Integrated Production and Protection Management (IPPM) Program For Cucumber Crop Under Greenhouse Condition For The Season 2002/2003 in Kuwait

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Abstract

Soil Solarization and IPPM Experiment was conducted at two places in Kuwait with 7 treatments at Rabia and 5 at Wafra. The treatments included control, black plastic sheet 100micron, black plastic sheet 100micron x 2, transparent plastic sheet 100micron x 2, transparent plastic sheet100micron, transparent plastic sheet 200micron and chemical treatment using Basamid.Isolation of pathogenic fungi was carried out at three different stages of the experiment i.e. before solarization, after solarization and after cropping season, when cucumber crop was over.The pathogenic fungi isolated included Fusarium spp. and Phytophthora spp. dominating, but Alternaria spp., Helminthosporium spp. and Curvularia spp., also showed up there rare presence. Number of pathogenic fungi dominated in after cropping stage followed by before solarization. In after solarization stage number of isolates was rare at both places.Among treatments, transparent 100micron x2 and black 100micron x2 appeared better than other treatments in reducing number of isolates even after cropping season. Chemical treatment (Basamid) did not show up effective as highest isolates were recorded there. Other treatments like transparent 200micron and transparent 100micron appeared better in reducing isolates of fungi at Wafra. Bacterial counts were also showing the same results.Yield of cucumber was at peak in transparent 100micron x2 (Double sheet) followed by black 100 micron x2 and then transparent 200 micron compared with control. As far as profit is concered, transparent double sheet (100 micron x2) gave the highest and control and chemical the lowest.Heavy metal analysis was conducted for cucumber fruit and compared with international standards (MRLs). At Rabia Zn in black sheet 100 micron, Na in chemical, Cu, Fe and K in black 100 micron x 2 were noted. At Wafra Zn and Cu in transparent 100micron, Fe in control, Pb and Cd in black sheet 100 micron, K was in all treatments except chemical.

الملخص

التعقيم الشمسي وبرنامج الإدارة المتكاملة للإنتاج والوقاية (IPPM) في منطقتين الرابية والوفرة الزراعية بالكويت.سبع معاملات بالرابية وخمسة معاملات بالوفرة وهذه المعاملات هي الشاهد – بلاستك أسود 100 ميكرون – بلاستيك اسود مزدوج – بلاستك شفاف مزدوج - بلاستك شفاف 200ميكرون - بلاستك شفاف 100ميكرون و الكيماوي مستخدما الباساميد. عزل الفطريات الممرضة كان على ثلاث مراحل وهي قبل التعقيم وبعد التعقيم وبعد المحصول. والفطريات التي تم عزلها هي Fusarium spp-Phytophthora spp كانت زيادة ولكن Alternaria spp- Helminthosporium spp- Curvularia spp أيضا كانت منخفضة. عدد الفطريات ارتفع بعد الحصاد بالمقارنة بعددها قبل التعقيم – إن المعاملات البلاستك الشفاف المزدوج والبلاستك اسود المزدوج كان أفضل عن باقي العاملات في انخفاض عدد الفطريات. المعاملة الكيماوية لم تظهر انخفاضا في عدد الفطريات. المعاملة بلاستك الشفاف المزدوج وبلاستك اسود المزدوج وبلاستك الشفاف 200ميكرون أعطت نتائج أفضل في انخفض عدد البكتريا. الإنتاج لمحصول الخيار كان أعلى ما يمكن في المعاملة للبلاستك الشفاف المزدوج يليه بلاستك الأسود المزدوج ثم البلاستك الشفاف 200ميكرون مقارنة بالكنترول.الزيادة في صافي الربح كان موجود بالمعاملة للبلاستك الشفاف المزدوج بالمقارنة بالكنترول والكيماوي كان اقلهم – العناصر الثقيلة كانت متواجدة بكثرة بالمعاملات البلاستك الأسود والكيماوي والشاهد في كل من الرابية والوفرة.

Introduction

Integrated Production and Protection Management (IPPM) program under green house conditions is a groups of methods to facilitate the benefits by reducing the attack of pests and when necessary to use reduced doses of specific pesticide to protect the crops for human consumption and reduce losses.

Soil solazation and IPPM program have been followed in different countries like USA, Jordan, Egypt and Pakistan and also in G.C.C countries with promising results for controlling soil borne pests and increasing crop yield.

On the basis of their results, this technology was adopted in the State of Kuwait to facilitate the possibilities to get natural crop produce of best quality by following IPPM program. Main target of this technology is to get maximum yield and to minimize quantities of pesticides used in State of Kuwait valuing $ 9-10 million annually. IPPM program will help increasing the safety of public health for human being and environment from pollution.

Therefore by using soil solarization and IPPM program, we can replace the existing methods of sterilization like using internationally prohibited pesticides (Methyl bromide, Vapam and Basamid..etc).In the State of Kuwait, area under protected houses is increasing day by day. It was 19373 Donums under different crops in green houses during 1996-1997 which increased to 20600 Donums during 1998-1999.

Objectives

The objective of this IPPM program was to grow cucumber crop under controlled condition in Kuwait with least pollution on the produce than the standards set internationally (MRLs).

Materials & Methods

First: Characters of green houses

1. The green houses were covered with polyethylene sheets
2. Area Three greenhouses were used for the experiment and each G.H. was 36 x 8 = 288 square meters
3. Ventilated and aerated house with only fans and without any cooling system.
4. Irrigation was given @5 minutes and 3 times a day with drip system.
5. Fertilization Fertilizer18 18183 [N P K Mg] @ 1.5. And 3kg/irrigation was applied.
6. 125 cucumber seedlings were transplanted in each treatment in a triangular shape (photo 1 and 2). Plant distance 50 cms and line-line distance also 50 cms was kept, 80 cms distance between plots/treatments and 107 cms was left on both sides of the green house.

Photo (1). Triangular arrangement of Cucumber transplanted for IPPM Experiment

Photo (2). Showing cucumber plant health

Second Preparation for experiment

1. Cleaning of green houses was done for weeds and other plant debris before soil solarization and at any time of the season when they appeared.
2. Solarization was carried out during July-August 2002.
3. Net cloth with very small openings was used at the end of the green houses, openings of fans and double doors.
4. Cucumber variety TAHREER was sown.
5. Yellow plastic slates were hanged at every 10M at 15 cms above plants.
6. Transplanting Time

a. Al-Rabia: :First crop- 19/10/2002-1/3/2003; Second crop-9/3/2003-7/6/2003

b. Al-Wafra: First crop-25/10/2002-9/2/2003 ,Second crop- /3/2003-28/5/2003

Third - Treatments

a. Following treatments were included in the experiment at Al-Wafra and Al-Rabia

Chemical treatment with Basamid; Black plastic sheet 100 microns; Transparent plastic sheet 100 micron; Transparent plastic sheet 200 micron; Control and at Al-Rabia also included; Black plastic sheet 100 micron x 2; Transparent plastic sheet 100 micron x 2;

b. Replications :Two replications in each case

Fourth- Measurements

Total yield of each treatment [in Kg]; Average yield/plant in each treatment [in Kg]; Average yield/donum in each treatment [in Kg]; Average yield/ square meter [in Kg]; Presence of some elements of heavy metals like Cd, Cu, Fe, K, Na, Pb, and Zn was checked in cucumber fruits collected from Al-Rabia and Al-Wafra during first and second crops and compared with Recommended International Standards; Continuous follow up of the experiment to know about insect and disease attack was carried out. In case of any attack spot treatment or full house treatment in case of full house affected by spraying with specific pesticides and mixed with soapy pesticides when needed.

Fifth- Isolation of fungi and Bacteria

Collection of soil samples soil samples were collected after cropping season from Rabiah and Wafra at depth of 5,15and 25 cms.

A. Isolation of Bacteria :Same methods were followed as in before and after solarization stages on Nutrient Agar.
B. Isolation of fungi:Same method was followed as described in before and after solarization stages on Potato Dextrose Agar and were counted, identified and tabulated.

Results and Discussion

A Plant Protection

The tables (1 and 2), it clear the plant protection on cucumber plants at experimental area, Rabiah and Wafra during 2002/2003.

Table (1) The time of insect pests and disease appearance and their chemical control at Rabiah.

(A) Autumn crop

	Date	**Date of spray**	**Pests & Deseases**	**Use pesticide**	**Rate of\ spray100L**
1	10\11\2002	10\11\02	Aphid	Soap pestside+ micromized sulfer	100cm^3\soap 10gm/ sulfer.
2	14\11\2002	16\11\02	Aphid	Marchal 25% E.C+Soap pesticide	100cm^3\Mar. 500cm^3\Soap 10gm sulfer
3	26\11\2002	27\11\02	White fly	Actara 25%	30 gm
4	5\1\2003	6\1\03	Aphid+stem rot	Soap.p ;Up rooted diseased plant with stem rot;2Double T. ;8´Black ;1Control 2 Tr.200m;2 Tr.100m;2Black100m	500cm^2\Soap
6	16\1\2003	19\1\03	Mite+Aphide	Marchal 25% E.C+ Soap pesticide	100cm^3\Marchal 500cm^3\Soap

(B) Winter crop

	Date	**Dare of spray**	**Pests & diseases**	**Use Pesticide**	**Rate of spray\100L**
1	23\3\2003	23\3\03	Aphid	Soap pesticide	500cm soap pesticide
2	6\4\2003	6\4\03	Aphid	Soap pesticide +Marchal 25% EC	500cm\soap p 100cm\Marchal
3	12\4\2003	12\4\03	Aphid+wilt and up root	Soap pesticide+Marchal 25%EC	500cm\soap 100cm\Marchal
4	19\4\2003	-	Namatouda diseas appear in some plants	-	-
5	22\4\2003	22\4\03	Mites and duts	Soap solution	500cm\soap
6	30\4\2003	30\4\03	Mite and aphid	Danpetol 20% EC soap pesticide	70cm \danpetol 500cm\Soap
7	3\5\2003	3\5\03	Nematode+ wilt	Marchal 10% G 10%+vydate 10%G	2 Kg/GH
8	5\5\2003	5\5\03	mites	Vertemic 1.8%+Soap pest .	40cm3vertemic 500cm3Soap
9	13\5\2003	13\5\03	mites	Vertemic 1.8% EC+ Soap pest .	40 cm3Vertemic 500cm3\Soap

*** Photo (3). White flies on cucumber leaf**

Table (2) The time of insect pests and disease appearance and their chemical control at Wafra.

(A) Autumn crop

	Date	Date of spray	Pests & diseases	Pesticide Use	Rate of spray\100 L
1	16\12\2002	16\12\2002	Aphid	Soap pesticide	1L \Soap
2	23\12\2002	23\12\2002	Aphid	25% Actara	30 cm^3
3	10\1\2003	10\1\2003	Downy mildew	Poliram	100cm^3

(B) Winter crop

	Date	Date of spray	Pests & diseases	Pesticide Use	Rate of spray\100 L
1	15\3\2003	16\3\2003	Mites and Aphid	Marchal+Soap	1L\Soap 100cm^3
2	4\4\2003	5\4\2003	Aphid+leaf miner	Neuron	100cm^3

Photo (5). Leaf miner attack on cucumber leaf

Photo (6). Wilting and death of cucumber plants with nematodes

B- Plant production

Table (3) shows the yield of cucumber fruit in kilogram per square meter of soil solarization and IPPM experiment under greenhouse conditions at the experimental area, Rabiah and Wafra during autumn crop of 2002/2003. The result cleared the following

Table(3) Yield of cucumber (kg) under greenhouse condition for IPPM program using soil solarization (Autumn crop) at experimental Area Rabiah (20002/2003).

Measuring	Treatments المعاملات						Control
	Double Tr	Doub black	Tr.200m	Tr.100m	Black 100 m	Chemical	
Average weight\plant	5.44	5.32	5.12	4.8	4.7	4.6	4.4
Average weight\ Treatment	680	665	640	600	588	575	550
Average weight\ donum	13600	13300	12800	12000	11750	11500	11000
Average weight\ M^2	13.6	13.3	12.8	12.0	11.75	11.5	11.0

1. Maximum production of cucumber fruit was observed from Transparent Double (13.60 kg), followed by Black. Double sheet (13.13 kg), Transparent 200 M (12.8 kg), Transparent 100 M

(12.0 kg), Black 100 M (11.75 kg), chemical (11.5 kg) and control (11.0 kg), where as previous crop (Autumn crop) maximum production was in case Transparent Double Sheet and minimum in control.

2. Clear differences were observed between control and other treatments.
3. In double sheet Transparent, Black sheet and Transparent 200 M there is little difference.

Table (4) Yield of cucumber (kgs) under greenhouse conditions using IPPM program with soil solarization at experimental area, Rabiah (winter crop) 2002/2003.

Measuring	Treatments المعاملات						Control
	Double Trt.	Double black	Tr. 200m	Tr. 100m	Black 100m	chemical	
Average weight\plant	3.54	3.50	3.46	3.17	3.00	2.63	2.50
Average weight\Treatment	425	420	415	380	360	310	300
Average weight\donum	8800	8750	8650	7930	7500	6580	6250
Average weight\ M^2	8.85	8.75	8.65	7.93	7.50	6.58	6.25

Table (4) Cucumber yield (kg) of (winter crop) 2002-2003 at Rabiah shows that

1. The results of cucumber production per sequent meter were perhaps in he following sequence
2. Maximum production in Transparent double sheet (8.85 kg), Black double sheet (8.75 kg), Transparent 200 M (8.65 kg), Transparent 100 M (7.93 kg), Black 100 M (7.50 kg), Chemical (6.58 kg) and the least control (6.25 kg).
3. The double sheet Transparent yielded maximum and control minimum in per sequence cucumber production.
4. Clear differences were observed between control and other treatments.
5. There is no difference in production between Transparent double sheet, black double sheet and Transparent 200 M.

Table (5) Yield of cucumber (kgs) under greenhouse conditions using IPPM program with soil solarization at experimental area, Wafra (Autumn crop) 2002/2003.

Measuring	Treatments المعاملات				Control
	Transp.200 micron	Trans. 100 micron	Black.100 micron	chemical	
Average weight\plant	1.66	2.44	2.29	1.89	1.20
Average weight\Treatment	192.5	293.25	274.75	227	144.5
Average weig\Donum	4150	6100	5730	4730	3000
Average weight\M^2	4.15	6.10	5.73	4.73	3.00

Table (5) Average yield of cucumber in kg per square meter at experimental Wafra for Autumn crop 2002-2003 shows that

1. Cucumber production was maximum in case of Transparent sheet 100 M (6.10 kg) followed by black sheet 100 M (5.73 kg), chemical (4.73 kg), Transparent 200 M (4.15 kg) and control (3.0 kg) respectively where as in autumn crop maximum production was in Transparent 100 M and minimum in control.
2. It is clear that Transparent sheet 200 M gave minimum production as compared to other treatments.
3. The production of same crop at Rabiah differ in sequence in yield quantity.

Table (6) Yield of cucumber (kgs) under greenhouse conditions using IPPM program with soil solarization at experimental area Wafra (Winter crop) 200-2003.

القياسات Measuring	Treatments المعاملات				Control
	Transp. 200 micron	Trans. 100 micron	Black.100 micron	Chemical	
Average weight\plant	4.58	4.85	5.03	4.82	3.89
Average weight\ Treatment	550	582.5	603.5	578.0	467.25
Average weig\Donum	11450	12130	12580	12050	9730
Average weight\M^2	11.45	12.13	12.58	12.05	9.73

Table (6) Average cucucmber production (in kg/m2) at experimental area, Wafra for winter crop 2002-2003 shows that

1. For average cucumber fruit production / M2 in winter crop sequence among treatments was the same as in case of winter crop.
2. Transparent sheet 200 M gave the minimum / M2 cucumber production in treatment. But in case of winter crop yield was even less than half as compared to winter crop at Wafra growing season 2002-2003.

In case of Rabiah it is clear that average yield / M2 is autumn crop was more than winter crop and this is just opposite to the yield at Wafra as yield was more in winter crop than in autumn crop.

Table (7) Economic cost of production for IPPM program experimental area, Rabiah (per meter square) in K.D. for autumn crop (2002-2003).

Treatments	**Economic Cost (Net Profit)**
Double Transp	1.630 – 0.460 = 1.17
Double black	1.600 – 0.500 = 1.100
Transp.200 micron	1.540 – 0.480 = 1.060
Transp.100 micron	1.440 – 0.460 = 0.980
Black 100 micron	1.410 – 0.500 = 0.910
Control	1.320 – 0.500 = 0.910
Chemical	1.380 – 0.550 = 0.830

Table (7) Cost of production per square meter at experimental area, Rabiah for autumn crop. The table (7) shows the expenses at Rabiah in decending order are as follow Transparent double sheet; Black double sheet; Transparent sheet 200 M; Transparent sheet 100 M & Black sheet 100 M

It shows maximum net profit in Transparent double sheet and minimum in black single sheet treatments.

Table (8) Economic cost of production for IPPM program experimental area, Rabiah (per meter square) in K.D. for winter crop (2002/2003).

Treatments	**Economic Cost (Net profit*)***
Double Transp	1.06 – 0.466 = 0.590
Double black	1.05 – 0.520 = 0.530
Transp.200 micron	1.04 – 0.500 = 0.540
Transp.100 micron	0.950 – 0.460 = 0.940
Black 100 micron	0.900 – 0.500 = 0.400
Control	0.75 – 0.450 = 0.300
Chemical	0.790 – 0.530 = 0.260

In Table (8) the cost of production per square meter, experimental area, Rabiah. The following is the economic cost descending order as compared between treatments

Transparent double sheet; -Transparent sheet 200 M; -Black double sheet; Transparent sheet 100 M; Black sheet 100 M; Control & Chemical treatment

It is clear from the table that Transparent double sheet gave maximum net profit and chemical treatment the least.

Table (9) Economic cost of production for IPPM program experimental area, Wafra (per meter square) in K.D. for autumn crop.

Treatments	**Economic Cost (Net profit)**
Transp 200 micron	1.060 – 0.443 = 0.060
Transp 100 micron	0.730 – 0.740 = 0.260
Black 100 micron	0.690 – 0.588 = 0.100
Control	0.360 – 0.490 = - 0.130
Chemical	0.750 – 0.665 = - 0.100

In Table (9), the cost economic cost of production for per m2 for autumn crop at experimental area Wafra, shows cost of production in descending order as followsTransparent sheet 100 M; Transparent sheet 200 M; Black sheet 100 M; Chemical treatment & Control

The economic cost of production for winter crop record in table (10) at experimental area, Wafra, the following is the arrangement in descending order Black sheet 100 M; Transparent sheet 200 M & Control. The table shows that the net profit of production for one meter square was highest in case of

black sheet 100 M treatment at Wafra for winter crop and least net profit was in case of transparent sheet 200 M. For the autumn crop Transparent sheet 100 M gave highest net profit and control the lowest.

Table (10) Economic cost of production for IPPM program experimental is, Wafra (per meter square) in K.D. for winter crop.

Treatments	**Economic Cost (Net profit)**
Transp 200 micron	1.370 – 0.500 = 0.870
Transp 100 micron	1.460 – 0.460 = 1.00
Black 100 micron	1.510 – 0.500 = 1.01
Control	1.17 – 0.450 = 0.720
Chemical	1.450 – 0.530 = 0.920

Table (11) Analysis of heavy metals in cucumber samples collected during autumn crop 2002-2003 at Rabiah (ppm).

TREATMENTS	**Zn Ppm**	**Pb Ppm**	**Na%**	**K%**	**Fe Ppm**	**Cu Ppm**	**Cd Ppm**
Double Black	155	0	0.125	2.5	8305	60	0
Double Transp.	52	0	0.2	3	1449	0	0
Basanid	17	0	0.175	3	91	0	0
Transp. 100 ul	36	0	0.15	2.2	83	0	0
Black 100 ul	16	0	0.20	2.8	127	0	2
Transp. 200	33	0	0.175	2.8	64	0	0
Control	30	0	0.20	2.49	378.5	0	3

In table (11) are given analysis of heavy metals in cucumber fruit of autumn crop in Rabiah in ppm, for 2002-2003 growing season. It is clear from table that

1. Zinc (Zn) was is the highest quantity in black sheet 100 M; as compared with control.
2. Iron (Fe) was the highest in black double sheet, followed by Transparent double sheet, control and the least in Transparent sheet 200 M.
3. Copper (Cu) was recorded only in case of black double sheet and did not get from other treatments.
4. Cadmium (Cd) was found only in control (3 ppm) and black sheet 100 M (2 ppm).

Table (12) Analysis of heavy metals in cucumber samples collected during autumn crop 2002-2003 at Wafra.

TREATMENTS	**Zn**	**Pb**	**Na**	**K**	**Fe**	**Cu**	**Cd**
Black	6.0	210.0	1750	7750	0.00	32.00	4.50
Transp. 100 ul	23.5	0.00	1750	7750	0.00	14.50	0.00
Transp. 200 ul	7	0.00	1250	6150	0.00	0.50	1.50
Chemical	0.00	49.5	250	0.00	0.00	0.00	5.0
Control	0.00	0.00	1750	4600	5.50	11.5	3.00

In table (12) shows that the results of analysis of heavy metals (autumn crop) in cucumber collected during autumn crop from Wafra for 2002-2003 growing season. It is clear from the table.

1. Highest quantity of zinc (Zn) was found in Transparent sheet 100 M (23.5 ppm) followed by Transparent sheet 200 M (7 ppm) and minimum was in black sheet 100 M.
2. Lead (Pb) was found in black sheet 100 M (210 ppm) as compared with control (49.5 ppm) in other treatments it could not appear.
3. Iron (Fe) was found only in control (55 ppm)
4. Copper (Cu) was present in Transparent sheet 100 M (14.5 ppm) and control (11.5 ppm).
5. Potassium (k) was found in all the treatments but not in chemical.
6. Cadmium (Cd) was recorded (4.5 ppm) in black sheet 100 M and (3 ppm) in control and (1.5 ppm) in Transparent sheer 200 M.

Isolation of Fungi and Bacteria

Soil samples were collected at three different stages of the experiment .The stages included were

before solarization stage;after solarization stage &after cropping stage

The results of isolations of first two stages had already been presented. Results of third stage along with other two stages are given in following tables

Table (13) comparison between fungi isolated from soil samples at 5cms collected from rabiah for soil Solarization and IPPM experiment for 2002-2003

treatments	fungi isolated	before solorization		after solorization		after cropping	
		diluted	not diluted	diluted	not diluted	diluted	not diluted
T1 Control	*Aspergillus spp.*	9	1	6	7		2
	Penicillium spp.						
	Rhizopus spp.		1			4	2
	Chaetomium spp.						
	Total Non Path	9	2	6	7	4	4
	Fusarium spp.		10				3
	Helminthosporiumspp.			1			
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	1		2			2
	Curvularia spp.			1			
	Cladosporium spp.						
	Total Path	1	10	4	0	0	5
T2 Chemical	*Aspergillus spp.*	9	1	4	8	8	1
	Penicillium spp.					3	
	Rhizopus spp.		1			1	3
	Chaetomium spp.					1	
	Total Non Path	9	2	4	8	13	4
	Fusarium spp.		10			2	20
	Helminthosporiumspp.						
	Alternaria spp.			1			
	Ulocladium spp.					1	
	Phytophthora spp.	1		1			
	Curvularia spp.						
	Cladosporium spp						
	Total Path	1	10	2	0	3	20
T3 Black 100	*Aspergillus spp.*	9	1	1	10	5	2
	Penicillium spp.					1	
	Rhizopus spp.		1			1	4
	Chaetomium spp.						
	Total Non Path	9	2	1	10	7	6
	Fusarium spp.		10				10
	Helminthosporiumspp.						
	Alternaria spp.			1		1	
	Ulocladium spp.						
	Phytophthora spp.	1					4
	Curvularia spp.					2	
	Cladosporium spp						
	Total Path	1	10	1	0	3	14
T4 Transparent 100	*Aspergillus spp.*	9	1	4	5	3	6
	Penicillium spp.						
	Rhizopus spp.		1			1	2
	Chaetomium spp.						
	Total Non Path	9	2	4	5	4	8
	Fusarium spp.		10				
	Helminthosporiumspp.			1			
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	1					2
	Curvularia spp.						
	Cladosporium spp.					3	
	Total Path	1	10	1	0	3	2
T5 Transparent 200	*Aspergillus spp.*	9	1	3		2	4
	Penicillium spp.						
	Rhizopus spp.		1			2	2
	Chaetomium spp.				7		
	Total Non Path	9	2	3	7	4	6
	Fusarium spp.		10				3
	Helminthosporiumspp.			1			
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	1					2
	Curvularia spp.						
	Cladosporium spp						
	Total Path	1	10	1	0	0	5

Table (14) comparison between fungi isolated from soil samples at 15 cm collected from rabiah for soil Solarization and IPPM experiment

treatments	fungi isolated	before solarization		after solarization		after cropping	
		diluted	not diluted	diluted	not diluted	diluted	not diluted
T1 Control	*Aspergillus spp.*	6	2	3	3	5	
	Penicillium spp.						
	Rhizopus spp.				4	1	5
	Chaetomium spp.	1			1		
	Total Non Path	7	2	3	8	6	5
	Fusarium spp.		5				
	Helminthosporium spp.						2
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	1					1
	Curvularia spp.						1
	Cladosporium spp.						
	Total Path	1	5	0	0	0	4
T2 Chemical	*Aspergillus spp.*	6	2		9		8
	Penicillium spp.						
	Rhizopus spp.				4		2
	Chaetomium spp.	1					
	Total Non Path	7	2	0	13	0	10
	Fusarium spp.		5				9
	Helminthosporium spp.				1		
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	1					
	Curvularia spp.						
	Cladosporium spp						
	Total Path	1	5	0	1	0	9
T3 Black 100 micron	*Aspergillus spp.*	6	2	6	2	7	4
	Penicillium spp.					2	
	Rhizopus spp.					1	3
	Chaetomium spp.	1		3	8	1	
	Total Non Path	7	2	9	10	11	7
	Fusarium spp.		5				10
	Helminthosporium spp.						2
	Alternaria spp.			1			
	Ulocladium spp.						
	Phytophthora spp.	1				1	1
	Curvularia spp.						
	Cladosporium spp					2	
	Total Path	1	5	1	0	3	13
T4 Transparent 100 micron	*Aspergillus spp.*	6	2			1	1
	Penicillium spp.						
	Rhizopus spp.					1	1
	Chaetomium spp.	1		1	7		2
	Total Non Path	7	2	1	7	2	4
	Fusarium spp.		5				
	Helminthosporium spp.						
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	1				2	5
	Curvularia spp.						
	Cladosporium spp.						
	Total Path	1	5	0	0	2	5
T5 Transparent 200 micron	*Aspergillus spp.*	6	2	5	9	3	10
	Penicillium spp.			1		1	
	Rhizopus spp.				1	2	2
	Chaetomium spp.	1			4		
	Total Non Path	7	2	6	14	6	12
	Fusarium spp.		5				5
	Helminthosporium			1			
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	1					2
	Curvularia spp.						5
	Cladosporium spp						
	Total Path	1	5	1	0	0	12

Isolation of Fungi

Isolation of fungi was made on PDA from soil samples collected from Rabia and Wafra experimental areas after cropping season (2002-2003) and results are discussed here.

Comparison of fungi isolated between treatments at Rabiah.

The results from Rabia area show that pathogenic fungi isolated were maximum in number in case of chemical treatment and black sheet 100 micron as compared with other treatments.

Fusarium spp and Phytophthora spp were prevalence in all the treatments but Fusarum spp. occurred more at 5 cm depth. Same way both fungi were isolated from all the treatments at 15 cm and 25 cm depth.It is clear from the results that after cropping season pathogenic fungi were activated by weather conditions during winter crop of the season 2002-2003.

Comparison Between Three Stages At (Rabia)

At 5 cm Depth When we compared the results of isolation of the three stages (before solarization, after solarization and after cropping season), we observed that at 5 cm depth among the pathogenic fungi Fusarium spp. and Phytophthora spp. were more in " before solarization " than after solarization results, where as they differ in comparison between "after solarization and "after cropping". Table (13 – 15) show that pathogenic fungi were maximum in chemical treatment than black sheet 100 micron followed by control and transparent sheet 200 micron and transparent 100 micron respectively in Rabiah.

At 15 cm Depth The pathogenic fungi viz. Phytophthora spp, Fusarium spp. and Curvularia spp. etc occurred more in black sheet 100 micron treatment followed by transparent sheet 200 micron, chemical, transparent sheet 100 micron and control treatments respectively and they were in more numbers than before solarization and after solarization.

At 25 cm Depth But at this depth control treatment fetched more colonies than all other treatments, followed by Chemical; black sheet 100 micron, transparent sheet 100 micron treatments, whereas no colony was observed in transparent sheet 200 micron. Before solarization we could get Fusarium spp. in isolation in case of non-dilution method. But in case of after solarization almost no pathogenic fungus could be isolated.

Comparison between treatments at soil Solarization with double plastic sheet and IPPM experiment at RABIA (2002-2003)

The isolation results of pathogenic fungi on PDA given in Tables (16-18) show number of colonies of 3 stages of soil samples collection at 3- different depths from solaraized area with double plastic sheet. The results of 3rd stage After Cropping Season (2002-2003) are

At 5 cm Depth

The results in the above table show the pathogenic fungi were more in number in case of Transparent Sheet 100 micron x 2 followed by Control and then Black Sheet 100 micron x 2 respectively. Colonies of Fusarium spp. dominated in Transparent Sheet 100 micron x 2 and then Control. No colony of Phytophthora spp. was observed in isolation from these treatments. In case of Black Sheet 100 micron x 2 Fusarium spp. and Phytophthora spp. were not in a considerable numbers.

At 15 cm Depth

At this depth Phytophthora spp. was isolated from Control Treatment only whereas it did not appear in other two treatments. Fusarium spp. was recorded more in Transparent Sheet 100 micron x 2 followed by Black Sheet 100 micron x 2 with no colony of Phytophthora spp. Alternaria spp. was isolated only from Transparent Sheet 100 micron x 2.

At 25 cm Depth

At this depth Phytophthora spp. dominated in Control Treatment followed by Transparent Sheet 100 x 2 and Black Sheet 100 micron x 2. Fusarium spp. was more in number in Transparent Sheet 100 micron x 2 followed by Black Sheet 100 micron x 2. No colony of Fusarium spp. was recorded in Control.

Comparison between 3 stages of ippm experiment [isolati ons]

In After Solarization Stage no pathogenic fungi were isolated from any depth of all the treatments using non-dilution method. In case of before-solarization-stage Fusarium spp. and Phytophthora spp. appeared in small numbers. In After Cropping Stage fungi were recorded more than Before Solarization stage. Perhaps it was due to higher sub-soil water level and favorable weather conditions for fungus growth.

Table (16) comparison between fungi isolated from soil samples at 5 cm collected from rabiah for soil Solarization and IPPM experiment for 2002 – 2003

treatments	fungi isolated	before solarizarion		after solarization		after cropping	
		diluted	not	diluted	not	diluted	not
T1 Control	Aspergillus spp.	3	14	2	5	1	
	Penicillium spp.						
	Rhizopus spp.	5			2		
	Chaetomium spp.						
	Total N. Path	8	14	2	7	1	0
	Fuserium spp.					1	8
	Helminthosporium pp.						
	Alternaria spp.						
	Ulocladium spp.		1				
	Phytophthora spp.						
	Curvularia spp.						
	Cladosporium spp.					1	
	Total Path	0	1	0	0	2	8
T2 Transparent 100 micron x 2	Aspergillus spp.	3	14			1	10
	Penicillium spp.						
	Rhizopus spp.	5					
	Chaetomium spp.						
	Total N. Path	8	14	0	0	1	10
	Fuserium spp.						9
	Helminthosporiumspp.						
	Alternaria spp.						
	Ulocladium spp.		1				
	Phytophthora spp.					1	
	Curvularia spp.						
	Cladosporium spp					1	
	Total Path	0	1	0	0	2	9
T3 Black 100 micron x 2	Aspergillus spp.	3	14	2	0	3	2
	Penicillium spp.						
	Rhizopus spp.	5					3
	Chaetomium spp.						
	Total N. Path	8	14	2	0	3	5
	Fuserium spp.						1
	Helminthosporiumspp.						
	Alternaria spp.						
	Ulocladium spp.		1				
	Phytophthora spp.						2
	Curvularia spp.						
	Cladosporium spp					1	

Table (17) comparison between fungi isolated from soil samples at 15 cm collected from rabiah for soil Solarization and ippm experiment for 2002-2003

treatments	fungi isolated	before solarization		after solarization		after cropping	
		diluted	not	diluted	not	diluted	not
T1 Control	*Aspergillus spp*	3	5	2	3		
	Penicillium spp.						
	Rhizopus spp.						
	Chaetomium spp.		1	3			3
	Total N. Path	3	6	5	3	0	3
	Fuserium spp.	5	1	1			
	Helminthosporium spp.						
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.		1				9
	Curvularia spp.		9	6	1		
	Cladosporium spp.						
	Total Path	5	11	7	1	0	9
T2 Transparent 100 micron x 2	*Aspergillus spp.*	3	5			3	2
	Penicillium spp.					1	
	Rhizopus spp.						
	Chaetomium spp.		1	2			
	Total N. Path	3	6	2	0	4	2
	Fuserium spp.	5					7
	Helminthosporium spp.		1				
	Alternaria spp.					1	1
	Ulocladium spp.						
	Phytophthora spp.		1			1	
	Curvularia spp.		9				
	Cladosporium spp					2	
	Total Path	5	11	0	0	4	8
T3 Black 100 micron x 2	*Aspergillus spp.*	3	5	0	3	4	15
	Penicillium spp.				1	2	
	Rhizopus spp.						
	Chaetomium spp.		1		2		
	Total N. Path	3	6	0	6	6	15
	Fuserium spp.	5					3
	Helminthosporium spp.		1				
	Alternaria spp.					1	
	Ulocladium spp.						
	Phytophthora spp.		1				
	Curvularia spp.		9				
	Cladosporium spp						
	Path Total	5	11	0	0	1	3

Table (18) comparison between fungi isolated from soil samples at 25 cm collected from rabiah for soil Solarization and IPPM experiment for 2002-2003

treatments	fungi isolated	before solarization		after solarization		after cropping	
		diluted	not	diluted	not	diluted	not
T1 Control	*Aspergillus spp.*	5	8	8	12		
	Penicillium spp.						
	Rhizopus spp.				3		
	Chaetomium spp.		1				
	Total N. Path	5	9	8	15	0	0
	Fuserium spp.	3	2				
	Helminthosporium spp.						
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	2	1			2	10
	Curvularia spp.						
	Cladosporium spp.						
	Total Path	5	3	0	0	2	10
T2 Transparent 100 micron x 2	*Aspergillus spp.*	5	8	2	3	6	10
	Penicillium spp.						
	Rhizopus spp.		1				
	Chaetomium spp.			1			
	Total N. Path	5	9	3	3	6	10
	Fuserium spp.	3	2				5
	Helminthosporium spp.						
	Alternaria spp.			2			1
	Ulocladium spp.						
	Phytophthora spp.	2	1				2
	Curvularia spp.						
	Cladosporium spp						
	Total Path	5	3	2	0	0	8
T3 Black 100 micron x 2	*Aspergillus spp.*	5	8	2	7	3	12
	Penicillium spp.						
	Rhizopus spp.						
	Chaetomium spp.		1				
	Total N. Path	5	9	2	7	3	12
	Fuserium spp.	3	2				3
	Helminthosporium spp.						
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	2	1			2	2
	Curvularia spp.						
	Cladosporium spp						
	Path Total	5	3	0	0	2	5

Table (19) comparison between fungi isolated from soil samples at 5 cm collected from wafra for soil soilarization and IPPM experement for 2002-2003

treatments	fungi isolated	before solarization		after solarization		after cropping	
		diluted	not	diluted	not	diluted	not
T1 Control	*Aspergillus spp.*	2	6	1	1	2	6
	Penicillium spp.					1	1
	Rhizopus spp.					3	5
	Chaetomium spp.	1					
	Total N Path	3	6	1	1	6	12
	Fusarium spp.	1	2				2
	Helminthosporiumspp.						
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	2	2				
	Curvularia spp.						
	Cladosporium spp.						
	Total Path	3	4	0	0	0	2
T2 Chemical	*Aspergillus spp.*	2	2	1	1	5	3
	Penicillium spp.					3	
	Rhizopus spp.					1	
	Chaetomium spp.	1	1				2
	Total N Path	3	3	1	1	9	5
	Fusarium spp.	1	1			1	7
	Helminthosporiumspp.						
	Alternaria spp.			1	1		
	Ulocladium spp.						
	Phytophthora spp.	2	2				
	Curvularia spp.						
	Cladosporium spp						
	Total Path	3	3	1	1	1	7
T3 Black 100 micron	*Aspergillus spp.*	2	2			1	10
	Penicillium spp.						1
	Rhizopus spp.						
	Chaetomium spp.	1	1				
	Total N Path	3	3	0	0	1	11
	Fusarium spp.	1	1				1
	Helminthosporiumspp.						
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	2	2				
	Curvularia spp.						
	Cladosporium spp						
	Total Path	3	3	0	0	0	1
T4 Transparent 100 micron	*Aspergillus spp.*	2	6	1	1	1	1
	Penicillium spp.					2	
	Rhizopus spp.						
	Chaetomium spp.	1					
	Total N Path	3	6	1	1	3	1
	Fusarium spp.	1	2				6
	Helminthosporiumspp.						
	Alternaria spp.			1	1		
	Ulocladium spp.						
	Phytophthora spp.	2	2				
	Curvularia spp.						
	Cladosporium spp.						
	Total Path	3	4	1	1	0	6
T5 Transparent 200 micron	*Aspergillus spp.*	2	6	1	1	2	3
	Penicillium spp.					1	3
	Rhizopus spp.						1
	Chaetomium spp.	1					
	Total N Path	3	6	1	1	3	7
	Fusarium spp.	1	2				3
	Helminthosporiumspp.						
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	2	2				
	Curvularia spp.						
	Cladosporium spp						
	Total Path	3	4	0	0	0	3

Table (20) comparison between fungi isolated from soil samples at 15 cm collected from wafra for soil soilarization and IPPM experement for 2002-2003

Treatments	Fungi isolated	Before solarization		After solarization		After cropping	
		Diluted	Not diluted	Diluted	Not diluted	Diluted	Not diluted
T1 Control	*Aspergillus spp.*	3	6	1	2	3	6
	Penicillium spp.					3	1
	Rhizopus spp.						5
	Chaetomium spp.	1					1
	Total N Path	4	6	1	2	6	13
	Fusarium spp.	1	2				1
	Helminthosporiumspp.						
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	2	1			4	
	Curvularia spp.						
	Cladosporium spp.						
	Total Path	3	3	0	0	4	0
T2 Chemical	*Aspergillus spp.*	3	6	2	3	5	3
	Penicillium spp.					6	1
	Rhizopus spp.						
	Chaetomium spp.	1					
	Total N Path	4	6	2	3	11	4
	Fusarium spp.	1	2				6
	Helminthosporiumspp.						
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	2	1				
	Curvularia spp.			2			
	Cladosporium spp						
	Total Path	3	3	2	0	0	6
T3 Black 100 micron	*Aspergillus spp.*	3	6	2	2	1	3
	Penicillium spp.					2	1
	Rhizopus spp.					1	1
	Chaetomium spp.	1					
	Total N Path	4	6	2	2	3	5
	Fusarium spp.	1	2				
	Helminthosporiumspp.						
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	2	1				3
	Curvularia spp.			1			
	Cladosporium spp						
	Total Path	3	3	1	0	0	3
T4 Transparent 100 micron	*Aspergillus spp.*	3	6	1	1	1	4
	Penicillium spp.					3	4
	Rhizopus spp.						1
	Chaetomium spp.	1					
	Total N Path	4	6	1	1	4	9
	Fusarium spp.	1	2		1		3
	Helminthosporiumspp.						
	Alternaria spp.			1			
	Ulocladium spp.						
	Phytophthora spp.	2	1				
	Curvularia spp.						
	Cladosporium spp.					1	
	Total Path	3	3	1	1	1	3
T5 Transparent 200 micron	*Aspergillus spp.*	3	6	1	1	1	
	Penicillium spp.					3	2
	Rhizopus spp.						2
	Chaetomium spp.	1					
	Total N Path	4	6	1	1	4	1
	Fusarium spp.	1	2				1
	Helminthosporiumspp.						
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	2	1				4
	Curvularia spp.						
	Cladosporium spp						
	Total Path	3	3	0	0	0	5

Table (21) comparison between fungi isolated from soil samples at 25 cm collected from wafra for soil solarization and ippm experement for 2002-2003

Treatments	Fungi isolated	Before solarization		After solarization		After cropping	
		Diluted	Not diluted	Diluted	Not diluted	Diluted	Not diluted
T1 Control	*Aspergillus spp.*	2	6	1	3	6	7
	Penicillium spp.					2	1
	Rhizopus spp.						4
	Chaetomium spp.	1					3
	Total N Path	3	6	1	3	8	15
	Fusarium spp.	1	1				5
	Helminthosporiumspp.						
	Alternaria spp.					1	
	Ulocladium spp.						
	Phytophthora spp.	2	1				1
	Curvularia spp.						
	Cladosporium spp.						
	Total Path	3	2	0	0	1	6
T2 Chemical	*Aspergillus spp.*	2	6	1	1	1	3
	Penicillium spp.					1	2
	Rhizopus spp.						
	Chaetomium spp.	1					
	Total N Path	3	6	1	1	2	5
	Fusarium spp.	1	1				3
	Helminthosporiumspp.						
	Alternaria spp.					1	
	Ulocladium spp.						
	Phytophthora spp.	2	1				5
	Curvularia spp.						
	Cladosporium spp						
	Total Path	3	2	0	0	1	8
T3 Black 100 micron	*Aspergillus spp.*	2	6			3	6
	Penicillium spp.					1	1
	Rhizopus spp.						1
	Chaetomium spp.	1					
	Total N Path	3	6	0	0	4	8
	Fusarium spp.	1	1			1	
	Helminthosporiumspp.						
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	2	1				3
	Curvularia spp.						
	Cladosporium spp						
	Total Path	3	2	0	0	1	3
T4 Transparent 100 micron	*Aspergillus spp.*	2	6	1	1	2	2
	Penicillium spp.					1	3
	Rhizopus spp.						2
	Chaetomium spp.	1					
	Total N Path	3	6	1	1	3	7
	Fusarium spp.	1	1	1			1
	Helminthosporiumspp.						
	Alternaria spp.				1		
	Ulocladium spp.						
	Phytophthora spp.	2	1				
	Curvularia spp.						
	Cladosporium spp.						
	Total Path	3	2	1	1	0	1
T5 Transparent 200 micron	*Aspergillus spp.*	2	6	1	1		3
	Penicillium spp.						6
	Rhizopus spp.						1
	Chaetomium spp.	1					
	Total N Path	3	6	1	1	0	10
	Fusarium spp.	1	1				1
	Helminthosporiumspp.						
	Alternaria spp.						
	Ulocladium spp.						
	Phytophthora spp.	2	1				1
	Curvularia spp.						
	Cladosporium spp						
	Total Path	3	2	0	0	0	2

Comparison between Treatments after Cropping

Isolation results from Wafra area show that maximum pathogenic fungi were isolated from chemical treatment samples at all the three depths (5,15,25 cm) followed by transparent sheet 100 micron at 5 cm, transparent sheet 200 micron at 15 cm, and control at 25 cm in case of non diluted method of isolation. The results recorded in tables (19-21).

At 5 cm Depth

Among pathogenic fungi Fusarium spp. appeared in all the treatments at 5 cm depth and no colony of Phytophthora spp. was isolated at this depth. Fusarium spp. colonies were recorded maximum in chemical treatment followed by transparent sheet 100 micron, transparent sheet 200 micron, control and black sheet 100 micron treatments respectively.

At 15 cm Depth

Fusarium spp. was maximum in isolation from chemical treatment followed by transparent sheet 200 micron followed by black sheet 100 micron and transparent sheet 100 micron and then control treatments respectively. Phytophthora spp. colonies were observed in transparent sheet 200 micron followed by black sheet 100 micron. No colony was observed in other treatments.

At 25 cm Depth

Fusarium spp. isolated from control was more than isolated from other treatments, whereas Phytophthora spp. appeared in chemical treatment followed by black sheet 100 micron and control and transparent sheet 200 micron. No colony was observed in transparent sheet 100 micron.

Comparison between 3 Stages of Treatments

Comparison of isolated pathogenic fungi from soil samples collected from Wafra IPPM Exp. Area at 3 different stage, (before and after solarization and after cropping) shows that number of colonies decreased in after solarization in all the case almost there was no pathogenic fungus present but after cropping season the colonies increased perhaps because of weather conditions were favorable for their growth.

At 5 cm Depth

Fusarium spp. was present in all the treatments before solarization and after cropping whereas Phytophthora spp. occurred only before solarization. No colony of Phytophthora spp. could be isolated after solarization stage in any of the treatments. Fusarium spp. was maximum in chemical treatment followed by transparent 100 micron, and transparent 200 micron.

At 15 cm Depth

Fusarium spp. colonies was present in chemical, transparent sheet 100 micron, control and transparent 200 micron. No colony was observed in black sheet100 micron after cropping season. After solarization there were no Fusarium spp colonies isolated. Phytophthora spp. was observed in transparent sheet 200 micron, black sheet 100 micron, in case of non-dilution method. Phytophthora spp. was isolated from samples before solarization, whereas no colony was observed in after solarization at 15 cm depth in all the treatments.

At 25 cm Depth

Fusarium spp. was isolated in maximum number for control followed by chemical, transparent sheet 100 micron and transparent sheet 200 micron. No Fusarium spp. could be observed after solarization stage in all treatments. As far as Phytophthora spp. is concerned it was isolated from chemical treatment with maximum number followed by black sheet 100 micron, control and transparent sheet 200 micron. No colony of Phytophthora spp. was observed during or after solarization.

Isolation of Bacteria after Cropping Season [2002-2003]

The bacterial colonies were isolated on Nutrient Agar Medium from soil samples collected from Rabiah and Wafra IPPM Experimental Area after cropping season and were compared with other two stages of the experiment.

Table (22) average number of bacterial colonies isolated from rabia soil samples during 2002-2003 soil solarization & ippm experiment double sheet

Treatment	Depths (CM)			
	5		15	25
Before Solarization	37		43	32
After Solarization or Before cropping Season	Control	44	51	21
	Double black sheet	28	34	47
	Double Transparent sheet	28	34	47
After Cropping Season	Control	24	20	15
	Double black sheet	32	69	40
	Double transparent sheet	60	48	53

It is clear from the results shown in Table (22 – 23) that the bacterial colonies increased in case of after cropping season isolation as compared with after solarization counts almost in all the treatments of Rabiah experiment

Treatment	Depths (CM)			
	5		15	25
Before Solarization	27		44	23
After Solarization or Before Cropping Season	Control	44	51	21
	Chemical	55	36	35
	Black sheet	22	39	46
	Transparent100 micron	37	39	40
	Thransparent200 micron	20	30	20
After Cropping Season	Control	66	45	66
	Chemical	46	63	45
	Black sheet	49	49	74
	Transparent 100 micron	44	43	50
	Thransparent200 micron	78	84	51

Table (23) average number of bacterial colonies isolated from RABIA soil samples during 2002-2003 soil solarization & ippm experiment

Treatment	Depths (CM)			
	5		15	25
Before Solarization	27		23	32
After Solarization or Before Cropping Season	Control	35	46	19
	Chemical	8	21	10
	Black sheet	24	13	11
	Transparent 100 micron	17	24	15
	Thransparent 200 micron	4	20	11
After Cropping Season	Control	37	7	35
	Chemical	64	39	30
	Black sheet	79	57	37
	Transparent 100 micron	59	47	14
	Thransparent 200 micron	83	51	75

Table (24) average number of bacterial colonies isolated from wafra soil samples during 2002-2003 soil solarization & ippm experiment

The Table (24) shows that the bacterial counts are maximum in number in case of after cropping season as compared with after solarization and before solarization of Wafra experiment.

Observations

1. A new disease was recorded for the first time on cucumber plants during winter crop. It appeared on plants of different treatments during December 2002-January 2003 when after rains humidity inside the green houses was very high.

SYMPTOMS The stems of the affected plants became gray and tissues became loose. Girdling of the affected plants was clear. A white cottony growth of the pathogen fungus was noted. With the passage of time black bodies of different shapes and sizes were observed. Same symptoms were also observed on flowers and fruits. With this disease plant growth and yield were affected (Photo no.7). The disease was named as STEM ROT and fungus was identified as Sclerotinia sclerotiorum. The diseased plant parts were removed and destroyed.

2. During winter crop the plants in replication no. 2, showed wilting and yellowing symptoms. Some of the affected plants were uprooted. Different sizes and shapes of knots in large numbers appeared on the roots. The disease was named as Root Knot caused by nematode Meloidogyne spp. With the passage of time, this disease increased and appeared in an epidemic form. The disease was severe in replication 2 of Single Plastic Sheet treatments. It also appeared in other replicates (Photo no. 8 and 9).

Conclusion

Soil Solarization and IPPM Program experiments were conducted at Rabiah and Wafra Agricultural Areas, to produce cucumber with minimum pollution compared with the international standards (MRLs). Seven treatments were followed (Control, Black sheet 100 micron, Transparent Sheet 100micron, Transparent sheet 200micron, Transparent sheet 100 micron x 2, black sheet 100 micron x 2 and chemical (Basamid) with two replications) at Rabiah and five treatments Control, Transparent sheet 100 micron, Black sheet 100micron, Basamid and Transparent sheet 200micron) with two replication at Wafra with following results of the cucumber production

1-Highest yield of cucumber was recorded in transparent 100 micron x 2, followed by black sheet 100 micron x 2, transparent sheet 200 micron and the lowest from control in autumn crop at Rabiah.

2- Same results appeared in winter crop at Rabiah as they were in autumn crop, i.e. transparent double sheet, black double sheet and transparent 200micron.

3- At Wafra transparent sheet 100micron gave highest yield and control the lowest both in autumn and winter crops.

It is clear from the comparison that yield is different in treatments at Rabiah and Wafra. Because double sheets gave best results and then transparent sheet 200 micron in Rabiah and the same time transparent sheet 100 micron was best in Wafra in both autumn and winter crops.

4- The treatment gave best net profit /m 2 was transparent double sheet with the lowest the control or chemical treatment at Rabiah in both crops autumn and winter crop.


Photo (7). Symptoms of the cottony rot fungus*(Sclerotinia sclerotiorum)* on cucumber flowers & fruits.

Photo (8). Knots on the roots of cucumber caused by *Meloidogyne spp*

Photo (9). Stem rot on cucumber caused fungus*Sclerotinia sclerotiorum*

5- It is clear that black sheets 100 micron gave highest net profit and transparent sheet 200 micron or control the lowest at Wafra in both crops autumn and winter crop.

6- (A)-Heavy metals analysis table of Rabiah autumn and winter results show the following

- Zinc (Zn) was highest in black double sheet as compared with control.
- Sodium (Na) was high in chemical treatment.
- Potassium (K) was high in black double sheet and control only.
- Iron (Fe) was high in black double sheet.
- Copper (Cu) was recorded high in double black sheet

(B) - Heavy metals Analysis in cucumber from Wafra samples autumn crop table shows the following

- Zinc (Zn) was the highest in transparent 100 micron transparent sheet 200 micron and black sheet 100 micron.
- Lead (Pb) was high perhaps in black sheet 100 micron.
- Potassium (K) was high in black sheet 100 micron and control.
- Iron (Fe) was found in control only.
- Copper (Cu) with high range in transparent 100 micron and black sheet 100 micron control.
- Cadmium (Cd) was recorded in black sheet 100 micron chemical treatment and control.

7- Isolation of fungi was made from soil sample collected after cropping season (2002 – 2003) from Rabiah and Wafra areas of IPPM experiment on PDA. Comparison between three depths (5, 15, 25 cm) and between before and after solarization and after cropping show

A. When we compared the results of isolation of the three stages (before solarization, after solarization, and after cropping season), we observed that at 5 cm and 25 cm depths among the

pathogenic fungi Fusarium ssp. and Phytophthora spp. were more in (before solarization) than after solarization results. Where as they differ in comparison between before and after solarization and after cropping. The results in tables show that pathogenic fungi were maximum in chemical treatment than black 100 micron follower by control, transparent sheet 200 micron and transparent 100 micron respectively in Rabiah.

B. Comparison of isolated pathogenic fungi from soil sample collected from Wafra IPPM experiment area at different stages, (before and after solarization and after cropping) show that the number of colonies decreased after solarization in all almost all cases. But after cropping season some colonies increased perhaps because of bad weather conditions were favorable for their growth. Fusarium spp. was present in all the treatments before solarization and after cropping, whereas Phytophthora spp. occurred only before solarization. Fusarium spp. was maximum in chemical treatment followed by transparent 100 micron and transparent 200 micron.

Recommendations

On the basis of results which were recorded during the last 2 years at Rabia and Wafra experimental areas we reached the following recommendations-

1) Transparent plastic sheet treatments gave highest cucumber yield and better soil sterilization than chemicals.

2) As far as yield is concerned, treatment with double transparent plastic sheet and transparent 200 micron were the best

3) Chemical and control treatments gave minimum yield and least soil sterilization as compared to transparent plastic sheet treatments.

4) Highest net profit /m2 received from transparent double sheet and transparent 200 micron.

5) Treatments with black sheet, chemical and control were lowest in yield and sterilization.

6) Lowest doses of heavy metals were recorded in transparent sheet as compared with other treatments. Treatment with black plastic sheet gave maximum dose of these elements and this was the result of analysis of cucumber fruits collected form Rabia and Wafra IPPM experiments.

7) Soil solarization gave better results in treatments with transparent double sheet and transparent 200 micron in reducing soil-borne bacteria and pathogenic fungi for longer time than other treatment.

And at the end, it is recommended to use the transparent double sheet and transparent 200 micron for soil solarization and IPPM to reduce the use of pesticides for controlling insect and diseases for the safety of human beings, no pollution of environment and safe produce.

Recommendation for the Coming Year

The experiment will be conducted at Rabia and Wafra Agri- Expt Area, Abdalli Agri- Expt Area, and also with the help, on two farms at Abdalli and two farms at Wafra will also be included in the program to confirm the results at different places through farmers. So that other farmers may follow the same methods to get good yield and to solve their nematode problems along with pathogenic fungi and bacteria.

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