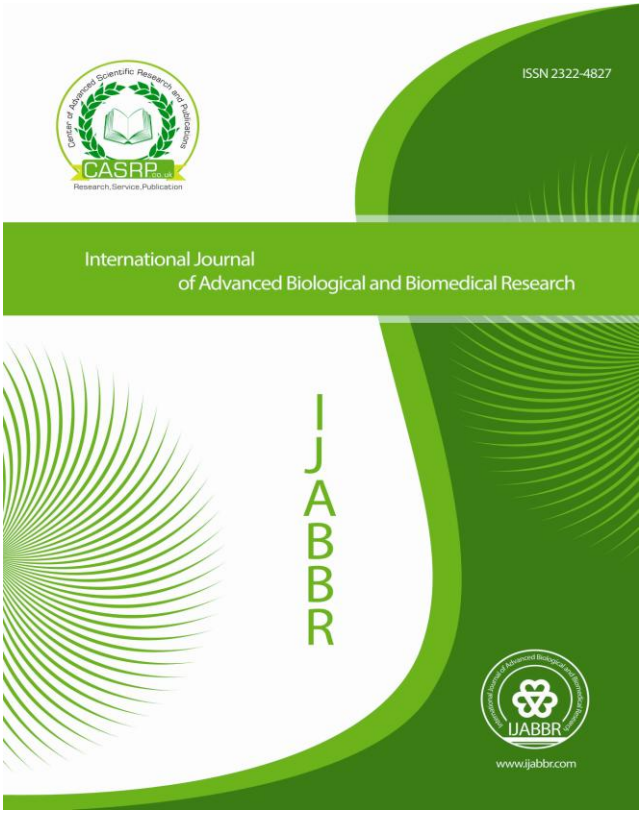

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The effect of different harvest times of first cutting in perennial alfalfa on percentage of dry weight of weeds and alfalfa in second cutting

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Abstract

This study was conducted in perennial alfalfa farm infected by weeds located at Km 7 Hamadan-Tehran road in the spring of 2014 and 2015 in a randomized complete block design with 11 treatments and 4 replications compared with control to investigate the effects of different harvest times of first cutting on the increase or decrease in percentage of dry weight of weeds and also alfalfa in second cutting. Treatments of this research were different harvest times in different stages of flowering in terms of percentage including: first harvesting in 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45% and 50% of flowering in Alfalfa farm. In both years, the treatments were performed only in the first cutting and their effects were evaluated on the first and second cutting. In the second cutting the harvest time took place in 50% of flowering. Sampling was performed to determine the dry weight of alfalfa and also density and dry weight of weeds. The results showed that when the weed infestation is high in established alfalfa farm, early harvest in the first harvesting can significantly reduce the percentage of weeds and also the positive effects of it can be observed in second harvesting, as if early harvest increased the percentage of dry weight of alfalfa and a wide range of weeds was controlled. The final results showed that alfalfa harvesting in lower percentages of flowering led to better control of weeds.

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Keywords: Alfalfa, Weeds, Harvest time.

1. Introduction

Alfalfa as a forage plant with the largest land under cultivation (Raoofi et al., 2014), having high protein and vitamins A, B and C plays an important role in the feeding of livestock (Khanjani and Soleymani pery, 2005). Fibers comprise more than 25% of dry weight of alfalfa (Mighani et al., 2012). Special attentions have not been taken on the production of this plant in Iran (Karimi, 1990). Weeds are the problems and challenges of alfalfa production (Mighani et al., 2012). Weeds apart from the competition reduce the quantity and quality of alfalfa and lead to 33 to 60% drop in its price (Khanjani and Soleymani pery, 2005; Khanjani, 2000). The highest damage of weeds in alfalfa is related to first harvesting (Zand et al., 2010). Weeds control in alfalfa farms was often done by herbicides (Raoofi and Giti, 2015). Six herbicides have been recommended for cultivation of alfalfa (Zand et al., 2008). Unfortunately, due to the quick impacts of herbicides, farmers generally prefer the use of herbicides to other methods and undoubtedly herbicides have irreparable impacts on environment. Harvest times are considered farming methods to control of weeds in Alfalfa (Raoofi, 2012). Certainly, the use of more than one step within consecutive years would be more effective compared to the usage in one step. According to excessive consumption of herbicides and hazards on human health and the environment, finding non-chemical method is reasonable which can significantly reduce the ratio of weeds; and this issue was considered in the protocol of this research. The main purpose of this study was to be overcome on weed control by a non-chemical method as well as be selected the best time for weed control among the times of harvesting. Certainly, this would be a method without environmental risk for weed management.

2. Materials and methods

This study was conducted in perennial alfalfa farm infected by weeds located at Km 7 Hamadan-Tehran road in the spring of 2014 and 2015 in a randomized complete block design with 11 treatments and 4 replications compared with control (without weeding) to investigate the effects of different harvest times of first harvesting on the increase or decrease in percentage of dry weight of weeds and also alfalfa in second harvesting. Treatments of design were different harvest times in different stages of flowering in terms of percentage including: first harvesting in 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45% and 50% of flowering in farm. In both years, the treatments were performed only in the first harvesting and their effects were evaluated on the first and second harvestings. In both years, the treatments were performed only in the first harvesting and their effects were evaluated on the first and second harvestings. Sampling in first harvesting was performed in the steps described above and in the second harvesting took place in conventional time i.e. 50% of flowering to determine the dry weight of alfalfa and also density and dry weight of weeds with constant quadrat of 50 × 50 m^2. Dry weight of alfalfa and weeds samples was determined after drying in the oven at 70 °C for 48 hours. Because of the wide range of weeds on the farm, dry weight index as a reliable indicator was used for comparison instead of density; although the density of weed was separately evaluated based on species. Data was analyzed by software SAS ver. 9.1 and comparison of means was calculated by Duncan's multiple range tests.

3. Results

In two-year study identified weeds were:

1) Safflower (*Carthamus* spp.)
2) Hardheads/ Knapweed (*Centaurea* spp.)
3) - / (*Ceratocephalus falcatus*)
4) Field bindweed (*Convolvulus arvensis* L.*)*
5) Field dodder (*Cuscuta* spp.)

6) Bermuda grass (*Cynodon doctylon)*
7) Tansy mustard (*Descarainia Sophia* L.*)*
8) Sun spurge (*Euphorbia* spp.*)*
9) Bulb barlet (*Hordeum bulbosum* L.*)*
10) Mouse barley (*Hordeum murinum* L.*)*
11) Prickey lettuce (*Lactuca* spp.)
12) Curled dock (*Rumex crispus* L.*)*
13) Violet sage (*Salvia nemorosa*, *Sisimbrium irio* L.*)*
14) Johnsongrass (*Sorghum halepense* L.*)*
15) Dandelion (*Taraxacum officinalis)*
16) Salsisfy (*Tragopogon* spp.) and
17) Cow cockie (*Vaccaria pyramidata Medic)*

It should be noted that all weeds had high density in farm, but the highest density was associated with (Tragopogon spp.), (*Descarainia Sophia* L.), (*Taraxacum officinalis)* and (*Hordeum murinum L.*). Effects of treatments on density and dry weight of weeds and dry weight of alfalfa were significant at level of 5% (Table 1). Flowering in low percentages of farm led to reduction of the density percentage of weeds (Table 2).

Table 1
Variance analysis of the density and dry weight biomass of weeds and alfalfa.

		Mean square		
SOV	**df**	**Weed density**	**Weed dry weight**	**Alfalfa dry weight**
Block	3	1.33 ns	0.77 ns	188.67
Treatment	11	198877.25*	4225.98*	4587.75
Error	33	4.8	1.32	118.87
CV		0.7	4.66	3.3

ns: No significant difference / * significant difference at 5% / ** significant difference at 1%.

Early harvest of first harvesting had significant effect on reduction in density of weeds so that showed a favorable decline up to 25% flowering, Harvest in 50% flowering caused weeds can grow completely and increased the density of weeds. In certain circumstances which the outbreaks of weeds are high, their density can be greatly reduced through early harvest of the first harvesting. Raoofi et al (2012) have also noted to similar results and suggested that early harvest in farms infected to weed of (*Hordeum murinum* L.*)* decreased its density and dry weight. We also observed such results in examining the dry weight. These results on dry weight of weeds showed that weeds have damaged in flowering of 25% and above and almost problems have been proven. There was no significant difference among treatments of 25%, 30% and 35% flowering and this means that the effects of primary densities of weeds would be more dangerous than the higher densities.

In assessment of increasing the percentage of dry weight of alfalfa in the first harvesting, because the harvest time was much earlier than the original time thus we were not faced with an increase in the dry weight of alfalfa in this harvesting; for this reason that by early harvest of alfalfa, this forage plant did not adequately grow and did not reach to favorable status of growth, but certainly positive result of this issue will be clear in the next harvesting. Table 3 shows that early harvest in the first harvesting had positive effects on second harvesting so that the density and dry weight of weeds decreased up to harvest of 30% flowering in the first harvesting, and also dry weight of alfalfa increased in second harvesting. In second harvesting, full weeding control had six percent of weeds because of implementation of treatments, even full weeding, only in the first harvesting. Full weeding was done until harvest time and after the first harvest were not any treatments. In general, it was concluded that wide range of weeds can be controlled by changing the harvest time in the first harvesting and prevented from transferring of weeds to reproductive phase in the farms of established alfalfa with high incidence of weeds. This issue also prevents the increase of soil seed bank. Also the next harvestings will be free of weeds and the efficiency of alfalfa will increase. The findings indicated that if established alfalfa farm has a high prevalence of weeds, variety of weeds can be managed by early harvesting. Harvesting in the early stages of flowering in the farm

caused to more desirable control of weeds and this had positive effects on the quantity of alfalfa production, especially in the next harvests. Obviously, if the weeds had not been controlled in an appropriate manner in the first harvests, the devastating effects would have caused a loss in production in the next harvests. In this study, the effect of the right time of weeds control was very clear on product yield.

Table 2

Comparison of the mean treatments and related traits of weeds and alfalfa in fist cutting.

Treatments	% Reduction In Weed Density / Plant.m^2	% Reduction In Weed Dry Weight / g.m^2	% Increase In Alfalfa Dry Weight / g.m^2
%5 Flowering	72 b	85 b	44 b
%10 Flowering	64 b	78 b	43 b
%15 Flowering	55 bc	71 b	43 b
%20 Flowering	53 bc	66 b	39 bc
%25 Flowering	44 d	58 bc	37 bc
%30 Flowering	41 d	55 c	37 bc
%35 Flowering	40 d	53 c	36 bc
%40 Flowering	25 e	38 d	34 bc
%45 Flowering	15 f	19 e	21 d
%50 Flowering	14 f	19 e	21 d
Weeding	86 a	100 a	100 a
Control	0 g	0 f	0.01 e

Values in the same row with distinct superscripts differ significantly-Dancan (P <0.05).

Table 3

Comparison of the mean treatments and related traits of weeds and alfalfa in fist cutting**.**

Treatments	% Reduction In Weed Density / Plant.m^2	% Reduction In Weed Dry Weight / g.m^2	% Increase In Alfalfa Dry Weight / g.m^2
%5 Flowering	91 a	92 a	98 a
%10 Flowering	90 a	92 a	97 a
%15 Flowering	91 a	91 a	97 a
%20 Flowering	92 2	91 a	97 a
%25 Flowering	95 a	98 a	95 a
%30 Flowering	89 a	88 a	95 a
%35 Flowering	75 b	75 b	87 ab
%40 Flowering	64 c	66 c	87 ab
%45 Flowering	55 d	56 d	71 c
%50 Flowering	55 d	56 d	69 c
Weeding	92 a	93 a	98 a
Control	0 e	0 e	0 d

Values in the same row with distinct superscripts differ significantly-Dancan (P <0.05).

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