ECONOMICS OF POST EMERGENCE HERBICIDES FOR CONTROL OF WEEDS IN WHEAT

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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 exhibit allelopathy (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 (Table 1):

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Herbicides</th>
<th>Dose applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Control (No weeding)</td>
<td>-</td>
</tr>
<tr>
<td>T2</td>
<td>Buctril Super</td>
<td>750 ml ha(^{-1})</td>
</tr>
<tr>
<td>T3</td>
<td>Bromoxynil</td>
<td>1250 ml ha(^{-1})</td>
</tr>
<tr>
<td>T4</td>
<td>Austrian-M</td>
<td>750 ml ha(^{-1})</td>
</tr>
<tr>
<td>T5</td>
<td>Segal</td>
<td>1250 ml ha(^{-1})</td>
</tr>
<tr>
<td>T6</td>
<td>Dormic</td>
<td>125 g ha(^{-1})</td>
</tr>
</tbody>
</table>

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.

![Figure 1: Maximum and minimum air temperature during seasons of 2014/2015.](image)

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.

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

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

Response of grain yield:

The data 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):

\[
\text{Benefit cost ratio} = \frac{TR}{TC}
\]

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.

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

- Price of Wheat (Rs. per kg) = 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.

REFERENCES

اقتصاديات استخدام مبيدات الحشائش لمحصول القمح في مرحلة ما بعد الإنبات

عبد الرشيد عبد العزيز، محمد إحسان إلهي، إبراهيم صادق، نجوى محمود أحمد

1- مركز بحوث المناطق الجافة - ديرإسماعيل خان - باكستان.
2- المعهد المركزي للمناخ الزراعي - مركز البحوث الزراعية - جيزة - مصر.

أقيمت هذه التجربة بهدف دراسة تأثير مبيدات الحشائش المختلفة على مكافحة الحشائش الضارة لمحصول القمح موسم 2015/2014. وقد تم ترتيب المعاللات بما في ذلك الكترول (T1)، بكتريل سوبر (T2)، بروموكسبين (T3)، النمساوية-M (T4) ودوريوك (T5). في تصميم قطاعات كاملة العشوائية في ثلاث مكررات في مزرعة مركز بحوث الدراسات القاحلة، ديفان باكستان. وأشارت بيانات المنتاج الكلي من حبوب القمح إلى أن جميع معالات مبيدات الحشائش تؤثر بشكل فعال على عدد الحشائش الضارة وتتوفر بيئة أفضل للمواد المضادة مما أدى في النهاية إلى زيادة محصول الحبوب من القمح.

لوحظ زيادة معنوية في وزن الألف حبة في جميع معالات مبيدات الأعشاب مقارة بالكترول. تم الحصول على أعلى محصول في معالمة بكتريل سوبرحيث تم التخلص من الأعشاب تماما مقارة بجميع المعالات الأخرى لمبيدات الأعشاب. وأظهر التحليل الاقتصادي أن نسبة العائد للكترول بالكتريل سوبر كانت الأعلى، وهكذا تم إثبات أن استخدام مبيد بكتريل سوبر معنوي/750 ملي/هكتار يعطي أفضل النتائج في مكافحة الحشائش الضارة في القمح وتحقيق أقصى قدر من المحصول.