International Journal of Agronomy and Agricultural Research (IJAAR)
ISSN: 2223-7054 (Print) 2225-3610 (Online)
http://www.innspub.net
Vol. 5, No. 3, p. 80-89, 2014

INNSPUB

RESEARCH PAPER OPEN ACCESS

The effect of application time of axial herbicide on the yield of different cultivars of wheat for the control of wild oat (*Avena fatua*)

Mehrnoosh Golabi[1*], Shapoor Lorzadeh[2], Nazer Arian Nia[3]

[1]*Islamic Azad University Shooshtar Branch, Iran*

[2]*Department of Identifying and Combating Grass Weeds Shooshtar Branch Islamic Azad University Shooshtar Iran*

[3]*Branch Islamic Azad University Shooshtar Iran*

Article published on September 22, 2014

Key words: Cultivar, herbicide, weed.

Abstract

A split plot experiment was carried out as a randomized complete block design with three replications. The main treatment included three cultivars of the wheat (Chamran Dez Star) and the sub treatment included three application times of herbicide (early tillering mid tillering late tillering) and the control with and without weeding. The results showed that the effect of cultivar on the wheat yield components was significant at 1% level and its effect on the plant height number of grains per spike grain yield and number of wild oats was significant at 5% level. The effect of application time on the wheat yield and its components and weeds characteristic was significant at 1% level and the interactive effect of cultivar and application time on the grain yield 1000-grain weight number of spikes per square meter number of grains per spike number of spikelet harvest index number weight and height of wild oats was significant at 1% level. The highest number of grains per spike and the highest number of spikes per square meter belonged to Chamran cultivar and the best application time of herbicide was in the early tillering. According to the results the highest grain yield by 5550 kg/ha belonged to the treatment with Chamran cultivar in the early tillering. Therefore the best cultivar is Chamran cultivar and the best herbicide application time is in the early tillering.

* **Corresponding Author:** Mehrnoosh Golabi ✉ mehrnooshgolabi@gmail.com

Introduction

Wheat with the scientific name of *Triticumaestivum L*belongs to Poaceae family and grows and grows in a large variety of weather conditions around the world and it is actually the main food for human being. In terms of production and the area under cultivation wheat is the main crop in Iran and its cultivation area is about 6.2 million hectare (about 53% of the arable land in Iran) with an annual production of about 11 million tons. Therefore the increase of the yield per area unit is very important and it is subject to certain factors. One of them is the right weed management. One of the main methods to control the weeds in the wheat fields in Iran during the last thirty years has been the application of herbicides. One of the herbicides used for the wheat around the world is pinoxadenwhich belongs to acetyl coenzyme A carboxylase (ACCase) inhibitors. These inhibitors are considered as important and effective herbicides which are used selectively to control narrow leaf weeds such as the wild wild oat.Pinoxadenis a post emergent herbicide which is used to control different narrow leaves particularly the wild oats and belongs to this family. Wild wild oat belongs to Poaceae family which is found in most provinces of Iran as a grass weed due to its adaptation to different biodiversity and ecological conditions and is considered as one of the most common grass weeds causing major damage annually. Moreover this grass weed belongs to the same family as the wheat. Many post-emergent residual herbicides do not harm the soil seriously so the farmers often delay the application of such herbicides and in order to ensure that the majority of grass weeds have grown they fight them in the last moments using more herbicides. This kind of struggle costs a lot and causes environmental pollution. Therefore by setting the right time to use the herbicides the problem is solved.

Chemical control of grass weed in wheat due to lower cost of spraying is preferred to the unusual manual weeding operation.One of the main methods to control the weeds in the wheat fields in Iran during the last thirty years has been the application of herbicides (Baghestani 2007; Zand 2007). Sabeti *et al.* (2009) stated that the best herbicide treatments in Kermanshah are Total Megaton and the hybrid of Bromicide and Topic respectively.

One of the herbicides used for the wheat around the world is pinoxaden which belongs to acetyl coenzyme A carboxylase (ACCase) inhibitors. These inhibitors are considered as important and effective herbicides (Délye 2005) which are used selectively to control narrow leaf weeds such as the wild wild oat (Friesen 2000). This group contains two families of Aryloxyphenoxypropionate (APP) and Cyclohexane Dione (CHD) aryloxyphenoxypropanwild oate) and CHD (cyclohexane Dione) which are generally known as “Fop” and “Dim” (Délye 2005). In an experiment Durgan *et al* (2007) showed that application of axial herbicide against the wild wild oat on May 18 and May 25 with equal proportion in three levels increased the wheat yield during the first time of fighting compared with the second time and no damage to the wheat was observed. Hofer (2006) stated that axial herbicide can be applied since 2-leaf stage to stem elongation stage.

Some of the objectives of this research are as the following:

1. Determining the effect of axial application at three different times
2. Determining the effect of axial application in three different wheat cultivars
3. Comparison of the cultivars’ responses to the herbicide at three different times
4. Comparison of wild wild oat control by axial herbicide in different wheat cultivars.

Materials and methods

This research was conducted in an experimental field located in Shooshtar MianAab region in the village of Hassam Abad. It was a split plot experiment in the form of randomized complete block design with three replications. The main treatment within the main plots included three cultivars of the wheat (a1= Chamran a2= Star a3= Dez) and the sub treatment included five levels of application time of axial herbicide (1.early wheat tillering 2. mid

wheattillering 3. late wheat tillering 4.control with weeding 5. control without weeding). The experiment was conducted with three replications and it generally contained 45 experimental plots. Before selecting the experimental field the project site was reviewed in terms of various ranges of grass weeds during the past years and after getting enough information about the site the experiment was conducted. Plantation was done manually due to having different cultivars. In order to calibrate the spraying the wet surface was calculated by application of 2 liters water and the required water for each plot was determined. In this experiment backpack type sprayer was used. The rate of applied herbicide according to the announced standards was 450 ml/ha along with the surfactant. The measured traits included number of spikes per area unit number of grains per spike 1000-grain weight biological yield of wheat grain yield number of spikelet harvest index number weight and height of wild oat number and weight of broad leaf and narrow leaf grass weeds and leaf area index of the wheat. With regard to the physiological maturity of all treatments that is when the wheat plants were getting yellow and the moisture content of the grains was 15% harvesting was done. Then all the sample bags were weighed in the laboratory. In order to analyze the data MSTATC software was used. The means were compared using Duncan's multi range test. In order to draw the diagrams Excel software was used.

Results and discussion

Number of Wild oats

The ANOVA results showed that the effect of application time and the interactive effect of cultivar and application time on the number of wild oats were significant at 1% level and the effect of cultivar on the number of wild oats was significant at 5% level (Table 1). Mean comparison results showed that the highest number of wild oats by 5.1 belonged to Dez cultivar and the lowest number by 3.9 belonged to Star cultivar (Table 2). Considering the application time the highest number of wild oats by 8.2 wild oats belonged to the control treatment without herbicide and the lowest number by 1.5 belonged to the early tillering time (Table 3). Moreover In terms of the interactive effect of cultivar and application time the highest number of wild oats by 9 wild oats belonged to Chamran cultivar in the late tillering stage and the lowest number by one wild oat belonged to Chamran cultivar in the early tillering stage (Table 4). It seems that the decrease of number of wild oats by the application of herbicide during the early tillering stage results from the small size of wild oat and more control and further effect during this time. S. Travlos *et al.* (2011) reported that axial herbicide affected 92% of the wild oat population resistant to diclofop.Jamali *et al.* (2010) compared axial with other herbicides and stated that application of at least 1.25 lit/ha new axial herbicide in Dez cultivar increased the control of wild wild oat and agricultural biomass of the wild oat.

Table 1. The ANOVA results of experimental treatments based on grass weeds and wild wild oat.

Weight of narrow leaf	Weight of broadleaf	Number of narrow leaf	Number of broadleaf	Wild oat height	Wild oat weight	Number of wild oats	Degree of freedom	Sources of variations
2/02	96	16	10/7	11/5	0/015	4/08	2	Replication
^{ns}16/7	^{ns}16/3	^{ns}5/8	^{ns}7	^{ns}1/1	^{ns}0/001	*4/7	2	Cultivar
46/3	158	8/4	18/2	1/29	0/013	0/33	4	Error
**53761	**47520	**3052	**4501	**1348	**17/7	**75/8	4	Application time
^{ns}28/8	^{ns}11/1	^{ns}5/9	^{ns}5/2	**30/9	**0/18	**0/86	8	Cultivar*application time
40/4	31	7/7	7/5	1/94	0/015	0/17	24	Error
10/9	10/6	17/3	16/8	4/9	9/2	9/3		CV%

The Wild oat Weight

The ANOVA results showed that the effect of application time and the interactive effect of cultivar and application time on the weight of wild oat were significant at 1% level but the effect of cultivar on the weight of wild oat was not significant (Table 1).Mean comparison results showed that within the application time treatments the highest weight of wild

oat by 3.3 g belonged to the control treatment without herbicide and the lowest weight by 0.25 g belonged to the early tillering stage (Table 2). The results of the interactive effect of cultivar and application time showed that the highest weight of wild oat by 3.4 g belonged to Chamran cultivar and the control treatment without weeding and the lowest weight by 0.21 g belonged to Chamran cultivar in the early tillering (Table 3). As the number of wild oats decreases in the early tillering stage the weight of grass weed of wild oat is less at this time.Chokar *et al.* (2008) observed thataxial herbicide was used for the good control of grass weeds of wild wild oat canary grass and wheat.

Table 2. Mean comparison of the effect of cultivars on grass weeds.

Narrow leaf weight	Broadleaf weight	Number of narrow leaf grass weeds	Number of broadleaf grass weeds	Wild oat height	Wild oat weight	cultivars
a25	a33	a10/9	a14/8	a19	a1/2	Chamran
a26	a34	a11	a15	a18/7	a1/2	Star
a26	a33	a11/1	a15	a19/4	a1/2	Dez

The Wild oat Height

The ANOVA results showed that the effect of application time and the interactive effect of cultivar and application time on the height of wild oat were significant at 1% level but the effect of cultivar on the weight of wild oat was not significant (Table 1). Mean comparison results showed that within the application time treatments the highest height of wild oat by 42.6 cm belonged to the control treatment without herbicide and the lowest height by 14 cm belonged to the early tillering stage (Table 3). The results of the interactive effect of cultivar and application time showed that the highest height of wild oat by 46 cm belonged to Chamran cultivar and the control treatment without weeding and the lowest height by 12 cm belonged to Chamran cultivar in the early tillering (Table 4). According to the results the height of grass weed of wild oat was affected by the spraying time and in the late tillering the height of wild oat was less.

Table 3. Mean comparison of the effect of herbicide application time on grass weeds.

Weight of narrow leaf	Weight broadleaf	of Number of narrow leaf grass weeds	Number of broadleaf grass weeds	Wild oat height	Wild oat weight	Treatments
d10/8	c9/7	d4	d3/2	d14	d0/25	Early tillering
c18/4	b14/6	c6/8	c4/9	c23/4	c0/46	Mid tillering
b25	c10	b9	b10	b32	b1/3	Late tillering
c173	a161	a43	a49/7	a42/6	a3/3	Control without weeding
d11	c10	d4	d3/4	d15	d0/29	Control with weeding

The Number of Broadleaf Grass Weeds

The ANOVA results showed that the effect of application time on the number of broadleaf grass weeds was significant at 1% level but the effect of cultivar and the interactive effect of cultivar and application time on this trait were not significant (Table 1).Mean comparison results showed that within the application time treatments the highest number of broadleaf grass weeds by 49.7 belonged to the control treatment without herbicide and the lowest number by 3.2 belonged to the early tillering stage (Table 3) which was possibly resulted from better competition of the wheat due to more control of narrow leaf grass weeds.

The Number of Narrow Leaf Grass Weeds

The ANOVA results showed that the effect of application time on the number of narrow leaf grass weeds was significant at 1% level but the effect of cultivar and the interactive effect of cultivar and application time on this trait were not significant (Table 1).

Mean comparison results showed that within the application time treatments the highest number of narrow leaf grass weeds by 43.4 belonged to the control treatment without herbicide and the lowest number by 4 belonged to the early tillering stage (Table 3). Poor Azar and Baghestani (2010) reported the efficiency of Axial in comparison to Topic in controlling narrow leaf grass weeds.Kieloch *et al.* (2006) stated that regardless of concentration and application time axial herbicide well controlled narrow leaf grass weeds which indicated high capability of this herbicide for application in a long period of time. Veneill (2002) reported that axial herbicide would cause no limitation for later cultivations and would be able to control wild wild oat bloody wash ryegrass foxtail lawn and sticky grass weeds. Veisi *et al.* (2008) concluded in their study that axial herbicide had a good efficiency in controlling narrow leaf grass weeds.

Table 4. Mean comparison of the interactive effect of cultivars and herbicide application time on grass weeds.

Wild oat height	Wild oat weight	time	Cultivars
i12	e0/21	Early	Chamran
g21	c0/41	Mid	Chamran
i12	e0/87	Late	Chamran
a46	a3/3	Without weeding	chamran
i12	e0/2	With weeding	Chamran
d33	b1/3	Early	Star
f24	c0/45	Mid	Star
h14	d0/3	Late	Star
b42	a3/3	Without weeding	Star
i11	d0/25	With weeding	Star
e29	b1/3	Early	Dez
ef26	c0/53	Mid	Dez
h16	d0/29	Late	Dez
c40	a3/3	Without weeding	Dez
h15	d0/28	With weeding	Dez

Table 5. The ANOVA of grain yield and yield components.

Mean of Squares							
Harvest index (%)	Biological yield (kg/h)	Grain yield (kg/h)	1000-grain weight (gr)	Number of grains per spike	Number of spikes /m²	Degree of freedom	Sources of variation
0/001	0/25	0/004	0/53	18/7	15/5	2	Replication
**25	**5/5	*0/05	**27/6	*70/1	**4236	2	Cultivar
0/62	0/25	0/003	1/04	8/2	12/9	4	Error
**209	**8/5	**4/7	**66/4	**379	**15990	4	Application time
**64/2	ns0/13	**1/03	**28/3	**37	**1401	8	Cultivar * time
0/56	0/21	0/01	0/53	1/4	23/8	24	Error
3/8	4/2	4/4	6/1	3/8	5/4		CV%

The Weight of Broadleaf Grass Weeds

The ANOVA results showed that the effect of application time on the weight of broadleaf grass weeds was significant at 1% level but the effect of cultivar and the interactive effect of cultivar and application time on this trait were not significant (Table 1).Mean comparison results showed that within the application time treatments the highest weight of broadleaf grass weeds by 161 g belonged to the control treatment without herbicide and the lowest weight by 9.7 g belonged to the early tillering stage (Table 3). Veneill (2002) reported that axial herbicide would cause no limitation for next cultivations and would be able to control wild wild oat bloody wash ryegrass foxtail lawn and sticky grass weeds. Veisi *et al.* (2008) concluded in their study that axial herbicide had a good efficiency in controlling narrow leaf grass weeds.

The Weight of Narrow Leaf Grass Weeds

The ANOVA results showed that the effect of application time on the weight of narrow leaf grass weeds was significant at 1% level but the effect of cultivar and the interactive effect of cultivar and application time on this trait were not significant (Table 1).Mean comparison results showed that within the application time treatments the highest weight of narrow leaf grass weeds by 173.3 g belonged to the control treatment without herbicide and the lowest weight by 10.8 g belonged to the early tillering stage (Table 3).Veisi *et al.* (2008) concluded in their study that axial herbicide had a good efficiency in controlling narrow leaf grass weeds. Kieloch *et al.* (2006) stated that regardless of concentration and application time axial herbicide well controlled narrow leaf grass weeds which indicated high capability of this herbicide for application in a long period of time. Porter (2005) reported that axial herbicide had a good control over narrow leaf grass weeds and could be used in low rainfall too.

Table 6. Mean comparison of the effect of cultivars on grain yield and yield components of wheat.

Harvest index	Biological yield	Grain yield	1000-grain weight	Number of grains per spike	Number of spikes/m2	Cultivars
a55/5	b10500	a5840	a35/9	a34/8	a362	Chamran
b44/5	b10700	b4790	b34/2	b30/9	b335	Star
c33/8	a11700	c3980	c32/8	c30/4	c326	Dez

Number of Spikes per Square Meter

The ANOVA results showed that the effect of cultivar application time and the interactive effect of cultivar and application time on the number of spikes per square meter was significant at 1% level (Table 5). Mean comparison results showed that within the cultivar treatments the highest number of spikes per square meter by 362 spikes belonged to Chamran cultivar and the lowest number by 310 spikes belonged to Dez cultivar (Table 6). Considering the application time the highest number of spikes per square meter by 371 spikes belonged to the control treatment with weeding and the lowest number by 279 spikes belonged to the control treatment without herbicide (Table 7). In terms of the interactive effect of cultivar and application time the highest number of spikes per square meter by 412 spikes belonged to Chamran cultivar in the early tillering stage and the lowest number by 277 spikes belonged to the Star cultivar and the control treatment without the herbicide (Table 8). According to the results the cultivars were genetically different from each other. Porter (2005) in an experiment showed that the axial herbicide had a good control over the grass weeds in the early tillering stage and led to the better competition of the wheat and consequently the increase of the number of spikes per area unit which was consistent with this research.

Number of Grains per Spike

The ANOVA results showed that the effect of cultivar application time and the interactive effect of cultivar and application time on the number of grains per spike was significant at 1% level (Table 5). Mean comparison results showed that within the cultivar treatments the highest number of grains per spikes by 34.8 grains belonged toChamran cultivar and the lowest number by 30.4 grains belonged to Dez cultivar (Table 6).Considering the application time the highest number of grains per spike by 36.2 grains belonged to the early tillering stage and the lowest number by 22.4 grains belonged to the control treatment without herbicide (Table 7). In terms of the interactive effect of cultivar and application time the highest number of grains per spike by 43.6grains belonged to Chamran cultivar in the early tillering stage and the lowest number by 21.3grains belonged to Dez cultivar and the control treatment without the herbicide (Table 8).According to the results the cultivars were genetically different from each other in terms of the number of grains per spike. Examining the application time of herbicide showed that the number of grains per spike decreased while approaching the end of application time which

indicated the effect of application time on the number of grains in the later stages of herbicide application time.

1000-Grain Weight

The ANOVA results showed that the effect of cultivar application time and the interactive effect of cultivar and application time on 1000-grain weight was significant at 1% level (Table 5). Mean comparison results showed that within the cultivar treatments the highest 1000-grains weight by 35.9 g belonged to Chamran cultivar and the lowest number by 32.8 g belonged to Dez cultivar (Table 6).Considering the application time the highest 1000-grain weight by 36.3g belonged to the early tillering stage and the lowest 1000-grain weight by 30.4 g belonged to the control treatment without herbicide (Table 7). In terms of the interactive effect of cultivar and application time the highest 1000-grain weight by 42.1 g belonged to Chamran cultivar in the early tillering stage and the lowest 1000-grain weight by 30 g belonged to Dez cultivar and the control treatment without the herbicide (Table 8). According to the results of the effect of application time on 1000-grain weight since the number of grains per spike has decreased in the late tillering stage it seems quite natural that the weight of 1000-grain in this application time will increase.

Table 7. Mean comparison of different application times of herbicides on grain yield and yield components of wheat.

Harvest index	Biological yield	Grain yield	1000-grain weight	Number of grains per spike	Number of spikes /m²	treatments
c37	b11300	ab5760	a36	a36/2	c350	Early tillering
b49/8	ab11400	b5700	b35	ab35	bc364	Mid tillering
a58	a11600	b5700	c34	c34	b371	Late tillering
d25/6	c9500	d2450	d30	d22/4	d279	Control without weeding
a52	a11640	a5810	a36	ab35	a380	Control with weeding

Grain Yield

The ANOVA results showed that the effect of application time and the interactive effect of cultivar and application time on grain yield were significant at 1% level and the effect of cultivar on grain yield was significant at 5% level (Table 5). Mean comparison results showed that within the cultivar treatments the highest grain yield by 5840 kg/ha belonged to Chamran cultivar and the lowest grain yield by3980 kg/ha belonged to Dez cultivar (Table 6). Considering the application time the highest grain yield by 5810 kg/ha belonged to the control treatment and the lowest grain yield by 2450 kg/ha belonged to the control treatment without herbicide (Table 7). In terms of the interactive effect of cultivar and application time the highest grain yield by 5550kg/ha belonged to Chamran cultivar in the early tillering stage and the lowest grain yield by 3127kg/ha belonged to Chamran cultivar and the control treatment without the herbicide (Table 8). Durgan *et al.* (2007) have similar opinion about the effect of application of axial herbicide on the grain yield. There are also some reports on the superiority of the total axial to the topic in production of more crops (Veisi *et al.* 2008; NoroozZadeh *et al.* 2007). The results of another study showed that if the wild wild oat is fought at the stem elongation of the wheat this grass weed can easily be controlled and it can't damage the wheat seriously. However if the grass weed is fought at the emergence of the second nodule or the emergence of flag leaf of the wheat the wheat will be damaged 6 and 16% respectively and more herbicide should be used as well (Kon 2007).

Biological Yield

The ANOVA results showed that the effect of cultivar and application time on biological yield was significant at 1% level but the interactive effect of cultivar and application time on biological yield was not significant (Table 5). Mean comparison results

showed that within the cultivar treatments the highest biological yield by 1175 kg/ha belonged to Dez cultivar and the lowest biological yield by11750 kg/ha belonged to Dez cultivar (Table 6). Considering the application time the highest grain yield by 5810 kg/ha belonged to the control treatment and the lowest grain yield by 2450 kg/ha belonged to the control treatment without herbicide (Table 7).Jamali *et al.* (2010) compared axial with other herbicides and declared that application of new axial and at least 1.5 lit/ha Dez controlled the wild wild oat and increased the agricultural biomass of barley.

Table 8. Mean comparison of the interactive effect of cultivars and different application times of herbicides on grain yield and yield components of wheat.

Harvest index	Grain yield	1000-grain	Number of grains per spike	Number of spikes	time	cultivars
a50/4	a5550	a42	a44	a412	Early	Chamran
c41/7	c4593	b37	ab39	ab402	Mid	Chamran
a51	e3540	bc35	b38	b400	Late	Chamran
c41/3	f3127	d30	d23	d280	Without weeding	Chamran
a52	a5400	ab41	a42	ab411	With weeding	Chamran
d38	c4550	c33	c31	c345	Early	Star
b46/8	b5150	b37	b36	c363	Mid	Star
b45	b5100	b36	c33	c356	Late	Star
e33/1	f3200	d30	d23	d277	Without weeding	Star
b47	b5200	b37	b37	c360	With weeding	Star
e32/8	d3940	d31	c32	cd324	Early	Dez
d38/1	c4583	c33	c32	c347	Mid	Dez
d37/4	b4873	b36	b36	c351	Late	Dez
e32/3	f3233	d31	d21	d281	Without weeding	Dez
d39	b4900	b37	b37	c350	With weeding	Dez

Harvest Index

The ANOVA results showed that the effect of cultivar application time and the interactive effect of cultivar and application time on the harvest indexwere significant at 1% level (Table 5).Mean comparison results showed that within the cultivar treatments the highest harvest index by 55.6% belonged to Chamranand Star cultivars and the lowest harvest index by 36.8% belonged to Dez cultivar (Table 6).Considering the application time the highest harvest index by 50.8% belonged to the early and mid tillering stage and the lowest harvest index by 25.6% belonged to the control treatment without herbicide (Table 7). In terms of the interactive effect of cultivar and application time the highest harvest index by 50.4% belonged to Chamran cultivar in the early tillering stage and the lowest grain yield by 32.3% belonged to Dez cultivar and the late tillering stage (Table 8). The increase of harvest index within the treatments of herbicide application time and also the interactive treatment is the result of the increase of the grain yield in comparison to the biological yield. The proportion of biological yield which makes up the economic yield is called the harvest index. The economic yield in the wheat is the grain wheat which is harvested.

Conclusion

With regard to the quantitative and qualitative properties of different treatments in this research the treatment of Chamran cultivar in the early tillering stage by the yield of 5550 kg/ha was the best treatment in terms of the grain yield. Moreover in terms of controlling grass weeds the best treatment except the control treatment with manual weeding was the herbicide treatment in the late tillering stage but it was not significantly different from the early

and mid tillering stages in terms of the number and cultivar. Therefore considering the grain yield and

the control of grass weeds the best treatment which is recommended by the research is Chamran cultivar and the best herbicide application time is in the early tillering stage. It should be noted that the appropriate cultivar for every climate is different.

References

Barjesteh A, Baghestani M. 2008. Investigating the efficiency of several new herbicides in controlling grass weeds of wheat farms. Avicenna University Hamadan. Semnan Province 18th Congress on Iranian MedicalPlants.

Baghestani MA, Zand E, Soufizadeh S, Jamali M, Maighany F. 2007. Evaluation of sulfosulfuron for broadleaved and grass weed control in wheat (*Triticum aestivum L.*). Crop Protec. 26 1385-1389.

Chhokar RS, Sharma RK , Verma RP. 2008. Pinoxaden for Controlling Grass Weeds in Wheat and Barley. Indian Journal of Weed Science **40(1&2),** 41-46.

Délye C. 2005 . Weed resistance to acetyl coenzyme A carboxylase inhibitors An update. Weed Sci. 53728-746.

Durgan BR, Jochum W, Jim C, Douglas WM. 2007. Wild wild oat control in hard red spring wheat with reduced rates of Puma Axial.Discover and Rimfire at crooksten MN.

Friesen LF, Jones TL, Van Acker RC, Morrison IN. 2000. Identification of Avena fatua populations resistant to imazamethabenz flamprop and fenoxaprop-P. Weed Sci. 48532-541.

GhazakhlooJ, Rashed Mohasel M, Nasiri Mahalati M, Zand A, Ghanbari A, Deprado R, Asona MD, Vidal R. 2007. Evaluation of herbicide resistance in Phalaris resistant to inhibitor herbicides of Acetyl CoA Carboxylase . 2ndIranian Congress on Grass Weeds Science.

Hofer U, Muehlebach M, Hole S, Zoschke A. 2006. Pinoxaden-for broad spectrum grass weed management in cereal crops. J. Plant Dis. Prot. 20989-995.

Jamali MR, Baghestani MA, Fereydoon Far M. 2010. Evaluating the efficiency of Traxos and Axial herbicides for grass weeds control in Barley fields In Fars Province. Proceedings of the 19thInternational Conference on Iranian Medical Plants 1-4August 2010.

Jamali M. 2008. Evaluating different products of Clodinafop- Propargyl andDiclofop Methyl herbicides in the wheat farms. Avicenna University Hamedan. Fars Province 18th Congress on Iranian Medical Plants.

Kieloch R, Domaradzki K, Gorniak J. 2006. Pinoxaden – a new active ingredient for grass weed control in cereals of South-West Poland. Journal of Plant Diseases and Protection 1067-1072.

Kon KF, Follas GB, James DE. 2007. Seed dormancy and germination PH enology of grass weeds and implications for their control in cereals. New Zealand Plant Protec. 60174-182.

Nowrooz Zadeh SH, Abbas Poor M. Baghestani MA. 2007. Evaluating the efficiency of several new narrow leaf herbicides in the wheat farms of KhorasanRazavi. The 2nd Congress on Iranian Grass Weeds Science 29 30 April 2007 Mashhad.

Poor Azar R, Baghestani M. 2010. The efficiency of axial herbicide (Pinoxaden 45% EC) for narrow leaf grass weeds control in Khuzestan barley farms. Proceedings of the 19th Congress on Iranian Medical Plant 1-4August 2010.

Porter DJ, Kopec M, Hofer U. 2005.

Pinoxaden-a new selective post emergence graminicide for wheat and barley. Weed Sci. Soc. Am. 4595.

Sabeti P, Zand A, Veisi M, Boroomandan P. 2009. Evaluation of some sulfonylurea herbicides for grass weeds control in wheat farms in Kermanshah. Proceedings of the Third International Conference on Grass Weeds in Iran **2,** 381-383.

Travlos IN, Giannopolitis C, Economou G. 2011. Diclofop resistance in sterile wild wild oat (Avena sterilis L.) in wheat fields in Greece and its management by other post-emergence herbicides. Crop Protection **30(11),** 1449-1454.

Steribig JC, Jensen JE. 2001. Action of herbicides in mixtures. In Herbicides and their mechanisms of action.

Veisi M, Baghestani MA, Sabeti P, Mohammadi AR. 2008. Evaluating the effect of new dual-purpose Total (Sulfuron methyl + Sulfosulfuron) for grass weeds control in wheat in Kermanshah 18th Congress on Iranian Medical Plant. 20. Veneill W. 2002. Herbicide hand book. Weed science Society of America gth edition. 491 p.

Zand E, Baghestani MA, Soufizadeh S, Eskandari A, PourAzar R, Veysi M, Mousavi K, Barjasteh A. 2007. Evaluation of some newly registered herbicides for weed control in wheat (Triticum aestivum). Crop Protec. **26,** 1349-1358.

Zand E, Rahimian H, Koocheki A, Khalghani J, Mosavi K, Ramazani K. 2005. Weed ecology implications for management . JMD Press. 558 p.