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Evaluation of weeds control methods in form of mechanical and chemical on onion yield

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Abstract

In order to weeds control in onion (*Allium cepa*), the research was conducted during cropping year of 2013 at Shabestar county, Iran in form of factorial based on randomized complete block design with three replications. The treatments were included: factor of three onion cultivars (Azarshahr red onion, Zargan and Swaet spanish) and factor of weeds control at five levels (control, mechanical weeding, Oxyfluorfen herbicide with amount of 480 g/ha^{-1} effective material, Oxadiazon herbicide with amount of 360 g/ha^{-1} effective material, composite of Ioxynil and Sethoxydim herbicides with amounts of 675 g/ha^{-1} and 250 g/ha^{-1} effective materials, respectively). Based on the results of variance analysis, mechanical method had the highest percentage of weeds control and caused to significant reduction in weeds dry weight and augmentation in yield was 75%. Among herbicides, Oxyfluorfen after weeding could have the highest effect on increment of yield (62%). Maximum yield was obtained in cultivar of swaet spanish and hand weeding treatment.

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Introduction

With consideration to major problem of area in weeds control at onion farms, economic conditions of agricultural sector, situation of current costs and crops production, on the other hand price jump of agricultural inputs such as fertilizers and chemical pesticides; process of crop production has encountered with serious challenges. In such circumstances, it can be stated that attention to production efficiency and necessity of reduction in costs should be considered seriously. In this regard, by considering to conditions and existent possibilities; selection of best method to weeds control could be effective in reduction of production cost, partly.

Knowledge of weeds biology and utilization of environmental management make it possible, populations and communities of weeds are directed in desirable path. Cultivation in an agricultural land makes favorable environment for crop and undesirable environment for competitive weeds. Correct management in opportune grazing and proper fertilization actuates environmental factors in pastures and grasslands to produce the highest amount of desirable plant species and to reduce weeds production. Usual hand weeding methods for removing unfavorable species of forest lands is one of the environmental management tools. Usage of herbicides can be considered as environmental management tools (Zand *et al*., 2007).

Due to overuse of herbicides, majority of weeds have become resistant to herbicides thus researchers have used new methods for weeds control which are included mechanical and integrated methods (Erfanifar *et al*, 2008). In general it can be stated that albeit in developed countries, main emphasis is on chemical control of weeds but it should not be forgotten that ecological and biological studies of weeds have been conducted in these countries and healthy, effective and economical management for weeds control requires sufficient information on field of Eco-biology of weeds (Mirshekary,2003).

Oxyfluorfen herbicide is used for control of broadleaf and narrow leaves weeds with dose of 0.7 kg/ha. This herbicide stops chlorophyll biosynthesis severely by inhibiting alteration route of Protoporphyrinogen IX to Protoporphyrin IX which is essential for chlorophyll synthesis (Geoffroy *et al*., 2003).

Ioxynil herbicide only has effect on broad leaves weeds which among these kinds of weeds; Solanum nigrum and Amaranthus retroflexus are more sensitive in comparison with Chenopodium album. Ioxynil herbicide is more successful than other herbicides due to less burn on crop and consumption ease because of its emulsion. Oxadiazon herbicide can also lead to significantly reduction in weeds and augmentation in crop yield (Dejam *et al*., 2010). In order to investigate the effect of two post-emergence herbicides of Ioxynil and Oxadiazon and their mixture on weeds control and onion (Azarshahr cultivar) yield, Shirzad and Sahebali (2002) conducted an experiment which the results demonstrated that Ioxynil treatment at doses of 0.6 and 0.7 kg/ha effective materials caused to control of broadleaf weeds such as Chenopodium album, Convolvulus arvensis and Amaranthus.

The purpose of this probe was to evaluate the effects of weeds control methods on yield of onion cultivars.

Materials and methods

This research was performed during cropping years of 2012-13 in the fields of rural production cooperative company (Sareban Goli- zeinab) at Shabestar County with geographical coordinates of 38˚09'23''N and 45˚52'22''E which climate is hot and semi-arid. According to meteorological information during growth and development period of plant, amount of rainfall has been reported about 290 mm and 38°C for maximum absolute monthly temperature and 2°C for minimum absolute monthly temperature. Soil texture was clay loam and pH amount was about 8.

Used cultivars: Three different varieties of onion were involved: Azarshahr red onion, Zargan and Swaet spanish)

Used herbicides were included: 1- Ioxynil 22.5% EC (emulsion) commercial name (tutorial): Ioxynil selective herbicide for broadleaf weeds in garlic and onion fields 2- Oxyfluorfen 25% (emulsion) commercial name (Gol): Oxyfluorfen contact selective herbicide for broadleaf and narrow leaves weeds in onion fields. 3- Oxadiazon 12% SL (soluble liquid in water) commercial name (Ronestar): Oxadiazon selective contact herbicide and inhibitor for weeds photosynthesis in rice fields. 4- Sethoxydim, commercial name (Naboas), systemic from group of cyclohexane dione oxime, selective herbicide in onion fields against weeds of Gramineae family.

Factor of weeds control methods was at five levels: control (non-weeding), hand weeding at all stages of growth, Oxyfluorfen herbicide with amount of 480 g/ha effective material, Oxadiazon herbicide with amount of 360 g/ha effective material, composite of Ioxynil and Sethoxydim herbicides with amounts of 675 g/ha and 250 g/ha effective materials, respectively.

Cultivation operations were included: plowing, distribution of requirement fertilizer based on recommendations of the Research Department of Soil and Water at East Azerbaijan Province of Iran and soil analysis was carried out also disk and striping for plots preparation was done.

Planting was conducted on March 2013. Plots dimensions were 7×1.8 meters and distance between plots in form of stack was considered 0.5 meter. Each plot had 3 rows which spaced 60 cm apart.

Sowing was done on 15th March in form of handy with spacing of 10cm on row and distance between planting rows was 50cm. Time of foliar spray was at stage of weed with 2-4 leaves which is about 50 days after planting.

Experiment was performed in 15 treatments and three replications, totally in 45 experimental units in form of factorial based on randomized complete block design.

Measured Traits were included:

1- 15 and 30 days after applying treatment, number of each kind of weed plants was determined by using a quadrat of 1×1m in each plot at both parts of foliar sprayed and non-foliar sprayed.

2- 30 days after weeds spraying, weed species in each plot were isolated and then weed plants were cleaned from mud and fresh weight of weeds was measured by scale with error rate of 0.0001.

3- After scaling fresh weight, weeds were putted at oven with temperature of 70^{o}C for 48 hours and then were measured by scale with error rate of 0.0001.

4- To determine amount of onion yield, harvest was done in about September 2013 depend on type of cultivars. In order to harvesting at each plot, 0.5 meter from top and bottom of planting rows and two border rows were eliminated as marginal effects and harvest was done in residual area. After yield determination, increase percentage of onion yield in treatments was measured toward control treatment.

Depend on time of onion harvest about in September; onions were evaluated in terms of kilograms per hector. Then we measured amount of augmentation percentage in yield.

Results and discussion

The results of variance analysis for the studied traits in form of factorial experiment based on randomized complete block design are visible at Table 1. The dominant weeds in this research were Amaranthus, Solanum nigrum and Chenopodium album. Analysis of variance demonstrated that no significant difference was observed among the studied cultivars from the view point of all evaluated traits in number of weeds. There were significant differences among the studied traits from the view point of weeds control methods. Also no significant difference was observed

among the studied traits for the interaction of Control methods×cultivars.

Table 1. Analysis of variance for number of weeds, 15 and 30 days after spraying.

Sources of variance	df	Amaranthus SPP 15	Amaronthus SPP 30	Solanum nigrum 15	Solanum nigrum 30	Chenopodium album 15	Chenopodium album 30
Bloke	2	0.111 ns	1.083 ns	4083 ns	1.334**	9.083**	8.111**
Cultivar	2	1.028 ns	0.582 ns	0.553 ns	0.333 ns	0.582 ns	0.694 ns
Control method	4	34.250 **	42.694 **	7.929**	9.852**	91.370**	22.407 **
Control method×cultivar	8	0.583 ns	1.028 ns	0.343 ns	0.407 ns	0.954 ns	0.657 ns
Error	28	0.384	1.144	0.174	0.212	0.992	0.990
Coefficient of Variation (%) cv	-	5.17	9.95	12.52	17.27	6.16	6.81

* and ** significance at %5 and %1 probability levels, respectively and ns: non-significant difference.

Table 2. Analysis of variance for weeds dry weight, 30 days after spraying.

Sources of variance	Degree of freedom	Mean squares		
		Amaranthus SPP	Solanum nigrum	Chenopodium album
Block	2	212/333 ns	161/333**	1825/00 **
Cultivars	2	114/333 ns	40/333 ns	156/25ns
Control Method	3	8368/111 **	1192/074	5041/667 **
Control method×cultivars	6	201/444 ns	49/294 ns	147/917
Error	28	224/212	25/667	222/727
Coefficient of Variation (%) cv	-	9/95	17/27	6/81

* and ** significance at %5 and %1 probability levels, respectively and ns: non-significant difference.

Analysis of variance for effects of different methods on percentage reduction of weeds dry weight, 30 days after spraying showed that there were significant differences between methods of weeds control in all weeds. But, no statistical differences were observed in the cultivars and interaction (Table 2). Among the studied traits, minimum coefficient of variation was belonged to dry weight of chenopodium album (6.81) and the highest coefficient of variation was related to dry weight of solanum nigrum (17.27).

Table 3. Percentage of control methods effect on augmentation of onion yield.

Control method	Yield (kg/h)	Percent of yield increase
Control	17521	-
Hand weeding	30532	74/25a
Oxadiazon Herbicide	25729	46/84 c
Oxyfluorfen Herbicide	28309	61/57 b
Composite of Ioxynil and Sethoxydim	23926	36/55d

Averages of weeds control methods from the view point of evaluated traits which had significant F are listed in Table 3. Among herbicides, Oxyfluorfen had the highest impact on yield which its reason could be durability and long-term sustainability of this herbicide in soil. Due to high durability and sustainability of this herbicide, it can be use as pre-emergency and post emergency herbicide. Minimum effect was related to composite of Ioxynil and Sethoxydim. Oxyfluorfen herbicide had the greatest increase in yield as compared with control treatment.

Oxadiazon herbicide in weeds control is intermediate of two others herbicides. This herbicide could cause to 8208 kg/ha for yield as compared with control treatment (non-weeding). The results of this research about Ioxynil and Sethoxydim herbicides were opposite with results of Taheriyan *et al* (Taheriyan *et al* 1992). They observed that these herbicides were better for control of broad leaf weeds and narrow leaf weeds in comparison with other studied herbicides. Also, the results of Shirzad and Bolandnazar represented that combination of Ioxynil and Oxadiazon herbicides had better effect in weeds control as compared with treatment of just Oxadiazon herbicide.

Table 4. Digits of interaction and control methods to enhance performance.

Onion varieties	Control method	Yield (kg/ha)	Percent of yield augmentation
Azarshahr red onion	Control	16405	
	Hand weeding	28509	73/78 a
	Oxadiazon herbicide	22245	35/59 c
	Oxyfluorfen herbicide	25728	56/83 b
	Composite of Ioxynil and Sethoxydim	20850	97/09 d
Zargan	Control	18768	
	Hand weeding	32000	70/50 a
	Oxadiazon herbicide	27152	44/67 c
	Oxyfluorfen herbicide	30032	60/01 b
	Composite of Ioxynil and Sethoxydim	25328	34/95 d
Swaet Spanish	Control	17392	
	Hand weeding	31088	78/74 a
	Oxadiazon herbicide	27792	59/79 c
	Oxyfluorfen herbicide	29168	67/70 b
	Composite of Ioxynil and Sethoxydim	25600	47/19 d

Mean comparisons for the interaction of Control methods×cultivars (Table 4) demonstrated that in treatment of hand weeding, Swaet Spanish had the highest yield. After this treatment, Swaet Spanish had maximum yield in treatment of Oxyfluorfen herbicide. It may be because of modification in Swaet Spanish cultivar and its resistance against weeds and its yield increase. Of course, these hypotheses should investigate by competition experiments. Minimum percent of yield augmentation was belonged to interaction of Azarshahr red cultivar×Composite of Ioxynil and Sethoxydim, it may be because of being local cultivar and its non-purity and totally low resistance against weeds which represented the lowest yield augmentation with applying treatments of spray and weeding as compared with control treatment. Van Heemst (1985) demonstrated that averages of yield reduction due to weeds were 25% in wheat, 49% in rice, 77% in sugar beet and up to 100% in onion. Yield and biomass of onion decreased with increasing competition period and the highest reduction of yield (%94.7) was obtained due to competition during all season (Rameshwar *et al.* 2001). Prakash *et al* (2000) reported that being long time for season of weed competition with crop reduced onion yield up to %81.2 in comparison to without weed conditions.

Herbicides have different effect on various types of weeds. Oxyfluorfen herbicide at 15 and 30 days after planting could control weeds of Amaranthus, Solanum nigrum and chenopodium album better than two other herbicides (Fig. 1, 2). Of course, the impact of this herbicide in control of Amaranthus at 15 days after planting and at control of Amaranthus and Solanum nigrum in 30 days after spraying was less than hand weeding treatment.

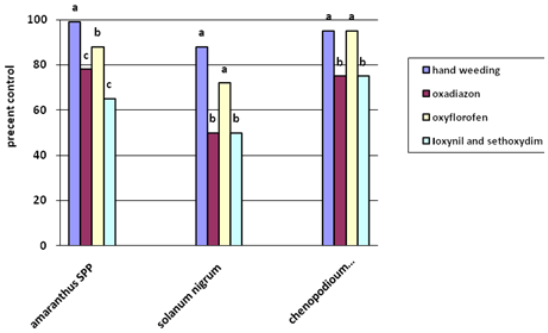

Fig. 1. Effect of mechanical and chemical control methods on percent of weeds control, 15 days after spraying.

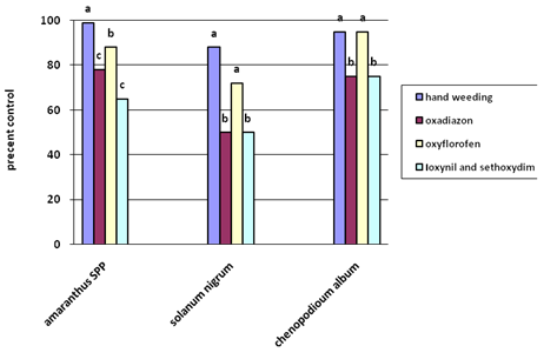

Fig. 2. Effect of mechanical and chemical control methods on percent of weeds control, 30 days after spraying.

Table 5. Effect of weeds control methods on reduction percentage of weeds dry weight, 30 days after spraying.

Control methods	Amara-nthus	Solanum nigrum	Chenopodium album
Hand weeding	100 a	100 a	100 a
Oxadiazon herbicide	68/06 c	55/27 b	82/32 b
Oxyfluorfen herbicide	81/33 b	50/00 b	95/24 a
Composite of Ioxynil and Sethoxydim	64/24 C	28/85 C	80/28 b

Averages which have been shown by common letters, had no significant different at 5% probability level based on Duncan's test.

Based on mean comparisons, after hand weeding treatment; treatment of Oxyfluorfen herbicide caused to the highest percent of reduction in dry weight of Amaranthus weed. Just in Amaranthus weed, no statistical difference was observed between oxadizaon herbicide and composite of Ioxynil and Sethoxydim herbicides so both treatments were placed in same statistical class (table 5). In solanum nigrum weed, there were significant differences between treatments of herbicide and weeding. Among herbicide treatments, Oxyfluorfen and oxadiazon had the greatest impact on reduction percent of weed dry weight and were placed after weeding. Composite of Ioxynil and Sethoxydim herbicides had the lowest effect on solanum nigrum weed which had significant difference with other herbicides. In chenopodium album, no significant difference was observed between treatments of weeding and Oxyfluorfen herbicide so both treatments were placed in same statistical class which Oxyfluorfen herbicide had the highest percent of reduction in weed dry weight. There were no significant differences between treatments of oxadiazon herbicide and composite of Ioxynil and Sethoxydim herbicides from the view point of dry weight reduction in chenopodium album. The results of herbicides effect on reduction of weeds dry weight are in conformity with results of Farids (2006). He demonstrated that Oxyfluorfen herbicide, 45 days after seedling transfer to field caused to control of onion weeds and reduction in dry weight after hand weeding.

Conclusions

Analysis of variance for evaluated traits indicated that there were differences between weeds control methods and between onion cultivars.

Mean comparisons demonstrated that hand weeding is the best method for weeds control and among herbicides; Oxyfluorfen had the highest effect which its reason could be durability and long-term sustainability of this herbicide in soil. In comparisons of control methods with cultivars yield, it was observed that after treatment of hand weeding, Swaet Spanish had the greatest yield among control methods and among other studied varieties. Based on mean comparisons, after hand weeding treatment; treatment of Oxyfluorfen herbicide caused to the highest percent of reduction in weeds dry weight and there were no significant differences between treatments of oxadiazon herbicide and composite of Ioxynil and Sethoxydim herbicides.

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