J.Pest Control & Environ.Sci. Vol:4 No:1 pp 51 - 70 (1992).

USING OF SOIL SOLARIZATION TO CONTROL SOIL BORNE PATHOGENS AND ITS RELATIONS TO TOMATO GROWTH AND PRODUCTIVITY

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Recived 15/1/1992 Accepted 7/4/1992.

ABSTRACT

The response of tomato plants to the solarization of soil was studied during the two seasons of 1990 and 1991.
Results can be summarized as follows:
1. Total and early yield/fed and yield/plant significantly increased by covering the rows with polyethyene sheets , specially with the treatment of transparent polyethylene followed by black covers. Also , total and early yields/fed significantly increased by increasing the covering period.
2. Plant height , number of side shoots , number of leaves,dry weight of shoots and the leaves area/plant,significantly increased by each of covering methods and periods.
3. Fresh weight of weeds/m^2 , significantly decreased by covering soil,the black covers gave the best results.
4. Solarized the soil significantly decreased the population density of plant parasitic nematodes infecting tomato plants.Transparent polyethylene was the best in reducing nematodes.
5. Solarized the soil showed the lowest numbers of fungi and total microbial count. Also, the numbers of fungi and microbial counts were decreased by increasing the covering period.

INTRODUCTION

Soil solarization is the method of using polyethylene as a row covers during the periods of high temperatures to control the weeds and other soil pests. Hartz *et al*. (1985) indicated that solarization increased yield of autumn-grown capsicums by 20% compared with conventional non-solarized culture. Reported beneficial responses of tomatoes to soil solarization by polyethylene including ; earlier production (Bhella, 1988;West and Pierce, 1988 and Decoteau *et al*., 1989), better fruit quality and greater total yield (Jones *et al*.,1977;Overman,1985;Wien and Minotti,1987 and Overman and Jones,1987).

Concerning the role of soil solarization in the control of soil borne plant pests (pathogens ,nematodes and weeds), previous studies were carried out in this respect. Hassan *et al*.(1987) reported that the severity of tomato foliage and root-rot disease and weed density were significantly decreased after soil solarization. Another study by Hassan and Younis (1984) indicated that the severity of foliage disease,root-knot nematode *Meloidogyne* spp. and weeds density were significantly reduced after soil solarization with plastic sheets.

The objectives of the present work are to:

1. Investigate the effect of soil solarization by using polyethylene row covers on growth and yield of tomato plants.
2. Study the role of this method in the eradication of soil borne pests before sowing and planting.
3. Use of the soil solarization as a biological control method for the control of many pests.

MATERIALS AND METHODS

Two field experiments were carried out at the experimental farm of the Faculty of Agriculture, Menoufia University, Shebin El-Kom, Egypt, during 1990 and 1991 seasons. Tomato seeds of Peto-86 Cv., were planted in seedbed on March 30th, April 10th, 20th and 30th in 1990 and 1991.

The field was prepared and given heavy irrigation before the begining of the experiment. Before the complete drying of the soil, the solarization process was carried out by covering the wet rows with black and transparent (clear) polyethylene sheets at different periods, i.e. 25, 35, 45 and 55 days. The non-covered soil (bare soil) is considered as a control.

Experimental design:

The treatments were arranged in split plot design with four replicates, where polyethylene covers were randomized as the main plot and the covered periods were the subplots.

Soil temperatures (Table 1) at 30 cm depth, were measured diurnal in all treatments using thermometers (Model Labortherm-N Skalenwert 1K) and the averages of temperature/week were recorded.

After each period of covering, the plastic covers were removed and the weeds were handly collected under plastic covers and in the bare soil, the fresh weight of weeds/m² were recorded, then tomato transplants were sown at 25 cm apart on rows of 60 cm wide and 4 m long. All normal cultural practices of growing tomatoes were applied except the control of pests.

The following parameters were measured:

1. Plant height, number of leaves and side shoots, and leaves area/plant were measured 90 days after transplanting.
2. The percentages of root-roted plants were calculated every week.
3. Total yield and early yield (during the first two weeks) were recorded.

4. **Sampling recovery and identification of nematodes:**
Nematode populations were extracted from 250 g soil samples(20 cm depth)by suspensing them in water , pouring through nested sieves (60, 100 and 325 mesh),and placing the residues on modified Baermann funnels. Nematode enumeration was determined using Hawksley counting slide and stereomicroscope. Key references of Oteifa (1964) and Nesterov (1979) were consulted. Other samples were taken at sowing time, 100 days after sowing , and at the end of the harvest season where also root-knot nematode galls were counted per root. The average numbers of nematodes and galls were computed as a mean of all covered periods.
5. Also, five randomized samples from the 20 cm layer of the soil were taken to count the microbial flora. Other samples were taken and 25 tomato seeds were sown in pots containing these soil samples to determine the percentage of seedling damping off. To determine microbial population , soil suspension was prepared (Bainhashemi and De Zeeuw, 1969) , then serial dilution was made as the usual manner. The total microbial count/g dry soil was obtained according to Katznelson (1984). Total number of fungi was counted using potato dextrose agar media containing 50 unit of 1 ml Penicillium, added to the media after autoclaving.The number of fungal colonies was counted 5 days after incubation at 28°C using microscopic examination.

RESULTS AND DISCUSSION

I. The effect of soil solarization on growth and yield of tomato plants:

Regarding the effect of soil solarization on tomato yield,results in Table(2) show that total and dry yield/fed, and yield/plant significantly increased by covering the rows with polyethylene

Table (1). Soil temperature (°C) recorded during soil solarization process by different polyethylene sheets in 1990 and 1991 seasons .

Dates	Mean soil temperature (°C) at 30 cm depth .					
	1990			1991		
	Bare soil	Black polyeth.	Transparent polyeth.	Bare soil	Black polyeth.	Transparent polyeth.
10/4-16/4	22.0	23.2	25.7	19.0	21.2	24.7
17/4-23/4	23.1	24.9	28.4	23.0	25.0	28.5
24/4-30/4	23.4	27.7	31.1	23.2	24.7	27.2
1/5- 7/5	23.6	26.1	29.7	24.5	27.2	30.0
8/5-14/5	24.7	29.2	31.5	23.8	26.0	31.6
15/5-21/5	25.0	29.7	32.7	26.6	28.4	32.2
22/5-28/5	25.3	29.5	31.1	28.2	28.3	32.4
29/5- 4/6	26.2	30.9	34.0	26.8	31.0	33.4

Table (2) Effect of soil solarization on the early and total yield of tomato crop during 1990 and 1991 summer seasons.

Characters	Total yield ton/Fed.				Early yield Ton/fed.				Yield Kg/plant			
Covering methods / Covered periods	Bare soil (control)	Black polyethy-lene	Clear polythy-lene	Mean	Bare soil (control)	Black polyethy-lene	Clear polythy-lene	Mean	Bare soil (control)	Black polyethy-lene	Clear polythy-lene	Mean
1990												
25 days	15.19	16.81	18.56	16.88	1.97	2.12	2.95	2.35	0.57	0.63	0.70	0.63
35 days	15.43	17.47	20.83	17.19	1.95	2.39	3.57	2.64	0.58	0.66	0.78	0.67
45 days	15.78	19.47	24.00	19.75	2.05	2.51	4.05	2.88	0.58	0.73	0.90	0.74
55 days	15.98	22.56	25.56	21.37	2.15	2.75	4.38	3.09	0.60	0.85	0.96	0.80
Mean	15.60	19.08	22.26		2.03	2.45	3.74		0.58	0.72	0.84	
L.S.D. at 0.05	A	B	AB		A	B	AB		A	B	AB	
	0.57	0.68	1.18		0.48	0.28	0.48		0.077	0.025	0.043	
1991												
25 days	14.36	22.18	22.40	19.65	1.57	2.98	4.44	2.99	0.62	0.95	0.96	0.84
35 days	14.98	24.84	28.18	22.67	1.78	3.76	5.10	3.55	0.64	1.06	1.21	0.97
45 days	15.56	24.48	28.19	22.74	1.95	4.72	5.94	4.20	0.67	1.05	1.21	0.98
55 days	16.13	27.70	30.18	24.67	2.05	4.79	6.42	4.48	0.69	1.19	1.30	1.06
Mean	15.26	24.80	27.24		1.84	4.06	5.48		0.66	1.09	1.17	
L.S.D. at 0.05	A	B	AB		A	B	AB		A	B	AB	
	1.54	2.68	N.S		0.44	0.72	N.S		0.17	0.15	N.S	

sheets. The highest yield was found by using transparent sheets followed by black covers. These results are true in both seasons.

Concerning the effect of covered periods, the same results indicate that total and early yield of tomatoes were significantly increased by increasing the covered period. Increasing the covering period from 25 to 55 days increased the yield from 15.6 and 15.26 to 22.26 and 27.24 tons/fed in the first and second seasons, respectively. Similar increases in early yield and yield/plant were found as a result of increasing covered periods.

The interaction between covered period i.e. 55 days and covering the rows with transparent polyethylene sheets gave the highest total and early yield in the first season, but in the second season there were no significant differences observed in this respect.

Similar effects of polyethylene covers on early and total yield had been previously reported for tomatoes (Jones et al.,1977; Schalk et al.,1979; Wien and Minotti,1987 ; Bhella,1988 and West and Pierce,1988).

As for the effect of soil solarization on growth characters, it is clear from the results in Tables (3 and 4) that there were significant differences among most of these characters.

Plant height increased with each of covering methods and periods, the tallest plants were observed by covering the rows with transparent polyethylene for 55 days, when compared with control. The interaction between row covers and covering periods significantly increased plant height. Similar increases in the number of side shoots and the leaves area/plant were observed by using row covers and by increasing the covered period.

Table (3) Effect of soil solarization on Plant height, No. of side shoots and No. of leaves / tomato plant during 1990 and 1991 seasons.

Characters	Plant height (cm)				No. of side shoots/plant				No. of leaves/ plant			
Covering methods / Covered periods	Bare soil (control)	Black polyethylene	Clear polyethylene	Mean	Bare soil (control)	Black polyethylene	Clear polyethylene	Mean	Bare soil (control)	Black polyethylene	Clear polyethylene	Mean
1990												
25 days	50.5	53.25	51.25	51.67	5.25	5.50	6.00	5.50	44.75	44.00	44.25	44.33
35 days	50.0	54.75	55.00	53.25	5.00	6.25	6.75	6.00	44.25	47.50	45.25	45.67
45 days	51.70	60.50	61.25	57.82	5.25	6.50	6.50	6.08	45.25	50.00	52.00	49.08
55 days	52.25	62.25	72.00	62.17	5.50	6.75	7.50	6.58	45.50	52.25	59.00	52.25
Mean	51.04	57.69	59.88		5.25	6.25	6.69		44.94	48.44	50.13	
L.S.D. at 0.05	A	B	AB		A	B	AB		A	B	AB	
	5.88	4.25	7.36		0.38	0.59	N.S		3.45	5.23	N.S	
1991												
25 days	67.00	75.00	70.00	70.67	6.50	7.00	6.00	6.5	46.00	46.50	47.25	46.58
35 days	69.15	81.00	82.00	77.38	7.00	7.50	8.25	7.58	46.50	49.00	47.50	47.67
45 days	68.20	80.75	83.25	77.40	7.00	8.00	8.75	7.92	47.50	52.25	54.75	51.50
55 days	73.00	83.00	87.25	81.08	7.50	8.75	9.00	8.42	47.25	52.75	57.75	52.58
Mean	69.34	79.94	80.63		7.00	7.81	8.00		46.31	50.13	51.31	
L.S.D. at 0.05	A	B	AB		A	B	AB		A	B	AB	
	4.96	5.04	[illegible]		0.45	[illegible]	N.S		[illegible]	[illegible]	4.19	

Table (4) Effect of soil solarization on dry weight of shoots, leaves area / tomato plant and fresh weight weeds/m²
during 1990 and 1991 summer seasons.

Characters	Dry weight of shoots gm/plant				Leaves area cm2/plant				Fresh weight of weeds gm/m2			
Covering methods / Covered periods	Bare soil (control)	Black polyethylene	Clear polyethylene	Mean	Bare soil (control)	Black polyethylene	Clear polyethylene	Mean	Bare soil (control)	Black polyethylene	Clear polyethylene	Mean
					1990							
25 days	20.53	23.48	27.55	23.85	904.46	1186.51	1197.62	1096.20	626.70	37.75	363.50	342.65
35 days	21.25	25.65	27.53	24.81	943.75	1250.79	1422.21	1205.58	1028.50	32.75	390.25	483.83
45 days	21.75	29.10	32.20	27.68	947.50	1289.20	1497.64	1244.78	1265.0	24.50	486.75	592.08
55 days	22.50	31.30	34.75	29.52	995.75	1354.91	1639.13	1329.93	1535.50	21.00	565.00	707.17
Mean	21.51	27.38	30.51		947.87	1270.35	1439.15		1113.80	29.00	451.38	
L.S.D. at 0.05	A	B	AB		A	B	AB		A	B	AB	
	5.32	3.85	6.68		207.47	172.94	279.52		51.6	49.48	85.70	
					1991							
25 days	30.00	34.90	41.65	35.52	1222.38	1262.55	1461.09	1315.34	625.0	82.50	300.0	335.83
35 days	31.00	45.98	45.73	40.92	1232.50	1476.30	1838.60	1515.80	992.0	62.50	330.0	461.50
45 days	31.25	51.95	59.00	47.40	1293.75	1661.45	2062.63	1672.63	1342.0	40.25	414.75	599.00
55 days	33.50	71.10	79.08	61.47	1320.50	2304.41	2432.50	2035.31	1842.0	45.00	469.50	785.50
Mean	31.44	50.98	56.28		1267.23	1676.19	1961.22		1200.25	57.56	378.56	
L.S.D at 0.05	A	B	AB		A	B	AB		A	B	AB	
	6.0	2.57	4.45		257.21	224.27	388.45		45.42	52.64	108.50	

With respect to the interaction , the same data (Tables 3&4) show that the interaction between rows covered with transparent polyethylene sheets for 55 days increased plant height, dry weight of shoots and the leaves area/plant in both seasons.

The obtained data are confirmed by those of Schalk et al. (1979) ; Hassan (1989) and Wolfe et al. (1989).

With regard to the weed density, it is obvious from the same data (Table 4) that soil solarization significantly decreased the fresh weight of weeds/m^2. The black covers gave the best results when compared with transparent covers and control (bare soil).

The interaction between the black covers and the periods of 55 and 45 days in the first and second seasons respectively decreased significantly the fresh weight of weeds/m^2. The possible mechanisms of weed control by solarization may be due to direct killing of seeds or breaking seed dormancy and consequent killing of germinating seeds(Horowitz et al.,1983 and Rubin and Benjamin,1984). Similar results on weed control by soil solarization were found by Hassan and Younis (1984);Hassan et al.(1987) and Hassan (1989).

II. The effect of soil solarization on nematode population:

In the pre-treatment samples representing all treatments, plant parasitic nematodes were recovered in the following genera: *Meloidogyne* , *Pratylenchus* , *Heliocotylenchus* , *Xiphinema* and other phyto-nematodes in few numbers and all will be considered as a group of phyto-parasitic nematods.

Data presented in Table (5) revealed that there were significant differences among

Table (5). The effect of soil solarization on plant parasitic nematodes infecting tomatoes during 1990 and 1991 Seasons.

Covering methods	Covered Periods	1990							1991						
		Average numbers of nematode genera/250 g. soil				Total plant parasitic nematodes	Reduction in population density %	Grand mean of treatments	Average numbers of nematode genera/250 g. soil				Total plant parasitic nematodes	Reduction in population density %	Grand mean of treatments
		Meloidogyne	Pratylenchus	Helicotylenchus	Xiphinema				Meloidogyne	Pratylenchus	Helicotylenchus	Xiphinema			
Bare soil	0	332.3	135.3	95.3	32.0	785.3	–		274.7	85.3	76.3	32.0	653.0	–	
	25 day	412.3	173.7	85.3	21.0	812.0	0.0		285.3	76.7	82.7	23.3	515.3	24.6	
	35 day	327.0	85.7	73.7	16.7	608.3	22.5	630.9	312.0	53.7	71.3	38.7	523.0	23.4	480.9
	45 day	270.7	76.0	82.0	15.7	531.7	32.3		188.7	62.0	52.7	22.7	375.3	45.1	
	55 day	213.0	52.3	63.3	16.3	417.0	46.9		163.3	43.0	45.7	13.3	307.3	54.9	
Black Polyethylene	0	425.7	142.3	82.7	25.3	823.3	–		212.0	93.9	83.0	35.3	518.3	–	
	25 day	385.3	85.3	71.7	23.7	603.3	26.7		185.0	82.3	62.3	12.3	423.3	18.3	
	35 day	215.0	73.0	63.3	18.7	422.0	48.7	479.3	163.3	63.3	43.3	18.0	332.7	35.8	317.9
	45 day	120.7	42.7	65.3	16.0	362.0	56.0		88.3	45.3	28.7	10.3	203.0	60.8	
	55 day	95.7	25.3	32.0	5.3	185.7	77.4		43.3	22.0	12.7	3.7	112.0	78.4	
Clear Polyethylene	0	335.3	186.7	63.7	36.7	793.3	–		235.7	117.7	96.0	26.7	587.3	–	
	25 day	210.0	108.3	52.7	18.3	502.7	36.3		117.7	53.3	43.0	12.0	273.0	53.5	
	35 day	117.3	32.0	21.0	10.0	210.0	73.5	341.7	75.0	37.3	22.3	8.0	165.0	71.9	230.7
	45 day	80.7	12.0	15.3	12.3	117.3	85.3		42.0	12.0	17.3	0.0	83.7	85.7	
	55 day	42.3	10.3	8.7	0.0	85.0	89.3		22.0	8.3	9.7	0.0	44.3	92.4	
Mean		242.2	82.7	58.4	18.0	433.9			185.8	57.1	49.8	17.1	343.1		

L.S.D at 0.05 for nematodegenera = 40.5   = 27.2
for covering method = 35.1   = 23.6
for covered periods = 45.3   = 30.4

Table (6) The of effect soil Solarization on plant Parasitic nematodes during the growth stages of tomato plants and root-knot galls at harvesting time during 1990 and 1991 seasons

Average numbers of nematode genera per 250 g. soil (Average of the all covered periods)					Reduction in Population density %	Average of root-Knot galls/ Plant at harvesting (Average of the all cover ed periods)	Reductiom in galls %
Covering methods	Sowing Time	100 days	Harvesting time	Mean			
			1990				
Bare soil	630.9	842.3	703.0	726.4	0.0	35.7	
Black P.	479.3	228.0	322.7	443.3	32.7	12.3	65.6
Clear P.	341.7	217.3	205.0	254.7	40.0	8.7	75.6
Mean	484.0	530.2	410.2	474.3			
			1991				
Bare soil	480.9	723.3	517.7	574.0	0.0	42.3	
Black P.	317.9	502.7	203.0	341.2	36.1	15.7	62.9
Clear P.	230.7	147.7	107.3	161.9	53.5	6.7	84.2
Mean	343.2	457.9	276.0	359.0			

L.S.D. 5% for growth stages = 103. 3; For covering methods = 103.3 , For seasons = 34.3 For galls = 5.3

nematode genera and each of periods and covering sheets. Transparent polyethylene was the best in reducing nematode populations, followed by black covers. Also, there were significant differences among the periods of solarization in reducing the numbers of all nematode genera. Grand mean reduction in nematode density was 25.5% for bare soil, 52.2% for black polyethylene , and 71.1% for transparent covers. In the second season, data showed the same trend where the grand mean reduction of nematodes were 37% , 48.3% , 75.9% for bare soil , black and transparent covers , respectively.

Data presented in Table (6) show that there were significant differences in the nematode population among all treatments of solarization and the growth stages of tomato plants. Also, there were significant differences in nematode galls as a result of soil solarization treatment.

Finally,it can be concluded that transparent covers can be used as a method of soil solarization for the economic period (33 or 45 days) to reduce most of plant parasitic nematodes.

These results are in harmony with those obtained by Smart and Locascio (1964) ; Stapleton and Devay (1983) ; Lamondia _et al_. (1985) and Fortnum _et al_.(1989) who controlled nematodes by using different plastic covers. Recently, Sharma and Nene (1990) reported that soil solarization with transparent sheets during summer months, significantly reduced nematode population infecting chickpea and pigeonpea.

III. Effect of soil solarization on microbial flora:

Data presented in Table(7) show clearly that the use of transparent or black polyethylene in soil solarization decreased the numbers of fungi and total microbial numbers comparing with bare soil during the two seasons. Solarized soil by

Table (7) Effect of soil solarizatin on average numbers of microbial Flora during 1990 and 1991 seasons.

Covering methods	Covered Periods	Mean numbers of colonces of microbial flora			
		Fungi Count		Total Count	
		1990	1991	1990	1991
Bare soil	0	202×10^5	168×10^6	602×10^8	705×10^9
	25 day	198×10^4	310×10^5	477×10^6	805×10^6
	35 day	873×10^3	368×10^4	805×10^5	845×10^4
	45 day	598×10^3	678×10^3	691×10^5	575×10^4
	55 day	137×10^3	172×10^2	287×10^5	460×10^4
Black Polyethylene	0	243×10^5	135×10^6	873×10^7	866×10^9
	25 day	164×10^4	92×10^5	616×10^6	264×10^7
	35 day	687×10^3	299×10^4	230×10^5	230×10^4
	45 day	460×10^2	464×10^3	115×10^5	921×10^3
	55 day	345×10^2	119×10^2	690×10^3	299×10^2
Clear Polyethylene	0	226×10^5	119×10^6	640×10^8	678×10^9
	25 day	140×10^4	241×10^4	310×10^6	184×10^6
	35 day	903×10^2	879×10^2	172×10^4	460×10^3
	45 day	103×10^2	115×10^2	48×10^3	230×10^3
	55 day	805	310	292×10^2	253×10^2

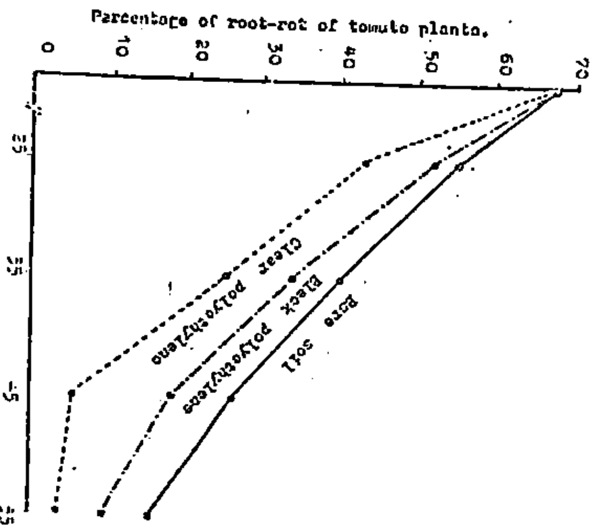

Fig (1) : Effect of soil solarization on the Percentage of root-rot of tomato plants. (Data are averages of 1990 and 1991 Seasons).

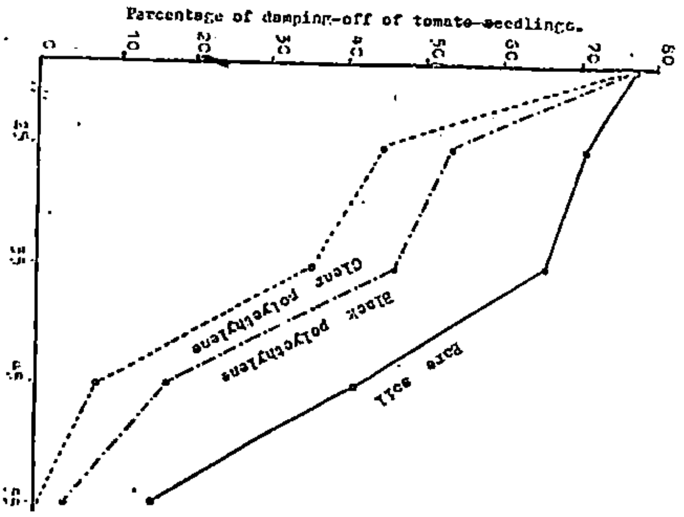

Fig (2) : Effect of soil solarization in the percentage of damping-off of tomato seedlings. (Data are averages of 1990 and 1991 seasons).

transparent polyethylene sheets recorded the lowest numbers of fungi and total microbial counts comparing with the solarization by black covers. These numbers of fungi and microbial count were also decreased according to the longation of covered periods, the lowest values were obtained after 55 days of solarization.

These findings may explain the decrease of percentage of root rot and seedling emergence of tomato as shown in Figs (1 and 2), as these diseases are known to be occurred mainly by attacking the soil borne pathogens to the tissues of seedlings and roots of adult plants.

These results are in harmony with those obtained by Katan (1981);Katan et al.(1983);Pinkas et al.(1984) and Satour et al.(1988).

REFERENCES

Bainhashemi, Z. and De Zeaw D.J. (1969). Two improved methods for selectively isolating Fusarium oxysporum from soil and plant roots. Plant Dis. Dept., 53: 589.

Bhella, H.S. (1988). Tomato response to trickle irrigation and black polyethylene mulch. J. Amer. Soc. Hort. Sci., 113: 543-546.

Decoteau, D.R.; M.J. Kasperbauer and P.G. Hunt (1989).Mulch surface color affects yield of fresh-market tomatoes. J. Amer. Soc. Hort. Sci., 114: 216-219.

Fortnum, B.A.;D.R. Decoteau and M.J. Kasperbauer (1989). Root-knot of tomato as affected by plastic mulch color. (Abstract). J. Nematology, 21: 561.

Hartz, T.K.; C.R. Bogle and C. Villalon (1985). Response of pepper and muskmelon to row solarization. Hort. Sci., 1985, 20 (4): 699-701.

Hassan, M.S. (1989). Soil sterilization by solar heating in Iraq. Arabian J. Pl. Prot. 7: 122-125.

Hassan, M.S. and M.A. Younis (1984). Cucumber cultivation with soil solarization and plastic mulching.Arabian J. Pl. Prot. 2: 65-69.

Hassan, M.S. ; A.H. El-Behadli and M.A. Younis (1987). Using of solar heating for soil sterilization and the effect of recovering with plastic sheets on tomato plants. Iraqi J. Agric. Sci. 18 (1).

Horowitz, M.; Y. Regev and G. Herzlinger (1983). Solarization for weed control. Weed Sci, 31: 170-179.

Jones, T.L. ; U.S. Jones and D.O. Ezell (1977). Effect of nitrogen and plastic mulch on properties of Troup Loamy Sand and yield of Walter tomatoes. J. Amer. Soc. Hort. Sci. 102: 273-275.

Katan, J. (1981). Solar heating (solarization) of soil for control of soil-borne pests. Ann. Rev. Phytopathol. 19: 211-236.

Katan, J. ; G. Fishler and A. Grinstein (1983). Short- and longterm effects of soil solarization and crop sequence on <u>Fusarium</u> wilt and yield of cotton in Israel. Phytopathology, 73: 1215-1219.

Katznelson, H. (1984). The rhizosphere effect of mangles on certain groups of soil micro-organisms. Soil Sci. 62: 343-354.

Lamondia, J.A.;B.B. Brodie and R. Carter (1985). The effect of solarization on decline of Globodera rostochiensis in naturally infected soil. (Abstract). J. Nematology 17: 503.

Nesterov, P.E. (1979). Nematodes of the Southern West of USSR. Academic Press, Maldavia, 312 pp.

Oteifa, B.A. (1964). A taxonomic guide of the common genera of soil and plant nematodes with a supplement of current known economic parasitic species of UAR, Cairo, 32 pp.

Overman, A.J. (1985). Off-season land management ,soil solarization and fumigation for tomato.Proceedings Soil and Crop Science ,Society of Florida. 44: 35-39.

Overman, A.J. and J.P.Jones(1987).Soil solarization , reaction and fumigation effects on double-cropped tomato under fullbed mulch. Proceeding Florida State Hort. Soc., 99: 315-318.

Pinkas, Y.; Y. Kariv and J. Katan (1984). Soil solarization for the control of Phytophthora cinnamoni : thermal and biological effects. Phytopathology, 74: 39-44.

Rubin, B. and A. Benjamin (1984). Solar heating of the soil: Involvement of environmental factors in the weed control process. Weed Sci., 32: 138-142.

Satour, A.M.F.;M.M. Mickail;K.Y. El-Eraki ; S.A. Grinsten; A.V. Chen and J. Katan (1988). Effectiveness of soil solarization in furrow-irrigated Egyptian soils. Plant Disease, 72: 143-146.

Schalk, J.M. ; C.S. Creighton ; R.L. Fery ; W.R. Sitterly ; B.W. Davis ; T.L. McFadden and A. Day (1979). Reflective film mulches influences insect control and yield in vegetables. J. Amer. Soc. Hort. Sci. 104: 759-762.

Sharma, S.B. and Y.L. Nene (1990). Effects of soil solarization on nematodes parasitic to chickpea and pigonpea. J. Nematology, 22 (45): 658-664.

Smert, G.C. and S.J. Locascio (1968). Influence of nematicides and polyethylene mulch color on the control of nematodes on strawberry. Soil and Crop Sci. Soc. Florida, 28: 292-299.

Stapleton, J.J. and J.E. De Vay (1983). Response of phytoparasitic nematodes and free living to soil solarization and 1, 3-dichloropropene in California. Phytopathology, 73 (10): 1429-1436.

West, J. and L.C. Pierce (1988).Yields of tomato phenotypes modified by planting density, mulch and row covers.Hort.Sci.23:321-324.

Wien, H.C. and P.L. Minotti (1987). Growth , yield and nutrient uptake of transplanted fresh-market tomatoes as affected by plastic mulch and initial nitrogen rate. J. Amer. Soc. Hort. Sci. 112: 759-763.

Wolfe, D.W.; L.D. Albright and J. Wyland (1989). Modeling row cover effects on micro-climate and yield: !. Growth response of tomato and cucumber. J. Amer. Soc. Hort. Sci. 114 (4): 562-568.

الملخص العربي

تم اجراء هذا البحث لدراسة استجابة نباتات الطماطم لتعقيم التربة بالطاقة الشمسية بعد تغطية الخطوط بالبلاستيك قبل الزراعة خلال فصول الصيف.

<u>وكانت اهم النتائج كالتالي:</u>

١- ازداد المحصول الكلى و المحصول المبكر للطماطم زيادة معنوية بتغطية التربة بالبلاستيك وكذلك بزيادة فترة التغطية وكان أعلى محصول عند استخدام البلاستيك الشفاف ثم البلاستيك الاسود ثم التربة الغير مغطاة.

٢- ازداد ارتفاع النبات وعدد الافرع الجانبية وعدد الاوراق و الوزن الجاف للسوق و الاوراق و المساحة الورقية للنبات زيادة معنوية بتغطية التربة بالبلاستيك. وكانت افضل النتائج لهذه الصفات باستخدام البلاستيك الشفاف ولمدة ٥٥ يوم.

٣- حدث نقص معنوى فى وزن الحشائش/متر مربع بتغطية الخطوط بالبلاستيك واعطى البلاستيك الاسود اقل وزن للحشائش/متر مربع.

٤- ادى تعقيم التربة بتغطيتها بالبلاستيك الى نقص معنوى فى اعداد النيماتودا وكذلك نقص عدد الفطريات و العدد الكلى لميكروبات التربة بعد المعاملة وكانت افضل النتائج عند تغطية التربة بالبلاستيك الشفاف يليها البلاستيك الاسود ثم بدون تغطية.

٥- يوصى البحث بامكانية استخدام تغطية التربة بالبلاستيك الشفاف لمده تتراوح بين ٣٥ - ٤٥ يوم حيث ادى ذلك الى نقص معنوى فى كل من أعداد النيماتودا المتطفلة على النبات وكذلك العدد الكلى لميكروبات التربة حيث لم يكن هناك فرق معنوى بين هذه الفترات وبين اكبر فتره تغطيه وهى ٥٥ يوم.

٦- "تغطية التربة" من الاتجاهات العلمية الحديثة و التى لها دور كبير فى الحفاظ على نظافة التربة الزراعية من عوامل التلوث الناتجة من استخدام المبيدات الكيميائية.