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EVALUATION OF DUAL PURPOSE HERBICIDES IN WHEAT (*Triticum aestivum* L.) UNDER DIFFERENT TILLAGE REGIMES

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ABSTRACT

Different doses of dual purpose herbicides (sulfosulfuron, metsulfuron-methyl 30 % + iodosulfuron–methyl–sodium 30 %, imazamethabenz- methyl and metribuzin) were studied to determine their effect on grain yield of wheat. The experiment was conducted at Islamic Azad University Experiment Station, Shooshtar Branch, Iran during 2006. Randomized complete block design was used having three replications, where two levels of tillage (conventional and minimum tillage) were assigned to the main plot while different levels of herbicides (sulfosulfuron 26.6 and 31 g a.i. ha^{-1}, metsulfuron–methyl 30 % + iodosulfuron – methyl l- sodium 30 % 350 and 400 g a.i. ha^{-1}, imazamethabenz - methyl 2 and 3 l ha^{-1} and metribuzin 200 and 300 g a.i. ha^{-1}) were assigned to sub-plots. The results showed that conventional tillage was better than minimum tillage in terms of weed control and significant difference was found between the tillage levels ($P< 0.01$). Using 31 g ha^{-1} sulfosulfuron in conventional tillage and 31 g ha^{-1} sulfosulfuron and 400 g ha^{-1} metsulfuron – methyl 30 % + iodosulfuron – methyl – sodium 30 % in minimum tillage were the best treatments. No significant differences were found in the tillage levels regarding broadleaf weed control although their density was more in conventional tillage. Using 31 and 26 g a.i. ha^{-1} sulfosulfuron, 350 g a.i. ha^{-1} and 400 g a.i. ha^{-1} metsulfuron – methyl 30 % + iodosulfuron – methyl – sodium 30 % in both tillage systems gave highest broadleaf weed control. Density of grassy weed was more in minimum tillage. The highest grassy weed control was observed using 31 and 26 g ha^{-1} sulfosulfuron, 350 g ha^{-1} and 400 g a.i.ha^{-1} metsulfuron–methyl 30 % + iodosulfuron –methyl–sodium 30 % in both tillage systems. There was no significant difference between two tillage systems regarding grain yield of wheat. Sulfosulfuron 26.6 and 31 g a.i. ha^{-1} and metsulfuron–methyl 30 % + iodosulfuron–methyl–sodium 30 % 350 and 400 g a.i. ha^{-1} had the highest level of wheat grain yield, respectively.

Key words: Wheat, tillage systems, weed, herbicide.

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INTRODUCTION

Weed infestations greatly decrease the wheat yield and quality and thus deprive millions of people of grains (Khan and Marwat, 2006). In advanced countries weeds are managed effectively and can cause minimum losses up to 5 % while in developing or under developed countries the losses may exceed 25 % in wheat. The increasing requirements of high crop production, energy crisis and minimizing weed control expenses have led us to use herbicides for weed control. Despite the facts that the use of chemicals deteriorates environment, herbicides are still the most common method of weed control (Montazeri, 2005). In minimum tillage systems, tillage is a part of the system and attached to herbicides. By using herbicides, the number of tillage operations could be decreased. In addition, using minimum tillage systems and tillage free system leads to moisture saving and reducing tillage expenses (Ross and Lembi**,** 1985). Usman *et al.,* (2009) reported that maximum weed density was observed in conventional tillage while minimum weed density was observed in zero tillage. However herbicides in combination will tillage greatly decreased the weed density and increased grain yield of wheat.

Despite using herbicides in minimum tillage system, there are limitations in selecting herbicides to control weeds in this tillage system and using a particular herbicide might lead to development of herbicide resistant broadleaf weeds and grasses (Holt**,** 1992).

Rojas *et al.,* (1984) compared conventional tillage (once with moldboard plow and twice with disk plow) and minimum tillage (once with disk plow) and without tillage by using herbicides found out that in minimum tillage weed population was less than other treatments; on the other hand, in zero tillage system, weeds were controlled better. Bradford and Calvin (2002) reported that in winter wheat, imazamethabenz-methyl herbicide in concentration of 0.36 kg ha^{-1} and 0.18 kg ha^{-1}, controlled wild oat up to 84 %. Using 0.18 kg ha^{-1} concentration in two stages showed 13 % more control of wild oat compared to one time application of 0.36 kg ha^{-1}.

The aim of this research work was to study weed control in wheat by using dual purpose herbicides and tillage systems and to select the best herbicide regarding the type of tillage as well as with respect to preventing acatalectic enzyme activity that decrease growth and finally destroy the weeds. These herbicides control weeds such as wild mustard as well as leave no undesirable effects on wheat growth. By increasing effectiveness of perennial broadleaf weed control, it is necessary to choose herbicides with better weed control and should be safe for the target crop and friendly to the environment.

MATERIALS AND METHODS

Field experiment was carried out in the Educational Research Experimental Farm, Faculty of Agriculture, Islamic Azad University, Shoushtar Campus in north Shoushtar, Iran; situated at 48° 50′ E longitude, 32° 3′ N latitude and at 67 m asl. This experiment was performed during 2006-2007 in randomized complete block design with split-plot arrangement replicated three times. To main plots two levels of tillage (conventional and minimum) and to the sub-plot were ten levels of herbicides (imazosulforon methyl 30 %, iodosulfuron methyl 30 %, 350 and 400 a.i. g ha^{-1}, sulfosulfuron 75 %, 26.6 and 31 g a.i. ha^{-1}, metribuzin 70 %, 200 and 300 g a.i. ha^{-1}, imazamethabenz methyl 25 %, 2 and 3 l ha^{-1}, a hand weeding and a weedy checks) were assigned. The distance between replications was 2 m and sub-plots were 1 m. The size of each main plot was 3.5x 30 and sub plot measured 3 x 2 m^2, respectively.

Imazasulfuron methyl 30 % and iodosulforon methyl 30 % as WDG (water diffusible granules) during the first stage of tillering alongwith surfactant moaning, 1.5 per thousand, sulfosulfuron 75 % as WDG in tillering stage plus one litre non-ionic moaning oil were used. Imazamethabenz-methyl with 25 % emulsion in the first stages of wheat tillering and metribuzin in powder formulation was applied as pre-emergence. In conventional tillage the land was prepared by plowing once with moldboard plow and plowings twice with disk plow vertical on each other. For minimum tillage, the land was plowed once with disk plow. On December 1, 2006, wheat was carefully cultivated manually with 400 bushes m^{-2} in homogenous spread in the experimental fields. Sampling was made in different stages of wheat growth until final harvesting. In each stage, samples were taken from middle lines of each plot by observing the margins from up and down with 50x50 cm frame. The samples were taken to the lab and data were recorded on harvest index of wheat and row and wheat yield m^{-2}. Weeds samples were taken before and after spray treatment. Number of weeds m^{-2} determined and the effects of herbicides were recoded. Counting, determining species, shape in terms of narrow leaf or broadleaf and dry weight of weeds were done 30 days after spray. Counting and sampling weeds were carried out in the center of the experimental field in one square meter area. The analysis of variance was run by MSTATC software, comparing mean averages by Duncan's multiple range test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The results showed that tillage system has a significant effect on controlling weeds. Weed control in conventional tillage was better than that of minimum tillage (Table-1). It was noted that using sulfosulfuron herbicides 31 g ha^{-1} in conventional tillage and sulfosulfuron 31 g ha^{-1},

metsulfuron methyl 30 % + iodosolforon methyl 30 % 400 g ha^{-1} in minimum tillage were more successful in reducing weed population. The higher doses of herbicides in both tillage systems were better in reducing weeds. Imazamethabenz methyl was poor in terms of weed control especially on broad leaf weeds. Hand *et al.,* (2002) also investigated metsulfuron methyl 30 % + iodosulfuron methyl 30 % had better performance in controlling broadleaf weeds in wheat. On the other hand according to Etzenberg and Wasser (2003), sulfosulfuron herbicide was superior in controlling narrow leave weeds. Metsulfuron methyl 30 % + iodosulforon methyl 30 % 400 g a.i. ha^{-1} and sulfosulfuron herbicides 31 g a.i. ha^{-1} were best in controlling broad leaf weeds (Fig. 1). However, metsulfuron methyl 30 % + iodosolforon methyl 30 % 350 g a.i. ha^{-1} were poor in controlling*Convolvulus arvensis*, sulfosulfuron 26.6 g a.i. ha^{-1} in controlling mallow and black bindweed (*Polygonum convolvulus*), imazamethabenz methyl herbicide 2 and 3 l ha^{-1} in controlling safflower, black bindweed and lesser bindweed (*Convolvulus arvensis*), metribuzin 200 and 300 g a.i. ha^{-1} in controlling lesser bind weed and mallow weeds, respectively.

Grassy weeds decreased in conventional tillage as compared to minimum tillage. It has been reported by Fenster *et al.,* (1969) that moldboard plow showed better narrow leave weed control than the disk plow. Mezasulfuron methyl 30 % + iodesolforon methyl 30 % herbicides 350 and 400 g ha^{-1} and sulfosulfuron 26.6 and 31 g ha^{-1} had highest effects in controlling grassy weeds. Dry weight of weeds was higher in conventional tillage. Desirable conditions in conventional tillage, high soil porosity and better gaseous exchange might have caused vigorous root growth of weeds which resulted in better weed growth and maximum utilization of resources. In contrary, dry weight of broad leaf weeds in minimum tillage were lower than that of conventional tillage, which might be attributed to lesser root growth under minimum tillage conditions (Zank**,** 1993).

There is no significant differences between tillage systems in terms of grain yield (Table-1); however, there was significant difference on grain yield in as much as sulfosulfuron 31 and 26.6 g ha^{-1} and mezasulfuron methyl 30 % + iodosulfuron methyl 30 % 350 and 400 g ha^{-1} were the most superior herbicides in grain yield; while imazamethabenz methyl 2 and 3 litre ha^{-1} was the weakest in wheat grain yield (Fig. 1). In terms of wheat stem height, there was a significant difference between tillage systems and conventional tillage was superior to minimum tillage (Table-1). Results showed control treatments had better height than herbicides treatments and followed by sulfosulfuron 26.6 g ha^{-1} and mezasulfuron methyl 30 % + iodosulfuron methyl 30 %, 350 and 400 g ha^{-1} (Fig. 2).

Table-1. Mean squares for measured characteristics in the experiment.

Source of Variation	Degree of Freedom	Weed density before application (m^{-2})	Weed density after application (m^{-2})	Density of broadleaf weeds (m^{-2})	Density of grassy weed (m^{-2})	Dry weight of weed (g m^{-2})	Harvest index of Wheat	Performance increased (%)	Straw yield (g m^{-2})	Grain yield (g m^{-2})
Replication	2	0/04^{ns}	0/087^{ns}	0/09^{ns}	0/015^{ns}	0/03^{ns}	0/83^{ns}	4^{ns}	827/25^{ns}	12/95^{ns}
Tillage systems	1	8/7**	1/7**	2/2**	0/1**	98/6**	4/86**	1^{ns}	572/08^{ns}	5783^{ns}
Herbicides	9	111/15**	41/002**	35/9**	3/9**	2914/1**	101/7**	4740/9**	148138**	94246**
Interaction	9	0/2**	0/4**	0/50**	0/1**	39/2**	9/5^{ns}	48/7**	1153/4^{ns}	912^{ns}
Coefficient of change		0/03	0/04	0/04	0/02	0/9	1/04	1/2	672/2	19/5

Ns *, **, non-significant, significant and highly significant, respectively.

In conventional and minimum tillage systems, there was no significant difference between wheat straw yield in as much that in conventional tillage and minimum tillage, due to surface wheat root, the existing space is used desirably without differences between the system; however, there was significant differences between the straw yield of the two systems (Table-1). The sulfosulfuron treatment 31 g ha^{-1} in both conventional and minimum tillage system increased wheat straw yield due to controlling weeds and no competition with farm plants and existence of suitable environment for root growth in soil. This increase in straw yield is a factor in increase in grains. Imazamethabenz methyl and metribuzin lower wheat straw yield due to burning effect, affecting growth of root and aerial parts of the wheat as well as their less efficient weed control. Marwat *et al.,* (2007) reported that conventional tillage decreased weed density and increased grain yield as compared to reduced tillage in maize.

In the light of our results it is concluded that using conventional tillage system along with herbicides effectively controlled weeds. By using higher dose of herbicides in minimum tillage system, we can achieve desirable weed control. Among herbicides, sulfosulfuron, 31 g ha^{-1} was more effective in controlling broadleaf as well as grassy weeds in both tillage systems, without damaging wheat. While, there was no significant difference on the yield and root growth of wheat under both tillage system.

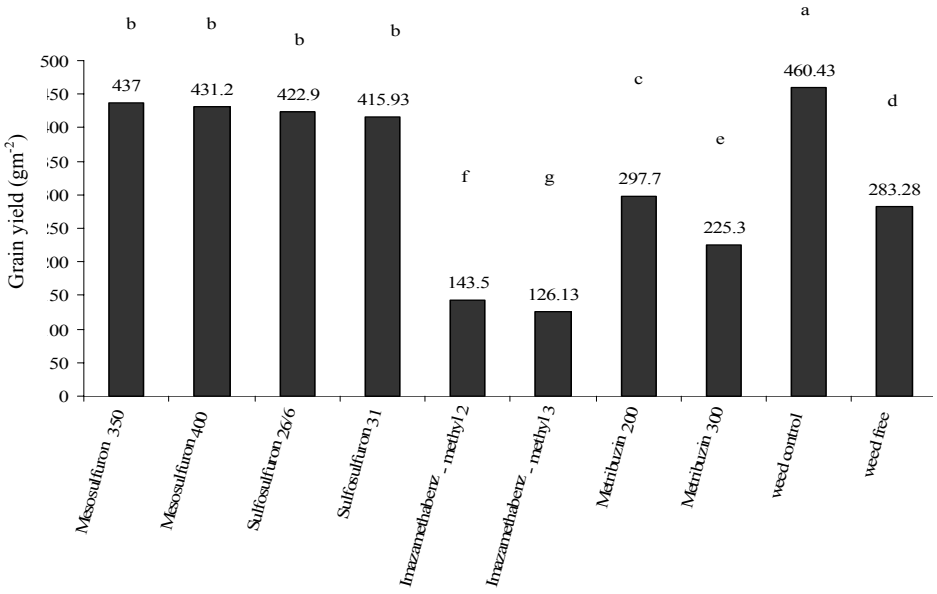

Fig. 1. Effects of different herbicides on grain yield (g m^{-2}) of wheat. (Bars as shown with different letters are significant at P≤0.05).

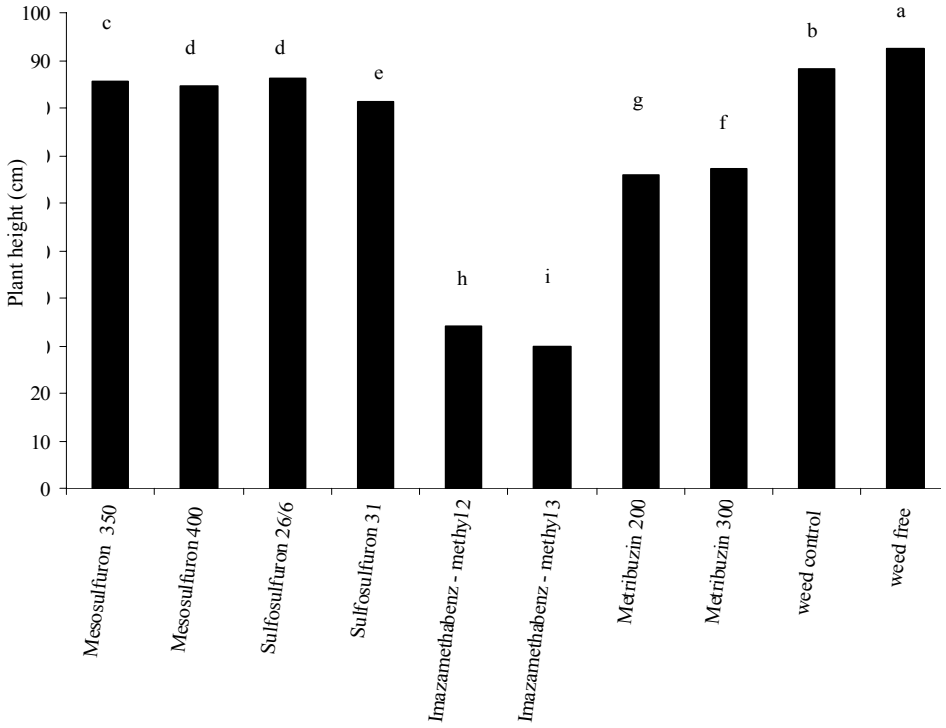

Fig. 2. Effects of herbicides on Plant height
(Bars as shown with different letters are significant at P≤0.05)

REFERENCES CITED

Bradford, K. and G. Calvin. 2002. Low-Rate split-Applied herbicide treatments for *Avena fatua* control in wheat. Weed Technol. 16: 149-155.

Etzenberg, H. and J. Wasser. 2003. The potential of sulfosulfuron to control troublesome weeds in tomato. Weed Technol.17: 133-137.

Fenster, C.R., C.E. Domingo and O.C. Burnside. 1969. Weed control and plant residue maintenance with various tillage treatments in a winter wheat fallow rotation. Agron. J. 61: 250-259.

Hand, S.S., T. Smith, J. Sanderson and G. Barr, W.F. Strachan and M. Paulsgrove. 2002.AEF130060-a new selective herbicide for grass control in wheat. Proc. South. Weed Sci. Soc. 55: 142-143.

Holt, J.S. 1992. History of identification of herbicide-resistant weeds. Weed Technol. 6: 615-620.

Khan, M.A. and K.B. Marwat. 2006. Impact of crop and weed densities on competition between wheat and *Silybum marianum*. Pak. J. Bot. 38 (4):1205-1215.

Marwat, K.B., M. Arif and M.A. Khan. 2007. Effect of tillage and zinc application methods on weeds and yield of maize. Pak. J. Bot. 39 (5): 1583-1591.

Montazeri, M. 2005, Weeds and Control in Wheat Farms of Iran. Research and Education of Agriculture, P. 85.

Rojas, G., D. Alvarez and J. Chavarria. 1984. Comparison of three soil tillage systems in wheat, barley and oats during three seasons. Ciencia-e-Investigacion Agraria 11: 63-72.

Ross, M.A. and C.A. Lembi. 1985. Applied Weed Science. Burgess Publishing Company, Minneapolis, USA. P. 340.

Steel, R.G.D. and J.H. Torrie. 1980. *Principles and Procedures of Statistics*. *A biometrical approach*, 2nd Ed. McGraw Hill, Inc. USA.

Usman, K., S.K. Khalil, F. Mohammad, M.A. Khan and A.Z. Khan. 2009. Weed management in wheat as affected by tillage and herbicides. Pak. J. Weed Sci. Res. 15 (2-3): 155- 169.

Zank, J.U. 1993. Effects of tillage and herbicides corn (*Zea mays*) production, net return, weeds, and soil properties. Dissert. Absts., Cornel University, Ithaca, New York, P. 3853.