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The Effect of integrated control methods of broadleaf weeds density on sugar beet yield in Kermanshah zone

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ABSTRACT

In order to study the impacts of mechanical (using cultivation), chemical (using herbicides) methods and their integration in controlling broadleaf weeds in sugar beet fields, this experiment was carried out as a randomized complete block design with 4 replications in Mahidasht-Kermanshah in 2006. In this experiment, 9 different treatments consisting a mixture of post-emergence herbicides phenmedipham + desmedipham + Ethofumesate and Triflusulfuron Methyl with Sittogate combined with cultivation and 2 check treatments with and without control of the weeds were investigated. The results indicated that cultivation treatment accompanied by Triflusulfuron Methyl reduced dry weight of weeds by 54.91% and showed 100% control of Amaranthus spp. In comparison with control treatment. Cultivation treatment combined with a mixture of phenmedipham+desmedipham+Ethofumesate and Triflusulfuron Methyl with Sittogate increased the sugar beet root dry weight by 159.89% and caused 100% control of the density of Conringia orientalis. Phenmedipham+desmedipham+Ethofumesate plus Triflusulfuron Methyl with sittogate treatment increased root yield by 121.86% compared to the check. In conclusion, the highest root yield was obtained in the cultivation treatment combined with phenmedipham + desmedipham+Ethofumesate, a mixture of phenmedipham + desmedipham + Ethofumesate and Triflusulfuron Methyl with Sittogate and cultivation treatments in sugar beet.

Keywords: Chemical control, Integrated management, mechanical control, Sugar beet, Weed

INTRODUCTION

Sugar beet is known as an important industrial crop which is cultivated in an area of 9 000 000 ha with mean yield of 28.6 t.ha^{-1}inthe world (Saee 2006). It is the main source of sugar in the world (Biancardi et al. 2008). Weeds have been traditionally the major problem in sugar beet cultivation (Cooke and Scott, 2000). Bazoobandi et al. (2007) stated that out of 152 weed species observed and recorded in sugar beet fields, 16 species are of more importance and are regarded as problematic weeds. Among the broadleaf weeds, *Amaranthus* spp., lamb's quarters and nightshade (*Solanumnigrum*) are the most important ones composing 70% of the weeds of all sugar beet fields altogether. Bazoobandi et al. (2010) notes that broadleaf weeds impose much greater losses, up to 100% of the crop in some cases, than the narrow-leaf weeds. Also, Bazoobandi et al. (2007) reports that avoiding this loss with only one method is not possible. As Najafi (2007) mentions, the growing resistance of weeds to herbicide marks the shortcomings of resorting only to chemical methods in weeds management. One of the approaches for reducing the application of the herbicides is to use integrated weeds management. As compared to the merely chemical methods, integrated weeds management decreased weeds density by 41%, increased the yield by 11-27%, and decreased herbicide application by up to 60%. Studies on reducing herbicides application show that the application of phenmedipham,

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Table 1. Description of the experimental treatments

Treatment	Type and doze of the applied herbicides
A	Phenmedipham + desmedipham + ethofumesate at the rate of 360 g essential oil per ha at cotyledon stage and 2-4-leaf stage of sugar beets (Sheikhi Gorjan et al., 2009)
B	Triflusulfuron methyl at the rate of 18 g essential oil per ha + (phenmedipham + desmedipham + ethofumesate) at the rate of 360 g essential oil per ha + sittogate (2:1000) at cotyledon stage of sugar beets + inter-row cultivator application at 8-leaf stage of sugar beets (Sheikhi Gorjan et al., 2009)
C	Application of phenmedipham + desmedipham + ethofumesate at the rate of 360 g essential oil per ha at cotyledon stage of sugar beets + cultivator at 8-leaf stage
D	Triflusulfuron methyl at the rate of 18 g essential oil per ha + sittogate (2:1000) at cotyledon stage and its replication at 2-4-leaf stage
E	Triflusulfuron methyl at the rate of 18 g essential oil per ha + sittogate (2:1000) at cotyledon stage of sugar beet + cultivator at 8-leaf stage
F	Control with no weeding
G	Triflusulfuron methyl at the rate of 18 g essential oil per ha + (phenmedipham + desmedipham + ethofumesate) at the rate of 160 g essential oil per ha + sittogate (2:1000) at cotyledon stage and its replication at 2-4-leaf stage (Sheikhi Gorjan et al., 2009)
H	Control with full weeding
I	Application of cultivator at 8-leaf stage of sugar beet

desmedipham + ethofumesate at one stage increases sugar beet yield by 27% and the mixed application of chloridazon + phenmedipham increases it by 65% (Ghanbari Birgani et al. 2000; Maleki et al. 2008). In addition to nonchemical methods of weeds management, resorting to the technique of increasing weeds control efficiency (e.g. by mixing the herbicides) is another advisable technique. For example, Abdollahian-Noghabi et al. (2006) concluded that the application of the mixture of triflusulfuron methyl and phenmedipham + desmedipham + ethofumesate and also, the mixture of chloridazon and phenmedipham + desmedipham + ethofumesate had the highest efficiency in controlling weeds and increasing the yield and that the application of merely cultivator + the application of low-efficiency herbicides controlled the weeds and so, increased the yield. Sadri et al. (2008) stated that mixed application of sugar beet herbicides was more effective than their separate application. Also, Maknali and Damanafshan (2008) recommended the integration of herbicides with cultivator for integrated control of weeds. In a study on integrated weeds management, Dezhjooy *et al*. (2008) found that tillage decreased weeds dry weight by 62% and increased the yield by 17% as compared to no-tillage treatment and that band herbicide application reduced herbicide application by 50%. The integration of tillage with band herbicide application resulted in 71% lower weeds dry weight and consequently, higher physiological indices of growth. Also, Fereidoonpoor and Behaeen (2008) stated that the application of inter-row cultivator and on-row band herbicide application resulted in the highest yield as compared to sole herbicide application and so, they recommended this treatment for reducing environmental contamination. The present study was carried out to study weeds management in sugar beet fields as reducing herbicide application, integrating the application of cultivator and herbicide, and integrating newly-introduced herbicides with split doses to improve the range of weeds being controlled.

MATERIALS AND METHODS

The present study was carried out in a field with the area of 1950 (65×30) m^2Mahidasht Research Station (Long. 46°50' E., Lat. 34°16' N., Alt. 1380 m) of Kermanshah, Iran in 2006. It was based on a Randomized Complete Block Design with four replications and nine treatments in which technical monogerm cultivar 7232 was used. The studied treatments are summarized in Table 1.

During the experiment, all narrow-leaf weeds were removed from the treatments and replications. A permanent quadrate (1×1 m^2) was mounted in the plots to examine the effect of experimental treatments on the population of weeds. The effect of experimental treatments was evaluated by three methods during the growth period: the number and species of broadleaf weeds inside the mounted quadrate were determined and then, their frequency percentage was calculated before the application of the experimental treatments. Then, these parameters measured again 2-4 weeks after the application of the treatments. Weeds dry weight, too, was

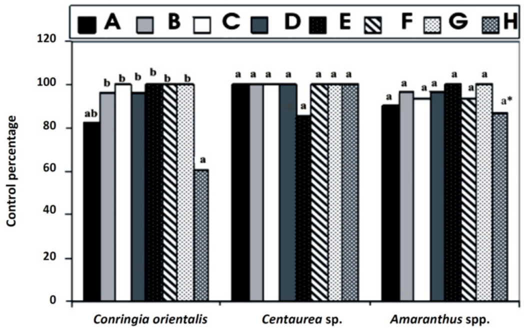

Fig. 1. The percentage of controlled dominant weeds 30 days after the application of the treatments as compared to control (no herbicide application)
On the basis of Duncan Test, similar letter(s) for each plant shows non-significant difference at 5% probability level.

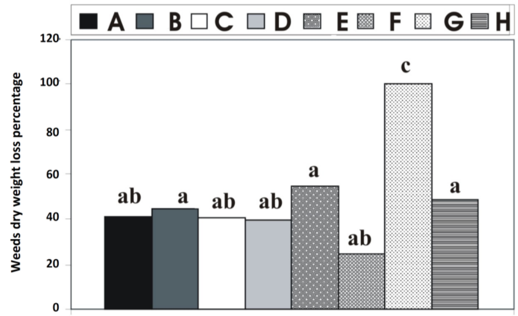

Fig. 2. Weeds dry weight loss percentage at the end of sugar beet growth period under the experimental treatments as compared to control (no weeding)
On the basis of Duncan Test, similar letter(s) for each plant shows non-significant difference at 5% probability level.

measured with the quadrates 4 weeds after the application of the treatments and sugar beet maturity. After the application of treatments, the sugar beet plants in an area of 1×1 m^2 were harvested fortnightly and their shoot and root dry weights were measured after oven-drying the weeds and sugar beets samples at 75°C for 48 hours. At the maturity time of sugar beets, root fresh weight was measured in addition to shoot and root dry weight. The collected data were statistically analyzed by MS-TATC and MS-Excel software.

RESULTS AND DISCUSSION

The most important weeds in the present study included *Amaranthus* spp., *Conringiaorientalis* L., licorice (*GlycyrrhizaglabraL.*), creeping thistle (*Cirsiumarvense* (L.) scop), field bindweed (*Convolvulus arvensis* L.) and cornflower (*Centaurea* sp.).

Number of weeds

Analysis of variance showed that the experimental treatments significantly ($P < 0.01$) affected the densities of *Amaranthus* spp., *Conringiaorientalis* and Centaurea sp. The evaluations carried out 31 days after the treatments revealed that treatments triflusulfuron methyl + cultivator, (phenmedipham + desmedipham + ethofumesate) + cultivator, and triflusulfuron methyl + sittogate + (phenmedipham + desmedipham + ethofumesate) controlled the weeds by 100% which is in agreement with Abdollahian-Noghabi et al. (2006) and also with Shimi et al. (2006) who reported that mixed application of herbicides controlled *Amaranthus* spp. more optimally (Fig. 1). In addition, Jamali et al. (2006) ranked the treatment of phenmedipham + chloridazon + clopyralid and the treatment of phenmedipham + ethofumesate in superior group which is in agreement with our findings. It was found that the studied cultivars, if used separately, would result in better weeds management if they are accompanied with cultivator application, and that if cultivator would not be used, it is recommended to mix both herbicides. Indeed, other studies confirm integrated weeds management and show that integrating nonchemical techniques with chemical methods results in 60% decrease in the application doze of the herbicides (Maleki et al. 2008).

Weeds dry weight

According to the analysis of variance, the studied treatments did not significantly influence weeds dry weight at 5% probability level, whereas this influence was significant at the end of the period. Evaluations at the end of sugar beet growth period revealed that treatment of triflusulfuraon methyl + cultivator resulted in 54.91% decrease in weeds total dry weight (Fig. 2). This finding is similar to the results reported by Abdollahian-Noghabi *et al*. (2006) and is in agreement with Maknali and Damanafshan (2008) and Dezhjooy et al. (2008) who stated the necessity of integrating chemical and mechanical (cultivator) methods for weeds management. This finding indicates that the rate of herbicide application can be decreased by the application of one herbicide + cultivator and that the best management of weeds can be realized by making use of the integrated chemical and mechanical methods.

Sugar beet biomass and root yield

The analysis of variance showed insignificant impact of the studied treatments on sugar beet shoot dry weight 80, 100, 115, 140 and 170 days after sowing (P < 0.01), but the impact was shown to be significant 130 and 185 days after sowing at 5% probability level. Evaluations during sugar beet growth period suggested the positive influence of the integrated treatments and cultivator application on sugar beet dry weight so that the treatments of (phenmedipham + desmedipham + ethofmesate) + cultivator and the cultivator alone gave the greatest increase in sugar beet dry weight by 210.39 and 84%, respectively (Fig. 3). These findings are in agreement with the results reported by Farajpour Kordasiabi *et al.*, 2008) suggesting that the application of phenmedipham + desmedipham + ethofumesate had no adverse effect on sugar beet shoots and their application accompanied with cultivator is recommended.

According to the results of analysis of variance, the impact of the treatments was not significant at 5% probability level on sugar beet root dry weight 80, 100, 115 and 185 days after sowing, but the impact was significant at 1% level 130, 140, 155 and 170 days after sowing. As evaluations during sugar beet whole growth period showed, the treatment of (phenmedipham + desmedipham + ethofumesate) + sittogate + triflusulfuron methyl + cultivator resulted in 159.89% higher root dry weight as compared to control (no weeding) (Fig. 4). This finding is consistent with Dezhjooy (2008) and Fereidoonpoor and Behaeen (2008).

The effect of the studied treatments on sugar beet root yield was found to be significant at 1% probability level. As evaluations revealed, the treatment of (phenmedipham + des medipham + ethofumesate) + sittogate + triflusulfuron methyl had the highest effect on root yield by resulting in 121.86% higher root yield (Fig. 5). It is inconsistent with the findings reported by Dezhjooy (2008) and Maknali and Damanafshan (2008). In this respect, Ghanbari Birgani et al. (2000) suggested the application of triflusulfuron methyl + phenmedipham as the best treatment for increasing sugar beet root yield. They reported the increase in yield as to be 79%. Taherian and Mohammad Khani (1986) recommended chemical method and reported that this method had the highest increase in root weight. In another study, Ghanbari Birgani et al. (2006) reported the treatment of chloridazon + (phenmedipham + des medipham + ethofumesate) as the best treatment which increased the root yield by 65%. It is in agreement with our findings about higher root fresh weight of sugar beet. In total, it was found that the application of cultivator + herbicides had the best influence on root dry weight, but the highest effect on root yield was brought about by the integrated application of herbicides.

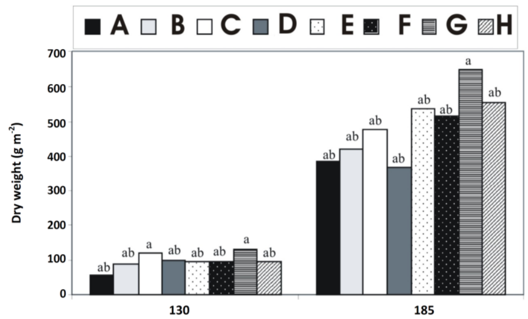

Fig. 3. Sugar beet shoot dry weight under the experimental treatments as compared to control (no weeding)
On the basis of Duncan Test, similar letter(s) for each plant shows non-significant difference at 5% probability level.

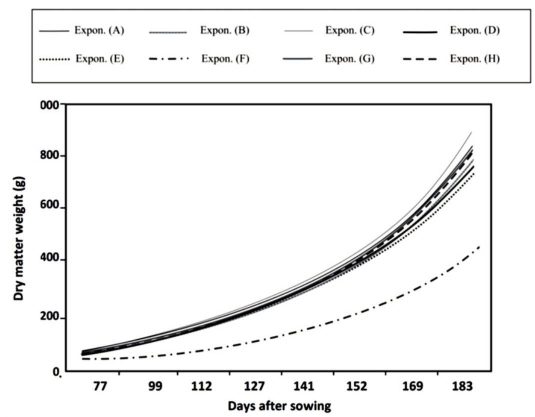

Fig. 4. Sugar beet root growth pattern under the experimental treatments as compared to control (no weeding)
On the basis of Duncan Test, similar letter(s) for each plant shows non-significant difference at 5% probability level.

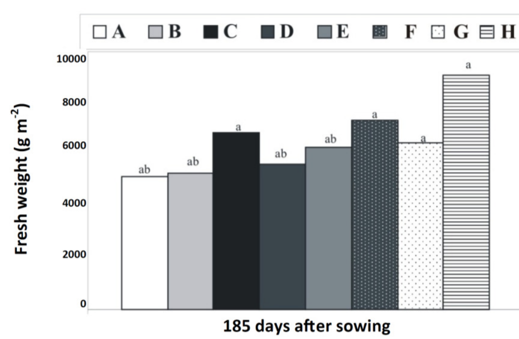

Fig. 5. Sugar beet root yield ratio under the experimental treatments as compared to control (no weeding)
On the basis of Duncan Test, similar letter(s) for each plant shows non-significant difference at 5% probability level.

References

Abdollahian-Noghabi M, Rahbari A, Alizadeh HM, Khalaghani

J, Rahimian Mashhadi H. Effect of weed control methods on yield and quality of sugar beet in seed bed preparation process in autumn. Proceedings of the 1st Iranian Weed Science Congress. Jan 25-26,2006; Tehran, Iran: pp 145-49. (in Persian)

Bazoobandi M, Baghestani Maybodi MA, Z and E. Weeds and their management in sugar beet fields. Plant Protection Research Institute of Iran, Tehran. 2007; 80 pp. (in Persian)

Bazoobandi M, Nikkhah MN, Nabavikalat M, Akhavan M. Floristic studies in weeds of sugar beet cropping in Shahrood. The Proceedings of the 3rd Iranian Weed Science Congress. Vol.1: Weed Biology and Ecophysiology, Feb 17-18, 2010; Babolsar, Iran: pp 64-68. (in Persian)

Biancardi EL, Campbell G, Skaracis GN, De biaggi M. Genetics and breeding of sugar beet. 2008. Shiraz University Press.

Cooke DA, Scott RK. The sugar beet crop science into practice. 2000. Translated from English to Persian. Tehran University Press. 731pp.

Dezhjooy M, Ahmadvand G, Sepehri A, Jahedi A. The effect of integrated weed control (mechanical-chemical) on reduction of herbicide dosage and physiological growth indices of corn (*Zea mays* L.).Proceedings of the 18th Iranian Plant Protection Congress.Vol.3 weeds. Aug 24-27, 2008; Hamedan, Iran, P. 128. (in Persian)

Farajpour Kordasiabi F, Filizadeh Y, Abtali Y, Fotoukian MH. Integrated weed management in soybean (*Glycine max* L.) by post-emergence herbicides. Proceedings of the 18th Iranian Plant Protection Congress. Vol.3 weeds. Aug 24-27, 2008; Hamedan, Iran. P. 133. (in Persian)

Fereidoonpoor M, Behaeen MA. Comparison of the efficacy of band and broadcasting application of herbicides in weed control of corn.Proceedings of the 18th Iranian Plant Protection Congress.Vol.3 weeds. Aug 24-27, 2008; Hamedan, Iran.P. 112. (in Persian)

Ghanbari Birgani D, Hosseinpoor M, Abdollahian-Noghabi M, Shimi p. Investigation on mixture of herbicides and oil adjuvant for increased efficacy in sugar beet. Proceedings of the 1st Iranian Weed Science Congress.Jan 25-26, 2006; Tehran, Iran. p. 404-7. (in Persian)

Ghanbari Birgani D, Mirkamali H. Mazaheri A. Investigation on herbicide efficacy of Betanal Progress A.M in control of broadleaf weeds in sugar beet. Proceedings of the 14th Iranian Plant Protection Congress.Vol.2 Plant Pathology and Weeds. Sep 14-17, 2000. Isfahan, Iran. P 286. (in Persian)

Jamali M, Afshari Nafar Kh. Evaluation of herbicides of sugar beet fields.Proceedings of the 17thIranian Plant Protection Congress Vol. 3 Weeds. Sep 11-14, 2006; Karaj, Iran.P. 49. (in Persian)

Maknali A, Damanafshan E. Investigation on integrated management of weeds in seed clover (*Trifoliumalexandrinum*). Proceedings of the 18th Iranian Plant Protection Congress.Vol.3 weeds. Aug 24-27, 2008; Hamedan, Iran. P. 134. (in Persian)

Maleki GH, Zand E. Mirhadi SMJ. Investigation of different weed management methods for reducing herbicide rates in sugar beet. Proceedings of the 2nd National Weed Science Congress. Vol.1: Weed Management and Herbicides, Jan 29 and 30, 2008; Mashhad, Iran: pp 81-84. (in Persian)

Najafi H. Non-Chemical Weed Management. Kankash Danesh Publications, 2007; 198 pp. (in Persian)

Sadri S, Sobhani A, Nabavi Kalat M, Bazoobandi M, Arian H. Evaluation of various herbicide mixtures on yield and root dry weight of sugar beet .Proceedings of the 2nd National Weed Science Congress. Vol.1: Weed Management & Herbicides, Jan 29&30,2008; Mashhad, Iran: pp 378. (in Persian)

Saee A. Sugar beet. Accessed 2006, Mar. 6 http://s_beet.persianblog.com/1383_4_s_beet_archive.html

Sheikhi Gorjan A, Najafi H. Abbasi S, Saber F, Rashid M. The pesticide guide of Iran 2009, Tehran: Ketab Paitakht Press. Pp 237. (in Persian)

Shimi P, Ghambari-Birgani D, Faravani M, Abdollahian Noghabi M. Evaluation of post-emergence herbicides in sugar beet. Iranian Journal of Weed Sci. 2006; 1: 97-105

Taherian P, Mohamad Khani A. Comparison of chemical methods with hand hoeing in control of weeds on sugarbeet fields in Karaj. Proceedings of the 8th Iranian Plant Protection Congress.Aug 30- Sep 4, 1986; Isfahan, Iran. P.129. (in Persian)