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Chemical control of wild darnnel (*Lolium perenne* L.) in the field of wheat (*Triticum sativum*)

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ABSTRACT: Herbicide control is now the merely option in wheat production in control of *Lolium perenne* because of the high level of infestation and the scarcity and cost of labor for hand rouging. In order to evaluate the effects of kind and dose of herbicide in control of darnnel and improvement of wheat yield, an experiment of factorial in the form of complete randomized block design with four replications was done in a field in saveh region. The first factor was four levels of herbicide, consists of Puma super, Topic, Showalie, and Total. The second factor, was three levels, consists of standard dose, standard dose + 25% extra, standard dose+ 50% extra. Results of this experiment showed that Total and Showalie can reduce some characters of darnnel such as number of plant, fresh and dry weight and height of darnnel more than puma super and Topic. Subsequently Tolal and Showalie were able improving agronomic characters of wheat such as plant density, fresh and dry weight and height of wheat and finally with reducing growth of darnel, increasing yield of wheat was observed. Moreover increasing dose of herbicide by 25% and 50% extra affected darnel and wheat traits.

Key word: herbicide, darnnel, yield, dose of application.

INTRODUCTION

Wheat production in world economy and role of it is significance both in terms of cultivated land and food supply, feeding and commerce (István). The largest crop area is devoted to wheat and the quantity produced is more than that of any other crop. This occupies about 17% of the world's cropped land and contributes 35% of the staple food (Pingali and Mexico 1999). In 2010, wheat (*Triticum sativum* L.) was the second most important cereal crop after maize, and it is a staple food for billions of people of the world (Satorre and Slafer 1999). Grain yield loss in wheat by weeds is estimated to be 25% (Montazeri *et al.,* 2005). Different methods, including agronomic practice, mechanical and chemical weed management have been reported, but one of the most important methods is chemical control so that without it crop yield will be decreased significantly due to weeds (Martin and Felton 1993). Chemical weed control seems indispensable and has proved efficient in controlling weed (Kahramanoglu and Uygur 2010). *Lolium perenne* is one of the dominant troublesome weed in most wheat field of Iran. Grain seed mixture with *L. perenne* is poisoning due to the function of fungus which is active on the *L. perenne* seed (Musavi *et al.,* 1380). Moreover it can reduce grain yields of wheat by as much as 36% through competition (Appleby *et al.,* 1976, Hashem *et al.,* 1998).

Wheat yield was reduced by 7% at the density of 10 weeds per m^2 (Liebl and Worsham 1984). An obvious reduction in wheat tilling and nitrogene and phosphor source (Perez-Fernandez *et al.,* 1998) was reported in wheat and *L. perenne* competition.

About 22 types of herbicide have been registered in Iran to control weeds in wheat fields, eight of them are suitable for broadleaves and five of them are dual purpose (Zand *et al.,* 2007). Therefore the aim of this experiment was to study a group of herbicides and dose of them to understand their effects for choosing the best treatment.

MATERIALS AND METHODS

Field trials were conducted at Agricultural Research Farm, in Saveh, Markazi province, Iran (35º18_ N latitude, 50º20_ E longitude and altitudes of 1580 m) during 2014. The research field had a clay loam soil. The location was chosen for heavy natural infestation of *L. perenne* and was also characterized by relatively low level of infestation of other weed species. After plough and disk, plots were prepared. The experimental design was laid out in a randomized complete block with four replications. The plots were 6 m long and consisted of 7 rows and 2 rows apart. The selected wheat rigid was Pishtaz and seeds were planted manually (250 kg/ha). Two factors including four kinds of herbicides and different dosage was conducted. The first treatment was four kinds of herbicides, consists of Puma super, Topic, Showalie and Total. The second treatment was three levels consist of standard dose, standards dose + 25% extra, standard dose + 50% extra. Standard dose for total, showalie, topic and puma super was 1, 1, 1 and 0.5/1000 respectively. Herbicide spraying was done at the 2-6 leave stage of plant.

A. Data collection

The data were recorded on the following parameters:

Plant density, plant height at maturity, fresh and dry weight bio-mass and grain yield (kg ha^{-1}). Data were collected in sample of 10 tagged plants of each plot of the inner three rows.

B. Statistical Analysis

The Collected dates were subjected to the analysis of variance using SAS software. Mean were compared with Least Significance Difference (LSD) at 1% probability level.

RESULTS AND DISCUSSION

A. Plant density

The statistical analysis showed that kind and dose of herbicides had a significant (P<0.01) effect on weed number per m^2. Maximum weed density was recorded with the application of Puma super (standard dose)(136.61 n/m^2) followed by Topic (standard dose)(108.45n/m^2) while minimum weed density was recorded at Showalie treated plot (32.15 n/ m^2) with weed controlling efficacy of (standard dose +50%). Non significant result was recorded at the application of (standard dose +50%) and (standard dose + 25%) (Table 1,2).

Different interaction of herbicide and dose had significant effects on wheat density(P<0.01). Greatest reduction of wheat density occurred at Topic(standard dose +50%) treatment which statically is in the same group with puma Super(standard dose +25% & 50%).

Although the Total herbicide treatment showed the highest number of wheat density, results showed that significant difference wasn't observed by increasing the dose of Total (standard dose+25%) in comparison standard dose and by increasing dose(standard dose + 50%), results led to significant reduction in wheat density.

Table 1: Analysis of variance of measured traits in *L. perenne.*

SOV	df	Weed density	Weed height	Fresh weight	Dry weight
repeat	3	75.03ns	20.73ns	26331.57ns	5954.63ns
Herbiside kind	3	17736.90**	1631.99**	18737.42ns	153244.05**
Herbiside dose	2	4044.60**	31.78ns	213490.51**	29882.05**
Kind * Dose	6	1390.29**	10.72ns	20031.61ns	5412.74ns
Error	33	23.90	47.40	18139.29	5026.82
CV	-	6.64	8.92	11.55	12.81

**: significant at the level of 1% ns: None significant at the level of 1%

B. Plant height

The results showed that interaction effect of herbicide kind and dose on weed height was significant (p<0.01). Maximum plant height was recorded at all three dose of puma super treated plots(90.49 cm^2) while minimum plant height was recorded at the Total plots (47.81cm^2) with the application of standard dose +50%. In addition Total (standard dose + 50%) is the best treatment for weed height reduction (Table 2).

According the results, herbicide kind hadn't significant effect on wheat height but herbicide dose and interaction effect of them had significant effect on plant height. The highest wheat height was related to the treatments of Total (standard dose) (112.20 cm^2) and the lowest height was belonged to the treatment of Puma super(standard dose + 50%)(103 cm^2) (Table 3).

None significant effect of herbicides on wheat parameters was expected due to the other analysis index results which proved that kind of herbicides didn't affected wheat parameters such as fresh and dry weight. Increase in wheat height in related treatments is due to better control of *L. perenne* not because of optimal effect on the wheat plant. In other words, the height of wheat plants treated with standard doses is due to reduced competition between wheat and weed.

C. Fresh weight

According the results, kind of herbicide, dose and interaction effect of them on fresh weed biomass was significant (p<0.01). Maximum fresh weed biomass (1373.93 kg/ha) was recorded in the Topic plots treated (standard dose) followed Puma super (1268.41 kg/ha) (standard dose) while minimum fresh weed biomass (872.98 and 907.40 kg/ha) was recorded at Showalie and Total plot treated with the application dose of standard +50%. According the results, Showalie (standard dose + 50%) is the best treatment for inhibitory effect on fresh weight biomass (Table 2). Wheat Fresh weight was affected by interaction effect of herbicide kind and dosage. Maximum fresh weight was observed in Total treatment (recommended dose +50%) and minimum fresh weight was related to Puma super for three mentioned dose (Table 3).The results show that increasing the dose of herbicide not only adversely affect the wheat crop , but also by reducing the growth of ryegrass can promote the growth of plants. Total Showalie can be more successful in promoting wheat growth in comparison with Puma super. Increasing in wheat growth not only is effective in yield, but also can reduce weed growth by shading.

Table 2: Effect of herbicides and dose on *L. perenne* traits.

Herbicide	Dose	Plant density n/m^2	Plant height cm^2	Fresh weight kg/ha	Dry weight Kg/ha
Total	standard	47.77 d	64.61 c	1010.97 cd	552.45b
	standard +25%	45.03 d	63.33 c	1076.63 cd	458.55c
	standard +50%	37.65 d	47.81 d	907.40 d	330.88 d
Showalie	standard	54.22 d	78.49b	1146.40c	497.41 bc
	standard +25%	38.61e	67.49 c	1015.22 cd	482.42 bc
	standard + 50%	32.15 e	63.88 c	872.98 d	461.09 c
Topic	standard	108.45b	79.33b	1373.93 a	704.89 a
	standard + 25%	98.35 b	79.13b	1216.79 b	677.75 a
	standard +50%	101.10 b	76.43b	1149.12 c	645.63 a
Puma super	standard	136.61a	90.49 a	1268.41 a	649.73 a
	standard +25%	98.34 b	90.49a	1299.74 b	616.91 ab
	standard + 50%	81.81 c	90.04 a	1149.54 b	593.30 b

Table 3: Effect of herbicides and dose on grain yield and yield components of wheat.

Herbicide	Dose	Plant Height Cm^2	Fresh weight Kg/ha	Dry weight Kg/ha	Grain yeild Kg/ha
Total	standard	112.20 a	25036.15 bc	8812.72 b	5214.27 b
	standard + 25%	109.50 ab	26473.35 b	9318.61 a	5608.24 a
	standard + 50%	111.00 a	27763.04 a	9772.59 a	5845.58 a
Showalie	standard	110.75 ab	24768.12 c	7818.38 b	5058.14 d
	standard + 25%	109.00 ab	25760.39 bc	9067.65 ab	5360.06 c
	standard + 50%	104.25 b	27017.42 a	9510.13 a	5683.80 a
Topic	standard	110.50 ab	20864.54 d	7344.32 c	4019.53 e
	standard + 25%	109.00 ab	22334.99 cd	7861.91 c	4417.03 e
	standard + 50%	106.00 ab	23773.98 c	8368.44 b	4806.15 d
Puma super	standard	108.25 ab	23623.72 c	8315.54 b	4765.39 d
	standard + 25%	110.75 ab	23900.56 c	7412.99 c	4840.13 d
	standard + 50%	103.00 b	24111.39 c	7877.21 c	3897.41 e

D. Dry weight

According the result, kind of herbicide, dose and interaction effect of them on fresh weed biomass was significant ($p<0.01$). The Lowest weed dry weight was related to the treatments of Total (standard dose + 50%) (330.88g) and the highest dry weight was belonged to Topic (standard dose)(704.89g) (Table 2).

Wheat dry weight significantly affected by herbicide kind, dose and interaction effect of them. The most effective herbicide on dry weight were total and Showalie (standard dose +50%) while Topic (satndard dose) and puma super (standard dose +25%) hadn't a good performance. In these treatments the wheat dry weight was 7344.32 and 7412.99 kg/ha respectively. Maximum dry weight was 9772.59 and 9510.13 kg/h which belong to total and Showalie respectively (Table 2). The results proved that increasing the dose of herbicide to reduce the growth of mentioned weed can cause further growth of wheat plant.

E. Grain yield

Statistical analysis shows that significant ($p<0.01$) variation was observed on grain yield of wheat. Maximum Grain yield was harvested at Total (standard dose +25% and) treated plots with the mean of 5845.58 kg/ha followed by Showalie (standard dose + 50%) (5683.80 kg/h) and Total(standard dose +25%)(5608.24 kg/ha). Although the differences between them is nearly 200kg/ha, but this difference was not significant statistically. Minimum grain yield was recorded at Puma super (standard dose +50%) (Table 1&2).

The results show that the Total and Showalie herbicide not only be to the good darnnel control, but can also increase the grain yield. Moreover they improve agronomic characteristics of wheat such as plant density, fresh and dry weight biomass and plant height and finally wheat yield will be increased by reducing the growth of *L. perenne.*

The results of this study showed that increasing the dose of herbicide strategy can be reduce indicators such as number of weed density, fresh and dry weight but significant effect in some wheat traits such plant density and grain yield wasn't observed. Increasing the dose of herbicide by 25 % and 50% more than the recommended amount statistically wasn't significant on weed weight loss and dry weight. Increasing the dose of herbicide by 50% more than recommended dose couldn't affect grain wheat. Therefore increasing the dose of herbicide strategy has been successful only in reducing the growth of darnnel and no role for increasing in grain yield was observed.

CONCLUSION

According the results of interaction effect of herbicide and dose, Total and Showalie (recommended dose +25%) are the most appropriate treatment in decreasing *L. perenne* traits (density, fresh and dry weight) and Improving wheat traits(yield, fresh and dry weight).

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