2).

The data concerning number of weeds m^2 after 7 days spray in Adaptive Research Farm Karor Lal Eason showed non-significantly difference among different herbicidal treatments (Table 1). Comparative study of means showed that minimum number of weeds (0.33 m^2) after 7 days spray was counted in T2, where Buctril Super 60 % EC (Bromoxynil + MCPA) @ 1125 ml ha^{-1} was applied, which is statistically at par with treatments T3 (2.00 m^2), T5 (2.77 m^2) and T4 (4.96 m^2) where Bromoxynil 40 % EC @ 1250 ml ha^{-1} , Clean wave (Imino Pyralid + Fluroxyber) @ 800 ml ha^{-1} and Findus Extra 60 WG (Mesosulfuron-Methyl + Iodosulfuron-Methyl-Sodium) @ 240 g ha^{-1} were applied respectively. The maximum number of weeds (14.0 m^2) were recorded in T1 (check plot), where no weedicide was applied. While the data regarding the number of weeds m^2 after spray, the similar trend of result was observed in farmers' field i.e. Chak No. 116/TDA, Tehsil Karor, Distt. Layyah (Table 2) as that of AR Farm, Karor (Table 1).

This result shows reduced number of weeds in wheat by using various herbicides. The reduced number of weeds in herbicidal treatment is attributed to the phytotoxic effect of herbicides on weeds (Khan *et al.*, 1999; Khan *et al.*, 2002).

Table 1. Effect of herbicides on the growth and yield parameters of wheat (*Triticum aestivum* L.) crop during the year 2022-23 at location 1.

Treatments with description	No of weeds m ² before spray	No of weeds m ² after spray	No of tillers m ²	Plant height (cm)	Spike length	No of spiklets/spike	1000 grain Weight	Grain yield(kg ha ⁻¹)
T1	13.40a	14.00 a	295.23c	98.00 b	8.55a	32.60 c	38.75b	3600.10 b
T2	13.65a	0.33b	378.3a	109.22 a	8.68a	46.16 a	47.33a	4635.50 a
T3	13.70a	2.00bc	366.7a	100.93 ab	8.63a	41.87ab	45.85a	4200.35 ab
T4	13.50a	4.96b	363.3a	102.93ab	8.59a	38.40b	43.57ab	4000.13 ab
T5	13.10 a	2.77 bc	356.7 ab	100.40 ab	8.57 a	44.73 a	45.78 a	4467.20 a

T1. Control, T2. Buctril Super 60 % EC (Bromoxynil + MCPA) @ 1250 ml ha⁻¹, T3. Bromoxynil 40 % EC @ 1125 ml ha⁻¹, T4. Findus Xtra 60 WG (Mesosulfuron-Methyl + Iodosulfuron-Methyl-Sodium) @ 240 g ha⁻¹, T5. Clean wave (Imino Pyralid + Fluroxyber) @ 800 ml ha⁻¹

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

Table 2. Effect of herbicides on the growth and yield parameters of wheat (*Triticum aestivum* L.) crop during the year 2022-23 at location 2.

Treatments with description	No of weeds m ² before spray	No of weeds m ² after spray	No of tillers m ²	Plant height (cm)	Spike length	No of spiklets/spike	1000 grain Weight	Grain yield (kg ha ⁻¹)
T1	14.30 a	15.21a	294.30c	99.47 b	8.58a	33.80 c	40.1 0 b	3822.30 b
T2	14.20 a	1.33 b	376.00a	110.8 a	8.70a	47.26a	49.36a	4833.35 a
T3	14.50 a	3.00 bc	365.2000 a	101.13 ab	8.64a	43.07 ab	47.20a	4410.45 ab
T4	14.10 a	5.90 b	361.00a	103.73 ab	8.61a	39.33 b	45.33ab	4210.20 ab
T5	14.00 a	3.91 bc	355.10 ab	101.70 ab	8.59a	45.53a	47.18 a	4600.25 a

T1. Control, T2. Buctril Super 60 % EC (Bromoxynil + MCPA) @ 1250 ml ha⁻¹, T3. Bromoxynil 40 % EC @ 1125 ml ha⁻¹, T4. Findus Xtra 60 WG (Mesosulfuron-Methyl + Iodosulfuron-Methyl-Sodium) @ 240 g ha⁻¹, T5. Clean wave (Imino Pyralid + Fluroxyber) @ 800 ml ha⁻¹

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

Average number of tillers (m⁻²)

The data concerning number of tillers m² at both locations showed non-significantly difference among different herbicidal treatments (Table 1, 2). Comparative study of means at Adaptive Research Farm Karor showed that maximum number of tillers (378.3) was counted in T2, where Buctril Super 60 % EC (bromoxynil + MCPA) @ 1125 ml ha⁻¹ was applied which is statistically at par with treatments T3 (366.70) T4 (363.30) and T5 (356.70), where Bromoxynil 40 % EC @ 1250 ml ha⁻¹, Findus Extra 60 WG (Mesosulfuron-Methyl + Iodosulfuron-Methyl-Sodium) @ 240 g ha⁻¹ and Clean wave (Imino Pyralid + Fluroxyber) @ 800 ml ha⁻¹ were applied respectively. The least number of tillers (295.33) were counted in control (check plot).

While the data regarding the number of tillers m^{-2} , the similar trend of result was observed in farmers' field i.e. Chak No. 116/TDA, Tehsil Karor, Distt. Layyah (Table 2) as that of AR Farm, Karor (Table 1), as concerned the tillers production (Noor *et al.*, 2012) reported higher number of tillers when narrow leaved weeds were managed properly at tillers initiation.

Average plant height (cm)

Data presented in Table 1 and 2 showed non-significantly difference among all the treatments regarding plant height (cm) of wheat at both locations i.e. Adaptive Research Farm, Karor as well as farmer's field at Chak No. 245/TDA, Tehsil Karor Distt. Layyah. The analysis of data regarding plant height at Adaptive Research Farm Karor showed non-significantly difference among the different herbicidal treatments (Table-1). Comparative study of means showed that maximum plant height (109.22) was counted in T2 where Buctril Super 60 % EC (bromoxynil + MCPA) @ 1125 ml ha^{-1} was applied which is statistically at par with treatments T4 (102.93), T3 (100.93) and T5 (100.40 cm), where Findus Extra 60 WG (Mesosulfuron-Methyl + Iodosulfuron-Methyl-Sodium) @ 240 g ha^{-1} , Bromoxynil 40 % EC @ 1250 ml ha^{-1} and Clean wave (Imino Pyralid + Fluroxyber) @ 800 ml ha^{-1} were applied respectively. The minimum plant height (98.00 cm) was recorded in control (check plot). While the data regarding the plant height (cm), the similar trend of result was also observed in farmers' field i.e. Chak No. 116/TDA, Tehsil Karor, Distt. Layyah (Table 2) as that of AR Farm, Karor (Table 1).

Average number of Spiklength (cm)

The statistical analysis of data regarding spike length at both locations showed non-significantly difference among all the treatments. The comparative study of means at Adaptive Research Farm Karor showed that maximum spiklength (8.68 cm) was counted in T2 where Buctril Super 60 % EC (Bromoxynil + MCPA) @ 1125 ml ha^{-1} was applied which is statistically at par with treatments T3 (8.63cm), T4 (8.59cm) and T5 (8.57cm) where weedicides Bromoxynil40 % EC @1250 ml ha^{-1} , Findus Extra 60 WG (Mesosulfuron-Methyl + Iodosulfuron-Methyl-Sodium) @ 240 g ha^{-1} and Clean wave (Imino Pyralid + Fluroxyber) @ 800 ml ha^{-1} were applied respectively. The minimum spike length (8.55cm) was recorded in T1 (Check plot) where no weedicide was applied. While the data regarding the average spike length (cm), the similar trend of result was also observed in farmers' field i.e. Chak No. 116/TDA, Tehsil Karor, Distt. Layyah as that of AR Farm, Karor. These results are in contrast to Hassan *et al.* (2003) and Khan *et al.* (2003) who evaluated varying spiklength of wheat treated with different herbicides.

Average number of spiklets/spike

The statistical analysis of data regarding mean number of spiklets/spike at both locations showed non-significantly difference among the different herbicidal treatments except treatment T4 (Table 1, 2). Comparative study of means at Adaptive Research Farm Karor showed that maximum number of spiklets/spike was counted in T2 (46.16) where Buctril Super 60 % EC (Bromoxynil + MCPA) @ 1125 ml ha^{-1} was applied which is statistically at par with treatments T5 (44.73), T3 (41.87) where Clean wave (Imino Pyralid + Fluroxyber) @ 800 ml ha^{-1} and Bromoxynil 40 % EC @ 1250 ml ha^{-1} were applied respectively. The remaining treatment T4 (38.40), where Findus Extra 60 WG (Mesosulfuron-Methyl +

Iodosulfuron-Methyl-Sodium) @ 240 g ha⁻¹ was applied which is significantly difference as compared to control plot T1 (32.60) where least number of spikelets/spike were counted.

While the data regarding the number of spikelets/spike, the similar trend of result was also observed in farmers' field i.e. Chak No. 116/TDA, Tehsil Karor, Distt. Layyah (Table 2) as that of AR Farm, Karor (Table 1) these results are in similar with Kumar and Singh (2010), who reported increase in number of grains per spike due to herbicides application.

1000-Grain weight (g)

The statistical analysis of data regarding 1000 grains weight at both locations (Table 1, 2) showed non-significantly difference among the different herbicidal treatments. The comparative study of means at Adaptive Research Farm Karor (Table-1) revealed that maximum number of 1000 grain weight was recorded in T2 (47.33 g) where Buctril Super 60 % EC (Bromoxynil + MCPA) @ 1125 ml ha⁻¹ was applied which is statistically at par with treatments T3 (45.85), T5 (45.78) and T4 (43.57) where Bromoxynil 40 % EC @ 1250 ml ha⁻¹, Clean wave (Imino Pyralid + Fluroxyber) @ 800 ml ha⁻¹ and Findus Extra 60 WG (Mesosulfuron-Methyl + Iodosulfuron-Methyl-Sodium) @ 240 g ha⁻¹ were applied respectively. The minimum numbers of 1000 grain weight (38.75) was found in T1 (Check plot), where no weedicide was applied. While the data regarding the 1000 grain weight (g), the similar trend of result was also observed in farmers' field i.e. Chak No. 116/TDA, Tehsil Karor, Distt. Layyah as that of AR Farm, Karor.

Average grain yield (Kg ha⁻¹)

The statistical analysis of data concerning grains yield at both locations showed non-significantly difference among the different herbicidal treatments as presented in. The comparative study of means at Adaptive Research Farm Karor (Table 1) showed that maximum grain yield (4635.50 kg ha⁻¹) was recorded in T2 where Buctril Super 60 % EC (Bromoxynil + MCPA) @ 1125 ml ha⁻¹ was applied, which is statistically at par with treatments T5 (4467.20 kg ha⁻¹), T3 (4200.35 kg ha⁻¹) and T4 (4000.13 kg ha⁻¹) where Clean wave (Imino Pyralid + Fluroxyber) @ 800 ml ha⁻¹, Bromoxynil 40 % EC @1250 ml ha⁻¹ and Findus Extra 60 WG (Mesosulfuron-Methyl + Iodosulfuron-Methyl-Sodium) @ 240 g ha⁻¹ were applied respectively. The minimum grain yield (3600.10 kg ha⁻¹) was found in T1 (Control plot). While the data regarding the grain yield of wheat, the similar trend of result was also observed in farmers' field i.e. Chak No. 116/TDA, Tehsil Karor, Distt. Layyah (Table 2) as that of AR Farm, Karor (Table 1).

The increase in number of tillers, 1000-grain weight and number of spikelets/spike may be attributed to better weed control and elimination of weed crop competition for water, nutrient, moisture and light and manage better utilization of sources by the crop. These results are similar with the finding of Hussain *et al.* (2003) who recorded similar increase in these yield components in their weed control experiments. These results are in similar with those of Malik *et al.* (1992). He reported increase in grain yield due to maximum values obtained those of yield components by the application of weedicides in treated plots.

Conclusion

The data collected on weed dynamics and yield parameters of wheat like plant height(cm), nos of fertile tillers, number of spikelets/spike, 1000-grain weight and grain

yield (kg ha^{-1}). The data exhibits that the best weedicides against the broad leaves weeds in the Buctril Super 60 % EC (Bromoxynil + MCPA) @ 1125 ml ha^{-1} as it out yielded all herbicides in both locations i.e. Adaptive Research Farm Karor and farmers field, Chak No. 116/TDA, Tehsil Karor, Distt Layyah by producing $4635.50 \text{ Kg ha}^{-1}$ and $4533.35 \text{ kg ha}^{-1}$ respectively.

Conflict of Interest

The authors have not declared any conflict of interest.

Authors Contributions

All the authors contributed equally in the manuscript.

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