Pak. J. Weed Sci. Res. 16(2): 199-206, 2010.

INFLUENCE OF TILLAGE AND WEED MANAGEMENT METHODS ON CHICKPEA (*Cicer arietinum* L.). II. EFFECT ON WEEDS

Fathi A.O. Emenky[1], Nahla M. Saleem[2] and Ahmed S. Khalaf[2]

ABSTRACT

An experiment was conducted at the Agricultural College farm Duhok University, Iraq to investigate the effectiveness of different types of tillage and weed management practices on weed control in chickpea field during the growing season of 2009-10. Tillage types included the use of disc plow, mouldboard plow, and cultivator and weed management practices included no weed control, hand hoeing, trifluraline (Treflan), haloxyfop-p-methy (Aloxy) and paraquat (Gramoxone). Results indicated that the plough type had no significant effect on number of weeds or their dry weight. Hand hoeing followed by paraquat herbicide were superior in number and dry weight of broad-leaved weeds (8 weeds m^{-2} and 11 g m^{-2}) and (35.22 weeds m^{-2} and 53 g m^{-2}), respectively. The interaction of hand hoeing with all types of tillage systems was significant. The interaction of paraquat with disc plow gave the lowest dry weight of broad leaved weeds (35 g m^{-2}). Neither the number of narrow-leaved weeds nor their dry weight had any marked effect on chickpea.

Keywords: Weeds, chickpea, management, herbicides, control, tillage systems.

ITRODUCTION

Chickpea (*Cicer arietinum* L.) ranks as the third most important grain legume in the world after dry bean and peas (Singh and Saxena, 1999). It is a poor competitor to weeds because of slow growth rate and limited leaf area development at early stages of crop growth and establishment. The demand for chickpea has increased as it is used in many public national food crops, and in various commodities and recipes. Weed competition is considered as one of the most important causes of low and inferior quality of chickpea produce and it is the limiting factor for expanding the area cultivated by this economically important crop in Iraqi Kurdistan Region. The situation is worse especially for the early local cultivars.

Weed control usually is done by different methods, tillage or types of ploughs may have their effect on weed population affecting

[1]Department of Horticulture, College of Agriculture, University of Duhok, Kurdistan, Iraq.
[2]Dept. of Soil & Water Sciences, College of Agriculture, University of Duhok, Kurdistan Region, Iraq. E-mail:fathiemenky@hotmail.com

soil moisture or soil seed bank dynamics during pulverizing the soil seed bed preparation. Chemical control of weeds also involves various options, pre-planting treatment is applied before crop is sown, where the herbicides used are acting on germinating seedlings. Pre-emergence treatments are applied after seeding but before the crop emerges; chemicals may control weeds by killing weed seedlings. While post emergence herbicides are applied after the emergence of crop plants and weeds; with selective herbicides weeds are killed with little damage to crop plants due to differential tolerance of the crop and weed to the herbicides.

The types of weeds that may be controlled depend on their susceptibility, and the tolerance of the crop to the herbicide. Treatment at the proper stage of crop development is important. Since most weeds are more susceptible to chemicals when young. Early treatments require less herbicide and result in less damage to crops from weed competition and from spray equipment.

Many studies refer to the above statements. Hand hoeing and tillage are the traditional methods practiced for a long time in most parts of the world (Solh and Pala, 1990). Ascandary (1981) stated that the use of mould board plow in spring has no significant effect on soil moisture. Similarly, Kakarash (2007) indicated that no significant differences in grown plants due to different plough types were evident including cultivator, mouldboard and disc harrow; Hassan (1987) demonstrated that plow types including mouldboard, vertical disc plow, and chisel plow have no significant influence on total fresh or dry weight of weeds in three locations in northern Iraq (Telafer, Hamam Al-Ali, and Sumail). While Khattak and Khan (2005) demonstrated during the use of different kinds of ploughs (chisel plow, mouldboard plow, disc harrow) with cultivator for covering the seeds, that the highest yield of chickpea were obtained from chisel plow with cultivator due to better control of weeds. They mentioned also that weed density m^{-2} increased because of increasing the rain during the growing season.

Regarding weed management practices, Yasin *et al.,* (1995) stated that chemical control of weeds will not be economical if weed interference is low because of low weed density. They also mentioned that the use of pre and post emergent herbicides reduced the total weed dry weight but the reduction did not effectively control grassy weeds. Chopra *et al.,* (2001) mentioned that the use of pre-planting herbicide (fluchloralin) with hand weeding gave the highest weed control efficiency. Similarly, Chaudhary *et al.,* (2005) found the lowest number and dry weight of total weeds was due to weeding at 20 and 40 days after sowing. In this context, Kayan and Adak (2005) stated that hand hoeing was more effective than herbicide application in

terms of reducing weed population and increasing chickpea yield. Kumar *et al.,* (1989) and Ahmad *et al.,* (1990) also confirmed that hand-weeding was superior to some pre planting (Fluchloralin) and pre-emergence (Pendimethalin and Oxadiazon) herbicides and reduced weed yield by 87% compared as compared to non-weeded control. Therefore, an experiment was designed to investigate the effect of different types of tillage methods and different methods of weed management on weed types and their population in chickpea field.

MATERIALS AND METHODS

An experiment was undertaken at the fields of Agricultural College, Duhok University, Iraqi Kurdistan Region during 2009 growing season (situated between longitudes 43.01º E, latitudes 36.847º N, and altitude 583 meters). The average rainfall for the months February to June was 158.5 mm. The data were statistically analyzed according to the strip plot design using the statistical analysis system (SAS, 2001). Duncan's multiple range test was used for mean separation at 0.05 probability level (Duncan, 1955).

Local chickpea (*Cicer arietinum* L.) seeds (Marakshi) were obtained from Duhok Agricultural Research Center, Iraq and treated with Diathane, M45 WP fungicide at a rate of 2g kg^{-1} before planting. Seeds viability was estimated by standard germination test according to ISTA (1985) which was 100%. The field was plowed as strips by specific ploughs (Mould board, Disc plow and Cultivator) on 14 January 2009. The field was leveled and the surface of soil was smoothed manually. The field was divided into plots according to Strip Plot Design with the distances of 2 by1m; each plot consisted of 4 lines; 20cm apart and 20cm among the plants.

The distance between tillage treatments in the same replicate was 1m. the experiment included two factors: type of ploughs as a main plot and methods of weed control comprising of control unit (weedy check), hand hoeing, non-selective herbicide (paraquat or Gramoxone), soil herbicide (trifluralin or Treflan) and grass specific herbicide (haloxyfop-p-methyl or Aloxy 10.8% EC) in sub plots. Trifluralin herbicide was applied to the soil in February 02, 2009 at the rate of 600 ml/donum (1 donum = 1000m^2; 13ml mixed with 14L water and spread on specified units (1.5L for each unit). Seeds were sown at February 15, 2009 at a depth of 7cm (Siddique and Loss, 1999). Gramaxone 20% soil-applied on 10 March 2009 after planting and before emergence of seedlings at a rate of 1000ml/donum; 14.5ml mixed with 15L of water and spread on the specified units. Aloxy herbicide which was used to control narrow leaved weeds was applied on 7 April 2009 at a rate of 187.5 ml /donum when the weeds were at 5-8 leaves stage. In the meantime hand-hoeing was practiced

in the required treatment. Samples of weeds were taken on 16 May 2009 from the two middle rows (1 m^2) and they were sorted into narrow or broad leaved and then incubated in oven at 75 C° for 48 hrs. The most common weeds found in chickpea field were *Polygonum aviculare* L., *Carthamus oxycantha*, *Xanthium strumarium*, *Lathyrus annuas*, *Cichorium intybus*, *Centaurea iberica*, *Hypericum perforatum*, and *Sinapis arvensis*.

RESULTS AND DISCUSSION

Results in Table-1 reveal that the type of ploughs had no significant effect on the number of broad leaved weeds per square meter in the field, although mouldboard plow recorded more number of broad leaved (41.33). The least No. of broadleaf weeds were found in the Cultivator (28.80). In respect to the methods of weed control, hand hoeing was the most superior among all treatments having only 8 weeds m^{-2} while all other treatments were not significantly different among themselves and even from the weed check. Aloxy herbicide inferred among them which gave 42.33 weeds m^{-2}very close to the weedy check, because it does not cause any phytotoxicity to broadleaf weeds. The interaction of each of disc and cultivator ploughs with hand hoeing gave significant control of broadleaf weeds among other interactions of tillage methods and weed control treatments (Table-1). The mouldboard plow recorded more number of broad leaved which could be attributed to the possibility of soil pulverization, which moved soil seed bank to soil surface and increased germination of broadleaf weed seeds. These results are in accordance to those of Ascandary (1981), Hassan (1987) and Kakarash (2007), who concluded that the different tillage methods have no effect on weed infestation. However, Khattak and Khan (2005) reported variable chickpea yield under different tillage regimes. Hand hoeing was more efficient among all methods of broad-leaved weed control.

Similarly, Hassan *et al.,* (2003) also observed a differential weed infestation under different methods of tillage systems. A perusal of data in Table-2 showed that the types of ploughs had non significant effect on dry weight of broad leaved weeds per square meter however; cultivator gave the lowest dry weight of broad leaved weeds (53.87 gm^{-2}). Hand hoeing was superior most among the weed control treatments, as it gave lowest dry weight of broadleaf weeds of only 11.00 gm^{-2}, followed by paraquat (53.00 gm^{-2}). The interaction of hand hoeing gave the lowest dry weight of broad leaved weeds per square meter across all the main-plots. The interaction of paraquat with disc plough also gave low and significant value (35 gm^{-2}) compared to the other interactions (Table-2).

Table-1. Effect of ploughs types and methods of weeds managements and their interactions on number of broad leaved weeds per square meter area.

Weed management methods / Ploughs types	Control	Hand hoeing	Gramoxone	Trifluralin	Aloxy	Means of ploughs
Disc plough	43.33d-f*	4.33a	20.33a-c	44.00d-f	35.00c-f	29.40
Mouldboard plough	43.66d-f	11.66ab	55.33f	42.00c-f	54.00ef	41.33
Cultivator	36.00c-f	8.00a	30.00b-d	32.00b-e	38.00c-f	28.80
Means of weed managements methods	41.00b	8.00a	35.22b	39.33b	42.33b	

*Means of the main effects and interaction shared by the same letter are not significantly different at the probability 0.05 Duncan's Multiple Range Test.

Table-2. Effect of ploughs types and methods of weeds managements and their interactions on dry weight of broad leaved weeds per square meter area (gm).

Weed management methods / Ploughs types	Control	Hand hoeing	Gramoxone	Trifluralin	Aloxy	Means of ploughs
Disc plough	78.00d-f*	7.66a	35.00b	161.66i	99.00g	76.27
Mould board plough	95.00fg	15.33a	70.33c-e	127.00h	88.66e-g	79.27
Cultivator	59.66cd	10.00a	53.66bc	72.33c-e	73.66c-e	53.87
Means of weed managements methods	77.55c	11.00a	53.00b	120.33d	87.11c	

*Means of the main effects and interaction shared by the same letter are not significantly different at the probability 0.05 Duncan's Multiple Range Test.

Table-3. Effect of ploughs types and methods of weeds managements and their interactions on number of narrow leaved weeds per square meter area.

Weed management methods / Ploughs types	Control	Hand hoeing	Gramoxone	Trifluralin	Aloxy	Means of ploughs
Disc plough	0.33	0.00	0.00	1.00	0.33	0.33
Mould board plough	0.00	0.33	0.66	0.66	0.00	0.33
Cultivator	1.33	0.00	0.33	0.66	0.00	0.46
Means of weed managements methods	0.55	0.11	0.33	0.77	0.11	

Table-4. Effect of ploughs types and methods of weeds managements and their interactions on dry weight of narrow leaved weeds per square meter area (gm).

Weed management methods / Ploughs types	Control	Hand hoeing	Garmoxone	Trifluralin	Aloxy	Means of ploughs
Disc plough	2.66	0.00	0.00	6.33	2.66	2.33
Mould board plough	0.00	3.00	4.00	8.66	0.00	3.13
Cultivator	0.00	0.00	2.33	12.66	0.00	3.13
Means of weed managements methods	0.88	1.00	2.11	9.22	0.88	

With regard to narrow-leaved weeds, neither plough types nor methods of weeds control and their interactions significantly affected the number of weeds or their dry weight per square meter (Tables-3 and 4), respectively. The data in the Table-3 exhibits that very few grassy weeds infesting the experiment, hence the control methods could not establish any differential efficacy. Aloxy herbicide; the grass specific herbicide failed to significantly differ from the other herbicides and hand weeded and weedy checks. Similar findings have been communicated by Chopra *et al.,* (2001), Chaudhary *et al.,* (2005), Kayan and Adak (2005), Kumar *et al.,* (1989) and Ahmad *et al.,* (1990).

The dry weight of broad-leaved weeds per square meter (Table-2) is coincide with the number of broad leaved (Table-1), and similarly the cultivator, hand hoeing and their interactions gave the lowest value. Tables-3 and 4, obviously showed that there were no significant effects of both plough types or methods of weed control and their interactions on the number of narrow-leaved weeds or on their dry weight per square meter, respectively. These results were in agreement with those of Yasin *et al.,* (1995).The explanation which can be offer for the results of narrow-leaved weeds, due to their existence in soil seed bank. Hand-hoeing surpassed all herbicides treatments which were similar to check plot (no treatment). Therefore, further studies are still required to compare the cost and economy of hand-hoeing compared with chemicals to detect the economic feasibility of chemical application.

REFERENCES CITED

Ahmad, M., S. Khalid and S.U. Siddiqui, 1990. Efficacy of per and post emergence herbicides and their application methods on the growth, yield and nodulation of chickpea (*Cicer arietinum* L.). Pak. J. Weed Sci. Res. 3(2):89-98.

Ascandary, E. 1981. Effects of different tillage and planting methods on soil moisture and seed yield of chickpea in dry land condition. Seeds and Seeding 19(4): 497-512.

Chaudhary, B.M., J.J. Patel and D.R. Delvadia. 2005. Effect of weed management practices and seed rates on weeds and yield of chickpea. Indian J. Weed Sci. 37(3/4): 271-272.

Chopra, N., H.P. Singh and N.K., Chopra. 2001. Effect of herbicide and weeding on weeds in chickpea. Indian J. Weed Sci. 33(3/4): 194-197.

Duncan, D.E., 1955. Multiple ranges and multiple F-test biometrics 11: 1-42.

Hassan, A.E., 1987. The effect of different plow types on production of some wheat (*T. aestivum*) cultivars under dry farming condition of Iraq. College of Agriculture, University of Salah Alddin, Erbil.

Hassan, G., N.U. Khan and H. Khan. 2003. Effect of zero tillage and herbicides on the weed density and yield of chickpea under rice-based conditions of D.I. Khan. Pak. J. Weed Sci. Res. 9(3&4): 193-200.

ISTA. 1985. International Rules for Seed Testing Association.

Kakarash, S.A. 2007. Ecophysiological study of soil seed bank for different arable systems at Erbil Governorate. College of Agriculture, Salah Alddin University, Erbil, Iraq.

Kayan, N. and M.S. Adak. 2005. Effects different soil tillage methods, weed control and phosphorus fertilizer doses on yield components in chickpea under Central Anatolian conditions. Pak. J. Biol. Sci. 8(11): 1503-1506.

Khattak, M.K. and M.J. Khan. 2005. Effect of different tillage practices on weeds and yield of chickpea under sandy loam soil condition. P. J. Weed Sci. 11(3/4): 157-164.

Kumar, Y., O.P. Gupta and O.P. Gill, 1989. Weed control studies in irrigated chickpea in Rajasthan, India. Sukhadia University, ICN 21: 28-30.

SAS. 2001. SAS/STAT\User's Guide for personal computers. Release 6.12. SAS Institute Inc, Cary, NC, USA

Siddique, K.H.M. and S.P. Loss. 1999. Studies on sowing depth for chickpea (*Cicer arietinum* L.), faba bean (*Vicia faba* L.) and lentil (*Lens culinaris* Medik) in a Mediterranean-type environment of South-Western. J. Agron. Crop Sci. 182:105-112.

Singh, K.B. and M.C. Saxena, 1999. Chickpea. The International Center for Agriculture Research in the Dry Area, International Chickpea and Pigeonpea Newsletter ICRISAT.

Solh, M.B. and M. Pala. 1990. Weed control in chickpea. International Center for Agricultural Research in the Dry Area (ICARDA). Options Méditerranéennes-Série Séminaires 9: 93-99.

Yasin, J.Z., S. Al-Thahabi, B.E. Abu-Irmaileh, M.C. Saxena and N.I. Haddad, 1995. Chemical weed control in chickpea and lentil. Inter. J. Pest Manag. 41(1): 60-65.