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THE EFFECT OF SOWING TIME, TILLAGE SYSTEM AND HERBICIDES ON WEED SPECIES DENSITY, WEED BIOMASS AND YIELD OF LENTIL WITHIN A LENTIL-WHEAT SEQUENCE

SUMMARY

Weeds are the major constraint to lentil production in the South East Anatolia region of Turkey. Tillage systems, herbicides and the timing of such operations significantly influence the weed density and yield of lentil. Therefore, two field experiments which lentil was shown on October 19 (Early planting, T_1) and November 23 (Late planting, T_2) were conducted during 2009-2010 lentil growing season to evaluate the effect of various forms of tillage and herbicides, and the timing of such operations on weed density and lentil (*Lens culinaris, L*) yield after wheat (*Triticum aestivum L.*) harvest in rain fed areas of the South-East Anatolia Region of Turkey. A Split plot design with four replications was used, in which three tillage method treatments [moldboard plough + cultivator + drill as conventional tillage (CT), cultivator + drill as reduced tillage (RT) and no-till planting (NT)] were main plots, and five herbicide applications [pre-emergence herbicide application after sowing to control the broadleaf weeds (PEH), post emergence herbicide application to control the grassy weeds (POH), pre-emergence after sowing to control the broadleaf weeds and post emergence to control the grassy weeds (PEOH), no weed control (NWC), hand weeding control (HWC)] were sub-plots. In the result of this study, it was found that late plantings which cultivator was used after rainfall reduced weed density and biomass dry weight, and gave significantly higher lentil seed than early plantings. No-till planting resulted in the highest weed biomass and the lowest lentil yield both early plantings and late plantings. The hand weeding control significantly resulted in the highest lentil yield.

Keywords: lentil, weed, tillage, herbicide

INTRODUCTION

In rainfed conditions of South East Anatolia Region of Turkey as well as in West Asia and North Africa (WANA), the production systems are dominated by cereals, primarily wheat and barley, in rotation with mainly food legumes such as chickpea, lentil and forage legumes. The major constraints to crop

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production in the region are low soil fertility, uncertain rainfall, low-productive genotypes, unsuitable soil, insufficient weed control and poor crop management practices. The unsuitable tillage method and weed competition causes yield reduction of lentil.

Cultivation is still the primary method of weed control in the most crop production areas where annual moldboard plough is used in production systems. However, intensive tillage systems cause environmental pollution and soil degradation. Besides, deep tillage is always costly in terms of fuel and time (Osunbitan et al., 2005; Ozturk et al., 2006; Pala et al., 2000).

Conservation tillage systems have gained widespread acceptance in many countries over the past 25 years because of savings in time and economic inputs, also reducing environmental pollution and soil degradation (Lahmar et al., 2007; Unger and McCalla, 1980; Lal, 1989; Farahani et al., 1998). A lot of research has been conducted to evaluate the applicability of conservation tillage technologies (Sayre et. al., 2001; Hernanz and Sanchez-Giron, 1988; Pelegrin et. al., 1990; Lopez et. al., 1996; Pala et al., 2000; Ortega et al., 2000; Aleman, 2001; Camara et al. 2003). These studies demonstrated that crop response to tillage systems is widely variable both in farmer's fields and in research plots. Some of the variability in crop growth and yield can be explained by climatic factors, soils and cropping sequence. These factors may vary by region, from farm to farm and often within individual fields. Therefore, choosing the "right" tillage system for a particular field is sometimes not a simple process. In addition to the influence of soil, climate and rotation on success of different tillage systems, yield relationships may also be influenced by pest control, fertility practices and weed management.

As tillage decreases, weed control can become a limiting factor in crop production (Buhler, 1992). Moreover, changes in tillage practices can affect weed population dynamics, including weed seed distribution and abundance in the soil seedbank (Mulugeta and Stoltenberg, 1997). Hatfield et al. (1998) stated that changing the tillage system will change the distribution and density of weed seeds in agricultural soils. There are reports that weed control was improved by moldboard plough (Durutan et al., 1989; Camara et al., 2003; Pala et al., 2000). But, Hooker et al. (2000) found no effect of tillage system on weed populations and stated that weeds could be effectively managed with reduced herbicide inputs in conservation tillage systems. On the other hand, the time of tillage can play a crucial role in exhausting the seedbank and controlling different life-forms and species of weeds and can also control the early germination of the annual broadleaf and grass weeds (Ozpınar, 2006). Boström and Fogelfors (1999) stated that soil disturbance in the autumn primarily stimulates the germination of the winter annual weeds, while its influence on the summer annuals is limited.

In conservation tillage systems, herbicides are the most important component of weed control. Sadeghi et al. (1998) reported that up to 70% of the active ingredient of the applied herbicide, especially of soil-applied herbicides, may be intercepted by crop residues, and this caused the reduced efficacy of herbicides in conservation tillage systems (Buhler, 1995). Thus, effective weed management is often considered to be the limiting factor in the adoption of conservation tillage systems (Buhler et al., 1994; Clements et al., 1994).

The objective of this study was to evaluate the effect of various forms of tillage and herbicide application, and the timing of such operations on weed species density, weed biomass and yield for lentil after wheat in rainfed areas of South-East Anatolia Region of Turkey.

MATERIAL AND METHODS

The experiments were carried out at the Experimental Station of GAP International Agricultural Research and Training Centre in Diyarbakir, Turkey during 2009-2010 lentil growing seasons. The experimental station is located at 37º55'36" N 40º13'49" E at 670 m above sea level. The soil at 0-15 cm of the experiment field according to the results of soil analyses conducted by the Soil Laboratory of the South East Anatolia Agricultural Research Institute was clay loam with pH of 8.06, organic matter content of 3.35 g kg^{-1}, ECe of 1.92 dSm^{-1}, $CaCO_3$ of 13.78 g kg^{-1} and extractable P of 15.7 kg ha^{-1}. The soil moisture content and bulk density at this depth was 10.50% (k.b.) and 1.224 g cm^{-2}, respectively.

The climate of the region is characterized by a semi-arid climate (humid winters and dry summers). Rainfall distribution is variable within and among years in this region. Mean annual precipitation, based on long-term average, is 491 mm, about 80% of which occurs from November to May. Monthly rainfall during the experimental years and the monthly average rainfall over the long term (62 years) are shown in Figure 1.

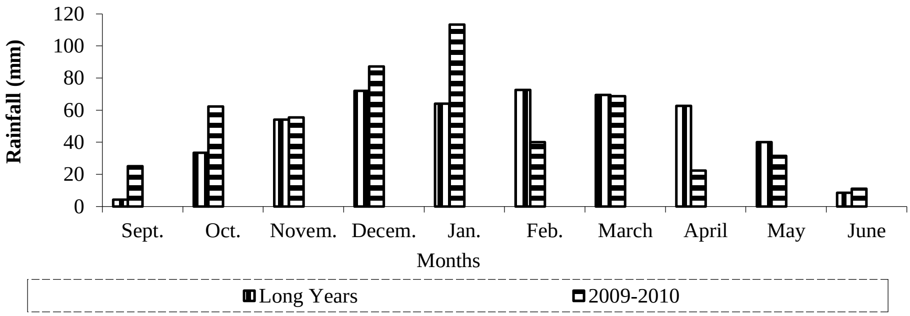

Figure 1. Long term average monthly rainfall at Diyarbakir and monthly rainfall during 2009-10 growing season in a field experiment at Diyarbakir, Turkey.

The rainfall over the growing season is the highest in January, and was slightly below long-term average in March and lower than long-term average in February, April and May.

Temperature records are summarized in Fig. 2. The average temperature was higher in growing season than long-term average.

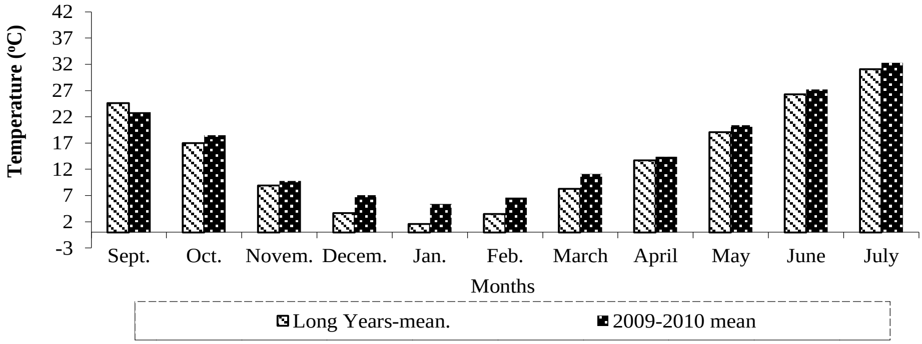

Figure 2. Long term average monthly temperature at Diyarbakir and average monthly temperature during 2009-10 growing season in a field experiment at Diyarbakir, Turkey.

Two field experiments, which lentil were sown on October 19 (Early planting, T_1) before rainfall for early planting and November 23 (Late planting, T_2) after rainfall for late planting, were conducted after wheat harvest. The straw of wheat was collected for livestock because it is usually valued for livestock in region. The experiments was established according to a split plot design with four replications, in which three tillage method treatments in which three tillage method treatments [moldboard plough + cultivator + drill as conventional tillage (CT), cultivator + drill as reduced tillage (RT) and no-till planting (NT)] were main plots, and five herbicide applications [pre-emergence herbicide application after sowing to control the broadleaf weeds (PEH), post emergence herbicide application to control the grassy weeds (POH), pre-emergence after sowing to control the broadleaf weeds and post emergence to control the grassy weeds (PEOH), no weed control (NWC), hand weeding control (HWC)] were sub-plots. The plough was used at 15-20 cm depth in conventional tillage treatments 20 days after wheat harvesting and the tillage with cultivator for conventional and reduced tillage treatments was implemented at 8-10 cm depth two days before planting of lentil. Firat-87, a winter lentil variety widely used in the region, was used for both early planting and late planting. Plot size was 100 m^2 (20 x 5 m). Planting density was 300 seeds m^{-2} in rows spaced 14 cm apart. A compound fertilizer (18% N, 46% P_2O_5) to supply 30 kg N plus 60 kg P_2O_5 ha^{-1} was applied as basal fertilizer at planting. The Prometryne (25 ml ha^{-1}) was implemented in PEH and PEOH treatments immediately after lentil planting in order to control the broadleaf weeds. Haloxyfop (R) methyl ester (4.5 ml ha^{-1}) was applied in POH and PEOH treatments during 2 – 3 leaves stage of weeds to control the grassy weeds. The herbicide was applied in 300 l of water ha^{-1}.

Weed density by species were determined by couting weed species in a sample area of 1 m^2 from each plot. Weed flora identified in the experimental field were given in Table 1.

Table 1. Weed flora identified in the experimental field

Fam: APIACEAE (Umbelliferae)	*Convolvulus galaticus* Roston. Ex Choisy
Coriandrum sativum L.	*Convolvulus stachydifolius* Choisy
Turgenia latifolia (L.) Hoffm.	**Fam: EUPHORBIACEAE**
Fam: ASTERACEAE (Compositae)	*Euphorbia* sp.
Carduus pycnocephalus L.	**Fam: LAMIACEAE**
Centaurea balsamita Lam.	*Lamium amplexicaule* L.
Centaurea solsitialis L.	**Fam: PAPAVERACEAE**
Cichorium intybus L.	*Papaver* sp.
Lactuca serriole L.	**Fam: POACEAE**
Senecio vernalis Waldst. And Kit.	*Triticum spp.*(volunteer wheat)
Tragopogon sp.	*Phalaris* spp.
Xanthium strumarium L	*Sorghum halepense* (L.) Pers.
Fam: BRASSICACEAE (Cruciferae)	**Fam: POLYGONACEAE**
Myagrum perfoliatum L.	*Polygonum aviculare* L.
Sinapis arvensis L.	**Fam: RANUNCULACEAE**
Fam: CARYOPHYLLACEAE	*Consolida axilliflora* (DC.) Schröd.
Vaccaria pyramidata Medik.	*Ranunculus arvensis* L.
Fam: CONVOLVULACEAE	**Fam: RUBIACEAE**
Convolvulus arvensis L.	*Galium aparine* L.
Convolvulus betonicifolius Mill.	*Galium tricornutum* Dandy.

Weed biomass was collected in late summer by harvesting total above ground weed biomass in a sample area of 1 m^2 from each plot and the biomass from these samples was oven dried at 55 ˚C for at least 72 h and weighed. Four counts of 0.25 m^2 each using metal quadrants were taken from each plot, resulting in a total sample area of 1 m^2. Grain yield was measured by harvesting the full length of each plot (20 m), using Hege-125 plot combine harvester (Hege Equipment, Inc., Colwick, KS, U.S.A.) with a 1.2 m wide header comb. Each plot sample was weighed and three sub-samples were dried to determine moisture content. Grain yields were converted to 14% moisture content.

The statistical analysis for all variables was done through ANOVA, and mean comparison were made using Fisher's unprotected LSD at $P \leq 0.05$ (SAS, 2002). There were 27 weed species in experimental field. But, the statistical analysis was performed for *Triticum spp.* (Volunteer wheat) and *Turgenia latifolia* (L.) Hoffm., which are the most dominant weeds in the experiment field. Before statistical analysis was performed on the weed species density and weed dry biomass data, a Bartlett's test was carried out to determine the homogeneity of variances. Square root (x + 0.5) transformation was deemed appropriate for data which had values less than 10 and had zeros present (Snedecor and Cochran, 1983).

RESULTS AND DISCUSSION

Significance of analysis of variance (ANOVA) for all variables as affected by tillage and herbicide applications in early and late planting of lentil is presented in Table 2.

The ANOVA indicated that while tillage systems had no significant influence on *Triticum spp.* (volunteer wheat density, VWD) and *Turgenia latifolia* (L.) Hoffm. density (TLD) in early planting, they significantly affected the VWD in late planting. The herbicide applications significantly influenced the VWD and TLD in both early and late planting (Table 2).

Tillage x herbicide interaction was significant for the TLD in early planting; for both the VWD and the TLD in late planting, but it was not significant for the VWD in early planting. This significant interaction indicates that effect of herbicide application on weed species densities changed according to tillage systems.

Table 2. Significance of analysis of variance (ANOVA) for *Triticum spp.* (volunteer wheat) density (VWD), *Turgenia latifolia* (L.) Hoffm. density (TLD), biomass dry weight of total weeds (BDW) and yield of lentil (LY) as affected by tillage and herbicide application in early and late planting of lentil.

		Early planting				Late planting			
Source of variation	Df	VWD	TLD	BDW	LY	VWD	TLD	BDW	LY
Tillage (T)	2	Ns	ns	ns	**	**	ns	*	**
Herbicide (H)	4	**	**	**	**	**	**	**	**
T x H	8	Ns	*	ns	**	**	*	ns	**

*, ** and ns refer to significant treatment effects in ANOVA at P ≤ 0.05, P ≤ 0.01 and not significant, respectively.

Late planting after rainfall reduced the VWD. The highest volunteer wheat density was determined in no-till planting system. Especially, in late planting, the tillage by cultivator after rainfall significantly reduced the volunteer wheat density (Table 3). This result supports the view presented by Pala et al. (2000) who argue that to facilitate weed control as well as proper seedbed preparation, the initial tillage should be carried out when the soil is still dry, but the secondary tillage should follow the first effective rain.

The HWC treatment resulted in the lowest *Triticum spp.* density in early planting, and this was followed by the POH, PEOH treatments. In late planting, the POH, PEOH and HWC treatments were in the same group. Post-emergence herbicide (Haloxyfop (R) methyl ester) application controlled nearly 90% of *Triticum spp.* (volunteer wheat).

Table 3. Effect of tillage and herbicide treatments on volunteer wheat density (number m^{-2}) in early and late planting lentil*.

	Early planting				Late planting			
Tillage[a] / Herbicide[b]	CT	RT	NT	Mean	CT	RT	NT	Mean
PEH	38.35	42.16	32.69	37.63 b[c]	1.04	4.12	14.19	5.18 b
POH	6.49	5.67	8.85	6.94 c	0.15	0.15	0.15	0.15 c
PEOH	5.31	6.82	8.62	6.85 c	0.39	0.28	0.15	0.26 c
NWC	58.91	56.59	60.85	58.77 a	1.78	4.64	43.32	11.30 a
HWC	0.00	0.00	0.00	0.00 d	0.00	0.00	0.00	0.00 c
Mean	14.70	15.14	15.80		0.57 b	1.24 b	5.44 a	
C.V.[d]	32.4				36			

*Weed density is expressed as square root (x + 0.5) transformed data; [a] CT, conventional tillage; RT, reduced tillage; NT, no-till planting; [b]PEH, pre-emergence herbicide application; POH, post emergence herbicide application; PEOH, pre-emergence and post emergence herbicide application; NWC, no weed control; HWC, hand weeding control; [c]Values within a column for the herbicide treatments means, or values in the row for the tillage means, followed by the same or no letter (s) are not significantly different at the 5% level of the LSD test; [d]Coefficient of variation.

Table 4 shows the density of *Turgenia latifolia* (L.) Hoffm. per square meter influenced by tillage and herbicide treatments in early and late planting lentil.

Table 4. Effect of tillage and herbicide treatments on *Turgenia latifolia* (L.) Hoffm. (number m^{-2}) in early and late planting lentil*.

	Early planting				Late planting			
Tillage[a] / Herbicide[b]	CT	RT	NT	Mean	CT	RT	NT	Mean
PEH	0.30	0.63	1.09	0.61 b[c]	3.17	6.44	1.31	3.36 b
POH	4.67	1.68	1.48	2.45 a	2.4	8.17	9.92	6.56 a
PEOH	0.20	5.29	3.67	2.45 a	8.36	2.60	6.45	5.54 ab
NWC	0.61	0.50	2.60	1.12 ab	3.92	5.80	1.59	3.58 ab
HWC	0.00	0.00	0.00	0.00 c	0.00	0.00	0.00	0.00 c
Mean	0.80	1.27	1.49		3.12	3.69	3.01	
C.V.[d]	48				40			

*Weed density is expressed as square root (x + 0.5) transformed data; [a] CT, conventional tillage; RT, reduced tillage; NT, no-till planting; [b]PEH, pre-emergence herbicide application; POH, post emergence herbicide application; PEOH, pre-emergence and post emergence herbicide application; NWC, no weed control; HWC, hand weeding control; [c]Values within a column for the herbicide treatments means, or values in the row for the tillage means, followed by the same or no letter (s) are not significantly different at the 5% level of the LSD test; [d]Coefficient of variation.

Late planting of lentil caused higher TLD than early planting. Tillage systems did not affect the TLD. Buhler (1995) determined that the effect of tillage systems on weed dynamics appears to be complex and controlled by interacting factors (soil type, weed species, quality and type of residue, allelopathy, and environmental conditions). Furthermore, Stevenson et al. (1997)

found no significant differences between the diversity indices describing moldboard and chisel weed communities in spring barley in Quebec. They stated that this could be resulted from several reasons such as climate conditions, geographical distribution of particular flora, rotation cycle, herbicide effects, variation in sampling dates, and whether density or biomass is used to compute the diversity indices. The TLD was 0.61, 2.45, 2.45, 1.12, 0.00 plants m^{-2} and 3.36, 6.56, 5.54, 3.58, 0.00 plants m^{-2} in PEH, POH, PEOH, NWC, HWC treatments in early and late planting, respectively. Pre-emergence herbicide did not control sufficiently *Turgenia latifolia* (L.) Hoffm. when comparing with no weed control. Whereas, Mohamed *et al*. (1997) advocated that pre-emergence herbicides provided excellent control of weeds over weedy check.

While the effect of tillage systems on biomass dry weight of total weeds (BDW) was not significant in early planting, it was significant in late planting (Table 2). Late planting after rainfall significantly reduced the BDW. While the highest BDW was found in the NT system, the lowest was found in the CT. The BDW in the RT system showed intermediate values between CT and NT (Table 5). These results are in agreement with other studies that reported greater weed densities under NT than under CT systems (Blackshaw et al., 1994; Dorado and López-Fando 2006; Primot et al., 2006) and intermediate values in the case of RT systems (Dorado and López-Fando 2006). Manual and herbicidal treatments significantly reduced dry weed biomass as compared to untreated control (Table 5). The PEOH following HWC treatment produced the lowest dry weed biomass in both early and late planting. This was followed by POH in early planting and PEH treatments in late planting. Stork (1998) stated that weed growth was significantly reduced by the use of herbicides and resulted in increased crop yield up to 50% than control.

Table 5. Effect of tillage and herbicide treatments on the biomass dry weight of total weed population (g m^{-2}) in early and late planting lentil*.

	Early planting				Late planting			
Tillage[a] / Herbicide[b]	CT	RT	NT	Mean	CT	RT	NT	Mean
PEH	362.05	402.22	413.60	392.31 b[c]	23.55	100.93	114.12	72.73c
POH	251.84	222.88	256.71	243.58 c	80.14	117.83	174.04	120.99b
PEOH	143.62	165.32	170.03	159.44 d	40.16	64.77	83.26	61.32c
NWC	538.71	569.31	569.02	558.92 a	108.84	199.75	320.24	200.32a
HWC	0.00	0.00	0.00	0.00 e	0.00	0.00	0.00	0.00e
Mean	199.06	208.62	217.30		38.53b	75.70ab	105.4a	
C.V.[d]	15.69				27.29			

*Weed density is expressed as square root (x + 0.5) transformed data; [a] CT, conventional tillage; RT, reduced tillage; NT, no-till planting; [b]PEH, pre-emergence herbicide application; POH, post emergence herbicide application; PEOH, pre-emergence and post emergence herbicide application; NWC, no weed control; HWC, hand weeding control; [c]Values within a column for the herbicide treatments means, or values in the row for the tillage means, followed by the same or no letter (s) are not significantly different at the 5% level of the LSD test; [d]Coefficient of variation.

The ANOVA showed that seed yield of lentil was significantly affected by tillage systems and herbicide applications in both early and late planting. Also, the interaction effect between tillage systems and herbicide applications was significant.

Table 6**.** Effect of tillage and herbicide treatments on grain yield (kg ha^{-1}) of early and late planting lentil.

	Early planting				Late planting			
Tillage[a] / Herbicide[b]	CT	RT	NT	Mean	CT	RT	NT	Mean
PEH	407 c[c]	211 c	332 c	317 c	1979 b	1935 ab	1251 b	1722b
POH	1224 b	1228 b	660 b	1040 b	1338 c	1817 b	1245 b	1467 c
PEOH	1359 b	1176 b	905 a	1147 b	1833 b	2067 a	1554 ab	1818 b
NWC	305 c	243 c	170 d	240 c	953 d	1007 c	646 c	869 d
HWC	1623 a	1707 a	1011 a	1447 a	2370 a	2069 a	1949 a	2130 a
Mean	985 a	913 a	615 b		1665 a	1779 a	1329 b	
C.V.[d]				16.10				12.24

*Weed density is expressed as square root (x + 0.5) transformed data; [a] CT, conventional tillage; RT, reduced tillage; NT, no-till planting; [b]PEH, pre-emergence herbicide application; POH, post emergence herbicide application; PEOH, pre-emergence and post emergence herbicide application; NWC, no weed control; HWC, hand weeding control; [c]Values within a column for the herbicide treatments means, or values in the row for the tillage means, followed by the same or no letter (s) are not significantly different at the 5% level of the LSD test; [d]Coefficient of variation.

All of the early planting treatments had significantly lower yields than all of the late planting treatments. This yield difference is attributed to increased competition from volunteer wheat in early planted crops. The volunteer wheat density was lower in late plating treatments than in early plating. Among tillage treatments, The NT system produced the lowest seed yield of lentil. However, there were no significant differences between CT and RT treatments (Table 6). The effect of tillage systems on crop yield performance has varied in the literature. Pala et al. (2000) found that deep tillage gave no advantage over a shallow sweep system, either for soil moisture storage or yield of lentil. They found that shallow tillage (ducks-foot cultivator) or zero-till were the best systems for legumes. Camara et al. (2003) found that yield was significantly greater if a moldboard plow was used rather than a subsurface sweep and offset disk. Sandoval-Avila et al. (1994) found no significant effect of tillage on bean yield. Results generally show that no-till planting has tended to be less productive than moldboard plowing, probably due to lack of weed control in the no-tillage system.

The grain yield was affected significantly by herbicide application methods. The highest grain yield was obtained from PEOH treatment after hand-weeding control plots in both early and late plating. This treatment was followed by POH in early planting and PEH treatments in late planting. This result is probably due to cultivating the volunteer wheat emerged after rainfall in late planting. In particular, the use of post-emergence herbicide in early planting significantly increased the lentil yield. This result was according to the findings of Chaudhary et al. (2011) who reported that post-emergence herbicide increased lentil yield. Also, Stork (1998) found that weed growth was significantly reduced by the use of herbicides and resulted in increased yield up to 50% than control. Manual hoeing gave maximum increase in yield because it gave early and 100% eradication of all types of weeds.

There was a significant tillage x herbicides interaction for lentil yield in both early and late planting times (Table 2). This interaction indicates that effect of herbicide applications on lentil yield changed according to tillage systems (Table 6).

CONCLUSIONS

The results of this study showed that late planting after rainfall reduced the *Triticum spp.* (volunteer wheat) density. The highest *Triticum spp.* density was determined in no-till planting system. The tillage by cultivator after rainfall significantly reduced the *Triticum spp.* density in late planting. Post-emergence herbicide application controlled nearly 90% of *Triticum spp.* Tillage systems did not affect the *Turgenia latifolia* (L.) Hoffm. density. Pre-emergence herbicide did not control sufficiently *Turgenia latifolia* (L.) Hoffm. when comparing with no weed control. While the effect of tillage systems on biomass dry weight of total weeds was not significant in early planting, it was significant in late planting. The no-till planting system resulted in the highest biomass dry weight of total weeds. The treatment of pre and post emergence herbicide application following hand weeding control produced the lowest dry weed biomass in both early and late planting. This was followed by post-emergence herbicide application in early planting and pre-emergence herbicide application treatments in late planting. The seed yield of lentil was lower in late plating treatments than in early plating. Among tillage treatments, the no-till planting system produced the lowest seed yield of lentil. In particular, the use of post-emergence herbicide in early planting significantly increased the lentil yield.

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EFEKAT VREMENA SIJANJA, SISTEMA ORANJA I HERBICIDA NA GUSTINU KOROVNIH VRSTA, BIOMASE KOROVA I PRINOSA SOČIVA U OKVIRU PLODOREDA SOČIVA –PŠENICE

SAŽETAK

Korovi su najveća prepreka za proizvodnju sočiva u regionu jugoistočne Anatolije u Turskoj. Sistemi oranja, herbicidi, kao i vrijeme takvih radnji značajno utiču na gustinu korova i prinos sočiva. Stoga su sprovedena dva eksperimenta na terenu gdje je sočivo sijano 9. oktobra (rana sadnja, T1) i 23. novembra (kasna sadnja, T2) tokom 2009-2010 u sezoni rasta sočiva kako bi se procijenili efekti različitih oblika oranja i herbicida, kao i vrijeme takvih radnji na gustinu korova i prinos sočiva (*Lens culinaris*, L) nakon žetve pšenice (*Triticum aestivum* L.) u kišnom području regiona jugoistočne Anatolije u Turskoj. Korišćen je „Split pot“ dizajn podjeljenih parcela sa četiri ponavljanja, gdje su korišćena tri metode tretmana oranja [plužna daska + kultivator + sadilica kod konvencionalnog oranja (CT), kultivator + sadilica kod smanjenog oranja (RT) i sijanje bez oranja (NT)] na glavnim parcelama, kao i pet aplikacija herbicida [aplikacija herbicida prije izbijanja biljke nakon sijanja kako bi se kontrolisali lisnati korovi (PEH), aplikacija herbicida nakon izbijanja biljke kako bi se kontrolisali travnati korovi (POH), prije izbijanja biljke nakon sijanja kako bi se kontrolisali lisnati kroorvi i nakon izbijanja biljke kako bi se kontrolisali travnati korovi (PEOH), bez kontrole korova (NWC), kontrola ručnim plijevljenjem (HWC)] na sporednim parcelama. Rezultati ovog istraživanja pokazuju da kasna sadnja sa kultivatorom nakon kiše je smanjila gustinu korova i sadržaj suve biomase, te je dala značajno veći stepen sjemena sočiva nego rane sadnje. Sadnja bez oranja je rezultrala najvećom biomasom korova i najniži prinos sočiva kod rane, a i kasne sadnje. Kontrola ručnim plijevljenjem je rezultirala značajno najvećim prinosom sočiva.

Ključne riječi: sočivo, korov, oranje, herbicid