



# Asian Journal of Plant Sciences

ISSN 1682-3974

**science**  
alert

**ANSI***net*  
an open access publisher  
<http://ansinet.com>

## Investigation on Weed Control Methods in Citrus Orchard in Cukurova Region-Turkey

Onur Koloren and F. Nezihi Uygur

Department of Plant Protection, Agricultural Faculty, Cukurova University,  
01330 Adana, Turkey

**Abstract:** The experiment was conducted in citrus growing areas in the Cukurova Region in 2002-2003, efficiencies of cultivator, glyphosate treatment and different cover crops (*Vicia sativa* L. (Common vetch) and *V. villosa* Roth. (Hairy vetch) have been investigated for controlling weeds, which is a considerable problem in citrus orchards. Experimental plots were arranged in a randomized complete block design with four replications and the plots size were from 2 to 40 m in orchard. Results of the studies showed that, the cover crop (*V. sativa*) was the most efficient method providing 2.95% efficacy in orchard (3 years old) than the other control methods. Weed coverage percentage of *V. villosa*, cultivator and glyphosate were determined 4.08, 18.40 and 18.85%, respectively. In the case of general weed cover, no significant differences were observed between the weed control efficiencies of cultivator and glyphosate, cover crop treatments with *V. sativa* L. and *V. villosa* Roth. in the citrus orchard. General weed coverage was negatively correlated with the coverage of cover crops. During the observations, 63 weed species have been found in the citrus orchard. *Fumaria officinalis* L. was dominant species in this orchard.

**Key words:** Cover crops, citrus, weed control methods, cultivator, weed

### INTRODUCTION

Cukurova is the biggest delta in Turkey, which is the second biggest delta after Nile in Mediterranean (Dinc *et al.*, 1990). Turkey is one of the important citrus producer in the world. Turkey's fruit production is 14070450 tons and citrus takes the fifth place with 2707500 tons among the others fruits. It has being grown Ege and Cukurova Region of Turkey. The region produces 5.04% of the Turkey's total agricultural products (Anonymous, 2005). Weeds are serious problems as a result of intensive production in Cukurova Region of Turkey. The cover of weeds can be reached up to 49% because of irrigation, mild climate and rainy weather in spite of weed control (Uygur, 1985). Weed management is as necessary in citrus orchards as in other crops. Chemical methods are used routinely to control weeds in the world (Giudice, 1981). Using herbicides are often applied more than necessary, cause environmental problems and increase the costs of production. Therefore some researches have been conducted to investigate the alternative methods to chemical control recently. Cover crop treatments for weed control are considered as an alternative method to herbicide applications investigated intensively. Besides of this, cover crops have many other advantages in

ornamental crops. A cover crop grown between the rows of horticultural or field crops increases soil organic matter, can fix nitrogen, improves soil physical properties, prevents soil erosion and can provide an integrated control method for problematic weeds without disturbing the balance of the ecosystem (Ito and Ueki, 1981; Smith *et al.*, 1987; Teasdale, 1996; Sainju and Singh, 1997).

The aim of this study was to evaluate the weed control efficacies of different weed control methods in citrus orchards in the Cukurova region of Turkey.

### MATERIALS AND METHODS

Experiment was conducted in 2002-2003 growing season in citrus orchard (3 years-old) at the experimental station of Cukurova University, Faculty of Agriculture in Cukurova Region. Some characteristics of orchard is given in Table 1.

Experimental plots were arranged in a randomized complete block design with four replications. The plots size were from 2 to 40 m in orchard. All cover crop species were hand-seeded as 10 lines onto plots with 20 cm row spacing in November 22, 2002. The sowing rates of cover crops *Vicia sativa* L. and *Vicia villosa* Roth are 100 and 80 kg ha<sup>-1</sup>, respectively according to Gulcan and Anlarsal

Table 1: The some features of citrus orchard (3 years-old) in 2002-2003

Features	Orchard
Varieties	Mixed citrus
Age of trees	3 years-old
Tree density	470 tree ha <sup>-1</sup>
Soil texture	Clay
Soil pH	7.38
Salinity	No

Table 2: The weeds and cover crop coverage (%) of the orchard (3 years old)

Cover crops	Weed coverage (%)	Cover crop coverage (%)
<i>Vicia sativa</i> L.	2.95c	78.13a
<i>Vicia villosa</i> Roth.	4.08c	75.58a
Glyphosate	18.85b	-
Cultivator	18.40b	-
Control	39.80a	-

Different letters show significant differences at 0.05 significance level according to Duncan's multiple range test)

(2001) are given in Table 2. Plots were fertilized with 15 kg da<sup>-1</sup> of nitrogen (18%) and phosphorus (46%) prior to cover crop seeding. Used cultivator plot, glyphosate treated and weedy control plots were included in each block for the efficacy comparison. When weed coverage was reached up to 10% on the cultivated and glyphosate treated plots, the treatments were repeated. The herbicide (Glyphosate) was applied to orchard at 3000 mL ha<sup>-1</sup> rate in March 21, 2003. Cultivator was carried out to orchard in April 2 and May 14, 2003. Two permanent area were selected in order to determine the number of cover crop plants and weeds in the plots of orchard (each in 1×1 m) and general weed coverage determined by Odum (1971). After the emergence of cover crops and weeds all plots were counted with 15 day intervals. In addition to general coverage and density of each weed species were calculated according to Odum (1971).

In this experiment, *Vicia sativa* L. (Common vetch) and *V. villosa* Roth. (Hairy vetch) were used as cover crops. The reason of selecting these were their nitrogen fixing capability into the soil and their widely usage as cover crop for weed control (Hoyt and Hargrove, 1986; Stivers and Shennan, 1989). On May 18, 2003, all cover crops and weeds within fixed 1 m<sup>-2</sup> areas were harvested by hand on each plot to determine cover crop biomasses. Data were subjected to ANOVA and means were separated using Duncan's Multiple Comparison test (p = 0.05).

## RESULTS AND DISCUSSION

The first counting was performed on December 25, 2002. After the emergence of cover crops and weeds all plots were counted at 15 day intervals. As a result, lowest weed coverage percentage (2.95%) was found in the *V. sativa* treatment when the average means took into

consideration. Weed coverage percentage of *V. villosa*, cultivator and glyphosate were determined 4.08, 18.40 and 18.85%, respectively (Table 3). The treatment of *V. sativa*, *V. villosa* and Cultivator-Glyphosate were not significant (p = 0.05) for weed coverage (Table 2). Koloren and Uygur (2003) reported that total weed cover was 9.8% in *Vicia sativa* L., 14.5% in *Poterium sanguisorba* L., 21.6% in *Trifolium alexandrinum* carmen L., 35.4% in *Medicago sativa* in 25 years-old citrus orchard. Teasdale (1996) found that winter cover crops could be used to suppress winter germinating annual weed species. Uygur *et al.* (1997) reported that although the cultivator and disc-harrow damaged the root system of trees they were the most economical effective treatments. As shown in Table 2, there was a negative correlation between percent weed cover and cover crop coverage of the all treated plots. Also, similar relationship between weed and cover crop cover was indicated by Barberi (1997), Koloren and Uygur (2003). Akman (1993) reported that legume species have the ability to suppress weed populations by natural mulching. In company sowing systems, providing natural mulching results in reduction of soil processing, besides this grows faster at early period according to nature dislike emptiness rule and suppress weeds and cover crops population is increased (Akman and Kara, 2001).

Sixty three species of the all weed species were recorded in the orchard. While the minimum number of weed species (17) was identified in *V. sativa*, maximum weed species (51) were found in the cultivator treatment. The numbers of weed species in the other treatment are as follows; *V. villosa* (28), Glyphosate (42) and Control (49). *Ammi visnaga* (L.) Lam., *Avena sterilis* L., *Capsella bursa-pastoris* (L.) Medik., *Convolvulus arvensis* L., *Fumaria officinalis* L., *Lamium amplexicaule* L., *Medicago polymorpha* L., *Mercurialis annua* L., *Ochtodium aegyptiacum* (L.) DC., *Oxalis corniculata* L., *O. per-caprae* L., *Senecio vernalis* Waldst and Kit., *Sinapis arvensis* L., *Sonchus oleraceus* L., *Stellaria media* (L.) Vill., *Veronica hederifolia* L. and *Vicia narbonensis* L. were found common species in all treatment. Moreover, *F. officinalis* was found dominant weed species in all treatments plot. Uygur *et al.* (1984) concluded that, the density and number of annual weed species may increase after intensive mechanical weed control, as in the case of present studies. According to Koloren *et al.* (1997), *Avena sterilis* L., *Convolvulus arvensis* L., *Cynodon dactylon* (L.) Pers., *Sinapis arvensis* L. and *Sorghum halepense* (L.) Pers. were the most important weed species in 2 years-old citrus orchard. *Convolus arvensis* L., *Stellaria media* (L.) Medik. and *Setaria glauca* (L.) P.B were the most abundant species

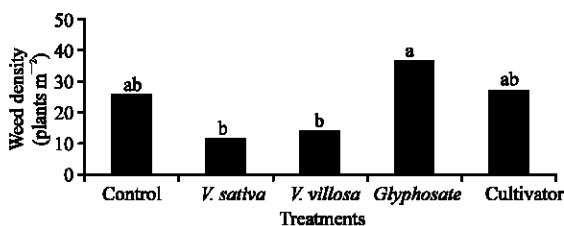


Fig. 1: Weed density on the different treatment of 3 years-old orchard. (Different letters show significant differences at 0.05 significance level according to Duncan's multiple range test)

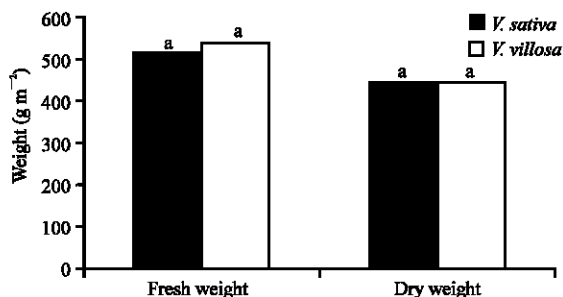


Fig. 2: Fresh and dry weight of cover crops of 3 years-old orchard at the harvest (Different letters show significant differences at 0.05 significance level according to Duncan's multiple range test)

in 25 years-old citrus orchard (Koloren and Uygur, 2003). Average weed density was 25.43, 11.85, 13.70, 36.37 and 26.77 plants m<sup>-2</sup> in the Control, *V. sativa*, *V. villosa*, Glyphosate and Cultivator, respectively (Fig. 1). As seen Fig. 1, glyphosate had maximum weed density among other treatments. The studies done by Altieri *et al.* (1989) showed that using *T. incarnatum*, *T. repens* and *V. villosa* as a cover crop weed density decreased. At the same time they found that *V. villosa* was used for weed control in vegetables as a cover crop.

When the fresh weight of cover crop species were taken into consideration *V. villosa* was the greatest value. No significant differences were found among *V. sativa*-*V. villosa* cover crops. Also the same results were obtained in dry weight of treatment as fresh weight (Fig. 2).

Consequently, this study indicates that cover crops vary in their ability to compete with weed species. This finding is important from several perspectives. *V. sativa* and *V. villosa* can be considered as an alternative weed control method instead of chemical method in many farming systems. Current studies using cover crops will be useful for sustainability in our and all over world by protecting ecosystem and improving the economy in the long term.

## ACKNOWLEDGMENTS

We would like to thank to Academic Research Projects Unit of Cukurova University/Adana/TURKEY for funding of this research.

## REFERENCES

- Akman, Z., 1993. Role of intercropping systems in conventional farming. *J. Hasat*, 101: 39-43 (In Turkish).
- Akman, Z. and B. Kara, 2001. Role of intercropping systems in ecological farming. 2nd ecological farming symposium of Turkey, November 14-16, 2001, Antalya, pp: 375-383. (In Turkish).
- Altieri, M.A., J.G. Farrell, S.B. Hecht, M. Liebman, F. Magdoff, B. Murphy, B. Norgaard and T.O. Sikor, 1989. Cover cropping and mulching. The science of sustainable agriculture. Westview Press, pp: 433.
- Anonymous, 2005. Republic of Turkey, prime ministry state institute of statistics, agricultural building and produce (In Turkish).
- Barberi, P., 1997. Weed suppression by cover crops in a continuous maize cropping system. Proceedings 10th EWRS (European Weed Research Society) Symposium, Poznan, pp: 98.
- Dinc, U., M. Sari, S. Senol, S. Kapur, M. Sayin, R. Derici, V. Cavusgil, M. Gök, M. Aydın, H. Ekinçi, N. Agca and E. Schlichting, 1990. Soil of cukurova region. C.U. Agricultural Faculty, Publication of Faculty, No. 26, pp: 172 (In Turkish).
- Giudice, V.L., 1981. Present status of citrus weed control in Italy. Proceeding of International Society of Citrus, 2: 485-487.
- Gulcan, H. and A.E. Anlarsal, 2001. Fodder crops II. C.U. Agricultural Faculty, Publication of Faculty, No. 5, pp: 95 (In Turkish).
- Hoyt, G.D. and W.L. Hargrove, 1986. Legume cover crops for improving crop and soil management in the southern united states. *HortScience*, 21: 397-402.
- Ito, M. and K.K. Ueki, 1981. Approaches to weed management of citrus from the aspect of weed science. Proceeding of IV Congress International Society of Citriculture, pp: 483-485.
- Koloren, O., F.N. Uygur and A. Cinar, 1997. Determining of effective weed control methods in citrus orchards under the cukurova region. 2nd Turkey citrus congress, September, 17-19, 1997, adana, cukurova university, subtropical fruits research and application center. *Citrus Bulletin*, Year: 7 September 1997, pp: 22-74.

- Koloren, O. and F.N. Uygur, 2003. Research on weed control using some cover crops. 7th EWRS (European Weed Research Society) Symposium, 6-9 May 2003, Adana, pp: 35.
- Odum, E.P., 1971. Fundamentals of Ecology. W.B. Saunders Company, Philadelphia, London, Toronto, pp: 574.
- Sainju, U.M. and B.P. Singh, 1997. Winter cover crops for sustainable agricultural systems: Influence on soil properties, Water quality and crop yields. HortScience, 32: 21-28.
- Smith, M.S., W.W. Frye and J.J. Varco, 1987. Legume winter cover crops. Adv. Soil Sci., 7: 95-139.
- Stivers, L.J. and C. Shennan, 1989. Winter cover cropping in processing tomato production. Am. Soc. Agron. Crop Sci. Soc. Madison, Wis., pp: 254.
- Teasdale, J.R., 1996. Contribution of cover crops to management in sustainable agricultural systems. J. Prod. Agric., 9: 475-479.
- Uygur, F.N., W. Koch and H. Walter, 1984. Introduction of weed science. PLITS, 1984/2 (1), verlag. J. Margraf, Stuttgart, Almanyay, pp: 114 (In Turkish).
- Uygur, F.N., 1985. Investigation on importance of weed problem considering weed species especially *Cynodon dactylon* (L.) Pers. and *Sorghum halepense* (L.) Pers. in Çukurova Region. PLITS, 1985/3 (5), Stuttgart, pp: 169 s.
- Uygur, F.N., O. Koloren, S. Uygur and I. Uremis, 1997. The effects of different weed control methods in citrus orchards of Turkey. 10th EWRS (European Weed Research Society) Symposium 1997, Poznan-Poland, 22-26 June 1997, pp: 126.