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An Evaluation of the Effectiveness of Different Methods for Weeds in Fig Nurseries

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Abstract The experiments were carried out at the Research and Application Farm in the Agricultural Faculty of Adnan Menderes University and was performed three times, in two locations in 2005 and once in 2006. Conducted according to a randomised complete block design and the plots were situated in an area of 9 m^{-2} (3 m x 3 m). Evaluation of pre-planting applications applied to the soil were: olive processing waste (OPW) (20 tons $hectare^{-1}$), metham sodium 500 kg a.i. $hectare^{-1}$, dazomet (485 kg a.i $hectare^{-1}$), *Vicia pannonica* (Hungarian vetch) (120 kg $hectare^{-1}$) as a cover crop. Post-planting applications applied after the fig nurseries had been planted were: glyphosate (2880 g a.i $hectare^{-1}$), sawdust (thickness of 8-10 cm), black polyethylene mulch, fluazifop-p-butyl (150 g a.i $hectare^{-1}$) after trifluralin (960 g a.i $hectare^{-1}$) and hand-hoed plots served as control plots. As a results, sawdust was reduced the density of annual weeds, especially common purslane. The application of OPW was been usable only annual weeds, especially common purslane; it was found that its effectiveness lasts for three months after it has been incorporated into the soil. Metham sodium and dazomet were also found to be effective on annual weeds. In all the experiments, there was neither a harmful nor a beneficial effect of applications on the fig nursery plants themselves.

Keywords Weed control, Fig nursery, Fumigant

1. Introduction

The fig (*Ficus carica* L.) is a Ficus species from the *Moracae* family of the *Urticales* class. In nursery gardens, weed management is carried out by applying methyl bromide to the soil before the figs are planted, applying herbicide, and hoe-cropping 3-10 times, until the figs are ready to be harvest. However, some of these methods are expensive and harmful to roots of the trees and restrict growth. In view of the fact that methyl bromide banned in Turkey by the end of 2008, the necessity of using different methods is an urgent requirement. One alternative method is mulching, which involves covering the soil surface with organic and inorganic materials, which both prevents loss of moisture and stops the penetration of light, thus inhibiting the emergence of many weeds. To this end, successful weed management could be effected using various organic and inorganic mulches such as black polyethylene, straw, sawdust, nutshell, perlite, oyster shell, and pumice and crumb rubber. [32]. Whatever material is used, it must be thick enough to prevent light from penetrating, and it must also protect the structure of the soil [32], [12], [39]. Many researchers have stated that mulch applications lead to yield increases in both annual and perennial crops, and these yield increases are achieved through the reduction of weed competition with the roots, the increase in nutrition uptake, and the amount of water available in the soil [36], [25], [2], [34]. The dried form of Olive Processing waste (OPW) will be referred to as 'solid OPW' in this paper. As OPW is rich in organic substances and nutrients such as phosphorus, potassium and magnesium, its usefulness in agriculture as a fertilizer has been investigated in some studies [19], [31]. There are two ways of using a cover crop: one is its incorporation into the soil; the other is growing the cover crop alongside the cultivated plant [35]. Metham sodium is a potential alternative to methyl bromide fumigation. Its strength makes it a strong candidate as a fumigant for many crops [10]. It has been registered for use in the control of a wide array of soil-borne pests. It can be used to control weeds, nematodes, and soil diseases. The other fumigant Dazomet, which can be applied to soil before planting, is effective on some emergent weeds, nematodes, soil borne fungi and insects [10]. A comprehensive study on weed management in nursery gardens has not yet been conducted in Turkey. Therefore this study represents a comprehensive investigation into these methods- hoeing, olive processing waste, sawdust, one of the cover crops (*Vicia pannonica*), the soil fumigants such as metham sodium and dazomet, and the herbicides trifluralin in conjunction with fluazifop-p-butyl, and glyphosate for

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control against these weeds.

2. Materials and Methods

The experiments were carried out at the Research and Application Farm of the Agricultural Facility at Adnan Menderes University in Aydın Provinces of Western Turkey in 2005-2006. The experiments were designed according to randomized complete block design (Table 1). Before the experiment, the field was irrigated and, when the humidity level was suitable, the soil was tilled and the surface was levelled using a disk harrow; then the plots for the experiment were placed in a block 3m x 3m wide, providing a total of 9 m^{-2}.

Hand-hoeing: Hand-hoe plots served as controls and the experimental plots were compared to them in terms of weed density. When the weed density reached 20% in the hand-hoe plots, the weed density in all the experimental plots was measured against them.

Sawdust: A thin application of sawdust was used (8-10 cm thick) but this prevented enough sunlight from reaching the soil to inhibit the emergence of some weeds [32], [12].

Solid OPW: Solid OPW (20 tons $hectare^{-1}$) was added to the soil before planting the fig cuttings [8] and incorporated to a depth of 0-20 cm.

Cover crop (*Vicia pannonica*): Before planting the fig cuttings, vetch seed (120 kg/hectare) was sown by scattering, and then it was incorporated into the soil and left to grow. After the fig cuttings had been planted, the vetches around the cuttings were pulled out by hand (because they are 20-25 cm wide) to permit better growing conditions for the cuttings. When the vetch came to flower it was then incorporated into the soil. So, in this experiment, the effects of vetch on fig cuttings both before flowering and after it had been incorporated into the soil were observed, allowing analysis of whether it had an allelopathic effect on the fig cuttings at either stage.

Dazomet: When the soil humidity was suitable, the soil surface was levelled smooth and the fumigant was evenly applied in a specified dose of 485 kg a.i./hectare. Immediately after application, the fumigant was incorporated into the soil with a harrow, and water (5 litres m^{-2}) was added. Then the soil surface was covered with polyethylene sheets so that any loss of gas emission could be prevented. After a week the polyethylene sheets were removed to allow ventilation of the soil.

Metham sodium: Metham sodium was incorporated to the soil in a dose of 500 kg a.i./hectare. The quantity of water used was 1.5 litres m^{-2}. Afterwards the soil surface was covered with polyethylene. A week later the polyethylene was uncovered so that the soil could be ventilated.

Fluazifop-p-butyl after Trifluralin: Before planting the fig cuttings, a 980 g a.i. ha^{-1} dose of trifluralin was used and incorporated into the soil. When the weed density reached 20%, fluazifop-p-butyl (normally used against grasses) was applied in a dose of 150 g a.i. ha^{-1}.

Glyphosate: After the fig cuttings had been planted and when the weed density reached a level of 20% level in the control plots - where hand-hoeing was used – 2880 g a.i. ha^{-1} of glyphosate was applied after the weeds had been counted. Contact between the herbicide and the cuttings was avoided by covering and protecting the cuttings in their early growth period [7]. Both applications of herbicide were made with a knap suck sprayer at 3 atm pressure with a 250 litres ha^{-1} water.

Black polyethylene mulch: Black polyethylene mulch was used only in the third experiment carried out in 2006. After planting, the fig cutting black polyethylene mulch was laid out so as to cover the whole plot area with the sides bound by soil.

Twelve Black Bursa and 12 Sarılop fig cuttings were planted in each plot after they had been treated with 250 kg ha^{-1} of 15-15-15 compound fertilizer, used as the underlying fertilizer, with a dose of 200 kg ha^{-1} ammonium nitrate fertilizer on top.

Weed counting and assessment: When the weed density in the control plots reached 20%, the weeds in the experimental plots were counted. This was done by randomly choosing four 50 cm x 50 cm (0.25 sq. meter) sections in each plot and calculating the percentage of weed infestation. The effect of the experiments on both annual and perennial weeds was calculated and the results can be seen in Tables 2, 3 and 4. Of the annual weeds, common purslane (*Portulaca oleracea* L.) was found predominant. Of the perennial weeds in the plots, purple nutsedge (*Cyperus rotundus*) is the most prevalent, invasive and troublesome.

These weeds were hoed with hand hoe and removed from the plots and then the experimental applications were made as detailed above. In plots, herbicides used, they were reapplied at the doses stated above, after each counting was made, except that the trifluralin was only applied before planting, so the effect of herbicides used in two different ways was demonstrated. Measurements were carried out continuously from the nursery stage to the time when the cuttings were replanted in the garden (between May and December, a period of nearly 7 months. All the nursery plants used in the experiment were measured according to the following criteria [38]. The height of the plants was measured with a tape measure to the point where the cuttings began to sprout their shoot tips. Their diameters were measured at the same place in the plant to within 1%, using electronic calipers. The nodes on the cuttings were counted and recorded and the average length of the internodes was calculated by dividing the height of the plant by the number of nodes are given in Table 5 [22].

Statistical Analyses: The variance analysis of the data obtained from the experiments was processed using an SPSS 14 statistical program and the figures relating to averages were subject to a Duncan multiple ranges test ($P < 0.05$).

Table 1. Features of the experiment

Treatments	I. Experiment	II. Experiment	III. Experiment
Occuring the parsel	10 Feb 2005		20 Feb 2006
Size of plots	3m*3m=9m^2		
Replications	4	3	4
Treatments and doses	1-Hand hoeing 2-Sawdust: (8-10 cm thickeness) 3-Olive Processing Waste (OPW): (20 tonnes/ha) 4-Cover Crop: *Vicia pannonica*-(120 kg/ha) 5-Metam sodium : (1000 l/ha) 6-Dazomet : (500 kg/ha) 7-Trifluralin+Fluazifop-p-butyl: (2000 cc/ha+1000 cc/ha) 8-Glyphosate : (6000 cc/ha)		In addition applications of I. and II. experiments, black polyethylene mulch was used
Sowing time of cover crop	10 Feb 2005		23 Feb 2006
Fumigations (Dazomet and Metam Sodium) Application Time and Duration	Starting: 4 Mar 2005-14 Mar 2005 Duration: 19 days		22 Feb 2006 2 Mar 2006 13 days
Application time of OPW	30 Mar 2005		12 Mar 2006
Applicaiton time of Trifluralin	30 Mar 2005		12 Mar 2006
Application time of Sawdust	3 Apr 2005		16 Mar 2006
Planting date of Cutting	2 Apr 2005		15 Mar 2006
Weeds counting time	16 May 2005 11 Jun 2005 12 Aug 2005 2 Aug 2005 28 Sep 2005	2 May 2005 30 May 2005 27 Jun 2005 19 Aug 2005	25 Apr 2006 26 May 2006 29 Jun 2006 25 Jul 2006 24 Aug 2006 4 Oct 2006
Date of removed the nursery	5 Dec 2005		2 Dec 2006

3. Results

The result of this study is shown in Tables 2-4 and 6: **Black polyethylene mulch** had a significant effect in supressing both annual and perennial weeds over a lengthy period. Common purslane in particular was suppressed in the experiments using black polyethylene mulch. The population of perennial weeds, including purple nutsedge, was also significantly reduced when compared to other weed management methods.

OPW was only effective on annual weeds, particularly common purslane, and it maintained its effectiveness for 3 months after being incorporated into the soil. It was ineffective against perennial weeds such as purple nutsedge, bermudagrass and johnsongrass**.**

***Vicia pannonica*,** used as a cover crop in weed management, significantly reduced the population of perennial weeds, especially purple nutsedge, before it was incorporated to the soil.

Sawdust, used as a mulch, significantly reduced annual weeds, especially common purslane.

Metham sodium, decreased the density of annual weeds, particularly common purslane, which is the predominant annual weed. However, it is less effective on perennial weeds.

A thorough dose of **dazomet,** gave effective results against annual weeds for the first three months of use, but its effectiveness against perennial weeds only lasted for a month.

Glyphosate, had a promising effect on perennial weeds, especially purple nutsedge. An application of the herbicide at an earlier time would certainly have given more effective results.

A through dose of **trifluralin,** followed by **fluazifop-p-butyl** did not reduce weed density appreciably. Fluazifop-p-butyl has no effect on purple nutsedge, so it was able to grow thickly in the experimental plots. It was also clear that fluazifop-p-butyl also has no effect on broad leaf weeds such as amaranth species, common lambsquarters, puncturevine and black nightshade. There was no harmful or beneficial effect of the applications on fig nursery plants (Table 5). Black polyethylene mulch can provide long-term weed management; it is both practical and economical, and it is a suitable method for use in nurseries where cuttings are grown (Table 6).

Table 2. Effect of treatments on weed density in fig nursery growing areas (I. Experiment)

1st Counting (16 May 2005)	Density (Number/0.25m^2) and % Efficacy							
	H. H[a]	OPW[b]	CC[c]	S[d]	M.S[e]	T+F[f]	G[g]	D[h]
Annual weeds	14.4a[i]	0.9c	8.9ab	1.9bc	1.6bc	5.4bc		0.1c
		(93.7)[j]	(38.2)	(86.8)	(88.9)	(62.5)	-	(99.3)
Common purslane	8.6a	0.0b	0.0b	1.2b	0.3b	3.7ab		0.0b
		(100)	(100)	(86.1)	(96.5)	(57.0)	-	(100)
Perennial weeds	12.7a	9.5a	0.5b	7.3ab	0.9b	9.4a		5.5ab
		(25.2)	(96.1)	(42.5)	(92.9)	(26.0)	-	(56.7)
Purple nutsedge	6.3ab	7.6a	0.5b	5.5ab	0.9b	7.6a		4.6ab
		(0.0)	(92.1)	(12.7)	(85.7)	(0.0)	-	(0.0)
2nd Counting (11 Jun 2005)								
Annual weeds	29.6a	2.3b	4.4b	5.3b	1.3b	4.7b	3.3b	2.5b
		(92.2)	(85.1)	(82.1)	(95.6)	(84.1)	(88.9)	(91.2)
Common purslane	20.1a	0.3b	0.0b	3.4b	0.6b	4.1b	2.7b	2.2b
		(98.5)	(100)	(83.1)	(97.0)	(79.6)	(86.6)	(89.1)
Perennial weeds	10.9a	13.1a	0.0b	14.5a	5.2ab	13.2a	6.8ab	10.5a
		(0.0)	(100)	(0.0)	(52.3)	(0.0)	(37.6)	(3.7)
Purple nutsedge	6.4ab	9.5a	0.0b	9.1a	4.4ab	13.2a	6.5ab	9.7a
		(0.0)	(100)	(0.0)	(31.3)	(0.0)	(0.0)	(0.0)
3rd Counting (12 Jul 2005)								
Annual weeds	14.8a	17.3a	15.2a	3.1b	1.1b	7.3ab	10.2ab	4.3b
		(0.0)	(0.0)	(79.1)	(92.6)	(50.7)	(31.1)	(70.9)
Common purslane	14.2a	14.5a	11.9ab	2.2bc	1.1c	6.0abc	6.1abc	4.3bc
		(0.0)	(16.2)	(84.5)	(92.3)	(57.7)	(57.0)	(69.7)
Perennial weeds	20.4a	18.5a	7.9a	17.1a	7.6a	17.4a	10.3a	17.0a
		(9.3)	(61.3)	(16.2)	(62.7)	(14.7)	(49.5)	(16.7)
Purple nutsedge	15.9a	17.4a	3.8a	13.9a	6.4a	16.8a	7.9a	15.3a
		(0.0)	(76.1)	(12.6)	(59.7)	(0.0)	(50.3)	(3.8)
4th Counting (2 Aug 2005)								
Annual weeds	22.7a	13.9a	9.4a	0.7a	1.2a	5.9a	19.8a	2.5a
		(38.8)	(58.6)	(96.9)	(94.7)	(74.0)	(12.8)	(89.0)
Common purslane	22.2a	12.0ab	8.8ab	0.4b	0.9ab	4.4ab	19.8ab	2.5ab
		(45.9)	(60.4)	(98.2)	(95.9)	(80.2)	(10.8)	(88.7)
Perennial weeds	17.1ab	23.8a	6.1bc	24.5a	13.8ab	8.2bc	1.6c	16.5ab
		(0.0)	(64.3)	(0.0)	(19.3)	(52.0)	(90.6)	(3.5)
Purple nutsedge	12.2abc	21.5a	4.5cd	19.3a	11.6abcd	7.7bcd	1.6d	15.7ab
		(0.0)	(63.1)	(0.0)	(4.9)	(36.9)	(86.9)	(63.4)
5th Counting (28 Sep 2005)								
Annual weeds	0.4b	5.4a	2.6ab	0.7ab	0.0b	1.2ab	1.2ab	0.6b
		(0.0)	(0.0)	(0.0)	(100)	(0.0)	(0.0)	(0.0)
Common purslane	0.4b	5.4a	2.6ab	0.7ab	0.0b	1.2ab	1.2ab	0.6b
		(0.0)	(0.0)	(0.0)	(100)	(0.0)	(0.0)	(0.0)
Perennial weeds	47.9a	29.1ab	25.0abc	50.2a	32.1ab	20.3 bc	0.9c	45.5ab
		(39.3)	(47.8)	(0.0)	(33.0)	(57.6)	(98.1)	(5.0)
Purple nutsedge	38.7ab	27.5ab	20.0bc	22.1bc	28.9ab	20.3bc	0.9c	45.5a
		(28.9)	(48.3)	(42.9)	(25.3)	(47.6)	(97.7)	(0.0)

[a]Hand hoeing, [b]Olive Processing Waste, [c]Cover crop, [d]Sawdust, [e]Metam sodium, Trifluralin+fluazifop-p-butyl, [g]Glyphosate, [h]Dazomet
[i]Same row with different letters show significant differences at Duncan (P<0,05)
[j]Effect (%) compared with hand hoeing.
Annual weeds were blackgrass (Alopecurus myosuroides Huds.), amaranth species (Amaranthus spp.), scarlet pimpernel (Anagallis arvensis L.), common lambsquarters (Chenopodium album L.), jimsonweed (Datura stramonium L.), junglerice (Echinochloa colona (L.) Link), henbit (Lamium amplexicaule L.), wild chamomile (Matricaria chamomilla L.), prostrate knotweed (Polygonum aviculare L.), annual bluegrass (Poa annua L.), littleseed canarygrass (Phalaris minör L.), wild radish (Raphanus raphanistrum L.), corn buttercup (Ranunculus arvensis L.), bristly foxtail (Setaria verticillata (L.)Beauv.), common chickweed (Stelleria media (L.) Vill.), puncturevine (Tribulus terrestris L.), common cocklebur (Xanthium strumarium L.), speedwell (Veronica hederifolia L.), and black nightshade (Solanum nigrum L.).
Perennial weeds were Bermudagrass (Cynodon dactylon (L.) Pers.) and johnsongrass Sorghum halepense (L.) Pers.) were other perennial weeds recorded.

Table 3. Effect of treatments on weed density in fig nursery growing areas (Experiment 2)

1st Counting (02 May 2005)	Density (Number/0.25m^2) and % Efficacy							
	H. H[a]	OPW[b]	CC[c]	S[d]	M.S[e]	T+F[f]	G[g]	D[h]
Annual weeds	22.6a[i]	3.4b	11.4b	6.1b	2.4b	5.4b		6.1b
		(85.0)[j]	(49.6)	(73.0)	(89.4)	(76.1)	-	(73.0)
Common purslane	8.3a	0.1b	0.0b	0.7b	0.2b	0.1b		0.6b
		(98.8)	(100)	(91.6)	(97.6)	(98.8)	-	(92.8)
Perennial weeds	25.3a	26.3a	2.3b	19.7a	5.9a	22.0a		16.3a
		(0.0)	(90.9)	(22.1)	(76.7)	(13.0)	-	(35.6)
Purple nutsedge	20.9a	23.6a	2.1a	18.8a	4.5a	20.2a		14.0a
		(0.0)	(89.9)	(10.0)	(78.5)	(3.3)	-	(33.0)
2nd Counting (30 May 2005)								
Annual weeds	48.5a	1.0c	4.2c	8.3bc	5.2c	15.7bc	26.9b	9.3bc
		(97.9)	(91.3)	(82.9)	(89.3)	(67.6)	(44.5)	(80.8)
Common purslane	28.2a	0.2c	0.0c	1.0c	2.2c	3.7c	15.6b	2.8c
		(99.3)	(100)	(96.4)	(92.2)	(86.9)	(44.7)	(90.1)
Perennial weeds	48.9ab	50.6a	2.2b	36.3ab	32.7ab	58.7a	16.7ab	51.6a
		(0.0)	(95.5)	(25.8)	(33.1)	(0.0)	(65.8)	(0.0)
Purple nutsedge	46.4ab	47.8ab	1.8b	32.6ab	29.2ab	58.5a	15.5ab	49.3ab
		(0.0)	(96.1)	(29.7)	(37.1)	(0.0)	(66.6)	(0.0)
3rd Counting (27 Jun 2005)								
Annual weeds	11.8b	10.7b	20.2a	5.1b	3.5b	8.3b	8.8b	7.2b
		(9.3)	(0.0)	(56.8)	(70.3)	(29.7)	(25.4)	(39.0)
Common purslane	8.2ab	5.2abc	10.8a	0.1c	2.9bc	3.0bc	6.4ab	3.6bc
		(36.6)	(0.0)	(98.8)	(64.6)	(63.4)	(21.9)	(56.1)
Perennial weeds	58.2a	51.1ab	33.3ab	49.1ab	40.1ab	63.8a	8.1b	54.2a
		(12.2)	(42.8)	(15.6)	(31.1)	(0.0)	(86.1)	(6.9)
Purple nutsedge	55.9a	48.3ab	30.8ab	43.7ab	37.9ab	63.2a	8.0b	51.9ab
		(13.6)	(44.9)	(21.8)	(32.2)	(0.0)	(85.7)	(7.2)
4th Counting (19 Aug 2005)								
Annual weeds	10.1b	8.9b	23.8a	3.7b	1.7b	24.6a	1.4b	5.9b
		(11.9)	(0.0)	(63.4)	(83.2)	(0.0)	(86.1)	(41.6)
Common purslane	8.7b	7.2b	22.7a	0.0b	1.4b	7.5b	1.2b	5.8b
		(17.2)	(0.0)	(100)	(83.9)	(13.8)	(86.1)	(33.3)
Perennial weeds	50.5a	56.5a	40.1a	35.6a	55.7a	39.9a	0.9b	61.4a
		(0.0)	(20.6)	(29.5)	(0.0)	(21.0)	(98.2)	(0.0)
Purple nutsedge	46.2ab	51.3ab	36.2ab	23.2bc	53.1ab	37.1ab	0.8c	59.6a
		(0.0)	(21.6)	(49.8)	(0.0)	(19.7)	(98.3)	(0.0)

[a]Hand hoeing, [b]Olive Processing Waste, [c]Cover crop, [d]Sawdust, [e]Metam sodium, [f]Trifluralin+fluazifop-p-butyl, [g]Glyphosate, [h]Dazomet
[i]Same row with different letters show significant differences at Duncan (P<0,05)
[J]Effect (%) compared with hand hoeing.

Table 4. Effect of treatments on weed density in fig nursery growing areas (Experiment 3)

1st Counting (25 Apr 2006)	Density (Number/0.25m^2) and % Efficacy								
	B.P.M[a]	H. H[b]	OPW[c]	CC[d]	S[e]	M.S[f]	T+F[g]	G[h]	D[i]
Annual weeds	0.0b[j] (100)[k]	34.4ab	0.0b (100)	65.4a (0.0)	1.8b (94.8)	21.1b (38.7)	6.1b (82.3)	-	3.7b (89.2)
Common purslane	0.0a (100)	2.3a	0.0a (100)	0.0a (100)	0.0a (100)	0.0a (100)	0.0a (100)	-	0.0a (100)
Perennial weeds	0.0a (100)	28.4a	26.5a (6.7)	3.7a (87.0)	7.9a (72.1)	3.4a (88.0)	21.2a (25.4)	-	10.5a (63.0)
Purple nutsedge	0.1a (99.6)	26.4a	23.6a (10.6)	1.7a (93.6)	6.5a (75.4)	3.4a (87.1)	20.2a (23.5)	-	10.4a (60.6)
2nd Counting (26 May 2006)									
Annual weeds	0.0c (100)	10.7a	0.0c (100)	12.7a (0.0)	0.0c (100)	0.7c (93.5)	6.9ab (35.5)	4.4bc (58.9)	0.2c (98.1)
Common purslane	0.0b (100)	7.1a	0.0b (100)	0.0b (100)	0.0b (100)	0.5b (93.0)	1.9b (73.2)	3.6ab (49.3)	0.1b (98.6)
Perennial weeds	0.5b (98.3)	30.3a	14.9ab (50.8)	0.8b (97.4)	9.4b (68.9)	9.3b (69.0)	11.5ab (62.0)	17.5ab (42.2)	30.6a (0.0)
Purple nutsedge	0.5c (97.8)	22.9ab	7.9 bc (65.6)	0.0c (100)	6.2bc (72.9)	8.5bc (62.9)	11.4bc (50.2)	15.8abc (31.0)	29.4a (0.0)
3rd Counting (29 Jun 2006)									
Annual weeds	0.0c (100)	13.9a	8.8ab (36.7)	1.3c (90.6)	0.0c (100)	0.6c (95.7)	12.6ab (9.4)	8.9ab (36.0)	5.4bc (61.2)
Common purslane	0.0b (100)	10.1a	6.3ab (37.6)	0.6b (94.1)	0.0b (100)	0.6b (94.1)	5.9ab (41.6)	7.2ab (28.7)	5.2ab (48.5)
Perennial weeds	0.3c (99.1)	42.4ab	32.3abc (23.8)	8.2c (80.7)	12.6bc (70.3)	19.7bc (53.5)	13.3bc (68.6)	21.4bc (49.5)	57.5a (0.0)
Purple nutsedge	0.3c (100)	34.3ab	20.5bc (40.2)	6.9bc (79.9)	10.9bc (68.2)	18.5bc (46.1)	10.5bc (69.4)	16.9bc (50.7)	55.7a (0.0)
4th Counting (25 Jul 2006)									
Annual weeds	0.0c[j] (100)[k]	11.5ab	12.8ab (0.0)	13.9ab (0.0)	0.0c (100)	6.6bc (42.6)	17.2a (0.0)	8.5abc (26.1)	8.9ab (22.6)
Common purslane	0.0b (100)	11.1a	11.6a (0.0)	12.4a (0.0)	0.0b (100)	6.6ab (40.5)	7.6ab (31.5)	7.8ab (29.7)	7.8ab (29.7)
Perennial weeds	0.5c (98.4)	30.8a	26.7ab (13.3)	12.9abc (58.1)	6.7bc (78.2)	17.7abc (42.5)	14.9abc (51.6)	18.78abc (39.0)	32.5a (0.0)
Purple nutsedge	0.5c (97.5)	19.9ab	19.9ab (0.0)	8.8bc (55.8)	5.5bc (72.4)	14.9abc (25.1)	14.2abc (28.6)	16.83abc (15.4)	29.8a (0.0)
5th Counting (24 Aug 2006)									
Annual weeds	0.0c (100)	14.4 ab	12.6ab (12.5)	21.5a (0.0)	1.2c (91.7)	6.3bc (56.3)	16.1ab (0.0)	7.3bc (49.3)	8.3bc (42.4)
Common purslane	0.0c 100	12.1ab	11.2abc (7.4)	20.2a (0.0)	0.0c (100)	5.5bc (54.5)	11.2abc (7.4)	7.2bc (40.5)	7.9bc (34.7)
Perennial weeds	0.0b (100)	37.8a	34.6a (8.5)	17.7ab (53.8)	4.9b (87.0)	24.6ab (34.9)	27.0ab (28.6)	40.8a (0.0)	34.2a (9.5)
Purple nutsedge	0.0c (100)	27.5a	23.8ab (13.5)	15.4 abc (44.0)	4.8bc (82.5)	20.3ab (26.2)	21.3ab (22.5)	20.5ab (25.5)	29.9a (0.0)
6th Counting (04 Oct 2006)									
Annual weeds	0.0b (100)	7.8b	8.9b (0.0)	6.6b (15.4)	0.0b (100)	2.9b (62.8)	25.8a (0.0)	2.9b (62.8)	7.4b (5.1)
Common purslane	0.0c (100)	6.9a	6.3ab (8.7)	5.9ab (14.5)	0.0c (100)	2.5bc (63.8)	5.8ab (15.9)	2.7bc (60.9)	6.5ab (5.8)
Perennial weeds	0.6c (97.9)	28.2abc	21.1abc (25.2)	13.9abc (50.7)	7.7bc (72.7)	22.3abc (20.9)	23.8abc (15.6)	40.4a (0.0)	34.4ab (0.0)
Purple nutsedge	0.6c (96.8)	18.8ab	10.4bc (44.7)	11.3 bc (39.9)	5.8bc (69.1)	16.9ab (10.1)	10.0bc (46.8)	7.3bc (61.2)	28.9a (0.0)

[a]Black Polyethylene Mulch, [b]Hand hoeing, [c]Olive Processing Waste, [d]Cover crop, [e]Sawdust, [f]Metam sodium, [g]Trifluralin+fluazifop-p-butyl, [h]Glyphosate, [i]Dazomet

[i]Same row with different letters show significant differences at Duncan (P<0,05)

[J]Effect (%) compared with hand hoeing.

Table 5. The effect of applications on nursery plants

Treatments	Fig Cultivar							
	Bursa siyahı				Sarı lop			
	Height (cm/plant)	Diameter of plant	Number of nod (No/plant)	Between nod (cm/plant)	Height (cm/plant)	Diameter of plant	Number of nod (No/plant)	Between nod (cm/plant)
Hand hoeing	36.24	1.15	13.48	2.56	34.90	1.07	15.96	2.18
OPW	35.26	1.18	14.50	2.46	37.49	1.24	16.58	2.24
Cover crop	29.65	1.00	12.56	2.37	45.83	1.31	19.17	2.37
Sawdust	38.85	1.10	13.76	2.84	56.34	1.50	21.19	2.63
Metam sodium	43.32	1.35	15.31	2.84	38.04	1.20	17.50	2.19
Dazomet	35.05	1.18	14.01	2.55	52.58	1.26	20.33	2.67
Glyphosate	41.82	1.29	15.44	2.78	26.00	1.11	15.02	2.45
Trifluralin+fluazifop-p-butyl	37.45	1.32	14.29	2.41	34.85	1.01	15.00	2.08
Statistical differences	NS	NS	NS	NS	NS	NS	NS	NS

N.S, Non-significant the differences at Duncan (P<0,05)

Table 6. Effect of black polyethylene mulch on fig nursery

Charecteristics	Fig Cultivar	
	Bursa Siyahı	Sarılop
Height (cm/plant)	65.07	34.44
Diameter (cm/plant)	1.68	1.34
Number of nod (number/plant)	17.38	15.09
Length of internod (cm/plant)	3.40	2.14

4. Discussion

Black polyethylene mulch is effective in both annual and perennial weed management. In the plots where it was used common purslane was suppressed for the whole season. The population of purple nutsedge, which is the most problematic and difficult to manage, also decreased significantly with this method compared to other methods. [7], [20], [15]. have corroborated our results, stating that the emergence of many annual weeds can be prevented and the density of the perennial purple nutsedge can be reduced by this method. OPW proved to be effective only against annual weeds, especially common purslane, when used in nurseries. However it was ineffective against perennial weeds and its allelopathic effect on all weeds decreased after 3 months. By 5 or 6 months, its effectiveness even against annual weeds, had disappeared. Elsewhere [9] evaluated the effectiveness of both solid and liquid forms of OPW on management of weeds in sunflower and maize and found it to be 99% effective against common purslane. [8] found that OPW decreased the density of littleseed canarygrass and wild radish, which are very troublesome weeds in the Aydin area, by 70% and 90%, respectively. [3] demonstrated that different doses of OPW are effective against a variety of weeds and will invariably lead to an increase in crop yield. [13] confirmed the advantage of OPW as a cheap organic substance, effective in the management of broomrape. Incorporating a cover crop as a weed management method decreased the occurrence of perennial weeds, especially purple nutsedge. The cover crop grows before the weeds grow and covers the plots, suppressing weeds which can be troublesome in summer. Even if weeds do emerge, thay are inhibited due to lack of sunlight and do not reach a troublesome density. However, if the cover crop reaches its flowering period, its effectiveness is negated and the plant actually leads to an increase in weed density. [23] showed that using cover crops reduces the density and biomass of some weeds in orchards. [18] also showed that the density of some monocotyledon and dicotyledon weeds decreased using this method. Using sawdust inhibited the density of annual weeds remarkably, particularly common purslane. A variety of materials for mulching have been studied by others with positive results and yield increases in some crop plants [7], [29], [16], [20], [1], [37], [27], [32], [4], [33]. Sawdust was not as successful against perennial weeds as against annual weeds. It is thought that, because moisture is retained in soil which is under sawdust, it allows the growth of weeds in the form of bulbs and rhizomes. Since purple nutsedge bulbs do not need sunlight at a depth of 20-25 cm [24], sawdust has no effect against the plant. Metham sodium was effective against annual weeds and common purslane in particular, which was the most pernicious annual weed quantified during the experiments. It was less effective against perennial weeds. Many researchers, including [17], [14], [11], [30], [5], [6] had similar results result to ours and confirmed that this fumigant was highly effective in weed management. Dazomet was seen to have an effective period of 3 months against annual weeds. Glyphosate had a promising effect on perennial weeds, especially the troublesome purple nutsedge. [7], [37], [26], [28], [21] also decided that this herbicide was a significant weed management agent. Our study was not so conclusive, most probably because we applied it too late in the growing season.

In order to determine the appropriate weed management method and the appropriate time of application, it is necessary to identify the main problem weeds and determine their usual density in the area where the crop is grown, before planting nursery gardens. The most suitable weed

management program can then be chosen accordingly. In order to achieve good results with cover crops, the correct crop must be chosen and grown at the appropriate time. Cover crop plants must be sown so as to cover row-spacing, but must be sown far enough away from the nursery plant roots so as not to compete with them. Metham sodium and dazomet applications are expensive, so their use should be limited. However, metham sodium is an indispensable weed control method for annual weed management over a lengthy period. Previous studies have shown that it has successfully controlled soil-born diseases, nematod and pests. In areas where perennial weeds are prevalent, effective weed management can be achieved by using glyphosate. For best results, it needs to be applied early on in the growth period of the weeds. Furthermore, the nursery plant vegetation must not come into direct contact with this herbicide when it is applied. Where trifluralin is used in combination with fluazifop-p-butyl, trifluralin is effective on annual weeds to begin with. However, a good result will not be obtained in plots where purple nutsedge is dense because fluazifop-p-butyl is ineffective against it.

In conclusion, the study of the management of perennial weeds in nursery gardens, especially troublesome purple nutsedge, is a matter of significant importance in the quest to improve agricultural systems in Turkey, and further studies need to be undertaken as a matter of urgency.

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