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Investigation of non-chemical weeds management methods in corn field

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ABSTRACT.

In order to determine the effects of various corn planting densities and mechanical management methods on weeds, this experiment was carried out at the research farm of Islamic Azad University of Takestan, Iran. A randomized complete block design (RCBD) in a factorial experimental design with four replications was used. Experimental treatments were density factor (including recommended density, 25 and 50% more than recommended one) and mechanical weed control (including two weedings, one weeding, without weeding, one cultivator at corn 25 cm height, and two cultivators at corn 35 cm height). According to the results, corn density and mechanical weed control had significant effect on the reduction of weeds biomass and density, in most cases. Thereby, among mechanical weed control, twice weeding and twice cultivator were the best, and without weeding and once weeding were the worst treatments, respectively. Also, maximum corn biological yield was obtained when twice weeding and twice cultivator was used. Furthermore, results showed that the best reduction of weeds density and biomass were achieved in density of 50% more than recommended one, but among corn traits, the most effective corn density was the recommended one.

Keywords: cultivator, density, mechanical control, weed, weeding.

INTRODUCTION

According to the increasing number of herbicide resistant weeds and environment pollution, developing other methods of weeds management as non-chemical methods by researchers is essential. Thereby, development of mechanical weed control [1] and ecological methods [2] are mentioned as instrumental methods. Mechanical control (cultivator) is one of the most effective weed management methods to suppress weeds, especially the proper time of using of mechanical implements in farms to weeds control is absolutely considerable [3]. In another research, Donald et al [4] stated that cutting down weeds between cultivated rows reduced the annual weeds the best without any yield reduction in corn. Hartzeler et al [5] determined that cultivator usage in early growth season will be more useful. Thus, another research in Iran by Zargar et al [1] determined that mechanical weeds control in early growth period of weeds would make farms free from broad leaf weeds considerably.

To evaluate the effect of corn density on weeds management, an experiment was conducted by Malik et al [6] and Teasdale [7] and demonstrated that by incrassating corn density and also appropriate land occupied by corn, consequently, interference of weeds with crop will be diminished. Reducing the distance between rows can reduce annual late- season weeds biomass by reducing light transmittance to the soil surface [8]. Additionally, reduction of light transmittance from crops canopy that are planted as higher densities affected weeds growth significantly [9]. Also, Tharp and Kells [10] found that biomass of *Chenopodium album* was less when corn density was increased. Similarly, in another research, Harbur and Owen [11] determined that seed production by *Abutilon theophrasti* was reduced by higher corn densities. Saberali et al [12] found that growth of *Chenopodium album* can reduce by an appropriate planting pattern and specific corn density. The aim of this experiment was to evaluate the effect of mechanical weed control in different corn densities to optimize the weeds management.

MATERIALS AND METHODS

In order to evaluate the effects of different corn planting densities and mechanical management methods on weeds control, this experiment was conducted at the research farm of Islamic Azad University of Takestan, Iran in 2009. Soil was a loam with 14% clay, 40% silt, 46% sand, with pH of 7.51. A randomized complete block design (RCBD) in a factorial experimental design with four replications was used. Experimental treatments were density factor (including the recommended density, 25 and 50% more than the recommended one) and mechanical weed control (including two weedings, one weeding, without weeding, one cultivator at corn 25 cm height, and two cultivators at corn 35 cm height).

To prepare the field for corn cultivation, deep plow was used in fall 2008, and other preparation as moldboard plow, disk and leveler were used in spring 2009. Corn cv. 'Single cross 600' was planted in July 2009, and after sowing, the field was irrigated to ensure proper germination. Each experimental plot included 4 rows, each 6m long and 50cm wide. Pest and other crop management strategies were conducted based on Takestan Cooperative Extension Service recommendations. Dominant weeds in this farm were *Chenopodium album*, *Amaranthus blitoides* and *Amaranthus retroflexus* which were evaluated. Thus, Weeds biomass and density were investigated and measured 2 months after treatments. To do this, a 50 × 50 cm quadrate was installed in each plot.

Data Analysis. ANOVA was conducted on all data using the PROC GLM, SAS (2002) [13], and means were compared using Duncan's multiple range tests at 0.05 probability level. Before analysis, data were tested for homogeneity of variance by plotting residuals.

RESULTS AND DISCUSSION

Weed density. The results of analysis of variance indicated that mechanical control had significant effect on density of *Chenopodium album*, *Amaranthud blitoides* and *Amaranthud retroflexus* ($p \leq 0.01$; Table 1). Corn density and interaction of corn density with mechanical control had only significant effect on density of *Amaranthus blitoides* ($p \leq 0.05$; Table 1). Mean comparison of the three corn densities indicated that density of 50% more than the recommended density significantly reduced density of *C. album* and *A. blitoide*, but among three studied weeds, *A. retroflexus* was not significantly affected by increasing corn density (Table 2). In another study, it was reported that reducing light transmittance from crop canopy which is planted in high density can avert weeds growth [9]. Mean comparison of mechanical control also showed the significant differences between various levels of the mechanical control. Among five various mechanical controls, in most cases, two weedings and two cultivators at corn 25 cm height were the best and without weeding and one weeding were the worst on reducing three weeds density, respectively (Table 2).

As it was previously mentioned, the interaction of corn density with mechanical weed control had only significant effect on *A. blitoides*. Thereby, the interaction of two cultivators at corn 35 cm height and 50% more than the recommended one caused the most reduction of *A. blitoides*. On the other hand, without weeding and 25% more than the recommended density was the worst interaction with the highest number of *A. blitoides* (Table 3). Mean comparison of interactions was only conducted for the weeds which were significantly affected by the treatments.

Weed biomass. Results showed that treatments had significant effect on reduction of weeds biomass. Corn density had significant effect on *A. blitoides* ($p \leq 0.01$) and *C. album* ($p \leq 0.05$), but the mentioned treatment had no significant effect on *A. retroflexus*. Moreover, mechanical control affected all three weeds ($p \leq 0.01$) but the interaction of corn density with mechanical weed control had no significant effect on biomass of any of the studied weeds (Table 1). According to mean comparison (Table 2), density of 50% more than the recommended one was the most effective treatment on biomass reduction of both *C. album* and *A. blitoides*, but *A. retroflexus* was not significantly affected by the mentioned treatment (Table 2). This is in agreement with the results published by Tarp and Kells [10] who demonstrated that high corn density could considerably reduce biomass of *C. album*. Also, researchers in another experiment proved that weeds biomass in corn field were significantly reduced by increasing corn density [14].

Mean comparison of mechanical control also indicated the significant differences between various levels of the mechanical control. Among various mechanical controls, two weedings and two cultivators at corn 25 cm height were the most effective treatments on reducing *C. album*, *A. blitoides* and *A. retroflexus*. Also, without weeding and one weeding were the least effective treatments on weeds biomass (Table 2). Mechanical weed control methods is one of the most effective weed management methods to reduce weeds, especially the proper using of mechanical implements in farms to weed control is absolutely essential [3]. The obtained results of the present study proved that two usages of mechanical methods of weed management could desirably reduce weeds biomass and density.

Table1. Analyses of variance of weed density and biomass

Source	d.f.	F ratio					
		Weed density			Weed biomass		
		C. Album	*A. blitoides*	*A. retroflexus*	*C. Album*	*A. blitoides*	*A. retroflexus*
Replication	3	NS	NS	NS	NS	*	NS
Corn density (A)	2	NS	**	NS	*	**	NS
Mechanical control (B)	4	**	**	**	**	**	**
A × B	8	NS	**	NS	NS	NS	NS
Error	42						
CV (%)	-	30.1	26.3	11.7	26.3	24.3	31.2

*Ns, no significant; **, significant at 0.01 and *, significant at 0.05.*

Table 2. Effect of treatments on weeds density and biomass

Treatments	Density (plant m²)			Biomass (g m²)		
Corn density	*C. Album*	*A. blitoides*	*A. retroflexus*	*C. Album*	*A. blitoides*	*A. retroflexus*
Recommended density	1.42ab	1.72a	1.22a	1.86ab	2.14a	1.52a
25% more than recommended density	1.53a	1.55a	1.19a	2a	1.96a	1.41a
50% more than recommended density	1.21b	1.15b	1.22a	1.61b	1.64b	1.58a
Mechanical control						
Two weedings	0.87b	0.92b	1.10b	1.35b	1.46b	1.10b
One weeding	2.10a	2.21a	1.14b	2.14a	2.46a	1.29b
Without weeding	2.11a	2.50a	1.55a	2.45a	2.74a	2.67a
One cultivator at corn 25 cm height	1.14b	0.94b	1.14b	1.61b	1.48b	1.27b
Two cultivators at corn 35 cm height	1.08b	0.91b	1.12b	1.57b	1.42b	1.19b

Means in columns followed by the same letter are not significantly different at P ≤ 0.05.

Table 3. Interactions of corn density and mechanical control on *Amaranthus blitoides*

Treatment	*A. blitoides* (plant m²)
Recommended density × Two weedings	1.04b
Recommended density × One weeding	2.46a
Recommended density × Without weeding	2.92a
Recommended density × One cultivator at corn 25 cm height	1.01b
Recommended density × Two Cultivators at corn 35 cm height	1.18b
25% more than recommended density × Two weedings	1.04c
25% more than recommended density × One weeding	2.01b
25% more than recommended density × Without weeding	2.98a
25% more than recommended density × One cultivator at corn 25 cm height	0.93c
25% more than recommended density × Two cultivators at corn 35 cm height	0.81c
50% more than recommended density × Two weedings	0.70c
50% more than recommended density × One weeding	1.30b
50% more than recommended density × Without weeding	2.16a
50% more than recommended density × One cultivator at corn 25 cm height	0.82c
50% more than recommended density × Two cultivators at corn 35 cm height	0.80c

Means in columns followed by the same letter are not significantly different at P ≤ 0.05.

Corn traits. Among experimental treatments, corn density significantly affected the corn stem diameter, corn net weight and biological yield ($p \leq 0.01$; Table 4). Mean comparison of corn density treatment showed that the recommended density was the most effective density on stem diameter and corn net weight. For biological yield, density of 50% more than the recommended density was the best one (Table 5). Also, this result coincided with Mehrabi et al [15] who reported that corn biological yield effectively increased by high corn density.

Mechanical weed control had only significant effect on stem diameter ($p \leq 0.01$; Table 4). Mean comparison of treatments indicated that two weedings was the most effective on stem diameter (Table 5). Moreover, none of the corn traits were significantly affected by the interaction of treatments (Table 4).

Although treatments had significant effect on weeds control considerably, but their effect on corn measured traits was not desirable. Mean comparison of interactions was only conducted for the traits which were significantly affected by the treatments.

Table 4. Analyses of variance of some corn traits

Source	d.f.	F ratio		
		Stem diameter	Corn net weight	Biological yield
Replication	3	NS	NS	NS
Corn density (A)	2	**	**	**
Mechanical control (B)	4	**	NS	NS
A × B	8	NS	NS	NS
Error	42			
CV (%)	-	12.1	25.1	25.9

*Ns, no significant; **, significant at 0.01 and *, significant at 0.05.*

Table 5. Effect of treatments on some corn traits

Treatment	Stem diameter (cm)	Corn net weight (g/plant)	Biological yield (kg/h)
Corn density			
Recommended density	1.58a	125.8a	2941.2b
25% more than recommended density	1.46b	119.4a	33808ab
50% more than recommended density	1.40b	97.3b	39155a
Mechanical control			
Two weedings	1.63a	122.5a	35857a
One weeding	1.46bc	125a	36695a
Without weeding	1.54ab	111.4a	33.96a
One cultivator at corn 25 cm height	1.44bc	105.2a	30636a
Two cultivators at corn 35 cm height	1.35c	106.7a	34341a

Means in columns followed by the same letter are not significantly different at P ≤ 0.05.

CONCLUSION

Overall results of this experiment indicated that two weedings and two cultivators were the most effective mechanical treatments in all cases, and among corn densities, 50% more than the recommended density was the best on the reduction of weeds and corn biological yield compared with others.

REFERENCES

[1] M Zargar, H Najafi, K Fakhri, S Mafakheri and M Sarajuoghi. *Research on Crops*, **2011**, 12 (1), 173-178.
[2] S Mafakheri, MR Ardakani, F Meighani, MJ Mirhadi and S Vazan, *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, **2010**, 38 (3), 117-123.
[3] W Donald, N Kitchen and K Sudduth, *Weed Technology*, **2001**, 15, 576-584.
[4] W Donald, *Weed Technology*, **2006**, 20, 143-149.
[5] RG Hartzeler, BD Van Kooten, DE Stoltenberg, EM Hall and RS Fawcett, *Weed Technology*, **1993**, 7, 1001-1004.
[6] VS Malik, CJ Swanton and TE Michaels, *Weed Science*, **1993**, 41, 62-68.
[7] JR Teasdale, *Weed Technology*, **1995**, 9, 113-118.
[8] SD Murphy, Y Yakubu, SF Weise and CJ Swanton, *Weed Science*, **1996**, 44, 865-870.
[9] SH Began, RI Hamilton, LM Dwyer, DW Stewart, D Cloutier, L Assemat and K Foroutan, *Weed Technology*, **1996**, 15, 647-653.
[10] BE Tharp and JJ Kells, *Weed Technology*, **2001**, 15, 413-418.
[11] MM Harbur and MDK Owen, *Weed Science*, **2004**, 52, 578-583.
[12] SF Saberali, MA Baghestani and E Zand, *Weed Biology and Management*, **2008**, 8, 54-63.
[13] SAS institute, The SAS system for windows, release 9.1. The Institute Cary, NC, USA, **2002**.
[14] M Tollenaar, AA Dibo, A Aguilera, SF Weise and CG Swanton, *Agronomy Journal*, **1994**, 86, 561-595.
[15] A Mehrabi Dolatabad, GA Akbary, A Zand, AA Dady and MA Baghestani, MSc thesis, Tehran University (Tehran, Iran, **2006**).