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Evaluation of bio-fertilizer effect on selective corn herbicides efficiency to control of *Chenopodium album* and *Amaranthus retroflexus*

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Key words: Herbicides, bio-fertilizer, weed biomass, weed density, 1000-grain weight, Grain yield, *Amaranthus retroflexus, Chenopodium album*.

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Abstract

This experiment was conducted during 2009 growing season as split plot with randomized complete block design arrangement in a field of Faculty of Agriculture, Islamic Azad University, Karaj branch, Iran. Application and non-application of bio-feltilizer (a strain of *Seudomonas* spp.) was the main treatments. The sub-treatments were application of herbicides consisted of EPTC, atrazin, nicosulfuron, foramsulfuron, rimsulfuron and 2,4-D plus MCPA respectively at 4100, 800, 80, 450, 12.5, 108 was effective in application of bio-fertilizer on efficiency of some herbicides g ha^{-1} and weedy check. In this research, decreasing weeds dry weight. Total evaluation indicated that all herbicides in both situation application and non-application of bio-fertilizer, significantly reduced weeds dry weight compare to weedy check. Atrazin and nicosulfuron, compared with weedy check, significantly reduced the number of lamb's quarters (*Chenopodium album*) plants. However, all herbicides significantly reduced the dry weight of this weed. EPTC, atrazin, rimsulfuron and nicosulfuron, compared with weedy check reduced the number of plants and dry weight of redroot pigweed (*Amaranthus retroflexus*). 2,4-D plus MCPA had no significant effect on this weed. Application of atrazin and EPTC resulted in significant increase of maize grain yield and the number of ear. Application of atrazin caused the highest 1000-grain weight of maize, but was not significantly different from nicosulfuron and foramsulfuron

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Introduction

Corn with the scientific name *Zea mays* L. is one of the four major grains in the world. And its production after wheat and rice is third (Mousavi, 2001). Lands under corn plantation in Iran in 2011, was approximately 252 thousand hectares and rate of production was estimated 2.2 million tone (FAO, 2013). One of the problems that related to corn production is the presence of weeds which causes interference in agricultural operations, increase labor and production costs, reduces plant height, leaf area, dry weight and corn yield (Rashed Mohasel *et al.*, 1999). If we don't control weeds, depended on density and varieties may reduced from 15 to 90% of corn yields (Zimdahl, 1993). Weeds of corn will struggle to nutrient availability with main plant and some of them till double of nitrogen and phosphorous and 3 times of potassium available in unit dry weight of corn plants (Tollenaar *et al.*, 1999). Competition of *C. album* L. with corn decreases the yield by 90% (Hartly *et al*, 1992). Presence 49 plants of *C. album* L. in each meter of row decreased the corn grain yield by 12% (Beckett *et al.*, 1988). The decrease rate of corn yield with increase density of *A. retroflexus* L. from 0.5 to 8 in each meter row of plant was increased from 5% to 34% (Kenzevic *et al.*, 1994). Stevan and associates (1998) showed the presence 0.5 and 4 plants of *A. retroflexus* L. in each meter of every row of crop at time of growth with same time of corn and in process of 3-5 leaf stage of corn, decreases the grain yield by rate of 5% (Stevan *et al.*, 1998). The average damage of weeds in corn plantation in Iran is reported at ratio of 86% (Mousavi, 2001). Hence, herbicides consumption trend in Iran during the previous years represented that this measure is going up. Already just about half of 24 million liter or kilogram of venom consumption in the term of agriculture devote to herbicides (Zand *et al.*, 2009). In other countries, many herbicides are registered to control weeds in corn. But in Iran, registered herbicide varieties are less. These herbicides (atrazin, alachlor, EPTC and 2,4-D) are being used in Iran for several years in corn fields. So now, weeds have good resistance toward herbicides (Zand *et al.*, 2007). New Solfonilurea herbicides family like nicosulfuron, foramsulfuron and rimsulfuron are the selective herbicide in corn plantation (Lemieux *et al.*, 2003) and due to some of individual characteristics like the lowest usage dose in surface area compered to other herbicides, higher biological activity, extent side effects, high herbicide leaching and so on, recently are being extended (Russell *et al.*, 2002).

In accordance with sustainable agriculture, some of soil micro organisms which have symbiosis with plants and use as bio-fertilizers to supply food elements are in extension (Sharma, 2003). This micro organisms usually are from bacteria, and equipped with an enzymatic system that enables them to break the triple bond between two nitrogen atmospheric atoms and produces ammoniac, that similar to industrial processes but has no expense for unrenewable energy resources (Dalla santa *et al.*, 2004). Varieties of Bacteria from *Azotobacter*, *Azospirillum*, and *Pseudomonace* strain which is known as the most important of plant growth promoting bacteria, not only facilitate the biological nitrogen fixation process and phosphate dissolution in soil. Also has a positive effect on crops growth development and crops yield by producing growth promoting hormones such as auxin, gibberellin and cytokinin (Zahir *et al.*, 2004). In agriculture, herbicides have been used in large scale. But often, there is no research on their sub effects. This is very important in crops. Because, herbicides not only will have adverse effect on plant growth, also influence on the interaction relation between symbiosis bacteria just like *rhizobioume*s and plant growth promoting bacteria (Brock, 1975). Forlani *et al.*, (1995), carried out a research to address the effect of Solfonilurea and imidazolinons herbicides family on 18 isolations from bacteria exists in soil just like varieties from *Azotobacter*, *Azospirillum*, *Bacillus*, *Pseudomonace* and *Seratia*. It is showed that chlorsulfuron and rimsulfuron from sulfonylurea herbicides family prevent the growth of one of two strains of *Azospirillum* and one of the four *Pseuodomonas* strains.

Even though bio-fertilizer application improved in

Iran, their interaction with herbicides is very less. Therefore, the aim of this research were evaluation of herbicides efficacy in control of corn weeds and checked their interaction with bio-fertilizer like (*Pseuodomonas* spp.), and the effect of bio-fertilizer on corn yield.

Materials and methods

Site description and experimental design

This experiment was conducted during 2013 growing season as split plot with randomized complete block design arrangement with two main treatments and seven sub-treatments in four repetitions in a field of faculty of agriculture Islamic Azad University Karaj, Iran. In position of (35° 45´´N, 51° 56´´E; 1313 m above the sea level), this area has average temperature with relative humidity of 36 to 73 percent and less rain per year (Anonymous, 2009). Main factors were application and non-application of bio-fertilizer (*Pseuodomonas* spp.), with the population of 5×10^{9} bacteria per each gram. For every kilogram of corn seed (*Zea maize* SC. 704) cultivar by ratio of 50 ml of solution was added and mixed well, till all the seeds to become uniformed with the substance. Then seeds were kept on the ground for period of 10 minutes in open air, in shadow. Then corn planted and watered immediately. The sub-treatments were application of herbicides consisted of EPTC EC 82%, atrazin WP 80%, nicosulfuron SC 4%, foramsulfuron OD 22.5%, rimsulfuron DF 25% and 2,4-D plus MCPA SL 67.5% respectively at 4100, 800, 80, 450, 12.5, 108 g ha^{-1} (Vencill, 2002; Tomlin, 2003) and weedy check. EPTC as pre-plant and soil incorporation, atrazin as pre-emergence, 2,4-D+MCPA at 10-15 cm of corn height and other herbicides applied as post-emergence in 3-4 leaves stage of corn. All herbicides were sprayed with hand lever knapsack sprayer equipped with standard flat fan T-jet nuzzle and calibrated to deliver 375 L ha^{-1} of spray solution at a pressure of 2.5 bar. Immediately after using pre-plant and soil incorporation herbicide helped the rake to mix them with soil, mixed done well, up to depth of 10 cm. Size of each plot was 3 m wide and 6 m length. Plots length consisted of four rows of plant with 6 m length. Distance of plots in every block was 75 cm. and distance of blocks from each other was 2 m. Also distance of plant lines were 75 cm. Sub plots were managed in such a way that while irrigation, water should not enter the other plot. All operations like fertilizing, irrigation, pest control were done according to the technical advises.

Weed and crop measurements

Evaluation including weeds population was measured separately for each weed species by counting the number of weeds 21 days after last treatment (DAT) within two fixed 0.5 m^2 quadrates that were dropped in to the treated of each plot accidently which showed total weeds of that plot. In kernel filling stage in ear by keeping quadrates 0.5 m^2 in two points from every plot accidently which declares total weeds of that plot. All weeds were mow at the ground level, separated by species and oven dried at 75°C for 48 hour. Then the biomass of all weed species was weighted. After seed maturity to value the corn yield, harvest was done from 2 middle lines of 6 m and then weighted. After harvest, sampling from seeds was done by each plot. 1000 grain weight in separate plot was determined.

Data analysis

All data were analyzed statistically using program procedure in SAS statistical software (SAS institute, 2000). Duncan multiple rang test (DMRT) set at 0.05 was used to determined the significance of the difference between treatment means and by using excel software graphics were drawn.

Results

Plant Phytotoxicity

In this research, 3 weeks after applying herbicide treatments, there is no evidence of plant phytotoxicity for using herbicides in advised time and recommended dose application. Among native weeds, analysis in herbicides applications were achieve on dominant weeds of area and are explained.

Weed Control

Amaranthus retroflexus L.

Statistical analysis (Table 1) showed significant differences between dry weights of *A.retroflexus* L.

within application of bio-fertilizer on the level of 1%. In this case, this parameter is reduced by utilizing all herbicides treatment. Whereas, the dry weight of this weed increased in none application of bio-fertilizer and this major was just rather more within 2, 4-D+MCPA (Figure 1). There were significantly differences between herbicides treatments in number and dry weight of *A. retroflexus* on the level of 1% (Figure 2). All herbicides treatment except 2, 4-D+MCPA in compare to weedy check, significantly reduced the number of *A. retroflexus* L. (Figure 2). Most reduction belonged to atrazin which was reduced at rate of 99% compare to weedy check; however this herbicide in statistics was equal to EPTC, foramsulfuron and rimsulfuron herbicides. On the view point of *A. retroflexus* L. dried weight is just like their number, all herbicide treatments except 2,4-D+MCPA in compare to weedy check were significantly decreased them (Figure 3). Dried weight of this weed in atrazin and EPTC treatments was approximately 92% less than weedy check and other treatments. However both of them were equal on the view of statistics with rimosolforon, nicosulfuron and foramsulfuron herbicide treatments. In addition, foramsulfuron had not significant difference with 2, 4-D+MCPA.

Table 1. Analysis of variance for different bio-fertilizer, herbicide and their interaction treatments on density and biomass of weeds and corn grain yield.

Mean Square						
S.O.V	DF	Grain yield (kg/ha)	Density (p/m²)		Biomass (g/m²)	
			AMARE	CHEAL	AMARE	CHEAL
Rep	3	27891	0.0025	0.1943	0.5370	1.6484
A (Bio-fertilizer)	1	5540$^{n.s}$	0.0561$^{n.s}$	0.0368$^{n.s}$	0.5043$^{n.s}$	4.0463$^{n.s}$
E(a)	3	7977	0.0080	0.0170	0.1174	0.7431
B (Herbicide)	6	53105**	0.0497**	0.3413**	3.7164**	18.5816**
A×B (Bio-fertilizer×Herbicide)	6	8596$^{n.s}$	0.0103$^{n.s}$	0.0161$^{n.s}$	1.9972**	3.1394*
E(b)	36	9669	0.0147	0.0699	0.5589	1.0743
C.V. %		17.34266	4.469510	9.143370	21.65511	22.77654
A×B Effect Sliced by A						
Bio-fertilizer	DF	Grain yield (kg/ha)	Density (p/m²)		Biomass (g/m²)	
			AMARE	CHEAL	AMARE	CHEAL
Application	6	19226.87$^{n.s}$	0.016832$^{n.s}$	0.177607*	3.546757**	10.316639**
Non-Application	6	42475.06**	0.043269*	0.179906*	2.166944**	11.404424**
A×B Effect Sliced by B						
Herbicide	DF	Grain yield (kg/ha)	Density (p/m²)		Biomass (g/m²)	
			AMARE	CHEAL	AMARE	CHEAL
EPTC	1	820.13$^{n.s}$	0.004171$^{n.s}$	0.003680$^{n.s}$	0.247248$^{n.s}$	0.024277$^{n.s}$
Atrazin	1	4465.13$^{n.s}$	1.522743$^{n.s}$	1.602470$^{n.s}$	0.275733$^{n.s}$	1.433277$^{n.s}$
Nicosulfuron	1	2964.50$^{n.s}$	0.004171$^{n.s}$	1.627411$^{n.s}$	2.819194*	2.910299$^{n.s}$
Foramsulfuron	1	10224.50$^{n.s}$	0.015687$^{n.s}$	0.012531$^{n.s}$	0.192988$^{n.s}$	0.005271$^{n.s}$
Rimsulfuron	1	242$^{n.s}$	0.016685$^{n.s}$	0.055640$^{n.s}$	0.000237$^{n.s}$	19.170135**
2,4-D + MCPA	1	36.13$^{n.s}$	0.062746*	0.047810$^{n.s}$	2.879419*	0.014331$^{n.s}$
Weedy check	1	38364.50$^{n.s}$	0.014874$^{n.s}$	0.014299$^{n.s}$	6.073278**	0.758569$^{n.s}$

(AMARE): *Amaranthus retroflexus* L., (CHEAL): *Chenopodium album* L.

ns: not-significant

**,* means within each column followed by same letter are not significantly different according to Duncan's multiple range test at the 1% and 5 % probability level.

Chenopodium album L.

Statistical analysis showed (Table 1) in both situation application and none application of bio-fertilizer, dried weight of *C. album*. L. in all herbicide treatment except rimsulfuron with bio-fertilizer was significantly less than weedy check (Figure 4). Also the average of dried weight in *C. album* L. with atrazin was significantly fewer than 2,4-D+MCPA treatment, in this regard except rimsulfuron there was no significant difference in herbicide efficiency with application and non application of bio-fertilizer (Figure 4). In bio-fertilizer application with rimsulfuron treatment, the dried weight of this weed was significantly higher than non-application of bio-fertilizer. Herbicides in number and dried weight of this weed had show significant differences in the level of 1%. Herbicide treatments like rimsulfuron, foramsulfuron and 2, 4-D+MCPA compared to weedy check, did not have significant effect in number reduction of *C. album* L. (Figure 5). Number of this weed in atrazin treatment was 98.62% lesser than weedy check and other treatments. However it had not significant difference with nicosulfuron and EPTC. In this research, all herbicide treatments in compare to weedy check were significantly reduced dry weight of *C. album* L. (Figure 6). Most decreased dry weight of *C. album* L. belonged to atrazin by the rate of 98.43% compare to weedy check. However in statistics view were equal to nicosulfuron. Hence other herbicide treatments like nicosulfuron, foramsulfuron and EPTC respectively, were significantly reduced dry weight of this weed more than others.

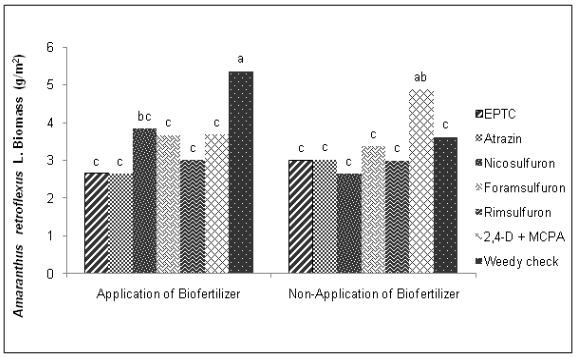

Fig. 1. Comparison of *Amaranthus retroflexus* dry weight in treatment's experiment. Mean within each column followed by same letter are not significantly different (Duncan 5%).

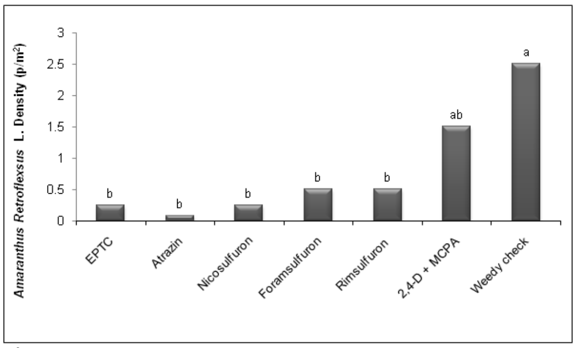

Fig. 2. Effect of different herbicide treatments on redroot pigweed (*Amaranthus retroflexus* L.) populations reductions. Means within each column followed by same letter are not significantly different (Duncan 1%).

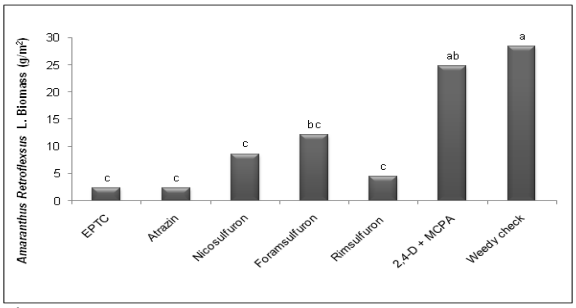

Fig. 3. Effect of different herbicide treatments on redroot pigweed (*Amaranthus retroflexus* L.) Biomass reductions. Means within each column followed by same letter are not significantly different (Duncan 1%).

Maize Grain Yield

Variance dissolve results showed (Table 1) that in situation of bio-fertilizer application, atrazine was the sole treatment which made significant increase in corn grain yield. But other herbicides treatment had no significant difference compare to weedy check (Figure 13). In none-application of bio-fertilizer, all herbicides treatment had significant increase in grain yield compare to weedy check. And also in this case herbicides had no significant differences with each other. The herbicides efficiency in grain yield in both situation application and none application of bio-fertilizer statistically was the same (Figure 13). The average comparison in Duncan test (Figure 14) showed that in herbicide treatments in level of 5%, there was significant difference. All herbicides treatments made increase in corn grain yield. In such, grain yield in atrazin and nicosulfuron treatments by the ratio of 56.80% and 51% significantly was more than weedy check. In this view, atrazin, nicosulfuron, EPTC, foramsulfuron and rimsulfuron were kept in a same statistics group. Also 2, 4-D+MCPA achieved the least increase in grain yield by the rate of 22% compare to weedy check.

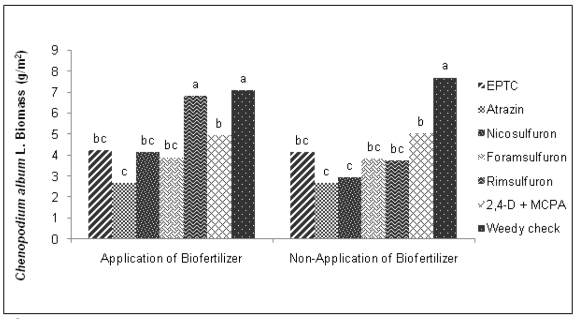

Fig. 4. Comparison of *Chenopodium album* dry weight in treatment's experiment. Mean within each column followed by same letter are not significantly different (Duncan 5%).

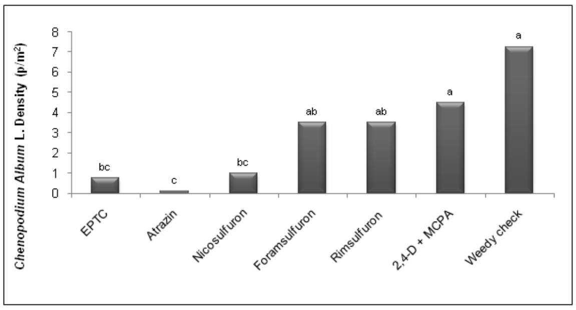

Fig. 6. Effect of different herbicide treatments on lamb's quarters (*Chenopodium album* L.) populations reductions. Means within each column followed by same letter are not significantly different (Duncan 1%).

Discussion

In Iran, there is no report in relation with herbicides interaction on biological nitrogen fixation in crops for example, corn with plant growth promoting bacteria such as *Azotobacter*, *Azospirillum* and *Pseuodomonas*. In agriculture, herbicides have been used in large scale. But often, there is no research on their sub effects. This is very important in crops because herbicides not only will have adverse effect on plant growth, also influence on the interaction relation between symbiosis bacteria just like *rhizobioum*es and plant growth promoting bacteria (Brock, 1975). Forlani *et al.*, (1995), carried out a research to address the effect of Solfonilurea and imidazolinons herbicides family on 18 isolations from bacteria exists in soil just like varieties from *Azotobacter*, *Azospirillum*, *Bacillus*, *Pseudomonace* and *Seratia*. It is showed that chlorsulfuron and rimsulfuron from sulfonylurea herbicides family prevent the growth of one of two strains of *Azospirillum* and one of the four *Pseudomonas* strains. Also imazapyr and imazethapyr from imidazolinones herbicides family had negative effect on two of five *Bacillus* isolations. Green house reaserches were done to evaluation of herbicides inhibition effect on bacteria growth on farm condition. Thus corn seeds with two strains of sensitive bacteria to Solfonilurea herbicides family inoculationed and rimsulfuron with ratios of 0, 0.2, 0.5 mol ai kg^{-1} applied. Significant difference was seen in concentration value of bacteria in root by using two strains of resistance and sensitive bacteria to herbicide. Rimsulfuron application significantly was the cause of increase resistance bacteria concentration on the root. Changing the structure of the bacteria in rhizospher was the result of consecutive usage of AHAS inhibitor herbicides in order to control weeds. Martenson and Nilson reported (1989) that when chlorsulfuron was used at rate of 4 and 8 g ha^{-1} for white clover and bird's foot terifoil, there was no node in plant. Eberbachk and douglas (1989) reported when amitrole at advised dose was used, then plant growth and nitrogenize activity and nodulation in clover decreased. They also declared 2, 4-D and diquat herbicides remains effected in nodulation and nitrogenize activity in clover. They declared diquat was initially effect on plant growth rather than appearance of nodes (Eberbachk *et al.*, 1989). Farm experiments showed, when simazine was used at the rate of 3 kg ha^{-1} for 3 consecutive years in corn, and then at fourth year it had reductive effect on soybean nodulation (Dunigan *et al.*, 1972). Moorman (1986) reported a reduction in soybean-node-weight by treating alachlor, linuron and trifluralin herbicides without any diminishing in crop yield. Mallik and Tesfa (1985) reported pre-emergence application of alachlor at 1.7 kg ha^{-1} and metribuzin at 0.34 kg ha^{-1} in soybean, significantly decrease the nodulation, nitrogenization activity and total rate of azote. It is observed that application of 2, 4-D & MCPA lead to decrease the activity *of rhizobioum* varieties (Dunigan *et al.*, 1972).

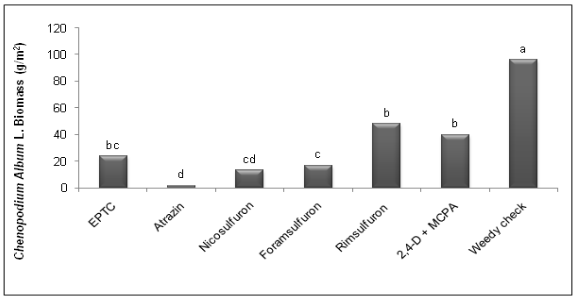

Fig. 6. Effect of different herbicide treatments on lamb's quarters (*Chenopodium album* L.) biomass reductions. Means within each column followed by same letter are not significantly different (Duncan 1%).

Therefore, with regards to above statements, azote biological fixation by plant growth promoting bacteria such as *Azotobacter*, *Azospirilium* and *Pseuodomonas* in crops like corn can be under impression of environmental circumstances and various herbicides. In such, these herbicides cause to reduction or inefficacy of plant growth promoting and azote biological fixation current in crop plants, which needs more researches.

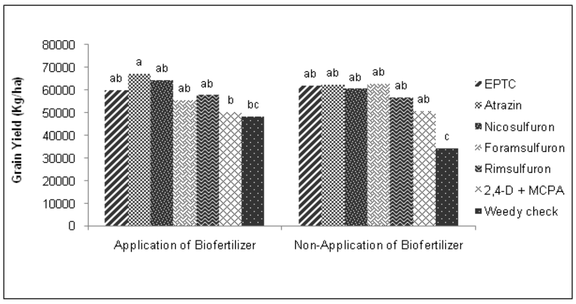

Fig. 7. Comparison of corn grain yield in treatment's experiment. Mean within each column followed by same letter are not significantly different (Duncan 5%).

The result of this experiment showed that all herbicide treatments, except MCPA+2, 4-D, appropriately controlled *A. retroflexus* L. and among them atrazin, EPTC and nicosulfuron were more satisfactory. Efficacy of these herbicides in weeds management was reported by (Osullivan & Bouw 1993; Zand *et al* 2006). Bunting *et al.*, (2005) in their research in Illinois reported foramsulfuron application at 35 g ha^{-1} advised dose controlled *A. retroflexus* L. by the ratio of 84%. Also Nurse *et al.*, (2007) in their report in Ontario mentioned that foramsulfuron application at 35 g ai ha^{-1} advised dose controlled *A. retroflexus* L. more than 90%. Arnold *et al.*, (2005), in their research, to control broadleave weeds by post-emergence herbicides in maize farm in New Mexico reported foramsulfuron application at 33 g ha^{-1}, controlled *C. album* L. by ratio of 98%. Zand *et al.*, (2006); Baghestani *et al.*, (2007), in their research to evaluate efficacy of new herbicides application to control weeds of maise in Iran, reported application of EPTC, 2, 4-D+MCPA and nicosulfuron respectively have most effect in decreasing population of *A. retroflexus* L. by ratio of 80.60%, 82.48% and 81.06% compare to decrease of 74.43% of other Solfonilurea herbicides family. Also atrazin+alachlor and 2,4-D+MCPA application respectively decreased 9.7 and 82.53% biomass of this weed. Atrazin and EPTC are standard herbicides in maize plantation and recently Solfonilurea herbicides family such as nicosulfuron, foramsulfuron and rimsulfuron for this plantation is registered. They were selectively herbicides in maize and have satisfactory control over weeds. Whereas 2, 4-D+MCPA is known as a selective herbicide in wheat and barley cultivation. Auskaliniene and associates reported that nicosulfuron and primisulfuron had satisfactory control over *C. album* L. however; rimsulfuron did not have effective control on that (Auskaliniene *et al.*, 2006). Nurse *et al.*, (2007) in his research in Ontario reported foramsulfuron application at 35 g ai ha^{-1}, controlled *C. album* L. by ratio of 76%. Bunting (2005) in his research in Illinois reported, foramsulfuron at 32 & 37 g ha^{-1} dose application controlled 81% of *C. album* L. Arnold (2005) in New Mexico reported, foramsulfuron application at 33 g ha^{-1} controlled 97% of *C. album* L. Their results are exactly as present researches. In research of Zand (2006) and Baghestani (2007), foramsulfuron at 450 g ai ha^{-1}, nicosulfuron at 60 g ai ha^{-1}, rimsulfuron at 11.25 g ai ha^{-1}, atrazin+alachlor at 800+2400 g ai ha^{-1}, EPTC at 4920 g ai ha^{-1} and 2,4-D+MCPA at 1080 g ai ha^{-1} controlled *C. album* L.

completely. Satisfactory control of atrazin and nicosulfuron related to selectivity of these herbicides for maize. More satisfactory efficacy of atrazin in controlling *C. album* L. can be attributed to better absorption of atrazin as a pre-plant application herbicide by weed. In this case, maize rozetic growth compare to C_3 weeds like *C. album* L., cause *C. album* L. absorb more of this herbicide. New Solfonilurea herbicides family, (nicosulfuron and foramsulfuron) in most times, have satisfactory control over *C. album* L., which has been advised in corn plantation. Even though rimosoforon in this case is under registration, unsatisfactory application of this herbicide compare to other treatments in its family is because of other environmental conditions or can be attributed to herbicide application method.

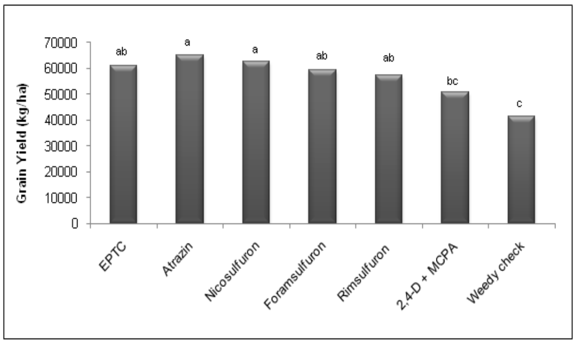

Fig. 8. Effect of different herbicide treatments on corn grain yield. Means within each column followed by same letter are not significantly different (Duncan 5%).

Osullivan & Bouw (1993) reported that atrazin, nicosulfuron and rimsulfuron treatments, even though acted satisfactory in controlling *A. retroflexus* L. and *C. album* L. in advised doses for 3 years continuously application but had not significant differences effects in corn grain yield by treatments. Burnside *et al.*, (1969) reported Using of atrazin at 2.2 kg ai ha^{-1} has effective control on weeds as well as increase of 3.1% corn grain yield in compare to weedy check. Nurse (2007) in his research in Ontario reported corn had excellent resistance to foramsulfuron in all doses application. Lume *et al.*, (2005) during 2000 and 2002 made some experiments about nicosulfuron at 50, 100, 150 and 200 g ai ha^{-1} and applied times of 1, 2, 3 and 4 weeks after plant in corn and reported nicosulfuron increases corn yield by the ratio of 96% in 2000, 100% in 2001 and 34 to 54% in 2002. Zand (2006), in his research to evaluation the efficacy of new herbicides on controlling weeds in corn plantation in Iran reported corn grain yield was most effectiveness with nicosulfuron and rimsulfuron at 60 and 12.5 g ai ha^{-1} application doses by the increase ratio of 5432.50 and 5485 kg ha^{-1} in Ahvaz, foramsulfuron at 450 g ai ha^{-1} by the ratio of 16643 kg ha^{-1} in Karaj, nicosulfuron and EPTC at 60 and 4920 g ai ha^{-1} respectively by the ratio of 9300 and 9177.80 kg ha^{-1} in Kermanshah; nicosulfuron, foramsulfuron and EPTC at 60, 450 and 4920 g ai ha^{-1} respectively by the ratio of 14013, 14325 and 13917 kg ha^{-1} in Varamin achieved. Baghestani (2007) reported nicosulfuron application at 80 g ai ha^{-1} significantly increased corn grain yield, which ranked after weed-free treatment. However, 2,4-D+MCPA showed the lowest grain yield among other herbicide treatments. In most of done studies, just like this research, satisfactory efficacy of Solfonilurea herbicides family leads a suitable control of weeds and significant increase in corn yield.

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