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Response of Dominant Weedsin Wheat Field to Herbicide Application Rate

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ABSTRACT

Providing a weed-free environment from the time of planting to canopy closure is important for strengthening the native ground cover's competitive ability against weed invasions. To study response of dominant weeds in wheat field to herbicide dose the experiment was conducted at the Research Station of the Islamic Azad University, Tabriz, Iran in 2012.The experiment was laid out in a randomized complete block design in field condition with three replicates. Seedswere hand sown on 5th April, andnitrogen was applied at the rate of 130 kg ha^{-1}, of which 50 % was applied basally and the rest at booting stage. Selective herbicides including Apyrus®, Total® and Shualieh® were used to control emerged broad leaf and narrow leaf weeds. The herbicides were applied before stem elongation of wheat in early spring with concentrations of 19.95 g *ai*, 15.96 g *ai*, 11.97 g *ai* ha^{-1} forApyrus®; 36 g *ai*, 28.8 g *ai*, 21.6 g *ai*ha^{-1}forTotal® and 24 g *ai*, 19.2 g *ai*, 14.4 g *ai*$ha^{-1}$for Shualieh®. Analysis of variance was used to test the significance of variance sources, while LSD test (P=0.05) was used to compare the differences among treatment means. Five weeks after spraying wheat plants treated with concentrations of 19.95 g *ai* ha^{-1} forApyrus®; 36 g *ai* ha^{-1} forTotal® and 24 g *ai* $ha^{-1}$for Shualieh® produced 1618, 1658 and 1620 g m^{-2} biomass, respectively, but only 1325 and 1210 g m^{-2} biomass from those treated with limited dose of 11.97 g *ai* ha^{-1} forApyrus®; 21.6 g *ai*ha^{-1}forTotal® and 14.4 g *ai*$ha^{-1}$for Shualieh®. Tillers number per plant was not affected by the treatments. With decreasing of herbicides application seed yield reduced nearly 60%, 6% and 36% in Apyrus®, Total® and Shualieh®, respectively, as compared to the full dose treatment. Wheat farmers could be obtain similar yield by reducing application rates of Apyrus® from 19.95 g *ai* to 15.96 g *ai* ha^{-1} andTotal® from 36 g *ai* to 28.8 g *ai* ha^{-1}.

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INTRODUCTION

Chemical weed control seems indispensable and has proved efficient in controlling weed [1]. In Iran, herbicide usage accounts for 41% of the total pesticide consumption. Indiscriminate use of herbicides for weed control during the past few decades has resulted in serious ecological and environmental problems, such as resistance and shifts in weed populations [2], and greater environmental and health hazards [3].

Providing a weed-free environment from the time of planting to canopy closure is important for strengthening the native groundcover's competitive ability against weed invasions. Selective herbicides kill specific targets while leaving the desired crop relatively unharmed [4]. Quality losses, due to contamination of cereal samples by wild oats, can be substantial, resulting in rejection for seed and milling. Success of a herbicide application is dependent upon weed species, the timeliness and thoroughness of application, conditions at the time of application, herbicide rate and crop management after the application. Application of herbicides in proper dose would reduce off-target movement of herbicide, and maximize weed control [5]**.**The efficacy of any herbicide depends predominately on the dose used [6] and in many instances the same is also decisive for its selectivity. Registered herbicide doses are set to achieve upper limits of weed control under varying compositions, densities, weed growth stages and environmental conditions, and there may be an overestimation of the dose required to get adequate control [7]. To ensure satisfactory weed control, even under unfavorable regimes of crop production factors, manufacturers often recommended higher than necessary doses of an herbicide. However, it is not always necessarily to apply full herbicide dose [8] and there can flexibility regarding herbicide rates depending on the weed spectrum, densities, their growth stage and environmental

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conditions[9]. In a study to compare the efficacy of Apyrus®, Total® as the two sulfonylurea herbicides on wild barley control in relation with growth stages of wild barley, Total® herbicide had better efficacy to control wild barley in comparison with Apyrus® so that by using Total in the second node and 2-4 leaf+second node density decreased to 0 (score 1). The application of herbicide Apyrus® in the second node and 2-4 leaf +second node stage of wild barley were low in quantity of wild barley efficient density and dry weight (score 5), respectively. Total® efficacy was high in 2-4 leaf stage compared to Apyrus® with decreasing 90.78% and 95.55% density and dry weight of wild barley, respectively [10]. Dose-response studies are an important tool in weed science. The use of such studies has become especially prevalent following the widespread development of herbicide resistant weeds [11].The present study was designed to determine the effect of reduced doses of newly introduced post-emergence herbicides on the weeds control under the semi-arid conditions of Tabriz, Iran.

MATERIALS AND METHODS

Site description:

The experiment was conducted at the Research Station of the Islamic Azad University, Tabriz, Iran in 2012.Tabriz (Lat. 38°, 5′; Long. 46°, 17′ and elevation 1360 m) is located at the north-west of Iran and the climate is semi-arid. Experimental soil was sandy-loam with EC of 0.80 $ds.m^{-1}$, pH of 7.2 and 0.81 % organic matter. Some of weather data in experimental site during crop growth cycle is given in table 1.

Table 1: Some of weather data for experimental site during growth period of wheat.

Month	Temperature (°C)	Precipitation (mm)	Relative humidity (%)
April	20.3	38.5	62.0
May	27.9	21.0	60.3
June	31.9	3.5	32.7
July	28.1	3.0	30.7
August	16.1	14.0	69.2
Total	-	79.0	-

Experimental design:

The experiment was laid out in a randomized complete block design in field condition with three replicates. Seeds of wheat (*Triticum aestivum* cv. *Alvand*) used for this study were obtained from Karaj Seed Improvement Institute, Iran. Moisture content of the seed was 10 %. The cultivar under study was a medium-repining variety with growth period of 115-120 days. Plot sizes was 5 m × 4 m.

In all the plots two cultivations with a tractor-drawn cultivator along with manuring 12 t ha^{-1} followed by a planking were given to achieve desirable soil structure. Then fields were plotted in the early spring before sowing. Seedswerehand sown on 5th April in rows 15 cm apart at 4-5 cm depth. Based on soil analysis fertilizers P and K were applied basally at the rate of 100 and 50 $kgha^{-1}$ respectively. Nitrogen was applied at the rate of 130 $kgha^{-1}$, of which 50 % was applied basally and the rest at booting stage. Fiveirrigations were given to all treatments until 20 days after flowering. Herbicides including Apyrus®, Total® and Shualieh® were used to control emerged broad leaf and narrow leaf weeds. These herbicides have been previously tested safe on well established wheat plants. The herbicides were applied before stem elongation of wheat in early spring with concentrations of 19.95 g *ai*, 15.96 g *ai*, 11.97 g *ai* ha^{-1} forApyrus®; 36 g *ai*, 28.8 g *ai*, 21.6 g *ai*ha^{-1}forTotal® and 24 g *ai*, 19.2 g *ai*, 14.4 g *ai*$ha^{-1}$for Shualieh®. Any pesticide used to control insects. The seeds harvested separately for each plot between 3-8August when spikes were fully ripened at the approximate moisture of 20 %.

Measurements:

At harvesting, agronomic traits and yield components was examined following standard procedures.

Statistical analysis:

Data were statistically analysed using the software MSTAT-C. Analysis of variance was used to test the significance of variance sources, while LSD test (P=0.05) was used to compare the differences among treatment means.

RESULTS AND DISCUSSION

Five weeks after spraying wheat plants treated with concentrations of 19.95 g *ai* ha^{-1} forApyrus®; 36 g *ai* ha^{-1} forTotal® and 24 g *ai* $ha^{-1}$for Shualieh® produced 1618, 1658 and 1620 g m^{-2}, respectively, but only 1325 and 1210 g m^{-2} biomass were produced in limited dose of 11.97 g *ai* ha^{-1} forApyrus®and 14.4 g *ai*$ha^{-1}$for Shualieh®. When wheat plants were sprayed with reduced doses of Total® biomass production in crop plants increased 8% and 7.4%, as compared with the over-dose treatment (Table 2). Belles *et al*. [12] reported > 85%

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and consistent control of wild oat with a half-dose of tralkoxydim and Atlantis 3.6 WG (iodo+mesosulfuron). It seems that weeds in lower dose of Apyrus® and Shualieh® have not completely controlled.

Table 2: Above-ground biomass and seed per spike in wheat plants as affected by hebicide dose.

Treatments	Apyrus®			Total®			Shualieh®			LSD (5%)
	Application rate (g *ai*ha^{-1})									
	19.95	15.96	11.97	36	28.8	21.6	24	19.2	14.4	
Above-ground biomass (g m^{-2})	1618	1400	1325	1658	1525	1535	1620	1200	1210	130.9
Seed no. per spike	20	25	24	24	27	24	13	24	25	3.2

Tillers number per plant was not affected by the treatments, and all plants produced nearlytwotillers.When crop plants were sprayed with different concentrations of post-emergence herbicides seed number produced in wheat spikes was 24.7, but only produced 20 and 13seeds per spike in those plants treated with limited dose of Apyrus® and Shualieh® (Table 2). It can be concluded that Total® is more effective than other herbicides in weed controlling especially in limited dose.

In this study, thousand grain weight in wheat follows the same trend asseed number per spike (Figure 1) and all plants improved seeds with 47 g thousand seed weight at interference with weeds, but thousand seed weight in plots with lower dose of Apyrus® and Shualieh® reduced thousand seed weight up to 23% and 19% compared with mean of other treatments. Madandoust*et al*. [13] in a study on selective herbicides and wheat cultivars resulted that there is a positive and significant correlation between thousand seed weight and seed yield of wheat.

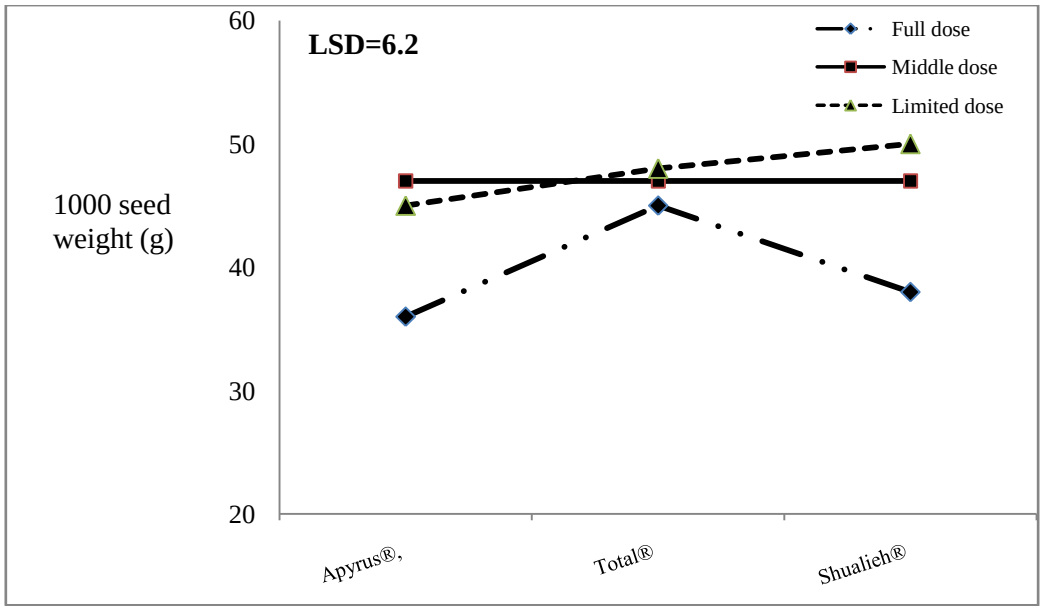

Fig. 1: Effect of herbicide dose on thousand seed weight of wheat.

Effect of herbicides and applied doses on seed yield of wheat was significant. The highest yield obtained from those plots treated with 19.95 g *ai* and 15.96 g *ai* ha^{-1} forApyrus® and 36 g *ai* and 28.8 g *ai* ha^{-1}forTotal® followed by24 g *ai* ha^{-1}for Shualieh®.

Avena species are highly competitive, resulting in greater reduction of wheat seed yield, i.e., 85% at 320 seedlings per square meter. Rao [3]emphasized on seed yield reductions of 26 to 63% from four bread wheat cultivars at 90 weed seedlings m^{-2}. With decreasing of herbicides application seed yield reduced 60%, 6% and 36% in Apyrus®, Total® and Shualieh®, respectively, as compared to the full dose treatment (Figure 2). A mix stand of narrow leaf and broad-leaved weeds is reported to cause 48% yield loss of wheat [14]. Numerous herbicide molecules at lower than recommended rates are effective enough to provide satisfactory weed control without sacrificing yields and increasing weed infestation in the following years [7, 15]. Reduced herbicide doses seem to offer a promising tool for decreasing herbicide usage across the globe. Zhang *et al*. [7] reviewed use of reduced herbicide doses and concluded that weed control efficiency tends to be lower and more erratic at reduced doses than at recommended doses, although it was commercially acceptable in most cases.

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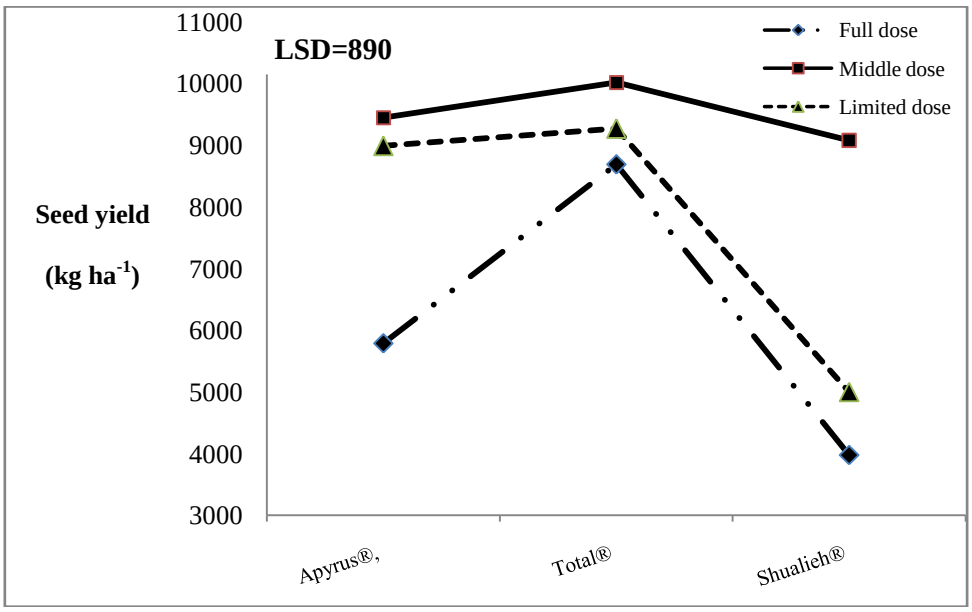

Fig. 2: Effect of herbicide dose on seed yield of wheat.

Conclusion:

Wheat farmers could be obtain similar yield by reducing application ratesofApyrus® from 19.95 g *ai* to 15.96 g *ai* ha^{-1} and Total® from 36 g *ai* to 28.8 g *ai*ha^{-1}.

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