Scientific Research and Essays Vol. 7(43), pp. 3727 -3736, 5 November, 2012
Available online at http://www.academicjournals.org/SRE
DOI: 10.5897/SRE12.276
ISSN 1992-2248 ©2012 Academic Journals

Full Length Research Paper

Effects of tillage, fertilization and weed control methods on corn yield in Khuzestan province

Ghasemi Nejad Raeini Mahmoud[1]*, Sheikhdavoodi Mohamad Javad[2], Almassi Morteza[2], Bahrami Houshang[2], Zand Eskandar[3] and Alamisaeid Khalil[4]

[1]Agricultural Machinery Mechanics and Mechanization Department, Faculty of Agriculture, Chamran University of Ahvaz, Iran.
[2]Weed Research Plant Protection Research Institute, Tehran, Iran.
[3]Khuzestan Ramin Agricultural and Natural Resources University, Ahvaz, Iran.

Accepted 17 October, 2012

This work was carried out to evaluate the effects of seed bed preparation, fertilization and weed control (after planting) methods on growth and corn yield in Khuzestan. One field experiment was conducted as strip plot within randomized complete block design with 4 replications during 2009 and 2010. Three seed bed preparation consisted of planting in wet soil (locally named Makhar) + conventional tillage (plough + disk + leveler), planting in wet soil + reduced tillage (disk) and planting in dry soil + reduced tillage and were performed in horizontal plots. Two methods of fertilizing (broadcasting and planting) as main factor and weed controlling methods [once using of felid cultivator in 20 cm height of plants, two times using of felid cultivator in 20, 40 cm height of plant, using of two liters Nicosufuron when the plant had 3 to 4 leaves, control without weed (hand weeding) and control with weed] as sub-factor were conducted in vertical plots. The results indicated that population and biomass dry weight of weed were significantly (P<%5) and were affected by planting in wet soil. Planting in dry soil caused reduction in the population and weed weight (30 and 40%) in Fifth week. In all tillage methods, effect of two times using of field cultivator and chemical control on grain yield and biological yield were statistically similar. In fertilizer planting method, grain yield and biological yield, kernel in rows and rows in ear were significantly (P<%1) more than planting broadcasting method. The most grain and biological yield were obtained in combination of planting in soil Makhar and fertilizer planting (in treatment of soil Makhar + planting + reduced tillage, grain yield was 9003.2 kg/ha). Two times using of cultivator reduced the population and weight of weed significantly more than chemical control in farm with plenty of Bindweed. In all of the fertilizer broadcasting methods, chemical control treatment had more yield, but in fertilizer planting method there was no significant difference between chemical and two times using of cultivator treatments. It seems that in corn farms when fertilizer is used, chemical control of weed is more effective and when plenty of fertilizer is used, two times using of cultivator is recommended.

Key word: Corn, weed management, fertilizing method, reduced tillage.

INTRODUCTION

Maize is one of the main foods for millions of people due to compatibility with different climatic conditions. Also, its area harvest has the third place around the world (Liebman et al., 2001). The highest damage is caused by weeds, pests and diseases. This damage is estimated between 10 to 15% of total production in developed countries in temperate zones, so it is more in developing countries in tropics zone. Therefore, the farmers sometimes spend more than half struggle to control weeds (Rashed et al., 2001).

Weeds compete with crop in different ways, and decrease quality and quantity of agricultural products

*Corresponding author. E-mail: ghasemi.n.m@gmail.com.

(Rashed et al., 2001). Results of some studies showed that weeds are able to use nutrition of soil more than crops (Yadavi et al., 2008; Rashid et al., 2008).

The weeds can grow in the beginning season due to the use of feature that reduces potency of competition plants by creating food shortages (Coulter and Nafziger, 2008; McCarthy et al., 1995; Robert et al., 2002). Weeds are able to compete with corn caused by their greater ability on the lack of resource such as light, water, food, oxygen, carbon dioxide and growing space, also lessen its yield. In corn field, if the weeds are to be controlled later, they can diminish yields by 15 to 100% depending on the number and type of weeds (Zand et al., 2005; Shirani et al., 2009; Kochaki et al., 1995; Nourmohammadi et al., 1998; Yadavi et al., 2008; Ghosheh et al., 1996; Knezevic et al., 2003; Rajcan and Swanton, 2001; Zimdahl, 1988). However, farmers have experienced different ways to destroy weeds on agricultural history. While nowadays they use herbicide and pesticides because of their tendency to methods of minimum tillage, lack of timely plowing farm, and reducing diversity of choice for culture products. But continuous use of the herbicide has reduced in spite of their negative effects, environmental preservation and sustainable production. Also, biological, physical and mechanical weeds controls are suggested for reducing economic losses. New approaches to integrated and sustainable management of weeds can be applied in order to reduce economic losses and weed management, while a manager should use appropriate methods for each regional and condition (Rashed et al., 2001; Zand et al., 2005; Zand et al., 2009; Liebman et al., 2004; O'Donovana et al., 2007).

Many research results showed that plowing increase weed population. However, other studies indicated that weeds population is higher in none tillage and reduced tillage methods (Smith, 2006). It is reported that a deep plowing reduced weeds due to transfer seeds through deep soil, and shallow plowing and reduced tillage increased the density of weed seeds due to transport through the soil surface (Nourmohammadi et al., 1998). The resultant effect of tillage and nitrogen on corn shown that the highest yield was obtained by using tillage from moldboard plow and chisel plow twice as well as using 138 kg nitrogen fertilizer (Abdollahi et al., 2011). Tillage methods have significant effect on grain yield, biological yield, grain number per corn and leaf index (Abdollahi et al., 2011). In a four-year study the effects of tillage and nitrogen application shown that corn grain yield in conventional tillage (moldboard plow) was higher than treatments without tillage (Halvorson et al., 2006). The effect of tillage systems and weed management shown that in reduced tillage systems, weed and seed bank increase faster than conventional tillage (William and Banks, 1995). The effects of different tillage methods on maize crop reported different results. In the United States, the result shown that average yield of no-tillage was higher than conventional tillage system, while these two treatments had similar yields in the South West locations (Marwat et al., 2011). In another study it was reported that yield of conventional tillage systems was higher than reduced tillage (by disc) (Rashid et al., 2008).

Rates and timing of nitrogen fertilization has significant effects on maize yield. Results shown that yield decreased by delay fertilization in the 6 leaf stage performance been approximately 12% (Binde et al., 2000; Coulter and Nafziger, 2008; Halvorson et al., 2005). The study about nitrogen and tillage effects on corn showed that the highest yield was obtained by using 138 kg of nitrogen as well as moldboard, also, minimum amounts in consumption of 98 kg of nitrogen as well as the chisel plow (Abdollahi et al., 2011). The effect of nitrogen on corn, tomatoes and sugar beet showed that corn requires more nitrogen and it is essential to the proper amount of consumption at the appropriate time (Muhammad, 2006). In three consecutive years, the research done by using strip tillage and water at 6 to 8 leaf corn and emergence of male flowers were achieved to maximum performance, reduce environmental pollution and reduce nitrogen losses. The comparison results showed that the consumption of fertilizer strip was more effective (Hajabbasi et al., 1999).

Combination of different methods of weed control appears necessary due to importance of weed management in corn crop and the researchers recommended the use of non-chemical methods in agriculture, also, in order to increase more and healthier produce (Zand et al., 2009; Liebman et al., 2001; Liebman et al., 2004; Marwat et al., 2011; O'Donovana et al., 2007). Heretofore, research has not been done that measured effect of three tillage methods, fertilization methods and controlling method on corn cultivation. This research was conducted on corn production in Khuzestan province, Iran which is one of the poles in corn production based on composition and selection of more appropriate methods, weed control and corn production. This study was noted with the aim of reducing the weed seed bank, in order to increase corn power in competition with weeds and control methods (after planting).

MATERIALS AND METHODS

A study was conducted as strip plot within randomized complete block design with 4 replications during 2009 to 2010 at the Agricultural Research field of Agriculture and Natural Resources University Ramin. It is placed on 36 km north of Ahvaz (31° 36´ N, 48° 53´ E; elev. 50 m). Consumption of fertilizers based on soil test (Table 1) was determined. 300 kg ha potash (K_2O 42%) and 150 kg ha triple superphosphate (P_2O_5 46%) were given before planting. Two stages of N (500 kg urea, 46%N_2, 50 to 50% ratio: use before planting and the 5-leaf stage of corn) were distributed. The test was administered as a split block with four replications due to operational limitations. Seed bed preparation methods including planting in soil Makhar + conventional tillage (plough + disk + leveler), planting in soil Makhar + reduced tillage (disk handling) and planting in dry soil + reduced tillage were performed in

Table 1. Physical and chemical characters of field soil test.

Sampling depth (cm)	Soil nitrogen(%)	pH	Available phosphorus (ppm)	Potassium (ppm)	EC (ds/m)	Soil texture
0 - 30	0.76	7.1	9.4	100	3.1	Clay loam

*, ** And ns, respectively, significant at 5% level, significant at 1% and non-significant.

horizontal plots. Two methods of fertilizing (broadcasting and fertilizer-planter) as main factor and weed controlling methods once using of felid cultivator in 20 cm height of plants, two times using of felid cultivator in 20, 40 cm height of plant, using of two liters Nicosufuron when the plant had 3 to 4 leaves, without weed (hand weeding) and not control (free weed) as sub-factor were conducted in vertical plots. These were implemented by fertilization methods in the main plots and weed control methods in subplots. According to this fact that the rotation of wheat - corn grown is one of very common patterns in Khuzestan province, this experiment was tested in the field that was cultivated wheat previously. For surveying effects of preparation land on weeds, before planting, wet-seeding treatments were irrigated twice and all tillage treatments were performed after 25 days. After a week, that opportunity for the effectiveness of tillage treatments on weeds, fertilization treatments was implemented by pneumatic planter. Cultivation act was used the rotary cultivator. Single grass 704 corn seed was planted in row spacing 6.5 cm by a Pneumatic planter. After growing seeds, two plants were deletion and one plant was remained for achieving the desired density (about 68 thousand plants per hectare). Corn and weed was harvested by using a wooden box 75 × 39 cm were randomly divided into two corn plants and weeds around at step 4 leaf stage of corn every two weeks for determining the growth of corn and weeds. Weeds were identified and were counted; also the dry weight was measured. The dry weight of corn was obtained by placing the samples at 70°C for 48 to 72 h. Corn leaf area index measuring the length and width was calculated and multiplied .0.75. At the time of final harvest, the number of 10 plants from central rows of each experimental unit harvested and grain yield, biological yield, grain number per ear and thousand grain weight was calculated (Fateh et al., 2007). Statistical analysis and lysergic acid diethyamide (LSD) mean comparisons procedure was performed using SAS and EXCEL software.

RESULTS AND DISCUSSION

The effect of year was significant on all factors except grain weight (Tables 2 and 3) and the average yield in the second year was higher than the first year significantly (Tables 4 and 5). This may happen due to delay in planting and more important reason may be the dust phenomenon in Khuzestan (11 days in the first year compared to 6 days in the second year) and because plants required oxygen, water vapor and carbon dioxide for carrying out the complex process of photosynthesis and exchanging gases. Besides, this exchange takes place through the stomata, any disruption of the stomata causes photosynthesis solely and final yield (Javaheri, 2000; Bayat et al., 2012; Siadat and Shaygan, 1991).

The interaction was not significant on any traits, except with the characteristics of control methods (Table 3). This indicates the same effects of tillage, fertilization and control methods on these traits in both years on the traits. Corn grain was not affected by tillage, fertilization methods and control methods (Table 3). These results were similar to the Bohrani et al. (2007) that reported that grain is a genetic characteristic and it is less influenced by environmental factors and management (Abdollahi et al., 2011; Kasper et al., 1990). Effect of tillage (Table 4) was significant on all factors except on mentioned trait. This is consistent with previous studies showing that tillage methods affect a significant effect on grain yield (Anonymous, 2009; Bahrani et al., 2007; Bakhtiar Gul et al., 2009; Coulter and Nafziger, 2008; Halvorson et al., 2006; DeFelice et al; Khalid Usman et al., 2010; Meskarbashi et al., 2006; Teasdale et al., 1991; Mirlohi et al, 2001; Usman et al., 2010), biological yield (Halvorson et al., 2005; Liebman et al., 2001), grain and row number per corn (Hajmohammadnia et al., 2011; Meskarbashi et al., 2006; Bahrani et al., 2007), Leaf Area Index (Hills et al., 1983; Knezevic et al., 2003) and weed characteristics (Ghosheh et al., 1996; Di-tomasa, 1995; Husseini et al., 2009; Khalid Usman et al., 2010; Marwat et al., 2011; Marwat et al., 2007; Nourmohammadi et al., 1998; Reddy et al., 2003; Yadavi et al., 2008).

Comparison of different compounds prepared field and fertilization method, the highest grain yield and biological yield (Table 6) was obtained to combine planting in soil Makhar-reduced-tillage and planting in soil Makhar-conventional tillage fertilizer planting method.

Since corn after planting (4 to 7 weeks) is very sensitive to weed competition (Zimdahl, 1995). So, any way which could reduce the weight of weeds and less fertilizer available to weed have helped to plant corn. Irrigation before planting (planting in soil Makhar) decreases weight and population of the weed (Table 7) significantly ($P \leq 0.05$). Therefore, treatment that combined with planting in soil Makhar could boost yield due to reduced weed. Correlation coefficient (Pearson) yield and biological yield between weight and number of weeds showed significant negative correlation between these traits (respectively: r=-0.64**, r=-0.65**, r=-0.54**, r=-0.6 ** (data not shown). Best method was planting in soil Makhar combination with fertilizer broadcast band to control weeds in corn. The results are agreement to the results of Robert et al. (2002) (Usman et al., 2010). Methods of combining the fertilization method after fifth week has not effect on the number, also after 7 weeks has not effect on their weight (Table 7). Since corn in beginning of growth is susceptible to weed (Knezevic et al., 2003; Muhammad, 2006; Zimdahl, 1995) their control in the early growth is sufficient for competition of power

Table 2. Analysis of variance of various traits of maize.

Source of variation	df	Mean squared					
		Yield (kg/ha)	Biological yield(kg/ha)	Kernel in ear	1000 kernel weight	Rows in ear	LAI in Week 9th
Year	1	14700564.5**	57334158**	35999.57**	574.31ns	31.03**	16.39**
Replications× year (Ea)	1	1466096.6**	6405197.6**	8654.99**	18811.35**	7.21**	1.32**
Tillage	6	6526921.3**	26439650.9**	28772.35**	229.9ns	52.04**	1.16**
Year × Tillage	2	4974.3ns	15897.8ns	50.99ns	1.03ns	0.06ns	0.01ns
Year × Replications × Tillage (Eb)	2	303248.8ns	1349972ns	1483.88ns	3422.98**	1.27ns	0.27ns
fertilization	12	12874296.6**	54354832.8**	73654.43**	2532.14**	184.98**	0.04ns
Year × Fertilization	1	11211.5ns	4487.5ns	4.72ns	545.05ns	0.06ns	0ns
Year× Replications × Fertilization	1	71414ns	327375.6ns	1014.06ns	2951.83**	6.09**	0.35ns
Fertilization × Tillage	6	2407393.1**	10462102.8**	271.95ns	5179.02**	1.14ns	0.7**
Year × Fertilization × Tillage	2	1511ns	308.6ns	28.21ns	2.75ns	0ns	0ns
Year × Replications × Tillage × Fertilization method	2	313465.5ns	1325505.5ns	748.31ns	944.84ns	0.74ns	0.24ns
Control method	12	32618794.3**	132484755.7**	44542.41**	548ns	64.49**	2.1**
Year × Control method	4	28482.2ns	70787.8ns	62.9ns	651.33ns	0.05ns	0.01ns
Control method × Tillage	4	2894593.1**	11904533.3**	3083.95**	1987.29ns	3.53**	0.99**
Control method × Fertilization method	8	3769385.7**	15442628.1**	7141.09**	1936.84**	8.7**	0.11ns
Tillage × Fertilization method × Control method	4	1202589.4**	4749273.5**	4486.44**	2038.12**	1.86ns	0.42**
Year × Tillage × Control method	8	2367.5ns	5007.6ns	46.19ns	1.39ns	0ns	0ns
Year × Fertilization method × Control method	8	3200.6ns	3615.4ns	53.08ns	187.85ns	0.02ns	0ns
Year × Tillage × Fertilization method × Control method	4	1299.5ns	3670.4ns	54.75ns	4.47ns	0.01ns	0ns
Residual Error (Ee)	144	29375294.7	858918	225412.77	1028.36	1.63	0.175
Coefficient of variation (%)		5.3	5.2	9	12.7	10.2	11.7

*, **, ns: significant at 5 and 1% level, and non-significant, respectively.

Table 3. Summary of analysis of the characteristics of weeds in early growth stages of maize.

Characteristics	df	The total weight of weed							
		3rd Week	5th Week	7th Week	9th Week	3rd Week	5th Week	7th Week	9th Week
Year	1	13.75[7]	24.77**	1468.7**	2256.29**	1864.[4]**	1976.3**	1987.7**	1982**
Year×Replications	6	0.45ns	17.37**	46.1**	332.19**	17.52**	32.49**	38.72**	104.8ns
Tillage	2	103.48**	2517.3**	100.8**	395.38**	182.16**	4397.7**	0.55ns	283.7**
Year×Tillage	2	0.66ns	13.34**	4.43ns	2.54ns	2.55ns	1.94ns	2.2ns	1.99ns
Year×Replications×Tillage	12	0.16ns	0.92ns	8.46ns	40.16ns	2.56ns	1.35ns	3.94ns	30.37ns
Fertilization method	1	42.47**	2312.6**	22815.9**	6365.13**	133.88**	2033.4**	6809.6**	6277.6**
Year×Fertilization method	1	0.34ns	0.98ns	151.06**	50.76ns	0.4ns	1.34ns	1.06ns	1.2ns
Year×Replications×Fertilizationn method	6	0.88**	1.63ns	9.94ns	93.12ns	5.2ns	13.33ns	5.44ns	90.96ns
Fertilization method×Tillage	2	101.[8]**	319.4**	140.3**	139.33ns	771.06**	242.8**	18.37ns	67.12ns
Year×Fertilization method×Tillage	2	0.46ns	1.17ns	0.12ns	0.34ns	3.72ns	1.35ns	1.51ns	1.2ns
Year×Replications×Tillage× Fertilization method	12	0.82**	2.7ns	23.88ns	30.71ns	3.59ns	6.31ns	12.45ns	71.84ns
Control method	4	141.95**	9576.1**	33125.[4]**	367051.43**	9834.12**	296743.**	94747.9**	216467.8**
Year×Control method	4	0.95**	2.44ns	144.06**	240.01**	270.59**	219.7**	222.89**	221.31**
Control method×Tillage	8	47.67**	1012.6**	1430.14**	1917.08**	206.73**	778.96**	601.56**	721.65**
Control method × Fertilization method	4	7.5**	485.61**	2181.15**	626.31**	71.03**	310.35**	588**	736**
Tillage×Fertilization method×Control method	8	30.81**	91.48**	345.07**	704.8**	184.5**	162.41**	83.92**	575.**
Year×Tillage×Control method	8	0.19ns	3.09ns	2.55ns	0.91ns	2.88ns	1.95ns	1.9ns	1.94ns
Year×Tillage×Control method	4	0.03ns	0.38ns	23.81ns	3.9ns	0.25ns	0.6ns	0.44ns	0.52ns
Year×Tillage×Fertilization method×Control method	8	0.07ns	0.77ns	0.4ns	0.6ns	1.88ns	0.6ns	0.7ns	0.52ns
Residual Error (Ee)	144	0.37	3.02	16.05	55.3	3.2	6.3	11	58.2
Coefficient of variation (%)	-	6.9	6.8	3.9	6.3	7.5	6.9	4.7	8

*, **, ns: significant at 5 and 1% level, and non-significant, respectively.

Table 4. Comparison of various characteristics of the corn crop in 2009 and 2010

Year	Yield (kg/ha)	Biological yield (kg/ha)	Kernel in ear	1000 kernel weight	Rows in ear	LAI in Week 9th
2009	8.266[b]	17.548[b]	422.14[a]	12.1[a]	250.9[a]	3.3[a]
2010	8.761[a]	18.525[a]	447.38[b]	12.8[b]	255.7[a]	3.8[a]

Means with similar letters in each column are not statistically significantly different (Duncan 5%).

Table 5. Comparison of the measured characteristics of weeds in crop years 2009 and 2010

Year	Total weight of weed				Total number of weed			
	3rd Week	5th Week	7th Week	9th Week	3rd Week	5th Week	7th Week	9th Week
2009	8.48[b]	25.06[a]	101.53[b]	114.54[b]	20.9[b]	33.7[b]	67.28[b]	92.75[b]
2010	8.9[a]	25.7[a]	106.48[a]	120.69[a]	26.5[a]	39.45[a]	73.05[a]	98.5[a]

Means with similar letters in each column are not statistically significantly different (Duncan 5%).

Table 6. Comparison of different compounds on the characteristics of corn seed bed preparation × fertilizing methods

Seed bed preparation	Fertilizing methods	Yield (kg/ha)	Biological yield (kg/ha)	Kernel in ear	1000 kernel weight	Rows in ear	LAI in Week 9th
Planting in soil Makhar + conventional tillage	Broadcasting	18382.77[bc]	8686.56[b]	423.62[b]	12.24[a]	252.4[a]	3.7[a]
	Planting	18648.75[ab]	8817 .93[ab]	462 .37[a]	13.98[a]	250.9[a]	3.65[a]
Planting in soil Makhar + reduced tillage	Broadcasting	17341.65[d]	8179 .75[d]	434 .73[b]	11.64[a]	238.2[a]	3.53[a]
	Planting	18949.09[a]	9003 .25[a]	466 .11[a]	13.68[a]	268.61[a]	3.34[a]
Planting in dry soil + reduced tillage	Broadcasting	16938.52[d]	7979 .74[e]	397 .01[c]	10.78[a]	247.8[a]	3.48[a]
	Planting	17840.25[c]	8414 .52[c]	431 .99[b]	12.32[a]	262.05[a]	3.66[a]

Means with similar letters in each column are not statistically significantly different (Duncan 5%).

Table 7. Comparison of the mean field interaction seed bed preparation × fertilizing methods on measured characteristics of weeds.

Seed bed preparation	Fertilizing method	Total weight of weed				Total number of weed			
		3rd Week	5th Week	7th Week	9th Week	3rd Week	5th Week	7th Week	9th Week
Planting in soil Makhar + conventional tillage	Broadcasting	8.44[c]	24.32[d]	112.89[b]	121.44[a]	23.7[c]	32.8[e]	75.62[a]	99.3[2a]
	Planting	7.13[e]	15.96[e]	92.96[d]	108.64[a]	20.7[e]	26.4[f]	64.8[a]	89.65[a]
Planting in soil Makhar + reduced tillage	Broadcasting	7.6[d]	25.5[c]	112.35[b]	122.43[a]	21.2[de]	36.85[c]	74.9[a]	98.98[a]
	Planting	9.21[b]	23.9[d]	95.64[c]	114.89[a]	26.5[b]	34.75[d]	65.25[a]	90.2[a]
Planting in dry soil + reduced tillage	Broadcasting	11.41[a]	35.67[a]	116.16[a]	124.42[a]	28.6[a]	48.9[a]	76[a]	103.95[a]
	Planting	8.58[c]	26.97[b]	94.19c[d]	113.8[a]	21.7[d]	39.[9b]	64.45[a]	91.6[5a]

Means with similar letters in each column are not statistically significantly different (Duncan 5%).

corn. Comparison of different compounds prepared field and control method (Table 8) maximum yield and biological was obtained in planting in wet soil-conventional tillage methods treatments from chemical and twice cultivation. No-planting in soil Makhar method in combination with all control methods had the loosest value. Chemical control is not able to greatly destroy population of the two types of weeds - *Sorghum*

Table 8. Comparison of different compounds on the characteristics of corn seed bed preparation × chemical control

Seed bed preparation	Control method	Yield (kg/ha)	Biological yield(kg/ha)	Kernel in ear	1000 kernel weight	Rows in ear	LAI in Week 9th
Planting in soil Makhar + conventional tillage	Chemical control	18732 .09de	8860.03^{d}	460.92^{bc}	13.31^{bc}	243 .29^{b}	3.78^{a}
	One times using of cultivator	18635 .18de	8817.3^{d}	433.86^{cdf}	12.24^{def}	253 .73^{ab}	3.58^{a}
	Two times use of cultivator	18757 .29de	8871.4^{de}	432.22^{cdf}	13.44^{bc}	257 .98^{a}	3.57^{a}
	Without control	16242 .72^{h}	7619.74^{g}	397.39^{gh}	11.98^{efg}	240 .0^{9b}	3.31^{a}
	Complete weeding	20211 .52^{b}	9592.64^{b}	472.45^{b}	14.58^{a}	250 .^{13a}	4.14^{a}
Planting in soil Makhar + reduced tillage	Chemical control	19118 .29de	8827.89^{de}	459.3b^{cd}	12.98^{cd}	253 .42^{a}	3.81^{a}
	One times using of cultivator	15977 .46^{h}	7505.27^{g}	424.27^{fg}	11.94^{efg}	234 .79^{b}	2.95^{a}
	Two times use of cultivator	17846 .99^{ef}	8522.41^{ef}	474.22^{b}	12.83^{cde}	256 .34a^{b}	3.68^{a}
	Without control	16590 .38^{gh}	7794.55^{g}	390.63^{h}	11.38^{fg}	261 .07^{a}	3.17^{a}
	Complete weeding	21443 .72^{a}	10207.39^{a}	503.75^{a}	14.16^{ab}	248 .91a^{b}	3.57^{a}
Planting in dry soil + reduced tillage	Chemical control	17814 .07^{f}	8409.64^{f}	416.2^{fgh}	12.83^{cd}e	258^{a}	3.34^{a}
	One times using of cultivator	17474 .33^{f}	8233.57^{f}	400.96^{gh}	11.18^{g}	256 .02^{ab}	3.54^{a}
	Two times use of cultivator	17523 .92^{f}	8265.53^{f}	424.71^{fg}	11.75^{fg}	242 .^{9b}	3.63^{a}
	Without control	14693 .1^{i}	6847.56^{h}	390.48^{h}	9.17^{h}	238 .89^{b}	3.55^{a}
	Complete weeding	19490 .93^{c}	9229.33^{c}	440.2^{cdf}	12.82^{cde}	266 .33^{a}	3.79^{a}

Means with similar letters in each column are not statistically significantly different (Duncan 5%).

Table 9. Comparison of different compounds prepared of seed bed preparation and control methods on weed characteristics measured

Seed bed preparation	Control method	Total weight of weed				Total number of weed			
		3rd Week	5th Week	7th Week	9th Week	3rd Week	5th Week	7th Week	9th Week
Planting in soil Makhar + conventional tillage	Chemical control	9.55^{g}	23.45^{g}	113.19^{ef}	103.01^{f}	31.5^{d}	39.75^{f}	84.38^{ef}	101.25e
	One times using of cultivator	8.82^{h}	19.05^{h}	134.38^{c}	137.6^{d}	21^{h}	29.88^{h}	83.5^{f}	106.5^{de}
	Two times use of cultivator	9.4^{g}	19.34^{h}	80.07^{h}	112.33^{e}	20.36^{h}	27.87^{i}	63.93^{i}	85.17^{g}
	Without control	11.16^{e}	38.83^{c}	186.99^{b}	222.26^{c}	38.19^{b}	50.5^{c}	119.25^{b}	179.5^{c}
	Complete weeding	0^{j}	0^{j}	0^{j}	0^{h}	0^{i}	0^{j}	0^{k}	0^{i}
Planting in soil Makhar + reduced tillage	Chemical control	8.21^{i}	28.7^{f}	121.63^{d}	98.01^{fg}	25.5^{fg}	44.88^{e}	85.88^{de}	94.13^{f}
	One time use of cultivator	12.21^{c}	23.26^{g}	132.25^{c}	133.65^{d}	29.63^{e}	36.63^{g}	88^{d}	103.63^{e}
	Two times use of cultivator	10.99e^{f}	18.91^{h}	76.1^{i}	101.7^{fg}	24.88^{g}	29.38^{h}i	51.13^{j}	76^{h}
	Without control	10.61^{f}	52.63^{b}	189.97^{b}	259.92^{a}	39.56^{a}	68.13^{b}	125.38^{a}	199.19^{a}
	Complete weeding	0^{j}	0^{j}	0^{j}	0^{h}	0^{i}	0^{j}	0^{k}	0^{i}
Planting in dry soil + reduced tillage	Chemical control	14.78^{a}	33.74^{d}	111.39^{f}	112.54^{e}	36.88^{c}	51.38^{c}	83.38^{f}	109.88^{d}
	One time use of cultivator	11.64^{d}	30.08^{e}	115.25^{e}	134.94^{d}	26.63^{f}	48.63^{d}	79.25^{g}	105.88^{de}
	Two times use of cultivator	12.85^{b}	16.78^{i}	102.23^{g}	97.03^{g}	26.13^{f}	35^{g}	71.88^{h}	86.88^{g}
	Without control	10.7^{f}	76^{a}	197.01^{a}	251.04^{b}	36.31^{c}	87^{a}	116.63^{c}	186.38^{b}
	Complete weeding	0^{j}	0^{j}	0^{j}	0^{h}	0^{i}	0^{j}	0^{k}	0^{i}

Means with similar letters in each column are not statistically significantly different (Duncan 5%).

halpepense L. and *Echinochloa crus-galli* significantly compared to other methods (Data not shown). Population of all types of weed reduced in Week 9th (Table 9). Twice cultivation with each tillage methods was the best control of weed population compared to other methods. Regarding the first weeks of corn growth, the best method was combination planting in soil Makhar – reduced tillage as well as twice cultivator, even if there was not any of the ivy weed in field, optimal way is combining planting in soil Makhar–reduced tillage with

Table 10. Comparison of different combinations of control methods × fertilizing methods on characteristics of corn

Fertilizing methods	Control method	Yield (kg/ha)	Biological yield(kg/ha)	Kernel in ear	1000 kernel weight	Rows in ear	LAI in Week 9th
Broad-casting	Chemical control	18459.41^{cd}	8727.36^{cd}	447.52^{b}	12.23^{de}	247.06^{cd}	3.61^{a}
	One time use of cultivator	16308	7663^{f}	390.02^{d}	10.58^{g}	250.5^{cd}	3.37^{a}
	Two times use of cultivator	17487^{e}	8248^{e}	434.88^{b}	11.73^{ef}	237.95^{d}	3.72^{a}
	Without control	16122.53^{f}	7558.69^{f}	372.02^{d}	10.63^{g}	250.84^{bcd}	3.33^{a}
	Complete weeding	19427.51^{b}	9211.13^{b}	447.82^{b}	12.6^{cd}	244.38^{d}	3.83^{a}
Fertilizer-planter	Chemical control	18350.22^{cd}	8671.02^{cd}	443.39^{b}	13.85^{b}	264.5^{abc}	3.67^{a}
	One time use of cultivator	18304^{d}	8647.01^{d}	449.37^{b}	12.99^{c}	245.86^{d}	3.34^{a}
	Two times use of cultivator	18844.38^{c}	8917.16^{c}	452.55^{b}	13.62^{b}	268.87^{ab}	3.53^{a}
	Without control	15561.6^{g}	7282.54^{g}	413.65^{c}	11.05^{fg}	242.52^{d}	3.35^{a}
	Complete weeding	21336.6^{a}	10141.77^{a}	496.4^{a}	15.1^{a}	280.87^{a}	3.84^{a}

Means with similar letters in each column are not statistically significantly different (Duncan 5%).

Table 11. Comparison of effects of fertilizing methods × control methods on characteristics measured on weed

Fertilizing methods	Control method	Total weight of weed				Total number of weed			
		3rd Week	5th Week	7th Week	9th Week	3rd Week	5th Week	7th Week	9th Week
Broadcasting	Chemical control	11.16^{b}	32.44^{c}	124.19^{d}	110.69^{e}	32.08^{c}	47.67^{c}	89.17^{c}	106.17^{d}
	One time use of cultivator	11.61^{a}	28.78^{d}	135.79^{c}	144.73^{c}	27.75^{e}	44.25^{d}	88.67^{c}	115.42^{c}
	Two times use of cultivator	11.21^{b}	18.16^{g}	99.49^{g}	110.74^{e}	22.91^{g}	31.91^{e}	71.2^{f}	90.45^{f}
	Without control	11.76^{a}	63.09^{a}	209.53^{a}	247.66^{a}	39.88^{a}	73.75^{a}	128.5^{a}	191.71^{a}
	Complete weeding	0^{e}	0h	0^{i}	0^{g}	0^{h}	0^{g}	0^{h}	0^{h}
Planting	Chemical control	10.53^{c}	24.82^{e}	106.61^{f}	98.36^{f}	30.5^{d}	43^{d}	79.92^{d}	97.33^{e}
	One time use of cultivator	10.17^{d}	19.48^{f}	118.8^{e}	126.07^{d}	23.75^{fg}	32.5^{e}	78.5^{d}	95.25^{e}
	Two times use of cultivator	10.94^{b}	18.52^{fg}	72.78^{h}	96.63^{f}	24.67^{f}	29.58^{f}	53.42^{g}	74.92^{g}
	Without control	9.89^{d}	48.55^{b}	173.12^{b}	241.16^{b}	36.17^{b}	63.33^{b}	112.33^{b}	185^{b}
	Complete weeding	0^{e}	0^{h}	0^{i}	0^{g}	0^{h}	0^{g}	0^{h}	0^{h}

Means with similar letters in each column are not statistically significantly different (Duncan 5%).

chemical struggle. These results are in agreement with previous studies that reported herbicide (Nicosufuron) affects two – *S. halpepense* L. and *E. crus-galli* (Hajmohammadnia et al., 2011; Najafi and Zand, 2008). Comparison of different compounds and methods of fertilizing and control methods (Table 10) highest grain yield, biological yield, value per cob was not significant difference between the two treatments chemical and twice cultivation with regard to the control treatments highest the seed and biological yield, value per cob was not significant difference between the two treatments chemical and twice cultivation with regard to the control treatments, planting broadcasting method, treatments against chemical and fertilizer in the method fertilizer planting method, given the negative correlation between weed and crop yield and value per cob and leaf area index, therefore, to prevent yield loss, weeds should be controlled in the early stages of corn growth. It can be concluded planting broadcasting method of the corn fields as fertilizer is planting broadcasting method; it used to be chemical for weed control and higher yield. While, fertilizer planting method of the corn fields, according to the same effects of chemical and twice cultivator, is recommended twice cultivator because of environmental problems.

Comparing methods of land preparation, fertilization methods and weed control methods, the mean difference in yield, biological yield, grain number per corn, weight and number of weeds was significant in the experiment. However, seed weight, leaf area index number of rows per corn was not affected by treatments and the mean difference showed a significant trend (Tables 12 and 13). It was expected that highest levels obtained in without weed treatment (hand weeding), while It obtained in fertilizer planting method. Accordingly, it became clear; the fertilizer planting method increased the yield. Although the fight could have a significant chemical to control weeds and increase the yield and biological yield

Table 12. Comparison of different compositions seed bed preparation × fertilizing methods × chemical control on different characteristics of corn

Seed bed preparation	Fertilizing methods	Control method	Yield (kg/ha)	Biological yield(kg/ha)	Kernel in ear	1000 kernel weight	Rows in ear	LAI in Week 9th
Planting in soil Makhar + conventional tillage	Broadcasting	Chemical control	18652.62^{efgh}	8822.4e^{fgh}	449.57^{cdefg}	12.46^{a}	237 .13^{a}	10 .95^{a}
		One time use of cultivator	17959.23^{hij}	8477.3^{hijk}	395.61^{lmn}	10.93^{a}	271 .71^{a}	12 .4^{a}
		Two times use of cultivator	18541 .35^{efgh}	8765.1^{efghi}	444.3^{cdefghi}	12.41^{a}	261 .23^{a}	12 .33^{a}
		Without control	17345.23^{jkl}	8163.1^{klm}	367.65^{n}	12.33^{a}	261 .34^{a}	13 .08^{a}
		Complete weeding	19415.4^{cde}	9204.8^{cde}	460.96^{bcde}	13.09^{a}	237 .72^{a}	14 .16^{a}
	Planting	Chemical control	18811.55e^{fgh}	8897.6^{efgh}	472.27^{bcd}	14.16^{a}	249 .45^{a}	13 .55^{a}
		One time use of cultivator	173011.12^{cde}	9157.3^{cde}	472.11^{bcd}	13.55^{a}	235 .75^{a}	14 .45^{a}
		Two times use of cultivator	18973.24^{defg}	8977.9^{def}	420.14^{efghijkl}	14.48^{a}	254 .74^{a}	11 .6^{a}
		Without control	15140.21^{no}	7076.3^{o}	427.13^{efghijkl}	11.64^{a}	218 .83^{a}	16 .08^{a}
		Complete weeding	21007.64^{b}	9980.4^{b}	483.95^{b}	16.06^{a}	262 .54^{a}	11 .95^{a}
Planting in soil Makhar + reduced tillage	Broadcasting	Chemical control	19287.08^{cdef}	9136.8^{cde}	481.98^{bc}	11.95^{a}	237 .48^{a}	10 .83^{a}
		One time use of cultivator	14389.13^{o}	6726.1^{o}	405.58^{ijklm}	10.81^{a}	216 .55^{a}	11 .65^{a}
		Two times use of cultivator	16299.08^{m}	7661.4^{n}	458.13^{bcdef}	11.64^{a}	245 .64^{a}	10 .65^{a}
		Without control	16770.47^{klm}	7874.5^{lmn}	376.23^{mn}	10.6^{a}	254 .82^{a}	13 .19^{a}
		Complete weeding	19993.11^{c}	9499.8^{c}	451.76^{bcdef}	13.19^{a}	243 .49^{a}	14 .03^{a}
	Planting	Chemical control	18949.5^{defg}	8918.9^{ef}	436.53^{defghijk}	14.01^{a}	269 .35^{a}	13 .05^{a}
		One time use of cultivator	17565.79^{ijk}	8284.4^{jkl}	442.96^{defghi}	13.08^{a}	253 .03a	14^{a}
		Two times use of cultivator	19394.9^{cde}	9183.4^{cd}	490.3^{b}	14.01^{a}	267 .04^{a}	12 .14^{a}
		Without control	16440.91^{lm}	7714.4^{n}	405.04^{ijklmn}	12.15^{a}	267 .32^{a}	15 .1^{a}
		Complete weeding	22894.34^{a}	10915.1^{a}	555.74^{a}	15.14^{a}	254 .33^{a}	12 .25^{a}
Planting in dry soil + reduced tillage	Broadcasting	Chemical control	17438.52^{jk}	8222.8^{klm}	411.02^{ghijkl}	12.28^{a}	266 .55^{a}	9 .98^{a}
		One time use of cultivator	16476.81^{lm}	7788.4^{m}	368.87^{mn}	10^{a}	263 .24a	11 .15^{a}
		Two times use of cultivator	17620.7^{ijk}	8320.3^{ijkl}	402.2^{klmn}	11.14^{a}	227 .98^{a}	8 .98^{a}
		Without control	14282.52^{o}	6638.5^{o}	372.19^{mn}	8.98^{a}	236 .36^{a}	11 .51^{a}
		Complete weeding	18874.03^{efgh}	8928.8^{efg}	430.76^{efghijk}	11.53^{a}	251 .92^{a}	13 .38^{a}
	Planting	Chemical control	18189.62^{ghij}	8596.6^{fghijk}	421.36^{efghijkl}	13.39^{a}	249 .45^{a}	12 .35^{a}
		One time use of cultivator	18372.98^{fghi}	8678.7^{fghij}	433.05e^{fghijk}	12.35^{a}	248 .81^{a}	12 .35^{a}
		Two times use of cultivator	17427.13^{jk}	8210.7^{klm}	447.22^{cdefgh}	12.36^{a}	257 .83^{a}	9 .35^{a}
		Without control	15103.68^{o}	7056.7^{o}	408.78^{hijklm}	9.36a	241 .42^{a}	14 .11^{a}
		Complete weeding	20107.83^{bc}	9529.9^{c}	449.53^{cdefg}	14.11a	280 .73^{a}	14 .11^{a}

Table 13. Comparison of different compounds seed bed preparation× fertilizing methods × control method on the measured characteristics of weed

Seed bed preparation	Fertilizing methods	Control method	Total weight of weed				Total number of weed			
			3rd Week	5th Week	7th Week	9th Week	3rd Week	5th Week	7th Week	9th Week
Planting in soil Makhar + conventional tillage	Broadcasting	Chemical control	9.16^{ijk}	30.04^{h}	121.73^{i}	101.55^{klm}	31.5^{e}	44.5^{i}	87.75^{gh}	119.25^{de}
		One time use of cultivator	9.07^{jk}	25.84^{j}	147.07^{f}	149.82^{e}	21.5^{klm}	36.75^{kl}	90.25^{fg}	124.5^{d}
		Two times use of cultivator	10.98^{f}	22.05^{l}	91.91^{m}	127.4^{fgh}	22.72^{jk}	29.99^{m}	72.1^{n}	87.25^{h}
		Without control	12.98^{d}	43.64^{e}	203.76^{b}	228.43^{c}	42.63^{b}	52.75^{f}	128^{a}	188.75^{b}
		Complete weeding	0^{n}	0^{o}	0^{p}	0^{3}	0^{p}	0^{p}	0^{r}	0^{j}
	Planting	Chemical control	9.93^{gh}	16.86^{m}	104.64^{l}	104.47jkl	31.5^{ef}	35^{l}	81^{jk}	100.5^{fg}
		One time use of cultivator	8.57^{kl}	12.27^{n}	121.69^{i}	125.37hi	20.5^{m}	23^{o}	76.75^{lm}	87.25^{h}
		Two times use of cultivator	7.82^{m}	16.63^{m}	68.23^{o}	97.25lmn	18no	25.75^{n}	55.75^{p}	86.5^{h}
		Without control	9.34^{hij}	34.01^{g}	170.23^{d}	216.09^{d}	33.75^{d}	48.25^{g}	110.5^{c}	184^{b}
		Complete weeding	0^{n}	0^{o}	0^{p}	0^{o}	0^{p}	0^{q}	0^{r}	0^{j}

Table 13. Contd.

Planting in soil Makhar + reduced tillage	Broadcasting	Chemical control	8.82^{k}	29.39^{hi}	134.79^{g}	104.61^{jk}	26.25^{h}	45.5^{h}	93^{ef}	100.75^{fg}
		One time use of cultivator	12.24^{e}	24.28^{jk}	138.71^{g}	134.55^{f}	29.25^{g}	38.25^{jk}	92.75^{ef}	106.75^{f}
		Two times use of cultivator	7.89^{m}	16.21^{m}	83.9^{n}	108.4^{j}	17.5^{o}	31^{m}	59.25^{o}	85.75^{h}
		Without control	9.05^{jk}	57.63^{c}	204.34^{b}	264.58^{a}	33.25^{e}	69.5^{c}	129.5^{a}	201.63^{a}
		Complete weeding	0^{n}	0o	0^{p}	0o	0^{p}	0^{q}	0^{r}	0^{j}
	Planting	Chemical control	7.59^{m}	28^{i}	108.47^{k}	91.41^{n}	24.75^{hi}	44.25^{i}	78.75k^{l}	87.5^{h}
		One time use of cultivator	12.19^{e}	22.24^{kl}	125.8^{h}	132.76^{fg}	30^{fg}	35^{l}	83.25^{ij}	100.5^{fg}
		Two times use of cultivator	14.09^{c}	21.61^{l}	68.31^{o}	95.02^{mn}	32.25^{e}	27.75^{n}	43^{q}	66.25^{i}
		Without control	12.17^{e}	47.63^{d}	175.6^{c}	255.26^{b}	45.88^{a}	66.75^{d}	121.25^{b}	196.75^{a}
		Complete weeding	0^{n}	0^{o}	0^{p}	0^{o}	0^{p}	0^{q}	0^{r}	0^{j}
Planting in dry soil + reduced tillage	Broadcasting	Chemical control	15.49a	37.87^{f}	116.06^{j}	125.9^{ghi}	38.5^{c}	53^{f}	86.75^{h}	98.5^{g}
		One time use of cultivator	13.52^{cd}	36.23^{f}	121.59^{i}	149.81^{e}	32.5^{e}	57.75^{e}	83^{j}	115^{e}
		Two times use of cultivator	14.78^{b}	16.23^{m}	122.65^{hi}	96.43^{mn}	28.5^{g}	34.75^{l}	82.25^{j}	98.35^{g}
		Without control	13.26^{d}	88^{a}	220.49^{a}	249.95^{b}	43.75^{b}	99^{a}	128^{a}	184.75^{b}
		Complete weeding	0^{n}	0^{o}	0^{p}	0^{o}	0^{p}	0^{q}	0^{r}	0^{j}
	Planting	Chemical control	14.07^{c}	29.6^{hi}	106.73^{kl}	99.19^{klm}	35.25^{d}	49.75^{g}	80^{jkl}	104^{fg}
		One time use of cultivator	9.76^{ghi}	23.92^{k}	108.9^{k}	120.08^{i}	20.75^{lm}	39.5^{j}	75.5^{m}	98^{g}
		Two times use of cultivator	10.92^{f}	17.33^{m}	81.82^{n}	97.62^{lmn}	23.75^{ij}	35.25^{l}	61.5^{o}	72^{i}
		Without control	8.15^{lm}	64^{b}	173.53^{cd}	252.13^{b}	28.88^{g}	75^{b}	105.25^{d}	174.25^{c}
		Complete weeding	0^{n}	0^{o}	0^{p}	0^{o}	0^{p}	0^{q}	0^{r}	0^{j}

Means with similar letters in each column are not statistically significantly different (Duncan 5%).

than other methods but work in fertilizer planting method ($P<0.05$). There was no significant difference with twice cultivation. The results showed the combination of twice cultivator as well as planting in wet soil was similar to was used chemical control when fertilizer. Methods for control of weeds after planting had different effects on the number and weight of weeds at different stages of plant growth (Table 13). This is because of different effects of each treatment and control different time in the applied treatment So for reducing the environmental problems, the use of pesticides is suggested. In fertilizer planting method, yield and biological yield in this case was significantly less than chemical methods, and this was due to the high weeds and severe competition with the plant and inability to control weeds between rows cultivator. These results are in agreement to Javaheri (2000) who had reported the results banding fertilizer has a greater effect on corn for example, two treatments are superior in the seventh week planting in soil Makhar - reduced tillage and twice cultivation with strip fertilization and planting in soil Makhar treatments - conventional tillage methods strip fertilization twice cultivator. These significantly had more weeds in other treatments.

REFERENCES

Abdollahi F, Ghadiri HMC, Hajbahrani J (2011). Effect of Tillage, Crop Residue Management and Nitrogen Fertilization on corn yield and yield components. Iran. J. Field Crop Res. 8(2):336-346. In Farsi.

Anonymous (2009). Meteorological Data, Iran, Meteorological Station of Khozestan Ramin agricultural and Natural Resource University. Documented reports, Engineering Department of Crop and Rural stations.

Bahrani MJ, Raufat MH, Ghadiri H (2007). Influence of wheat residue management on irrigated corn grain production in a reduced tillage system. Soil Till. Res. 94:305-309.

Bakhtiar G, Marwat KB, Hassan G, Azim KM, Hashim S, Khan IA (2009). Impact of tillage, plant population and mulches on biological yield of maize. Pak. J. Bot. 41:2243-2249.

Bayat F, Jamali F, Ahmadyan S (2012). Possible influence of dust storm on agricultural. The 1st International Congress on Dust Haze and Combating it's Adverse Effects pp. 36-37. In Farsi.

Binde D, Sander LDH, Walters DT (2000). Maize response to time of nitrogen application as affected by level of nitrogen deficiency. Agronomy 92:1228-1236.

Coulter JA, Nafziger ED (2008). Continuous corn response to residue management and nitrogen fertilization. Agron. J. 100:1774-1780.24

DeFelice CMSPR, Mitchell SB (2006). Influence of tillage on corn and soybean yield in the United States and Canada. Online. Crop Management doi:10.1094/CM-2006-0626-01-RS.

Di-tomasa JM (1995). Approach for improvement crop compotation through the manipulation of fertilizion strategies. Weed Sci. 43:491-497.

Fateh E, Sharifzadeh F, Mazaheri D, Baghestani MA (2007). Evaluation of competition ability between corn (*Zea mays*) and lambs quarter (Chenopodium album) influenced by planting pattern and their effect on corn yield component. Iran, Pajouhesh Sazandegi. 73:87-95. In Farsi.13

Ghosheh HZ, Holshouser DL, Chandler JM (1996). Influence of density on Johnsongrass (*Sorghum halepense*) interference in field corn. (*Zea mays*). Weed Sci. 44:879-883.

Hajabbasi MA, Mirlohi AF, Sadrarhami M (1999). Tillage Effects on Some Physical Properties of Soil and Maize Yield in Lavark Research Farm JWSS - Isfahan University of Technology; 3(3):13-24. In Farsi.

Hajmohammadnia GK, Rashed MMH, Nassiri MM, Zand E (2011). Dose

Response of Barnyardgrass and Velvet leaf to Glyphosate and Nicosulfuronat Greenhouse Condition. J. Plant Prot. 25(2):202-213, in Farsi.
Halvorson AD, Schweissing F, Bartolo M, Reule CA (2005). Corn response to nitrogen fertilization in a soil with high residual nitrogen. Agron. J. 97:1222-1229.
Halvorson AD, Mosier AR, Reule CA, Bausch WC (2006). Nitrogen and Tillage effects on irrigated continuous corn yields. Agron. J. 98:63-71.
Hills FJ, Broadbent FE, Lorenz OA (1983). Fertilizer nitrogen utilization by corn, tomato and sugar beet. Argon. J. 75:423-426.
Husseini AA, Rashed Mohassel, Nassiri MH, Mahallati M, Hajmohammadnia GK (2009). The influence of nitrogen and weed interference periods periods on corn (*Zea mays* L.) yield and yield components. J. Plant Prot. 23(1):97-105. In Farsi.
Javaheri A (2000). Effect of timing and nitrogen fertilizer use in corn. Abstracts of Iranian Congress of Agronomy and Plant Breeding, Babolsar, Mazandaran University p. 493. In Farsi.
Kasper TC, Erback DC, Cruse RM (1990). Corn response to seed row residue removal. Soil Sci. Soc. Am. J. 54:1112-1117.
Khalid USK, Khan K AZ, Khalil I H, Khan MA (2010). Tillage and herbicides impact on weed control and wheat yield under rice-wheat cropping system. Soil Till. Res. 110:101-107.
Knezevic SZ, Evans SP, Mainz M (2003). Yield Penalty Due to Delayed Weed Control in Corn and Soybean. Crop Management doi: 10. 1094/CM- 2003- 0219-01-RS.
Kochaki A, Rahimian H, Nasiri M, Khyabani H (1995). Weed Ecology (translation). Ferdousi University Press, Mashhad, Iran p. 243. In Farsi.
Liebman M, Mohler CL, Staver CP (2001). Ecological management of agricultural weeds. Cambridge University Press, New York. Extension Report No. 18.
Liebman M, Mohler CL, Staver C (2004). Ecological Management of Agricultural Weeds, M. Liebman, C. L. Mohler and C. Staver. Cambridge University Press, Cambridge.
Marwat KB, Khan MA, Hashim S, Nawab K, Khattak AM (2011). Integrated weed management in wheat. Pak. J. Bot. 43:625-633.
Marwat KB, Arif M, Azim KM (2007). Effect of tillage and Zn application methods on weeds and yield of maize. Pak. J. Bot. 39:1583-1591.
McCarthy GW, Meisinger JJ, Jenniskens FM (1995). Relationship between total- N, biomass- N and active- N under different tillage systems and N fertilizer treatments. Soil Biol. Biochem. 27:1245-1250.
Meskarbashi M, Bakhshandeh AA, Nabipour M, Kashani A (2006). The effects of plant residues and chemical fertilizers on grain yield and yield components of two wheat cultivars in Ahvaz. Sci. J. Agric. (SJA) 29(1):53-62. In Farsi.
Mirlohi A, Hajabassi MA, Razavi SJ, Ghanaati E (2001). Corn Hybrids Responses to Two Methods of Tillage. Isfahan University of Technology JWSS 5(1):117-126. In Farsi.
Muhammad MM (2006). Weed Completion in Maize under different agro- management practice. PhD thesis, University of Agriculture, Faisalabad.
Najafi H, Zand E (2008). Study of possibility of integrating chemical and non-chemical methods in management of Johnsongrass (*Sorghum halepense* L.) and herbicides evaluation in corn field. Pajouhesh Sazandegi 76:148-156. In Farsi.
Nourmohammadi G, Siadat SA, Kashani A (1998). Cereal crops. Shahid Chamran University Press, Ahvaz, Iran p. 446. In Farsi.
O'Donovana JT, Blackshawb RE, Harkerc KN, Claytonc GW, Moyer BJR, Dosdalld LM, Mauricee DC, Turkingtonc TK (2007). Integrated approaches to managing weeds in spring-sown crops in western Canada. Crop Prot. 26:390-398.
Rajcan I, Swanton CJ (2001). Underestanding maize-weed competition: Resource completion, light quality and whole plant. Field Crop Res. 71:139-150.
Rashed MMH, Najafi H, Akbarzadeh MD (2001). Weed Biology and Control. Ferdousi University Press, Mashhad, Iran p. 404. In Farsi.7
Rashid M, Keshavarzopor F, Gholami M (2008). Effect of different tillage method on tilled and yield component of forage corn. American-Eurasian J. Agric. Sci. 3(3):343-351.
Reddy KN, Zablotowicz RM, Locke MA, Koger CH (2003). Cover crop, tillage, and herbicides effects on weeds, soil properties, microbial populations, and soybean yield. Weed Sci. 51:987-994.
Robert EB, Semach G, Henry JH (2002). Fertilizer application method affects nitrogen uptake in weeds and wheat. Weed Sci. 50:634-641.
Shirani, H, Hajabbasi MA, Afyuni M, Hamat A (2009). Effect of tillage systems and organic manure on root morphology of corn. J. Water Soil 23(1):101-107. In Farsi.11
Siadat SA, Shaygan A (1991). Agronomic performance and grain yield of corn hybrids as affected by date of planting. Sci. J. Agric. 17:75-91. In Farsi.
Smith RG (2006). Timing of tillage is an important filter on the assembly of weed communities. Weed Sci. 54:705-712.
Teasdale JR, Beste CE, Potts WE (1991). Response of weeds to tillage and cover crop residue. Weed Sci. 39:195-199.
Usman S, Khan KS, Khan KK, Azimkhan M (2010). Impact of tillage and herbicide on weed density and some physiological trait of wheat under rice. Sarhad J. Agric. 26:475-487.
William K, Banks PA (1995). Effect of Tillage System and Weed management on weed population in grain sorghum. Weed Sci. 42:541-547.
Yadavi A, Ghalavand H, Aghalykhany M, Falah S (2008). Effect of corn density and spatial arrangement on redroot pigweed (*Amaranthus retroflexus* L.) growth indices. Pajouhesh va Sazandegi 75:33-42. In Farsi.
Zand A, Rahimian H, Mashhad A, Kochaki J, Khlghany SK, Mousav R (2005). Weed ecology (management applications). Ferdousi University Press, Mashhad, Iran p. 560. In Farsi.
Zand E, Baghestani MA, Atri A, Ramazani MK (2009). New global approach in using herbicide: A model for optimum use and risk reduction of herbicide in Iran. The Tenth Crop Science Congress pp. 63-82. In Farsi.
Zimdahl RL (1988). The concept and application of the critical weed-free period. M. A. Altieri and M. Liebman, ed. Weed Management in Agroecosystems: Ecological Approaches. Boca Raton FL: CRC Press.
Zimdahl RL (1995). Fundamental of Weed Science. Academic Press, inc., USA. pp. 91-133.