Pak. J. Bot., 37(3): 667-672, 2005.

WEED FLORA CHANGES IN COTTON GROWING AREAS DURING THE LAST DECADE AFTER IRRIGATION OF HARRAN PLAIN IN ŞANLIURFA, TURKEY

BEKİR BÜKÜN

Department of Plant Protection,
Faculty of Agriculture, Harran University, 63040 Şanlıurfa, Turkey
bbukun@harran.edu.tr Fax: +90 414 2474480

Abstract

In order to determine changes in weed flora due to continuous cotton production related to irrigation, the results of surveys performed in 1995-1996 and was recently performed at the end of July 2004, were compared. Based on the results of first surveys (1995-1996), 36 weed species belonging to 14 botanical families were identified and in the second surveys (2004), 24 species were recorded. *Amaranthus albus, Amaranthus retroflexus, Convolvulus arvensis, Cynodon dactylon, Echinocloa colonum, E crus-galli, Physalis angulata, Physalis philadelphica, Setaria verticillata, Solanum nigrum, Sorghum halepense* and *Xanthium strumarium* are more frequent and densities species. It was assumed that as well as the other factors, irrigation and continuous cotton cultivation had an important role to influence on the shifting of weed flora.

Introduction

Weeds are major constrains reducing the crops yield since they compete with crop for the nutrients, moisture, light and space (Nasir & Sultan, 2004). The yield reductions due to weed-crop competitions mainly depend on weed species and their densities as well as crop species. As the distribution and infestation intensity of each weeds are different, extent of crop yield reduction mainly depend on the number and kind of weeds (Frisbie *et al*., 1989).

Densities of weed species can be changed depending on some factors during long period (Mennan & Işık, 2003). There are many factors which influence the weed flora, however Chancellor (1985) reported that herbicide usage, rotation, fertilizing are major factors to changing in weed flora.

Suitable conditions causes well adjusting of some weed species. Water is essential for the growth of all plants and irrigation is the main component of water supply where soil moisture or rainfall are in deficit. However, some weed species unlike most of crops, are well adapted to high soil moisture conditions. The experimental areas were started to irrigation in 1995. Obviously some weed species which can grow in dry and arid conditions subsidize moist favored species after irrigation. There was no information about the floral weed change of continuously cotton plantations related to irrigation. The present study is the first report as to how weed flora of cotton was affected by the monoculture of cotton growing over 10 year period. The objective of this study was to determine the changing of weed species and their densities from beginning of irrigation for over 10 year period under continuous cotton production in Şanlıurfa, Turkey. In order to identify the past, current and potential weed problems associated with cotton crop of the area as well as providing base information the data can also facilitate the establishment of properties for future research and weed control programs.

Material and Methods

The cotton production system involves an average of five month cycle in which crop is sown in first half of May and harvested in the second half of October in Şanlıurfa. In order to determine the distribution and densities of weeds in cotton fields of the area, three surveys were carried out. The first survey was carried out in 1995-1996 by Bükün & Uygur in the same areas in Şanlıurfa (Bükün & Uygur, 1997) and the last one was performed more recently at the end of July 2004. The first surveys which were performed in 1995 and 1996 have been in two stage of cotton, one of them beginning of flowering stage, the other just after boll formation of cotton plants and also 55 fields were sampled in each year. The second surveys were performed before boll formation of cotton plants in 50 fields in 2004. Fields were randomly selected and surveys were performed following the methodology of McCully *et al*., (1991) with some modifications.

Four $1m^{-2}$ quadrates were placed randomly along an inverted "W" pattern in each field. First quadrate was placed after walking 20 paces from one corner along the edge of field, turning 90˚ and moving 15 paces into fields this was to avoid edge effect. The distance between each quadrate depended upon size and shape of the field. The larger fields were greater distance between quadrates. Also the distance between fields were at least 5 km. Frequency, densities of each weed species were calculated according to Odum (1971).

$$\text{Frequency (\%)} = \frac{\text{Number of surveyed areas where species occured}}{\text{Number of total surveyed areas}}$$

$$\text{Density (plants m}^{-2}\text{)} = \frac{\text{Total number of individual species}}{\text{Total surveyed area}}$$

Results

According to the results of two survey period 36 weed species belonging to 14 families were identified in 1995-1996 period (Table 1). However, to compare with the results of 2004, similar species were documented as in Table 1. *Physalis* species was not identified in the first surveys, However, Bükün *et al*., (2002) identified *Physalis angulata* and *Physalis philadelphica* in Şanlıurfa. The results of 2004 showed that there was an important change in weed flora of cotton plantation. During the last 10 years periods, the frequencies of *Alhagi camelorum, Amaranthus graecizans, Chenopodium album, Cyperus rotundus, Echinocloa colunum, Echinocloa crus-galli, Portulaca oleracea, Setaria verticillata, Sorghum halepense* and *Xanthium strumarium* increased from 3.60%, 1.81%, 3.60%, 1.81%, 45.45%, 1.81%, 23.63%, 12.72%, 23.63%, 5.45% to 18%, 12%, 10%, 8%, 62%, 16%, 54%, 58%, 60% and 72% respectively (Table 1). Additionally, frequency of *Physalis* spp., recorded as 74.74% in the last survey, there were an increase related to *Physalis angulata* (60%) and *Physalis philadelphica* (98%). In contrast, the frequencies of *Amaranthus albus, Chrozophora tinctoria, Convolvulus arvensis, Cynodon dactylon, Glycrrhiza glabra, Prosopis farcta, Solanum nigrum* and *Xanthium spinosum* gradually decreased from 49%, 20%, 49%, 39.90%, 18%, 41.80%, 43.63%, 5.45% to 40%, 6%, 26%, 10%, 14%, 16% and 2% respectively (Table 1). The frequencies of most important species are shown in Fig. 1.

Table 1. Frequencies and densities of weed species in cotton growing areas of Şanlıurfa during last decade.

Weed species	Frequency (%)			Density (plant m^{-2})		
	1995	1996	2004	1995	1996	2004
Alhagi camelorum Fisch.	3.60	9.09	18.00	0.03	0.04	0.60
Amaranthus albus L.	49.09	41.81	40.00	0.23	0.77	1.32
Amaranthus graecizans L.	1.81	7.27	12.00	0.01	0.03	0.66
Amaranthus retroflexus L.	56.36	25.45	40.00	0.21	0.01	2.88
Chenopodium album L.	3.60	1.81	10.00	0.01	0.02	0.32
Chrozophora tinctoria (L.) Rafin	20.00	18.18	6.00	0.01	0.05	0.10
Convolvulus arvensis L.	49.00	36.36	16.00	0.73	1.16	1.16
Cynodon dactylon (L.) Pers.	30.90	27.27	26.00	0.87	7.59	9.00
Cyperus rotundus L.	1.81	1.5	8.00	0.01	0.01	0.10
Echinochloa colonum (L.) Link.	45.45	52.72	62.00	2.48	8.16	12.00
Echinochloa crus-galli (L.) P.B.	1.81	5.45	16.00	0.05	0.16	1.66
Euphorbia supina Rafin.	7.27	16.36	8.00	0.01	0.10	0.40
Glycrrhiza glabra L.	18.00	18.18	10.00	0.04	0.15	0.66
Hypericum perforatum L.	7.27	9.09	2.00	0.02	0.04	0.33
Physalis angulata L.	-	-	60.00	-	-	3.16
Physalis philadelphica Lam. var. *immaculata*	-	-	98.00	-	-	6.12
Physalis sp.	74.54	87.27	--	0.40	3.26	-
Prosopis farcta (Banks and Sol.) Mac.	41.80	38.18	14.00	0.53	0.93	0.40
Portulaca oleracea L.	23.63	25.45	54.00	0.13	0.21	0.66
Setaria verticillata (L.) P.B.	12.72	25.45	58.00	0.17	0.39	2.50
Solanum nigrum L.	43.63	20.00	16.00	0.20	0.58	3.60
Sorghum halepense (L.) Pers.	23.63	34.54	60.00	0.91	4.54	10.16
Tribulus terrestris L.	9.09	7.27	8.00	0.02	0.03	0.54
Xanthium spinosum L.	5.45	5.45	2.00	0.01	0.01	0.56
Xanthium strumarium L.	56.36	70.90	72.00	0.40	0.03	4.56

Weed density is the main factor to determine weed flora changes. The changing in frequency always may be not sufficient alone to explain the reasons of weed flora changes. Density of weeds can be explanatory why the densities of certain species are increased while their frequencies decreased.

Results showed that the densities of *Amaranthus albus* increased from 0.25 to 1.32 plant m^{-2}, *Amaranthus retroflexus* from 0.21 to 2.88 plant m^{-2}, *Convolvulus arvensis* from 0.73 to 1.16 plant m^{-2}, *Cynodon dactylon* from 0.87 to 9 plant m^{-2}, *Echinocloa colunum* from 2.48 to 12 plant m^{-2}, *Echinocloa crus-galli* from 0.05 to 1.16 plant m^{-2}. *Physalis angulata* and *Physalis philadelphica* densities was reported as 0.96 and 2.82 plant m^{-2} in 2000, respectively (Bükün & Uygur, 2003). The densities of *Physalis angulata* and *Physalis philadelphica* increased to 3.16 and 6.12 plant m^{-2} in 2004, respectively. Also, the densities of *Setaria verticillata* increased from 0.17 to 2.50 plant m^{-2}, *Solanum nigrum* from 0.20 to 3.60 plant m^{-2}, *Sorghum halepense* from 0.91 to 10.16 plant m^{-2}, and *Xanthium strumarium* from 0.40 to 4.56 plant m^{-2}. These weeds became more common and dominant over last decade in cotton growing areas of Harran plain in Şanlıurfa (Fig. 2).

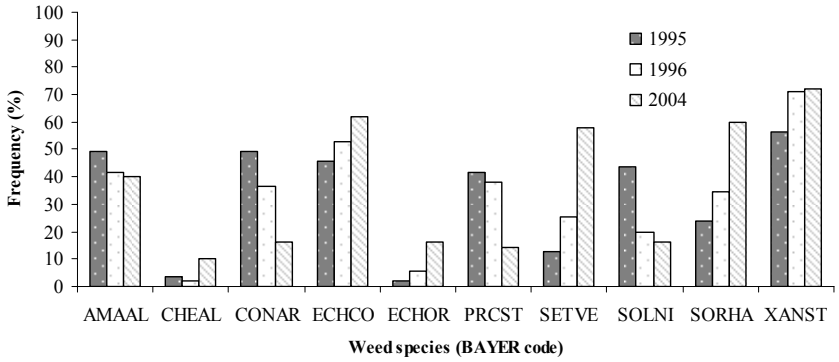

Fig 1. Frequencies changes of some important weed species in cotton fields from 1995-1996 to 2004.

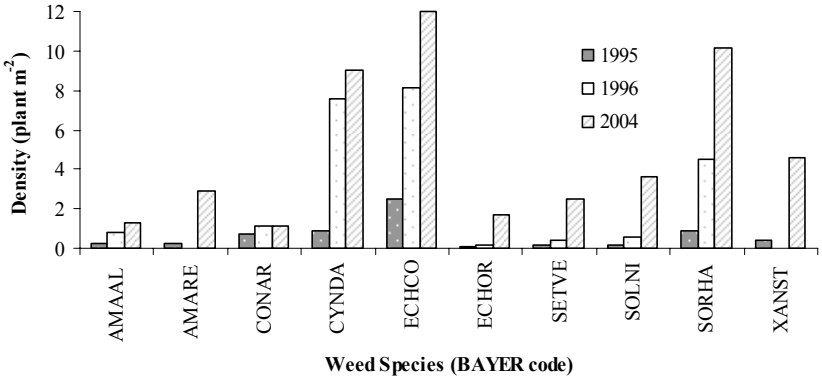

Fig 2. Densities changes of some important weed species in cotton fields from 1995-1996 to 2004.

Discussion

The frequency and density of weeds are differently affected by continuously cotton growing and irrigation. Density and composition of weed flora are strongly affected by crop production system and agricultural practices (Mennan & Işık, 2003). Herbicides usage is other important factors to changing in weed species composition. Results of two survey period showed that while frequency of some species such as *Amaranthus albus, Amaranthus retroflexus, Convolvulus arvensis, Cynodon dactylon* and *Solanum nigrum,* decreased in contrast, their densities increased. It was assumed that this can be related with weed control methods as well as irrigation. Because irrigation encourages soil salinity and so the species that prefer these conditions are well adjusted and become dominant. The increases in frequency of *Alhagi camelorum* could be attributed with this reason. Another important finding is decreasing both the frequency and density of *Prosopis farcta*. It is known that this weed species mainly preferred arid conditions. The reasons of high frequency occurrence of *Prosopis farcta* in the first surveys could be attributed with new starting of irrigation in Harran plain.

The majority of cotton growers of Şanlıurfa commonly use preplant herbicides such as Trifluralin, Ethalfluralin and Trifluralin+Linuron to control of some annual broad-leaved and grass weeds and post emergences herbicides such as Haloxyfop-R-Methylester, Fluazifop Butyl, Fluazifop-P-Butyl to control of grass weeds. The use of herbicides are causes of changing of weed flora in cultivated lands too (Chancellor & Froud-Williams, 1986; Streibig & Andreasen 1993; Mennan & Işık, 2003). The evidence of effects of herbicide use in change of weed flora can be inference while the frequency of *Amaranthus albus, Cynodon dactylon, Solanum nigrum* decreased their densities were increased. This result indicated that where herbicides have not been applied weed species densities were increased. However it is known that most of herbicides that labelled for the cotton are not as effective in the control of majority of weed species.

Irrigation also stimulated the density of some weed species. *Echinocloa colunum, Echinocloa crus-galli, Physalis angulata*, *Physalis philadelphica, Portulaca oleracea*, *Setaria verticillata, Sorghum halepense* and *Xanthium strumarium* are more stimulated species by the irrigation. These species especially grow well in moist conditions. These results are similar to the finding of Mennan & Işık (2003), and Bükün & Uygur (2003). Parker (1997) reported that *Sorghum halepense and Echinocloa crus-galli* could be or more problems in future after irrigation began. Bükün & Uygur (2003) indicated that weed species such as *Amaranthus albus*, *Cynodon dactylon, Echinocloa colunum*, *Physalis angulata*, *Physalis philadelphica, Portulaca oleracea*, *Setaria verticillata* and *Xanthium strumarium* are well adapted and become more common species in cotton growing areas. Also they recommended that crop rotations are the best precaution against these weeds species. Thus the growing of these species would be limited due to various herbicides use and habitat disturbance.

Another factor which has played an important role on the weed composition is the crop rotation. In the crop rotation system various crop can be grown and different crops are required different agricultural practices such as different herbicide usage so the adaptations of certain species could be prevented. Hochól *et al*., (1999) reported that total surface coverage by weeds was reduced on herbicides treated fallow. However, based on the results, in Harran plain, Şanlıurfa continuously monoculture cotton growing leads the adaptation of certain species and causes increasing of both their frequency and densities. The prevalence of some weed species also might be due to their prolific seed out put which ensure their large seed quantity in the fields. The most persistent and abundant weeds are easily dispersed and persist a long time in the soils as a dormant seeds (Bükün, 2004).

The role of factors which lead weed floral changes could not clearly be distinguished from each other. However this study renders most important results for cotton grower and weed scientist for their future work to focus on agricultural practices related with weed control management. Results also provide useful information about the impact of irrigation and importance of crop rotation to avoid infestation of nuisance weeds in cotton growing areas.

References

Bükün, B. and F.N. Uygur. 1997. The weed species and their distributions in cotton growing areas of Harran plain. *J. Agric. Fac. Harran Univ*. 1: 1-8.

Bükün B., F.N. Uygur, S. Uygur, N. Türkmen and A. Düzenli. 2002. A new record for the flora of Turkey: *Physalis philadelphica* Lam. var. *immaculata* Waterf. (Solanaceae). *Turk. J. Bot.*, 26: 405-407.

Bükün, B. and F.N. Uygur. 2003. The impact of irrigation on weed species composition and density in cotton plantations of Harran Plain (Turkey). Proc. *7th EWRS Mediteranean Symp*. *Adana, Turkey*, 143-144.

Bükün, B. 2004. The weed flora of winter wheat in Şanlıurfa, Turkey. *Pak. J. B. Sci.,* 7(9):1530-1534.

Chancellor, R.J. and R.J. Froud-Williams. 1986. Weed problems of the next decade in Britain. *Crop Protection*, 5(1): 66-72.

Frisbie, R.E., K.M. El-Zik and L.T. Wilson. 1989. *Integrated Pest Management System and Cotton Production*. pp. 359.

Hochól, T.E. Stupnicka-Rodzynkiewicz and T. Labza. 1999. Floral changes one one-year fallows under different treatments. *Proc. 11th EWRS Symp*. *Basel, Switzerland*, 76.

McCully, K.V, M.G. Sampson and A.K. Watson. 1991. Weed survey of Nova Scotia, Lowbush blueberry (*Vaccinium angustifolium*) fields. *Weed Sci*., 39: 180-185.

Mennan, H. and D. Işık. 2003. Invasive weed species in onion production systems during the last 25 years in Amasya, Turkey. *Pak. J. Bot*., 35(2): 155-160.

Odum, E.P. 1971. *Fundamentals of ecology*. W.B. Saunders Company, Philadelphia, p.574.

Parker, C. 1997. Prediction of new weed problems especially in developing world. *Proc. 18thSymp. Br. Ecol. Soc., Blackwell Scientific, Bangor Wales*, 249.

Streibig, J.C. and C. Andreasen. 1993. Crop management affects the community dynamics of weeds. *BCPC, Weeds*, 487-493.

(Received for publication 8 October 2004)