American Journal of Plant Sciences, 2014, 5, 1272-1276
Published Online April 2014 in SciRes. http://www.scirp.org/journal/ajps
http://dx.doi.org/10.4236/ajps.2014.59140

Chemical Control of Monocot Weeds in Wheat (*Triticum aestivum* L.)

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Received 18 January 2014; revised 15 March 2014; accepted 27 March 2014

Abstract

Due to similar growth pattern and morphology, monocot weeds offer more severe competition with wheat. A field experiment was conducted to screen herbicides most suitable for the control of monocot weeds in wheat. Seven herbicides viz., Puma super 69EW @ 862.5 g a.i. ha^{-1}, Bristle 69 EW @ 1250 ml, Topik 15WP @ 37.05 g a.i. ha^{-1}, Safener15WP @ 247g, Certain 80WD @ 395.2 g and Tremor 24EC @ 247 ml/ha were used. Weedy check where no weed control was practiced was kept as control. All herbicides were sprayed as post-emergence with second irrigation 38 days after crop sowing. The best weed control was accomplished by Safener 15WP 247 g ha^{-1} as significantly lower weed counts per m^2 (11.0) and higher percent weed control (73.4%) were noted after 21 days of its spray. Wheat growth parameters like plant height, number of tillers per m2, spike length and number of spikelets per spike remained statistically at par among various treatments. Significantly higher number of grains per spike (55.67) and 1000 grain weight (36 g) were noted with Puma Super 69EW @ 1250 ml ha^{-1} and Certain 80WD 395.2 g ha^{-1}, respectively. Although treatments did not differ significantly with respect to wheat grain and biological yields, yet the highest grain yield (3708.3 kg ha^{-1}) and biological yield (10208.3 kg ha^{-1}) were produced by Puma Super 69EW @ 1250 ml ha^{-1}. Based on better weed control and wheat yield, Safener 15WP @ 395.2 ml ha^{-1} and Puma Super 69EW @ 1250 ml ha^{-1} were proved to be better in areas where wheat fields are predominantly infested by monocot weeds. Puma super, Bristle Tremore, Safener and Certain were found effective against *Avena fatua* and *Polypogon monspelliensis*, less effective against *Phalaris minor* and ineffective against *Poaannua* grass.

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How to cite this paper: Mehmood, Z., *et al.* (2014) Chemical Control of Monocot Weeds in Wheat (*Triticum aestivum* L.). *American Journal of Plant Sciences*, **5**, 1272-1276. http://dx.doi.org/10.4236/ajps.2014.59140

Keywords

Screening; Herbicides; Contributing Traits; Infestation; Yield

1. Introduction

To fulfill the world food demand, wheat ranks top mostly grown and consumed in almost whole of the world [1]. Wheat (*Triticum aestivum* L.) which belongs to family *Poaceae*, is a worldwide cultivated important cereal crop. In Pakistan, it is the most important cereal crop and staple food of the people [2]. It serves as the backbone of economy of the country. It is the most preferable staple food in Pakistan, while, at world level, it is ranked at 3rd position after the maize and rice. It is the cheapest source supplying 72% of calories and protein in the average diet [3] [4]. In Pakistan, it was grown on an area of 8.69 million ha with total production of 24.23 million tonnes and average yield of 2787 kg ha^{-1}. It contributes 10.1 percent to the value added in agriculture and 2.2 percent to GDP [5]. The average yield of wheat in country does not go beyond 30% - 35% of its optimum potential [6] which is far below the yield level obtained in the other wheat growing countries of the world. It is true that wheat production may be increased by either increasing the area under wheat crop or maximizing yield per unit area. To increase area under wheat crop is difficult, because of pressing needs for other agriculture commodities under the existing conditions [7]. The other option is to increase the productivity that seems possible but by the efficient use of inputs (fertilizer, irrigation, pesticides etc.).

Despite among top ten ranked country in the wheat production in the world, our national average grain yield is still far below than other wheat producing countries of the world [8] [9]. The average world wheat yield is 3210 kg ha^{-1} while in Pakistan it is 2787 kg ha^{-1} [10]. There are many factors for this decline such as late sowing, improper seed rate and sowing methods, inadequate plant population, nutrient deficit soils and lack of irrigational water at critical stages of crop, weed competition causing the reduction in the yield of wheat [11]. The most important factor among them is weed attack. Weeds reduce crop yield from 9.5% to 16.05% depending on intensity of weeds [12]. The weeds represent most costly and limiting factor in crop production, posing harvesting and threshing problem [13]. Weeds are one of the major problems in crop production because they compete with crop plants for light, moisture, nutrients and space. [14] reported that the annual losses in wheat are amounted to more than 28 billion rupees at national level. Weed infestation is one of the main causes of low wheat yield not only in Pakistan but all over the world, as it reduces wheat yield by 37 to 50 percent. Weeds also increase harvesting costs, reduce quality of the produce, clog water ways and increase fire hazards. Therefore, it is essential to control weeds in order to obtain maximum yield of wheat having good quality grain. These methods, besides being laborious and tiresome, are expensive due to increasing cost of labor, draft animals and implements escalating costs have stimulated interest in the use of chemical weed control. But, the exclusive reliance on herbicides results in pollution of the environment and inter- and intra-specific shifts of weed flora. [15] revealed that chemical control of weeds is being emphasized in modern agriculture while [16] stated that in other studies researchers obtained an effective weed control in wheat through chemicals. The present study was conducted with an objective to identify herbicides more effective in controlling monocot weeds and increasing yield in wheat.

2. Materials and Methods

A field experiment was conducted at research area of Plant Physiology Section, Ayub Agricultural Research Institute (AARI), Faisalabad, Pakistan during the winter season 2012-13. Five herbicides namely Puma Super 69EW @ 1250 ml ha^{-1} (Active ingredient Fenoxaprop), Bristle 69EW @ 1250 ml ha^{-1} (Active ingredient Fenoxaprop), Topik 15WP 247 g ha^{-1} (Active ingredient Clodinofop) Safener 15WP 247 g ha^{-1} (Active ingredient Clodinofop) Certain 80WD 395.2 g ha^{-1} (Active ingredient Tralkoxydia and Tremor 24EC 247 ml ha^{-1} (Active ingredient Clodinofop) were sprayed as post-emergence application after 2nd irrigation 38 days after sowing. A weedy check was kept as control where no weed treatment was applied. The experiment was laid out in randomized complete block design (RCBD) with three replications. Wheat variety Punjab 2011 was used as test crop. A net plot size was kept 2 × 8 m^2. Crop was sown on 20th November, 2012. Nitrogen, P and K were applied at the rate of 150, 100 and 50 kg ha^{-1}, respectively. One third dose of N was applied at the time of sowing whereas remaining N doses were applied in two splits at tillering and booting stages of wheat. All dicot weeds were ma-

nually removed from all treatments while only grassy and monocot weeds were kept alive to check the herbicide action. This trial was repeated twice. The second trial was glutted with the grassy weeds species *Phalaris minor* and *Avena fatua* (**Table 1**).

Weed control parameters like weed count per m^2 and percent weed control was taken after 21 days of herbicide spray. Wheat growth parameters, yield and yield components including plant height, number of fertile tillers, number of infertile tillers, plant height, spike length, number of spikelets per spike, number of grains per spike, 1000-grain weight, grain yield, biological yield and harvest index were recorded near crop maturity and at harvesting, All data were subjected to analysis of variance (ANOVA) techniques by MSTAT-C computer software and means were separated by using DMR test according to [17].

3. Results and Discussion

3.1. Weed Control

Weed count per m^2 and percent weed control are important parameters showing effect of a management practice on weed control. Data regarding weed control are presented in **Table 2** which showed that all herbicides significantly reduced number of weeds per m^2 resulting in significant increase in percent weed control compared with weedy check. However, the minimum weed count per m^2 (11.0) and the highest weed control (73.4%) were recorded with Safener 15WP @ 247g/ha.

3.2. Wheat Growth and Yield Components

Plant height, number of tillers, spike length and number of spikelets per spike near crop maturity are direct indicators of vegetative growth progress of cereal crops. Data represented in **Table 3** showed that these parameters did not differ significantly among various treatments. This might be due to reason that herbicides had been previously applied to the experimental field for wheat for last few years therefore residual herbicidal effect resulted in suppressed weed growth rate resulting in little or little effect on wheat growth. [18] also reported that herbicides did not cause significant reduction in spike length of wheat. However, our results are contradictory to those of [19] [20] who noted significant inhibitory effect of herbicides on fertile tillers per m^2 and spikelets per spike of wheat.

Number of grains per spike and 1000 grain weight are considered important yield contributing traits. Significantly higher number of grains per spike (55.7) was recorded with Puma Super @ 1235l/ha which remained statistically at par with those observed with Bristle 69EW @ 1250 ml ha^{-1}, Topik 15WP @ 247 g ha^{-1}, Safener 15WP 247 g ha^{-1} and Certain 80WD 395.2 g ha^{-1} (**Table 3**). However, minimum number of grains per spike (45.7) was produced by weedy check. Data presented in **Table 3** showed that significantly higher 1000 grain weight (36 g) was found in treatment receiving spray of Certain 80WD @ 395.2ml ha^{-1} which remained statistically at par with those obtained in Puma Super 69EW @ 1250 ml ha^{-1}, Topik 15WP @ 247 g ha^{-1} and Safener 15WP 247 g ha^{-1}. However, minimum 1000 grain weight (32 g) was found in weedy check.

3.3. Wheat Grain and Biological Yields

Data arranged in **Table 3** showed that wheat grain and biological yields did not differ significantly among various treatments. However, Puma Super 69EW @ 1250 ml ha^{-1} can be ranked at first position as it produced higher grain yield (3708.3 kg ha^{-1}) and biological yield (10208.3 kg ha^{-1}). However, weedy check gained the higher harvest index (37.7%) than all other treatments. Our results are in line with those of [21] who also noticed non-significant effect of various herbicides on grain yield, biological yield and harvest index of wheat.

Table 1. Monocot weeds present in field.

Sr. No.	Common Name	Botanical Name
1	Dumbi sitti	*Avena fatua*
2	Jangli jai	*Phalaris minor*
3	Poa grass	*Poa annua*
4	Dhanak grass	*Lolium temulentum*
5	Dumb grass	*Polypogon monspelliensis*

Table 2. Control of monocot weeds by various treatments in wheat.

Treatment	Weed count/m2	Percent Weed control
Puma Super 69EW @ 1250 ml ha^{-1}	13.67 b	68.50a
Bristle 69EW @ 1235 ml ha^{-1}	12.67b	71.97a
Topik 15WP @ 247 g ha^{-1}	12.33b	72.03a
Safener 15WP 247 g ha^{-1}	11.00b	73.37a
Certain 80WD 395.2 g ha^{-1}	15.00b	69.10a
Tremor 24EC 247 ml ha^{-1}	16.33b	58.77a
Weedy check (Control)	40.67a	7.033b

Table 3. Wheat yield and yield components as influenced by various weed control treatments.

Treatment	Plant height	Total tillers per m^2	Fertile tillers per m^2	Infertile tillers per m^2	Spike length	No of spikelets per spike	Grain per Spikes	1000 grain weight (g)	Grain yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)
Puma Super 69EW @ 1250 ml ha^{-1}	90.5	297.7	265.0	32.7	10.6	13.3	55.7 a	34.7 abc	3708.3	10208.3	36.5
Bristle 69EW @ 1235 ml ha^{-1}	88.1	283.3	249.3	34.0	10.0	15.7	55.0 a	33.3 bcd	3666.7	10104.0	36.3
Topik 15WP @ 247 g ha^{-1}	89.4	280.7	248.0	32.7	10.6	15.3	54.0 ab	34.0 abcd	3500.0	10208.3	34.4
Safener 15WP 247 g ha^{-1}	89.6	285.7	253.3	32.3	9.5	14.0	51.7 abc	35.3 ab	3500.0	10208.3	34.3
Certain 80WD 395.2 g ha^{-1}	85.8	298.7	266.7	32.0	9.8	14.7	50.0 abc	36.0 a	3270.0	9791.7	33.6
Tremor 24EC 247 ml ha^{-1}	88.3	295.3	262.0	33.3	10.5	15.7	47.7 bc	32.7 cd	3583.3	10104.2	35.6
Weedy check (Control)	88.7	306.7	275.0	31.7	10.7	15.0	45.7 c	32.0 d	3645.0	9687.5	37.7

4. Conclusion

Puma super and *Bristle* were found effective against *Avena fatua* and *Polypogon monspelliensis* comparatively weak against *Phalaris minor* and ineffective against *Poaannua grass*. *Tremore*, *Safener* and *Certain* also have the same trend. However, these were found also effective against *Phalaris minor* in addition to *Avena fatua* and *Polypogon monspelliensis*. Regarding control of monocot weeds in wheat like *Avena fatua*, *Phalaris minor*, *Poaannua*, *Lolium temulentum* and *Pseudoroegneria spicata*, Safener (15WP) @ 395.2 ml/ha was proved to be the best. However, Puma Super 69EW @ 1250 ml ha^{-1} gave the highest grain and biological yields in wheat. Therefore, farmers whose wheat fields are prevalently dominated by monocot weeds should use Safener15WP @ 395.2 ml ha^{-1} and Puma Super 69EW @ 1250 ml ha^{-1}.

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