ECONOMICS OF POST EMERGENCE HERBICIDES FOR CONTROL OF WEEDS IN WHEAT

ABDUL AZIZ, ABDUR RASHID [1], M. E. ELAHI[1], I. I. SADEK[2] and NAGWA M. AHMED[2]

1. *Arid Zone Research Center (PARC), Dera Ismail Khan, Pakistan.*
2. *Central Lab. for Agricultural Climate (CLAC), ARC, Giza, Egypt.*

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Abstract

Experiment was conducted to study the effect of different herbicides, for weed control in wheat fields, during 2014-2015, at the Arid Zone Research Farm, D. I. Khan, Pakistan. The treatments; including control (T1), Buctril Super (T2), Bromoxynil (T3), Austrian-M (T4), Segal (T5) and Dormic (T6); were arranged in Randomized Complete Block Design (RCB) with three replications. The grain yield and yield components data of wheat indicated that all the treatments of herbicides effectively control weeds and provide better environment for growth of crop that ultimately increased wheat yield. The number of grain spike^{-1} and thousand-grain weight was significantly increased in all the treatments of herbicides compared to control. The highest yield grain was obtained in the treatment of Buctril Super where weeds were completely wilted compared to all other treatments of herbicides. Economic Analysis showed that the benefit cost ratio (BCR) of the treatment Buctril super was higher. Thus, Buctril super at 750 ml ha^{-1} proved to be the best herbicide for weed control in wheat and to achieve the maximum yield.

Key Words: Wheat. *(Triticum aestivum),* Herbicides, Weeds Control, Grain Yield, Pakistan

INTRODUCTION

Agriculture is a basic source of revenue and employment for the development of agrarian society in Pakistan. The life standard of people can be improved by making agriculture a profitable sector, which contributes 10.1% towards value added and 2.2 % in GDP of Pakistan. Wheat is the major cereal crop covered 0.904 m.ha of cultivated area with 2.528 million tons annually (GoP, 2013). The average yield of 2787 kg per ha of wheat is very low than the actual potential compared to other wheat growing countries e.g. Germany 8087 kg, China 4762 kg/ha etc (FAO, 2011). Many factors including weed control play a significant role in the production of wheat in Pakistan. Hassan and Marwat (2001) reported that the annual losses in wheat is around 28 billion (Pakistani Robbie's (RS) due to weeds at national level and 2 billion (RS) in case of Khyber PakhtoonKhawa.

In Pakistan, important weeds in wheat growing areas are *convolvulus arvensis L.*, *Medicago polymorpha L., Euphorbia, Anagallisarvensis L., Cyprcesrotundus,*

Fumarianidica, Cynodondactylon, setaria and carthamusoxycantha etc. Weeds infestation not only compete with the crop for moisture, nutrients, space and sunlight etc, but also provide habitat for harmful organisms, and might act as an alternate host for pathogens, resulting in productivity decrease. Moreover, contamination of weeds also deteriorate the quality of seed, create storage problem besides some other adverse effects in harvesting of the crop and ploughing of the field particularly weeds species that exhibitallelopathy (Hassan, 1983 and Hussain *et al.*, 1984). Besides other constraints, high weed infestation and poor weed management practices caused significant losses in yields (Jarwar *et al., 2005;* Varshney *et al.*, 2012; Hussain, 2013)

In light of adverse effects of weeds on crop production, best tool is weed control for agriculture to be profitable (Din *et al.*, 2011). Physical methods include hand weeding which is important for weed control, (Wszelaki *et al.*, 2007 and Ulloa *et al.,* 2011). Therefore, this study was conducted to study the herbicidal effects on weed control in wheat fields.

MATERIALS AND METHODS

This experiment was conducted at the Arid Zone Research Centre (AZRC), Dera Ismail Khan, Pakistan, during 2014/2015 to study the herbicidal effect on weed control in wheat fields. An improved variety (Hashim) of wheat was planted in this study. Row length was 10 m and width was 30 cm. The experiment was comprised of six different treatments including control (No weeding). It was laid out in a Randomized Complete Block Design (RCBD) with three replications. The treatment details were as follows (Table1):

Table 1. Herbicide treatments used in the study.

Treatments	Herbicides	Dose applied
T1	Control (No weeding)	-
T2	Buctril Super	750 ml ha^{-1}
T3	Bromoxynil	1250 ml ha^{-1}
T4	Austrian-M	750 ml ha^{-1}
T5	Segal	1250 ml ha^{-1}
T6	Dormic	125 g ha^{-1}

Seedbed was well prepared for sowing and seed rate of 100 kg per ha was used during the second week of November 2014. All the agronomic practices were kept constant except herbicides spray for the control of weeds in each treatment. The data recorded was subjected to the analysis of variance (ANOVA) using Least Significant Differences (LSD) test at $P \geq 0.05$ level of probability to determine the significance of variance between the treatment means of herbicides (Steel *et al.* 1997).

RESULTS AND DISCUSSION

Temperature Profile:

Illustrated data in figure (1) indicated that, highest average maximum temperature during both studied seasons was 36.1°C. This was recorded in 21/4 – 30/4/. Whereas, the lowest observed average maximum temperature was 11.5°C, and was found in 21/1- 31/1/.

On the other hand, the highest observed average minimum temperature was 22.2°C, which was recorded in 11/10- 20/10/. On the contrary, the lowest average minimum temperature was 3°C, and was recorded in 21/1 and 31/1.

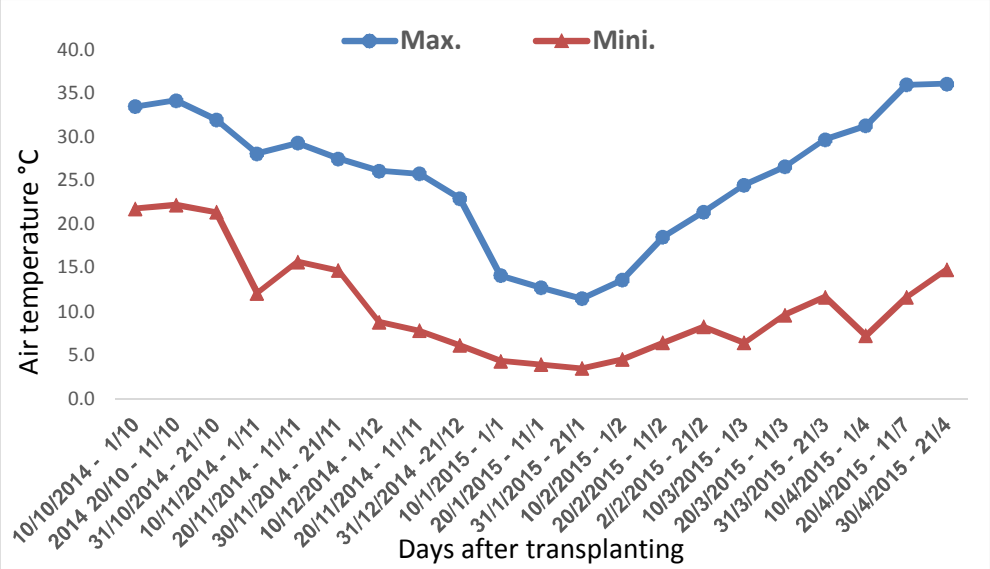

Fig. 1. Maximum and minimum air temperature during seasons of 2014/2015.

Response of yield components:

The data in Table (2) indicated that different treatments of herbicides had significantly affected the yield components and grain yield of wheat. Data on grains spike^{-1} indicated that the different treatment of herbicides had significantly affected the number of grains spike^{-1}. The number of grains spike^{-1} ranged between 45-52.33. Maximum number of grains/spike (52.33) was recorded in the treatment of Buctril super showing non-significant difference with all other herbicidal treatments except Dormic which produced 48 grains spike^{-1}. The lowest number of grains spike^{-1} (45) was recorded in the control plot. Similarly, the thousand grains weight (g) was also affected significantly. The highest thousand grains weight (46.80 g) was noted in the treatment of Buctril Super followed by Bromoxynil (46.40 g) of thousand grains weight. The lowest thousand grains weight (44.93 g) was recorded in the control treatment. The yield components data revealed that the controlling of weeds in wheat

had positive impact on the growth and production of wheat crop. The findings are in line with Hussain (2013) and Din *et al*. (2011).

Table 2. Yield and yield components of Wheat as affected by different herbicides.

S.No.	Treatments	Number of grains spike^{-1}	1000 grain weight (g)	Grain yield (t ha^{-1})
T1	Control	45.0c	44.93c	1.30d
T2	Buctril Super	52.33a	46.80a	2.85a
T3	Bromoxynil	52.33a	46.40a	2.61b
T4	Austrian-M	52.33a	45.07c	2.69b
T5	Segal	51.67a	45.87ab	2.56b
T6	Dormic	48.0b	45.27bc	2.32c

Mean followed by similar words do not differ significantly at 5% level of probability.

Response of grain yield:

The date in Table (2) indicated that different herbicidal treatments had significant effect on wheat grain yield. The grain yield of wheat had significantly increased with all the treatments of weed control by different herbicides compared to the control plot which produced the lowest grain yield of 1.3 t ha^{-1}. The highest grain yield (2.85 t ha^{-1}) was obtained with the treatment of Buctril Super showing 53% increase over control treatment. Austrian-M stands second in producing grain yield (2.69 t ha^{-1}) of wheat followed by Bromoxynil, which produced grain yield of 2.1 t ha$^{-1,}$ with non-significant difference to each other. The data revealed that either herbicide applied for control of weeds contributes towards crop productivity. Different herbicides behaved differently in control of weeds as visually observed that weeds in all the treatments of Buctril Super were completely wilted at early stage of the crop. Bromoxynil and Austrian-M were similar in wilting of weeds while the effect of Dormic was hardly 10-15%.

Economic feasibility:

Agro-economic feasibility of any agricultural input is ultimately determined by its net monetary gain. An estimate of the economic aspect of this study was computed and results obtained are relative to the net income. All the relevant calculations and interpretations are presented in Table (3). It is evident from the data that herbicide applications had substantially affected the net income per hectare of the crop. The highest net income of Rs. 89,200/ha showing 114 percent increase over control was obtained from Buctril Super compare to other herbicidal treatments. The benefit cost ratio was calculated on the basis of prevailing market rates of wheat and different herbicides using the formula also used by Santha (1993):

Benefit cost ratio = TR / TC

Whereas, the TR is total benefit in rupees and TC is the total cost in rupees.

Table 3. Economic Analysis of post emergence herbicides for production of Wheat.

Treatment	Herbicides used	Grain yield (kg ha^{-1})	Gross income (Rs.)	Cost of Herbicides (Rs. Ha^{-1})	Net Income (Rs)	%age increased over control	Benefit Cost Ratio (BCR)
T1	Control	1300	41600	-	-	-	41600
T2	Buctril Super	2850	91200	2000	89200	114	45.60
T3	Bromoxynil	2610	83520	2000	81520	96	41.76
T4	Austrian-M	2690	86080	2325	83755	101	37.02
T5	Segal	2560	81920	2000	79920	92	40.96
T6	Dormic	2320	74240	2200	72040	73	33.75

- Price of Wheat (Rs. perkg) = Rs. 32.
- Cost of Herbicides (Rs. per hectare as per market rate)

Thus, it can be concluded that weeds free environment provide opportunity to crop for better utilization of the nutrients etc., and thereby increased the yield and net increase of the crop. Same results reported by Rashid *et al.* (2009), Thakar *et al.* (2000) and Elkoca *et al*. (2005).

CONCLUSION

Using different treatments of herbicides led to increase yield components and grain yield of wheat, significantly. Applied Buctril super treatment had greatest values for tested parameters (Number of grains $spike^{-1}$, 1000 grain weight (g) and Grain yield (t ha^{-1})), compared with other treatments. In addition, Buctril super treatment increased grain yield by 53% more than control treatment.

Moreover, applications of herbicide had substantially effect on net income/hectare of wheat crop. The highest net income of Rs. 89,200/ha by (114%) increase over control was obtained with Buctril Super treatment compare to other herbicidal treatments.

Gnarly, controlling of weeds in wheat had positive impact on the growth, production and net income of wheat crop.

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إقتصاديات استخدام مبيدات الحشائش لمحصول القمح في مرحلة ما بعد الإنبات

عبد الرشيد عبد العزيز[١]، محمد إحسان إلهي[١]،إيهاب إبراهيم صادق[٢]، نجوى محمود أحمد [٢]

١- مركز بحوث *المناطق الجافه – ديرا إسماعيل خان – باكستان.*
٢- *المعمل المركزي للمناخ الزراعي – مركز البحوث الزراعية – جيزة – مصر.*

أقيمت هذه التجربة بهدف دراسه تأثيرمبيدات الحشائش المختلفة على مكافحة الحشائش الضارة لمحصول القمح موسم ٢٠١٥/٢٠١٤. وقد تم ترتيب المعاملات بما في ذلك الكنترول (T1) ، بكتريل سوبر(T2) ، بروموكسينيل(T3) ، النمساوية – M (T4)، سيغال (T5) ودورميك (T6). في تصميم قطاعات كاملة العشوائية في ثلاث مكررات في مزرعة مركز بحوث الدراسات القاحله، ديخان (باكستان). وأشارت بيانات المحصول الكلي من حبوب القمح إلى أن جميع معاملات مبيدات الحشائش تؤثر بشكل فعال على عدد الحشائش الضارة وتوفر بيئة أفضل لنموالمحاصيل مما أدى في النهاية إلى زيادة محصول الحبوب من القمح.

لوحظ زيادة معنوية في وزن الألف حبة في جميع معاملات مبيدات الأعشاب مقارنة بالكنترول. تم الحصول على أعلى محصول في معاملة بكتريل سوبرحيث تم التخلص من الأعشاب تماما مقارنة بجميع المعاملات الأخرى لمبيدات الأعشاب. وأظهرالتحليل الاقتصادي أن نسبة العائد لتكاليف الرش بالبكتريل سوبركانت الأعلى. وهكذا تم إثبات أن استخدام مبيد بكتريل سوبربمعدل ٧٥٠ مللي/ هكتاريعطي أفضل النتائج في مكافحة الحشائش الضارة في القمح وتحقيق أقصى قدرمن المحصول .