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HORTING

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Contract No: 2004/180
Order :16000712
UNIDO Project Number: TF/ROM/02/001

Final Report

1. OBJECT OF REPORT:

The report deals to the activity of the UNIDO project No: TF/ROM/02/001 concerning the "phase-out methyl bromide in horticulture sector in Romania".

2. REPORT PERIOD:

The present report's data refers to the data recorded until of 26 of December 2005.

3. DESCRIPTION OF ACTIVITY:

According to the TOR attached to the Contract, they have executed the following activities:

3.1. The companies involved in the project

In this period a number of 8 greenhouse companies were involved, companies representatives for Romania, in which the pilot plots were established:

1. S.C. CODLEA GREENHOUSES S.A.
2. S.C. BRASOV GREENHOUSES S.A.
3. S.C. LEADER INTERNATIONAL S.A. - CONSTANTA
4. S.C. RJ IMPORT – EXPORT ISALNITA
5. S.C. LEOSER S.A. – BUCHAREST
6. S.C. BERSER S.A. – BUCHAREST
7. RA APPS PIPERA - BUCHAREST
8. I.C.D.I.M.P.H.- HORTING BUCHAREST

3.2. Insuring the project's development with materials and equipments

In accordance with the project documents and the proposal from the plan of activity, the following equipments and materials have been provided by UNIDO and installed at HORTING :

Structure of greenhouse
Trays for seedlings
Central power
Data was collected and systemized, concerning:

- greenhouse temperature
- rainfall
- the pathogen agents, identified prior to the organization of the demonstrative plots
- greenhouse soil analysis
- the analysis of greenhouse irrigation water
- the species grown in the last 3 years on the demonstrative plots
- the prior fertilization program
- the prior disinfection treatments
- alternatives cost assessment

3.2.1. The greenhouse air temperature

The data concerning the temperatures registered in the project location are present in table 1.

Table 1. The average air temperatures, min and max in project locations

Location	2004 October			2004 November			2004 December			2005 January			2005 February			2005 March		
	med	max	min	med	max	min	med	max	min	med	max	min	med	max	min	med	max	min
Bucuresti	11.6	24.7	1.4	5.4	20.7	-7.1	0.4	12.0	-10.1	- 2.7	11.6	-5.2	- 0.5	20.1	-13.4	5.5	26.3	-2.3
Constanta	13.5	27.3	1.8	7.9	19.3	-4.5	2.7	12.4	-7.7	0.2	15.5	-4.3	1.3	13.9	-12.3	4.1	24.2	-1.4
Craiova	11.7	29.2	-1.1	5.7	18.8	-8.2	1.3	9.2	-11.5	- 1.3	12.1	-5.3	0.3	18.9	-12.5	5.5	27.3	-4.1
Brasov	9.0	27.5	-6.6	3.3	17.5	-12.0	-1.7	11.8	-17.5	- 3.4	12.0	-9.5	- 1.6	19.5	-14.5	4.0	22.5	-4.8
Location	2005 April			2005 May			2005 June			2005 July			2005 August			2005 September		
	med	max	min	med	max	min	med	max	min	med	max	min	med	max	min	med	max	min
Bucuresti	11.8	26.4	3.3	16.6	34.5	14.5	20.0	36.4	8.5	22.6	35.5	16.9	22,2	36,2	14,1	17.5	33.2	5.4
Constanta	9.4	23.4	3.4	15.4	28.5	7.7	19.0	31.8	10.6	22.2	33.5	17.0	21,8	32,7	14,7	18.1	29.7	7.5
Craiova	11.6	26.3	1.2	17.6	34.9	5.6	20.9	38.0	10.5	23.4	35.7	16.6	22,5	38,3	14,4	18.4	33.3	5.8
Brasov	9.5	14.6	-3.6	14.9	29.7	-0.9	17.5	31.5	4.1	19.1	31.6	8.2	18,6	32,8	6,3	14.2	29.6	0.2

3.2.2. Rainfall

The monthly rainfall in project location are present in Table 2 .

Table 2. The monthly and totally rainfall in project locations

mm

Year	2004			2005								
Location	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.
Bucuresti	40.4	48.1	40.3	40.2	34.5	37.6	44.6	67.7	86.4	58.9	56.8	39.0
Constanta	33.4	38.2	34.6	29.0	27.7	23.0	87.9	34.9	43.5	33.2	27.9	28.2
Craiova	48.6	53.6	48.5	40.1	38.8	38.4	47.3	61.8	65.0	45.8	36.1	38.5
Brasov	44.0	34.8	29.4	29.5	26.5	30.8	54.1	78.3	106.8	86.2	73.4	53.2

3.2.3. The pathogens agents, identified before to the organization of the pilot plots

The results were collected before pilot plots' organization and were based on own farmers statements (table 3).

Table 3. The agents determined in the pilot plots

No	Agents pathogens	Codlea	Brasov	Leader Constanta	Isalnita	Leoser	Berser	Pipera	Horting
1.	Pythium debaryanum			X	X		X		X
2.	Fusarium sp.		X	X	X	X	X	X	X
3.	UMC1, UMC2			X	X		X		x
4.	Pseudoperonospora cubensis			X	X			X	
5.	Marmor tabaci			X	X				
6.	Phytophtora infestans	X		X	X	X		X	
7.	Phytophtora parasitiaca	X		X	X	X	X	X	X
8.	Didymella lycopersici	X		X			X		X
9.	Pseudomonas lacrimans			X			X		X
10.	Verticillium sp.						X	X	X
11.	Meloidogine incognito		X	X	X	X	X	X	X
12.	Agriotes sp.			X	X			X	
13.	Thrips tabaci			X	X				
14.	Frankliniela occidentalis	X		X	X		X		X
15.	Tetranychus urticae		x	X	X			X	
16	Aphys gossypii	X		X	X		X	X	X
17.	Liriomyza trifolii				X			X	
18.	Trialeurodes vaporariorum	x		x			x	x	x

3.2.4. Soil analysis

The main features of the soil in the pilot plots are presented in table 4.

Table 4. The main features of the soil in the pilot greenhouses

Location	pH	H-NO_3	P_2O_5	K_2O	CaO	Organic matter
Codlea	6.4	12.2	4.9	31	87	9.1
Brasov	6.6	11.5	5.8	32	85	9.4
Leader Constanta	6.6	11.7	4.7	33	87	8.3
Isalnita	6.5	13.1	3.2	33	91	6.6
Leoser	6.7	13.0	5.3	28	86	8.5
Berser	6.5	12.6	5.0	31	88	10.3
Pipera	6.4	13.5	5.1	30	90	9.8
Horting	6.6	13.2	5.1	29	87	9.2

3.2.5. The analysis of greenhouse irrigation water

Analyses referring to the irrigation water have been made in greenhouses from Bucharest(Horting),Codlea(S.C.Codlea S.A.) and Constanta(S.C.Leader S.A.).The samples have been taken from the only source of each company. Dates are presented in table 5.

Table 5. The main features of the irrigation water

Features	Location		
	Horting	S.C.Codlea S.A.	S.C. Leader S.A.
CSR	2.5	2.3	2.6
PS	26.33	27.2	27.0
RM	443 g/l	429 g/l	416 g/l
CI	19.8	19.0	18.7
CE	700 ms	670 ms	690 ms
RAS	1.7	1.5	1.4

3.2.6. The species grown in the last 3 years on the pilot plots

The species of vegetables cultivated in pilot plots of greenhouses during the last three years are presented in table 6. The pilot plot represents a surface for soil disinfection' variants, using different chemical substances;

Table 6. Species of vegetable cultivated during the last 3 years on the pilot plots

Location	2002	2003	2004	2005
Codlea	tomatoes cucumbers	tomatoes cucumbers	tomatoes	cucumbers tomatoes
Brasov	beans chrysanthemum	tomatoes cucumbers	cucumbers	pepper
Leader Constanta	cucumbers	tomatoes cucumbers	cucumbers	tomatoes
Isalnita	tomatoes	cucumbers	tomatoes	cucumbers
Leoser	tomatoes cucumbers	tomatoes cucumbers	cucumbers	tomatoes
Berser	tomatoes	tomatoes	tomatoes cucumbers	tomatoes
Pipera	cucumbers tomatoes	cucumbers tomatoes	tomatoes	cucumbers
Horting	cucumbers	cucumbers	tomatoes	tomatoes

3.2.7. The fertilization program before transplanting

The quantities of mineral and organic fertilizer applied in the last year to the pilot plots are presented in table 7.

Table 7. The quantities of fertilizer applied to the pilot plot during the last year

Location	Nitrate ammo-nium	Calcium Ammo-nium	Complex 20:20:0	Complex 15:15:15	Mono ammo-nium phosphate	Super-phosphate	Poli-feed	NKP	Organic
Codlea	920	1.400	900	300	200	400		600	200.000
Brasov	400	200	300			300			100.000
Leader Constanta	800	650	450		600	400			200.000
Isalnita	400	480			600		400		
Leoser	750	2.125	1.400	900	200	200			100.000
Berser	400	300		500					100.000
Pipera	650		850		400	400	1.200	450	100.000
Horting	600			400	800		400		80.000

3.2.8. The soil disinfection treatments

The data concerning the treatments mode for the soil sterilization in the pilot plots during the last three years are shown in table 8.

Table 8. The treatments of soil sterilization in the pilot plots during the last 3 years

No:	Location	Treatment of the soil			
		2002	2003	2004	2005
1	Codlea	-	-	Methyl Bromide	Metam Sodium
2	Brasov	-	-	-	Metam Sodium
3	Leader Constanta	-	Methyl Bromide	Dazomet	Dazomet Methyl Bromide
4	Isalnita	-	-	-	Dazomet Methyl Bromide Metam Sodium
5	Leoser	Methyl Bromide	Methyl Bromide	Methyl Bromide	Dazomet Methyl Bromide Metam Sodium
6	Berser	Steam	Steam	Steam	Steam
7	Pipera	-	-	Vydate	Dazomet Vydate
8	Horting	-	-	-	Dazomet Metam Sodium

3.3. The organization of the pilot plots in 2005

According to the TOR provisions annexed to the contract, the following alternatives were applied in the pilot plots organized in the greenhouses involved in the project:

- Metam Sodium 100g a.i./sqm
- Dazomet 60g a.i./sqm

Bearing in mind each greenhouse's particular situations, there were organized additional pilot plots in which the soil disinfection was carried out by:

- Vydate 3g a.i./sqm
- Steam 120C la 30 cm in sol,120min.

The greenhouses that had in stock Methyl Bromide organized also pilot plots in which soil disinfection was carried out by bromide, 70g/sgm.

The application was undertook, as fallows:

Table 9. The data concerning the treatments made for the soil sterilization

Location	*Dazomet*	*Metam Sodium*	*Methyl Bromide*	*Steam*	*Vydate*
Codlea		*03.03.2005*			
Brasov		*22.03.2005*			
Leader	*08.04.2005*		*08.04.2005*		
Isalnita	*30.03.2005*	*30.03.2005*	*30.03.2005*		
Leoser	*10.11.2004*	*10.11.2004*	*01.11.2004*		
Berser				*10.11.2004*	
Pipera	*20.10.2004*				*20.10.2004*
Horting .	*25.10.2004*	*15.04.2005*			

Metam Sodium was applied with this technology :

Table 10. The technical dates of application Metam Sodium

1. Pilot plots	l = 3.2m L* = 30m S = 100m2
2.Drip irrigation systems for MS fumigatiton	l = 3.2m 5 lines drip irrigation
3. Water applied – total amount l/m2	30
4. Metam Sodium (g.a.i. /m2)	100
g a.i. 100g MS formulation	50
g a.i./1lt MS formulation	528g
ml Metam Sodium necessary for fumigation	189ml/m2

*L= length g= grams
w= wide lt= litres
S= area ml=millilitres

Metam Sodium was applied throw drip- irrigation system, using Venturi pomp. After MS was applied the soil was covered with plastic; pause time was of 21 days for soil temperature higher than 15 C at the 15 cm depth.

Dazomet powder was applied by spread on a very good prepared soil with a 50% field capacity and it was immediately incorporated so that water to be found at 20cm depth. The soil was covered with plastic; pause time was of 21 days for soil temperature higher than 15 C at the 15 cm depth.

The plots whose soil wasn't disinfected and on which normal plants seedbeds were planted were considered as control.

In this pilot cycle was use only standard plants (no grafted).

As for the above, the variability were:

Table 11. Alternative to Methyl Bromide

VARIANT	CODE
Metam Sodium	MS
Dazomet	DZ
Non treated	NTC
Methyl Bromide	MB
Vydate	Vy
Steam	Sm

One variant has three to five repetitions.

According to those presented, the pilot plots are related in table 12; the dimension and number of these pilot plots are different from one unit to another.

For the statistics insurance of these recorded results it was used the multiple compare method.

Table 12. Pilot plots 2005

(m.p.)

GREENHOUSE	DZ	MS	MB	Sm	Vy	NTC	Total
TOMATOES							
S.C.Berser S.A.				10.000		10.000	20.000
S.C.Leoser S.A.	1.000	1.000	1.000				3.000
Horting Institut	2.500	2.500				2.500	7.500
S.C.Codlea S.A.		1.000				1.000	2.000
S.C.Leader Constanta S.A.	10.000		10.000			10.000	30.000
Subtotal I	**13.400**	**4.400**	**11.000**	**10.000**		**23.400**	**62.500**
GREEN PEPPER							
S.C.Brasov S.A.		1.200				1.200	2.400
Subtotal II		**1.200**				**1.200**	**2.400**
CUCUMBERS							
S.C.Codlea S.A		1.000				1.000	2.000
R.A.Pipera	2.000				2.000		4.000
Isalnita S.A.	300	300	300				900
Subtotal III	**2.300**	**1.300**	**300**		**2.000**	**1.000**	**6.900**
TOTAL GENERAL	**15.700**	**6.900**	**11.300**	**10.000**	**2.000**	**25.600**	**71.800**

Table 13. Comercial area treated with Methyl Bromide alternatives and Methyl Bromide in 2005

mp.

Greenhouse	DZ	MS	MB	Sm	Vy	TOTAL
S.C.Codlea S.A	10					10
S.C.Brasov S.A						-
S.C.Leader S.A		16				16
S.C.IsalnitaS.A				6		6
S.C.Leoser S.A	28				20	48
S.C.Berser S.A		6		24		30
R.A.Pipera					16	16
Institut Horting	1	0,5				1,5
Total	**39**	**22,5**		**30**	**36**	**127,5**

3.4.Complementary activities

Between 07 – 20 December 2005 I participated at the Workshop on :" Promotion of Methyl Bromide Alternatives to comply with its Phase Out" organized by MASHAV and CINADCO Israel.

The main item in the frame of the workshop was:

- the policy and legal aspects of MB phase out
- the international effort of MB replacement
- chemical MB substitutes:
  - Telopic,Telodrip
  - Condor
  - Telon II
  - Metam Sodium
  - Basamid
  - Formaldehyde
  - Vydate
  - Nemacur
  - Rugby
- virtually impermeable films
- MB alternatives for weed control
- MB alternatives for the control of nematodes
- the economic impact of MB substitution
- solarization and reduced rates of MB,Polymer sprays
- suppression of soil-borne diseases by compost
- critical use exemption
- quarantine and pre-shipment applications
- MB alternatives of stored products

During of the workshop it was presented an Country Report (see abstract in attachment nr.1) and at the final of activity have been preparation and presentation un project concerning "Investigating Methyl Bromide substitutes for managing soil borne pathogens in greenhouse-grown vegetables"(see paper in attachment nr.2).

4. RESULTS

According with the set working schedule(see in attachment), observations and determinations during the growth and development in the 1st production cycle, the targets were:

- the plants replaced within the first 15 days after planting
- remove weeds
- pathogen identification
- identification nematodes
- yield production
- cost assessment

4.1. S.C. CODLEA S.A.

Cucumbers
Variety: Mathilda F1
Investment, plants/Ha:24,000

Tomatoes
Variety: Shyrlei F1
Investment,plants/Ha:27,000

As above the number of plants and the date of their planting are shown in table 13.

Table 14. N° of transplanted plants (date of transplanting)

CUCUMBERS

Treatment	Plot 1	Plot 2	Plot 3	Plot 4	Date
MS	600	600	600	600	28.04.05
NTC	600	600	600	600	28.04.05

TOMATOES

Treatment	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Date**
MS	675	675	675	675	30.04.05
NTC	675	675	675	675	30.04.05

Plot area= 250 mp

In the 1st 15 days since the planting, a small number of plants have been replanted

Table 15. N° of replanted plants within 15 days after the transplant

CUCUMBERS

Treatment	Plot 1		Plot 2		Plot 3		Plot 4	
	Nr pl.	Reason	Nr pl.	reason	Nr pl.	reaso	Nr pl.	Reason
MS	-	-	4	mech.causes	-	-	-	-
NTC	2	mech.causes	-	-	-	-	3	mech.causes

TOMATOES

Treatment	Plot 1		Plot 2		Plot 3		Plot 4	
	Nr pl.	Reason	Nr pl.	Reason	Nr pl.	reason	Nr pl.	Reason
MS	3	mech.causes	-	-	-	-	2	mech.causes
NTC	4	mech.causes	-	-	2	mech. causes	-	-

The soil maintenance consisted in the carrying-out of a weeding operation throughout a period of May - July (table 16).

Table 16. Weeds eradication

1st eradication
CUCUMBERS

Treatment	Date	Plot 1		Plot 2		Plot 3		Plot 4		$\bar{X}$	
		weeds		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr	kg
MS	26.05	10	0.15	20	0.20	18	0.25	3	0.10	12,7	0,17
NTC	26.05	200	1,00	175	0.85	160	0.50	132	0.35	166,7	0,67

TOMATOES

Treatment	Date	Plot 1		Plot 2		Plot 3		Plot 4		$\bar{X}$	
		weeds		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr	kg
MS	26.05	15	0.13	12	0.17	25	0.30	5	0.15	14,2	0,18
NTC	26.05	183	0.90	130	0.25	107	0.45	115	0.60	133,7	0,55

2nd eradication
CUCUMBERS

Treatment	Date	Plot 1		Plot 2		Plot 3		Plot 4		$\bar{X}$	
		weeds		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr	kg
MS	20.06	5	0.18	8	0.20	12	0.135	5	0.100	7,5	0,153
NTC	20.06	110	0.63	97	0.42	135	0.400	67	0.185	102,2	0,400

TOMATOES

Treatment	Date	Plot 1		Plot 2		Plot 3		Plot 4		$\bar{X}$	
		weeds		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr	kg
MS	20.06	7	0.19	10	0,163	15	0,148	4	0,150	9,0	0,162
NTC	20.06	120	0.47	98	0,370	93	0,400	80	0,280	97,7	0,380

Determinations were carried-out in order to identify the attack produced by pathogen agents. The results are presented in table 17.

Table 17. Disease identification

CUCUMBERS

Treatment	Plot 1		Plot 2		Plot 3		Plot 4	
	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason	Nr pl.	Reason
MS	-	-	-	-	-	-	-	-
NTC	5	Phytium sp.	4	Fusarium sp.	3	Fusarium sp.	-	-

TOMATOES

Treatment	Plot 1		Plot 2		Plot 3		Plot 4	
	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason	Nr pl.	Reason
MS	3	Botrytis cinerea	5	Botrytis cinerea	-	-	-	-
NTC	2	Fusarium sp.	7	Botrytis cinerea	5	Botrytis cinerea	6	Botrytis cinerea

No were identified or determined galls on the plants roots.
In general, the absence of nematodes was noticed in the greenhouse cultures at S.C. Codlea .
The production obtained is presented in table 18.

Table 18. Yield *

CUCUMBERS

Treatment	Plot 1 Kg	Plot 2 kg	Plot 3 kg	Plot 4 kg	t/ha
MS	1.853	1.964	1.925	1.858	76
NTC	1.684	1.679	1.805	1.732	69

*selling production until 25 of August

TOMATOES

Treatment	Plot 1 Kg	Plot 2 kg	Plot 3 kg	Plot 4 kg	t/ha
MS	2.917	2.835	2.875	2.973	116
NTC	2.457	2.449	2.440	2.454	98

*selling production until 30 of September

It's obvious that yield for MS variant is bigger then NTC variant for both cultures (tomatoes and cucumbers). For MS variant yield is bigger than NTC variant because of the soil disinfection alternative which has positive effect on plants production. The good effect of soil disinfection turned up because of the reducing weed number, better healthy plants rank respectively, who induce bigger quality and much more fruits.

4.2. S.C. BRASOV S.A.

Pepper
Variety: Bianca F1
Investments, pl/HA: 29.000
As above the number of plants and the date of their planting are shown in in table 19.

Table 19. N⁰ of transplanted plants (date of transplanting)

Treatment	Plot 1	Plot 2	Plot 3	Date of transplanting
MS	1.160	1.160	1.160	20.04.2005
NTC	1.160	1.160	1.160	07.04.2005

Plot area= 400 mp

In the first 15 days since the plantation, a small number of replaced plants was recorded especially due to mechanical causes and the attack of Fusarium oxysporum (table 20).

Table 20. N° of replanted plants by 15 days after the transplant

Treatment	Plot 1		Plot 2		Plot 3	
	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason
MS	2	Mech.causes	-	-	-	-
NTC	3	Fusarium oxysporum	5	Fusarium oxysporum	-	-

During the vegetation period, two weeding operations were carried – out. (table 21).

Table 21. Weeds eradication

1st weeds eradication

Treatment	Date	Plot 1		Plot 2		Plot 3		$\bar{X}$	
		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg
MS	10.05.2005	16	0.06	10	0.05	14	0.05	13.3	0.053
NTC	21.04.2005	110	0.50	160	0.65	180	0,90	150.0	0.680

2st weeds eradication

Treatment	Date	Plot 1		Plot 2		Plot 3		$\bar{X}$	
		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg
MS	27.05.2005	5	0.01	6	0.08	4	0.05	5,0	0.04
NTC	09.05.2005	45	0.10	70	0.18	60	0.15	58.3	0.14

A reduction of the number of weeds was observed, when the soil was treated with Metam Sodium.

Determination sick plants has lead to the identification of pathogen agents that provoked the plants death or drying (table 22).

Table 22. Disease identification

Treatment	Plot 1		Plot 2		Plot 3	
	Nr pl	reason	Nr pl	reason	Nr pl	Reason
MS	-	-	-	-	-	-
NTC	9	Fusarium oxysporum	5	Fusarium oxysporum	5	Botrytis cinerea

The recorded data state a more powerful attack produced by Fusarium oxysporum in NTC variant.

To the moment of clear crop don't identify the attack produced by nematodes.

The achieved production obtained indicate a favourable influence of metam sodium treatment (table 23).

Table 23. Yield

Treatment	Plot 1 kg	Plot 2 Kg	Plot 3 kg	t/ha
MS	2482	2478	2480	62
NTC	2036	2041	2043	51

*selling production until 28 of October

4 .3. S.C. LEADER INTERNATIONAL S.A. Constanta

Tomatoes:
Variety: Katerina F1
Investments, pl/HA: 27.000
As above the number of plants and the date of their planting are shown in table 24.

Table 24. N° of transplanted plants (date of transplanting)

Treatment	Plot 1	Plot 2	Plot 3	Plot 4	Date of transplanting
DZ	6.750	6.750	6.750	6.750	08.05.2005
MB	6.750	6.750	6.750	6.750	11.05.2005
NTC	6.750	6.750	6.750	6.750	11.05.2005

Plot area= 2500 mp

In the 1st 15 days since the planting, a small number of plants have been replanted (table 25).

Table 25. N° of replanted plants by 15 days after the transplant

Treatment	Plot 1		Plot 2		Plot 3		Plot 4	
	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason
DZ	10	Mechanical causes	5	Mechanical causes	15	Mechanical causes	17	Mechanical causes
MB	12	Mechanical causes	8	Mechanical causes	7	Mechanical causes	14	Mechanical causes
NTC	15	Mechanical causes	10	Mechanical causes	9	Mechanical causes	7	Mechanical causes

During the vegetation period, two weeding operations were carried – out. (table 26).

Table 26. Weeds eradication

1st weeds eradication

Treatment	Date	Plot 1		Plot 2		Plot 3		Plot 4		$\bar{X}$	
		weeds		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr*	kg
DZ	12.06	15	0.138	20	0.145	13	0.121	23	0.130	17,70b	0,133
MB	15.06	10	0.110	8	0.112	7	0.123	12	0.128	9,25a	0,118
NTC	15.06	98	0.630	120	0.679	132	0.898	141	0.901	122,70c	0,777

*) The values noted with the same letter do not present significant difference after the Duncan tests.

2nd weeds eradication

Treatment	Date	Plot 1		Plot 2		Plot 3		Plot 4		$\bar{X}$	
		weeds		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr*	kg
DZ	20.07	9	0.15	12	0.10	15	0.13	18	0.19	13,5a	0,143
MB	22.07	7	0.10	5	0.12	6	0.18	8	0.12	6,5a	0,130
NTC	22.07	45	0.35	72	0.87	78	0.93	64	0.77	64,75b	0,730

Insignificant problems were recorded due to foliar diseases, caused especially by Botrytis sp., Phytophtora spp and accidentally by Fusarium oxysporum (table 27).

Table 27. Disease identification

Treatment	Plot 1		Plot 2		Plot 3		Plot 4	
	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason
DZ	5	Fusarium oxysporum	20	Botrytis cinerea	12	Botrytis cinerea	7	Botrytis cinerea
MB	20	Botrytis cinerea	12	Botrytis cinerea	25	Botrytis cinerea	19	Botrytis cinerea
NTC	7	Fusarium oxysporum	8	Fusarium oxysporum	15	Phytophtora parasitica	30	Phytophtora parasitica

To the end of the crop , no plants affected by nematodes were identified.
The production obtained is presented in table 28.

Table 28.Yield *

Treatment	Plot 1 kg	Plot 2 kg	Plot 3 kg	Plot 4 kg	t/Ha
DZ	25250	25253	25257	25240	101a
MB	24751	24762	24739	24748	99a
NTC	18984	19007	19003	19006	76b

* 30 August 2005

**) The values noted with the same letter do not present significant difference after the Duncan tests.

4.4. S.C.S.R.I. Import – Export ISALNITA

Cucumbers:
Variety: Mathilde F1
Investments, pl/HA: 27.000
As above the number of plants and the date of their planting are shown in table 29.

Table 29. N^0 of transplanted plants (date of transplanting)

Treatment	Plot 1	Plot 2	Plot 3	Date of transplanting
DZ	240	240	240	30.04.2005
MS	240	240	240	30.04.2005
MB	240	240	240	30.04.2005

Plot area= 100 mp

In the firs 15 days since the transplanting a number of plants were replaced:

Table 30. N° of replanted plants by 15 days after the transplant

Treatment	Plot 1		Plot 2		Plot 3	
	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason
DZ	2	Mech.causes	2	Mech.causes	2	Mech.causes
MS	1	Mech.causes	3	Mech.causes	-	Mech.causes
MB	3	Mech.causes	2	Mech.causes	3	Mech.causes

Two weeding (weed removal) operations were carried – out in the cucumber culture at the fallowing dates:25.05.2005 and 12.07.2005 (table 31).

Table 31. Weeds eradication

1st eradication

Treatment	Date	Plot 1		Plot 2		Plot 3		$\bar{X}$	
		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg
DZ	25.05	28	0.10	32	0.29	35	0.35	31,60	0,246
MS	25.05	21	0,17	25	0,21	29	0,18	25,00	0,186
MB	25.05	16	0.12	21	0.23	20	0.20	19,00	0,183

2st eradication

Treatment	Date	Plot 1		Plot 2		Plot 3		$\bar{X}$	
		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg
DZ	18.06	20	0.17	32	0.21	25	0.18	25.66	0,186
MS	18.06	19	0.15	25	0.19	22	0.13	22,00	0,156
MB	18.06	12	0.14	21	0.16	17	0.14	16,66	0,146

There have been identified plants affected by the attack of the Sphaerotheca fulginea and Fusarium oxysporum fungi(table 32).

Table 32. Disease identification

Treatment	Plot 1		Plot 2		Plot 3	
	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason
DZ	10	Sphaerotheca fulginea	7 3	Sphaerotheca fulginea fusarium oxysporum	6 2	Sphaerotheca fulginea fusarium oxysporum
MS	5	Sphaerotheca fulginea	-		-	
MB	7	Sphaerotheca fulginea	10	Sphaerotheca fulginea	5	Sphaerotheca fulginea

To the finish of the yield (17 09 2005) no plants have been identified to carry soil diseases or nematodes.

The achieved production obtained do not indicate a significant difference between variants (table 33).

Table 33. Yield

Treatment	Plot 1 kg	Plot 2 Kg	Plot 3 kg	t/ha
DZ	490	514	496	48
MS	532	498	560	53
MB	515	510	505	51

4.5. S.C. LEOSER S.A.

Tomatoes:
Variety: Fado F1
Investments, pl/HA: 27.000
As above the number of plants and the date of their planting are shown in table 34.

Table 34. N° of transplanted plants (date of transplanting)

Treatment	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Date of transplanting
DZ	540	540	540	540	540	20.12.2004
MS	540	540	540	540	540	20.12.2004
MB	540	540	540	540	540	20.12.2004

Plot area= 200 mp

In the 15 day period since their planting some plants died, and they were replaced (table 35).

Table 35. Success of transplanting (plants to be replanted and reason)

Treatment	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5	
	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason
DZ	4	Accidental breaking	5	Accidental breaking	5	Accidental breaking	4	Accidental breaking	3	Other reason
MS	5	Accidental breaking	6	Other reason	3	Accidental breaking	7	Accidental breaking	8	Accidental breaking
MB	4	Accidental breaking	5	Accidental breaking	7	Accidental breaking	5	Accidental breaking	5	Accidental breaking

Two weed removal operations from the culture were executed (table 36).

Table 36. Weeds eradication

1st eradication

Treatment	Date	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		$\bar{X}$	
		weeds		weeds		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr	kg	nr *	kg
DZ	24.01.05	8	0.18	7	0.19	9	0.20	6	0.17	10	0.18	8 a	0.18
MS	24.01.05	7	0.13	6	0.11	4	0.12	9	0.15	9	0.14	7 a	0.13
MB	24.01.05	6	0.12	3	0.13	7	0.12	6	0.11	8	0.13	6 a	0.12

*) The values noted with the same letter do not present significant difference after the Duncan tests.

2st eradication

Treatment	Date	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		$\bar{X}$	
		weeds		weeds		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr	kg	nr*	kg
DZ	02.04.05	9	0.15	8	0.21	8	0.20	10	0.25	9	0.25	8.8a	0.21
MS	02.04.05	10	0.13	7	0.14	5	0.17	10	0.23	4	0.16	7.2a	0.16
MB	02.04.05	4	0.17	5	0.15	3	0.16	7	0.11	6	0.23	5,0a	0.16

The given data states a significant reduction of the weed number square meter, as well-as that of the quantity (kg/m^2) in the case of soil disinfection with Methyl Bromide and Metam Sodium compared with the soil disinfection with Dazomet .

During the plants growth and development, as well as during the culture's grubbing, pathogen agents were determined and identified, agents that lead to some plants suckering (table 37).

Table 37. Disease identification

Treatment	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		
	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason	$\bar{X}$
DZ	2	Botrytis cinerea	2	Botrytis cinerea	1	Botrytis cinerea	5	Botrytis cinerea	3	Botrytis cinerea	2.6
MS	3	Botrytis cinerea	2	Botrytis cinerea	2	Botrytis cinerea	3	Botrytis cinerea	1	Botrytis cinerea	2.2
MB	4	Botrytis cinerea	5	Botrytis cinerea	3	Botrytis cinerea	2	Botrytis cinerea	3	Botrytis cinereea	3.4

The climate conditions of 2005, as well as a flawed ventilation, lead to a higher frequency of the Botrytis cinerea pathogen; the attack was stopped by the application of the Rovral 50 WP, Sumilex 50 WP, Bavistin 50 WP fungicides and bushing of the lesions. The Meloidogyne incognito disease (pest) was present in all analyzed sorts(table 38).

Table 38.Effect of soil disinfestation treatments on galling infestation

Treat-ment	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		$\bar{X}$	
	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants
DZ	1,2	1,5	1,6	1,6	1,3	1,4	1,1	2,3	1,3	1,7	1.3	1,7
MS	0,4	4,6	0,3	4,1	0,6	4,2	0,4	4,6	0,3	4,0	0,4	4,3
MB	0,2	1,4	0,3	1,6	0,5	1,6	0,1	1,6	0,4	1,3	0,3	1,5

The yield registered at the 28 August are presentation in table 39.

Table 39. Yield *

Treatment	Plot 1 kg	Plot 2 kg	Plot 3 Kg	Plot 4 kg	Plot 5 kg	t/ha
DZ	1.942	1.950	1.948	1.939	1.921	97 a*
MS	2.242	2.244	2.240	2.245	2.229	112 b
MB	2.164	2.157	2.160	2.156	2.163	108 b

* 28 of August

The values noted with the same letter do not present significant difference after the Duncan tests.

4.6. S.C. BERSER S.A.

Tomatoes:
Variety: Fado F1
Investments, pl/HA: 24.000
As above the number of plants and the date of their planting are shown in table 40.

Table 40. N° of transplanted plants (data of transplanting)

Treatment	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Date of transplanting
SM	4.800	4.800	4.800	4.800	4.800	14.01.2005
NTC	4.800	4.800	4.800	4.800	4.800	14.01.2005

Plot area= 2000 mp

In the first fortnight (15 days) since the transplantation, a relativity small number of plants were replaced, due to their mechanical broken (table 40).

Table 41. Success of transplanting (plants to be replanted and reason)

Treatment	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5	
	Nr. pl.	reason	Nr. pl.	Reason	Nr. pl.	reason	Nr. pl.	reason	Nr. pl.	reason
SM	49	Accidental breaking	43	Accidental breaking	56	Accidental breaking	57	Accidental breaking	44	Accidental breaking
NTC	30	Accidental breaking	15	Accidental breaking	32	Accidental breaking	29	Accidental breaking	28	Accidental breaking

In the February-March period, 2 weed removal operations were executed (table 42).

Table 42. Weeds eradication

1st eradication

Treatment	Date	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		$\bar{X}$	
		weeds		weeds		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr	kg	nr	kg
SM	16.02.05	5	0.10	7	0.16	4	0.08	3	0.09	6	0.10	5	0.10
NTC	16.02.05	132	0.22	125	0.23	135	0.40	115	0.27	124	0.32	126	0.28

2nd eradication

Treatment	Date	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		$\bar{X}$	
		weeds		weeds		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr	kg	nr	kg
SM	14.04.05	4	0.12	5	0.13	4	0.13	5	0.15	4	0.13	4.4	0.13
NTC	14.04.05	100	0.25	105	0.22	106	0.29	104	0.31	96	0.30	102	0.27

A significant reduction of the weed number/m^2 was recorded in the soil disinfection by steam .

Following the determination made on plants attacked by different pathogen agents, plants were identified infested by Botrytis sp., Fusarium sp. (table 43).

Table 43. Disease identification

Treatment	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5	
	Nr. pl.	reason	Nr. pl.	reason	Nr. pl.	reason	Nr. pl.	reason	Nr. pl.	reason
SM	3	Botrytis cinerea	4	Botrytis cinerea	5	Botrytis cinerea	12	Botrytis cinerea	-	-
NTC	3	Fusarium	4	Fusarium	6	Botrytis cinerea	13	Botrytis cinerea	5	Fusarium

The attach produced by Botrytis cinerea was stopped by applying treatments with fungicide products (spraying and bushing).

The plants manifested typical attach symptoms, produce by the (nematodes), Meloidogyne spp.(table 44).

Table 44. Effect of soil disinfestation treatments on galling nematode infestation

Treat-ment	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		$\bar{X}$	
	root index° (0-5)	% Infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants
SM	0	1,2	0,2	1,1	0,3	1,5	0,2	1,0	0,5	1,9	0,24	1,34
NTC	1,8	2,3	2,1	3.7	1,9	3,4	1,6	2,8	1,4	4,1	1,76	3,26

The production obtained is presented in table 45.

Table 45.Yield *

Treatment	Plot 1 kg	Plot 2 kg	Plot 3 kg	Plot 4 kg	Plot 5 kg	t/ha
SM	22.818	22.812	22.765	22.805	22.800	114
NTC	20.206	20.190	20.205	20.201	20.198	101

* *selling crop to 24 of August*

The dates show a significant difference (13 t/ha) concerning yield between steam soil disinfection and one non treated.

4.7. R.A. PIPERA GREENHOUSE

Cucumbers:
Variety: Pyralis.
Investments, pl/HA: 24.000
As above the number of plants and the date of their planting are shown in table 46.

Table 46. N⁰ of transplanted plants (data of transplanting)

Treatment	Plot1	Plot2	Plot3	Plot4	Plot5	Date of transplanting
DZ	960	960	960	960	960	15.01.2005
VY	960	960	960	960	960	15.01.2005

Plot area= 400 mp

A relatively small number of plants were replaced in the first 15 days (table 47)

Table 47. Success of transplanting (plants to be replanted and reason)

Treat ment	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5	
	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason	Nr pl.	reason
DZ	5	Accidental breaking	3	Accidental breaking	8	Accidental breaking	4	Accidental breaking	5	Accidental breaking
VY	15	Accidental breaking	19	Accidental breaking	18	Accidental breaking	15	Accidental breaking	26	Accidental breaking

During the vegetation period 2 soil maintenance works were carried out (table 48).

Table 48 . Weeds eradication

1st eradication

Treatment	Date	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		$\bar{X}$	
		weeds		weeds		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr	kg	nr	kg
DZ	21.02.05	5	0.12	4	0.11	6	0.13	3	0.11	7	0.12	5	0,12
VY	21.02.05	15	0.23	20	0.34	21	0.36	9	0.26	10	0.25	15	0,28

2st eradication

Treatment	Date	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		$\bar{X}$	
		weeds		weeds		weeds		Weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr	kg	nr	kg
DZ	28.03.05	7	0.13	5	0.13	4	0.12	4	0.11	5	0.14	5	0,12
VY	28.03.05	12	0.17	17	0.23	14	0.19	7	0.12	8	0.14	11	0,17

The data analysis shows a reduction of the weed number in the sorts whose soil disinfection was carried out by Dazomet.

The pathogen agents that had caused harvest lasses during the cucumber growth and development were identified (table 49).

Table 49. Disease identification

Treat-ment	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5	
	Nr. pl.	reason	Nr. pl.	reason	Nr. pl.	reason	Nr. pl.	reason	Nr. pl.	reason
DZ	8	Sphaerotheca fulginea	6	Sphaerotheca fulginea	3	Sphaerotheca fulginea	4	Sphaerotheca fulginea	5	Sphaerotheca fulginea
VY	4	Sphaerotheca fulginea	5	Sphaerotheca fulginea	7	Sphaerotheca fulginea	6	Sphaerotheca fulginea	12	Sphaerotheca fulginea

In the cucumber culture grubbing signs of nematode attack on plants roots were observed(table 50).

Table 50. Effect of soil disinfestation treatments on galling infestation

Treatment	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		$\bar{X}$	
	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants
DZ	1,4	2,1	1,8	2,7	0,9	1,4	1,3	3.1	0,9	1,8	1,26	2,36
VY	1,8	2,8	1,9	2,7	2,1	3,2	1,6	2,8	1,7	3,2	1,82	2,94

At the end of the production cycle, the following harvested cucumber were recorded (table 51).

Table 51. Yield *

DZ	6.720	6.704	6.725	6.731	6.720	168
VY	5.764	5.759	5.757	5.768	5.752	144

* selling crop to 26 of June

DZ variant have a bigger yield than VY variant (24t/ha differences between this two variants).

4.8. I.C.D.I.M.P.H.- HORTING

Tomatoes:
Variety: Katerina.
Investments, pl/HA: 27.000
As above the number of plants and the date of their planting are shown in table 52.

Table 52. N^0 of transplanted plants (date of transplanting)

Treatment	Plot 1	Plot 2	Plot 3	Plot 4	Date of transplant
DZ	1.687	1.687	1.687	1.689	12.04.2005
MS	1.687	1.687	1.687	1.689	08.05.2005
NTC	1.687	1.687	1.687	1.689	12.04.2005

Plot area= 625 mp

In the first 15 days since the transplantation a significant number of plants that would necessitate replacement were observed, especially at NTC variant.(table 53).

Table 53. Success of transplanting (plants to be replanted and reason)

Treatment	Plot 1		Plot 2		Plot 3		Plot 4	
	Nr. pl.	reason	Nr. pl.	reason	Nr. pl.	reason	Nr. pl.	reason
DZ	5	Mechanical causes	4	Mechanical causes	6	Mechanical causes	4	Mechanical causes
MS	4	Mechanical causes	3	Mechanical causes	4	Mechanical causes	5	Mechanical causes
NTC	15	Gryllotalpa	21	Gryllotalpa	11	Gryllotalpa	24	Gryllotalpa

There were 2 weeding operations which were carried –out to the date of the collected data recording (table 54).

Table 54. Weeds eradication

1st eradication

Treatment	Date	Plot 1		Plot 2		Plot 3		Plot 4		$\bar{X}$	
		weeds		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr	kg
DZ	18.05.2005	10	0.128	15	0.136	7	0.140	5	0.153	9,25 a	0,139
MS	26.06.2005	8	0.115	7	0.125	8	0.118	11	0.123	8,5 a	0,120
NTS	18.05.2005	127	0.508	138	0.323	123	0.297	100	0.200	122 b	0,332

*) The values noted with the same letter do not present significant difference after the Duncan tests.

2nd eradication

Treatment	Date										
		weeds		weeds		weeds		weeds		weeds	
		nr	kg	nr	kg	nr	kg	nr	kg	nr	kg
DZ	20.06.2005	9	0.113	10	0.130	8	0.126	7	0.130	8,5	0,124
MS	31.07.2005	5	0.100	6	0.121	7	0.135	12	0.130	7,5	0,121
NTC	20.07.2005	101	0.187	92	0.210	120	0.207	73	0.182	96,5	0,196

To the date of the report's drafting some plants were recorded to have dried or died following the attack of pathogen agents (table 55).

Table 55. Disease identification

Treatment	Plot 1		Plot 2		Plot 3		Plot 4	
	Nr. pl.	reason	Nr. pl.	reason	Nr. pl.	reason	Nr. pl.	reason
DZ	3	Fusarium sp.	12	Phytophtora parasitica	17	Botrytis cinerea	15	Botrytis cinerea
MS	5	Phytophtora parasitica	-	-	-	-	-	-
NTC	16	Botrytis cinerea	25	Phytophtora parasitica	12	Botrytis cinerea	12	Phytophtora parasitica

There has been identified an attack of Botrytis cinerea and Phytophtora sp. in tomatoes, Fusarium oxysporum in small percentage.

The Meloidogyne incognito disease (pest) was present in all analyzed sorts(table 56).

Table 56.Effect of soil disinfestation treatments on galling infestation

Treat-ment	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		$\bar{X}$	
	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants	root index° (0-5)	% infested plants
DZ	1,0	3,6	1,8	3,1	1,1	4,6	1,2	3,6	1,6	3,3	1.1	3,3
MS	0,3	1,3	0,7	1,2	0,8	1,7	0,7	2,4	0,7	1,4	0,7	1,4
NTC	2,1	4,3	3,3	4,2	2,5	5,6	2,1	4,2	2,4	3,7	2,3	3,5

The table 57 shows a significant difference between DZ and NTC yields knowing it was the same date of transplanting. Concerning MS variant, yield is reduce because it was 26 days difference between dates of transplanting.

Table 57 . Yield *

Treatment	Plot 1 kg	Plot 2 kg	Plot 3 kg	Plot 4 kg	t/ha
DZ	4.545	4.540	4.547	4.548	72,72 a
MS	3.534	3.530	3.538	3.536	56,55 b
NTC	3.590	3.597	3.588	3603	57,51 b

*(until 1 October 2005)

**The values noted with the same letter do not present significant difference after the Duncan tests.

Aspects concerning variants' economical efficiency in the S.C. Leoser S.A. pilot plots are presented in table 58.

Table 58. Costs

USD/HA

VARIANT	DZ	MS	MB
SALARY	15867	15867	15867
MATERIALES	12667	14100	13579
UTILITIES	4000	4000	4000
INDIRECT COSTS	6833	7133	7023
TOTAL I	39367	41100	40469
PROFIT(10%)	3936.7	4110	4047
TOTAL II	43303.7	45210	44516
INCOMES	73400	84733	81733
FINANCIAL RESULT	30096.3	39523	37217

Recorded results show good financial result for all of the pilot plots, highest for metham sodium and methyl bromide ,respectively(over 37 200 US$/ha).

At the last crop had been taken several probes from each location and were made determinations concerning the solubility of dry substance, the content in soluble glucides, ascorbic acid and acidity.

The determinations are presented as averages of recorded results(table 59 – 60).

Table 59. The alimentation value of tomato fruits

(average dates)

Treatment	Solubility of dry substance (%)	Total glucides (%)	Acidity (% acid citric)	Ascorbic acid mg/100g
MS	5,6	2,47	0,41	21,7
DZ	5,4	2,44	0,40	22.1
MB	5,5	2,46	0,41	21,6
SM	5,5	2,51	0,43	22,6
NTC	5,4	2,46	0,44	22,4

Table 60. The alimentation value of cucumber fruits

(average dates)

Treatment	Solubility of dry substance (%)	Total glucides (%)	Acidity (% acid citric)	Ascorbic acid (mg/100g)
MS	3,9	2,1	0,08	10,9
DZ	3,6	2,1	0,09	11,0
MB	3,9	2,3	0,08	11,0
NTC	3,8	2,1	0,08	10,8

*tip Chornichon

CONCLUSIONS

The recorded results of pilot plots emphasized as suitable in soil disinfection for Romanian climate the next Methyl Bromide' alternatives :

- Metham Sodium chemical treatment
- Dazomet chemical treatment
- Grafted plants

The recorded results in soil disinfection using Metham Sodium, steam and Methyl Bromide showed a superior rise compare to Dazomet and Vydate.

All these because of steam and Methyl Bromide alternatives have a total eradication effect in pests, pathogens and weeds and Metam Sodium respectively, who has a better efficacy in pest, pathogens eradication and some weeds as secondary effect.

Dazomet treatment has a preventive, eradication efficacy only for nematodes and soil pests, secondary herbicide effect being very low.

Vydate treatment shows a nematode effect only.

Where are problems in nematodes only, the Romanian farmers are using Vydate and Rugby because of lower costs.

In this year climatic conditions the most greenhouses adopted a technology with one long cycle for tomatoes crop (for tomatoes the cycle begins in January- February and ends in September- October).

For the first cycle 2005/2006 we will supply the greenhouses site in project and another stakeholders(greenhouses cover with plastic film and field crops) with grafted seedlings what will be produced in the pilot nursery ,what will start up in the first part of November 2005.

The Metam Sodium can be buy with 2,73 Euro/liter (supplier Sumittagro Romania, the representative of Taminco) and the Dazomet powder from Borzesti factory Romania(3,06 Euro/kg).

An important part of the activities included the start of the pilot nursery and central power annexed to it.

By this moment it were finished the assemble works for greenhouse structure, it were set in all the accessories need for grafting technology, growth and rise of seedlings inside the greenhouse.

It were sign the agreements with utility purveyors (water, natural gases, electricity) and ended the process of connections at these utilities.

It were also performed the assemble works for central power and heat distribution system in the greenhouse, respectively. It was finalized all the activities so can be start the pilot greenhouse at normal parameters .

During of the first quarter 2006 (01 January – 31 March) the technical program of nursery foresees the next realizations:

	Beneficiary
A- 20000 seedlings of tomatoes normal plants - 6000 seedlings of tomatoes grafted plants	- S.C.Leader International Constanta Term of delivery:01 April 2006
B.-28000 seedlings of tomatoes normal plants - 8000 seedlings of tomatoes grafted plants	- Horticulture Partnership" 756" Term of delivery:10 March 2006
C. -40000 seedling of tomatoes normal plants	- small private enterprises Term of delivery:10 March 2006

Date of the report
26 decembre 2005

Signature
Marian Bogoescu

ACADEMIA DE ȘTIINȚE AGRICOLE ȘI SILVICE
INSTITUTUL DE CERCETARE-DEZVOLTARE PENTRU INDUSTRIALIZAREA ȘI MARKETINGUL PRODUSELOR HORTICOLE
HORTING
ROMÂNIA

Distribution

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Attachment nr.1

COUNTRY REPORT

Phase - out of Methyl Bromide in horticulture, Romanian

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Rodica Morohoi, Environmental Ministery, Bucharest, ROMANIA

The consumption of Methyl Bromide has begun in greenhouses from Romania since 1972.
The only domestic producer of methyl bromide is Sinteza-Oradea.
The main importer of methyl bromide is Petrostedesa Foreign Trade Company Bucharest, for the purpose of soil fumigation.
Small quantities of methyl bromide are also used in grain storage (all storage uses were covered by the domestic production).
The treatment of the soil with Methyl Bromide was used only in large commercial farmers.
Since 2000, there was no request for the use of Methyl Bromide in quarantine of agricultural products and pre-shipment applications (QPS).
The Multilateral Fund is supporting an on going project for the phase out of methyl bromide in the horticulture sector since 2002.
The use of methyl bromide in soil treatments for plant protection (fumigation applications) is banned from 1 January 2002 and the use of methyl bromide in storage applications is banned from 1 January 2005 (Gov Ordinance no. 89/1999, approved by Law No. 159/2000, art. 9).
Consumption decreased by approximately 40% by 2003 (approx 70% if expressed in ODP tones) compared to 1993.
The legal framework now in place in Romania includes legislation discharging the requirements of the Vienna Convention and additional legislation adopted in Romania thereafter.
The institutional framework for Montreal Protocol implementation, now in place in Romania through which the legal framework will be implemented is well established.
Beginning with 2002, started the UNIDO project "Phase - out of Methyl Bromide in horticulture, Romanian". The aim of the project is to establish some alternatives to use of methyl bromide in Romania protected horticulture sector for phase-out the residual 156,5 tones of Methyl Bromide.
The results of the project showed the main alternatives to phase out methyl bromide in Romanian horticultural protected crops are: soil disinfection with Dazomet or Metham Sodium and grafted plants.
The Multilateral Fund made one evaluation in November 2004 after two years of activity and the results of evaluation showed that the country is in full compliance with the Montreal Protocol's requirements as far as Methyl Bromide reduction targets are concerned and it moved up its phase out deadline in the horticulture sector to January 1, 2005.

Attachment nr. 2

THE INTERNATIONAL WORKSHOP ON PROMOTION OF METHYL BROMIDE ALTERNATIVES TO COMPLY WITH ITS PHASE OUT

07.12.2005 - 19.12.2005

Final Project

Group 5 (European and Middle East Countries)

INVESTIGATING METHYL BROMIDE SUBSTITUTES FOR MANAGING SOILBORNE PATHOGENS IN GREENHOUSE-GROWN VEGETABLES

BY

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ISREAL, DECEMBER 2005

Summary

Soilborne pathogens are very destructive in greenhouse-grown vegetable crops and one of the most limiting factors to farmer's income. Their management worldwide has been based on pre-plant soil fumigation with methyl bromide, a compound whose phase-out procedure was initiated in the Montreal Protocol (1992) due to its hazardous effects on the environment. All the current methyl bromide substitutes and control measures for controlling soilborne pathogens in greenhouse-grown vegetable crops have limitations, compared with methyl bromide. The alternatives to methyl bromide should be based on an integrated crop management approach, implementing and alternating powerful control measures such as soil disinfestation with soil fumigation, solarization and steaming, and the use of plant resistance. Other control measures such as the use of commercial formulations of biological control agents, the incorporation into the soil with organic soil amendments and cultural practices such as rotation, bare fallow and farm hygiene are less effective than soil disinfestation but they usually suppress the development of soilborne diseases.

I. Introduction

The production of greenhouse-grown vegetables is an important sector in European and Middle East countries. Soilborne pathogens are very destructive in greenhouse-grown vegetable crops and one of the most limiting factors to farmer's income. Their management worldwide has been based on pre-plant soil fumigation with methyl bromide, a compound whose phase-out procedure was initiated in the Montreal Protocol (1992) due to its hazardous effects on the environment. Methyl bromide is probably the only fumigant that is effective against nematodes, weeds, pathogens, insects and rodents. Worldwide, about 79,000 tons of MB have been used annually for agricultural uses. As a soil fumigant, it is widely used not only for greenhouse-grown vegetables but also for other horticultural field crops.

However, MB has been classified as a chemical that contributes to depletion of the Earth's ozone layer. Ozone depletion increases UV-B radiation, which has been linked to skin cancer, eye cataracts and degradation of the immune system. Recent studies indicated that bromine derived from MB is 50 times more effective at destroying ozone than chlorine from chlorofluorocarbons. Methyl bromide reaches the stratosphere through emissions from agricultural use, from burning of biomass and leaded gasoline, and from the oceans. Recent data on the loss of MB to the atmosphere indicate that of the total amount applied for soil fumigation, up to 90 % is lost to the atmosphere. It has also been shown to have hazardous effects on human and animal health. It is toxic to the central nervous system and damages lungs, kidneys, eyes and skin.

According to Montreal Protocol (1997), methyl bromide, as an ozone-depleting compound, has been scheduled to be phased out of production, importation and use as an agricultural chemical in developed countries by 2005 and in developing countries by 2015. Research has therefore been focused on finding effective alternatives to this fumigant in order to control soilborne pathogens. The aim of this study is to describe the current methyl bromide substitutes for controlling soilborne pathogens.

II. Discussion

During the last decades, the research was focused on investigating methyl bromide alternatives for controlling soilborne pathogens, mainly in greenhouse-grown vegetable crops. These substitutes have been based on using other registered chemical compounds, biological control agents, or physical and cultural control measures.

2.1 Chemical methods

Chemical compounds have provided great benefits to agricultural production for many years.

During the last ten years new fumigants such as Dazomet and Condor have been introduced and in many country registered.

The post-planting pesticides can be applied during cropping system, as their phytotoxicity is usually low, in order to control specific soilborne fungi and plant parasitic nematodes .

2.1.1 Soil fumigation

Even without MB, fumigation will remain an important control measure for greenhouse-grown vegetables. A small number of soil fumigants are currently

available and considered as possible alternatives to MB. These include chloropicrin, 1,3-dichloropropene (1,3-D), formaldehyde and MIT generators such as metham sodium and dazomet. These fumigants are used individually or as mixtures to achieve optimum control of soil-borne pathogens. While these fumigants do not cause depletion of stratospheric ozone, they all have limitations in activity or versatility as soil fumigants.

Chloropicrin has fungicidal and nematicidal activity but is much less nematicidal than MB or 1,3-D. While it is registered in some countries as a soil fumigant, there is resistance in some others to the high rates known to be most effective. Regulations on its use are still evolving.

1,3-Diclorpropene (Telon or Condor) was initially developed as a soil nematicide but now is available in mixtures with chloropicrin (Telopic®, TeloDrip®) in order to increase the former efficacy against soil-borne pathogens.

The MIT generators also have activity against plant-parasitic nematodes, weeds and a variety of plant pathogenic fungi. However, their effectiveness against plant-parasitic nematodes and weeds is limited.

Metham sodium is now widely used in many countries as MB substitute, it does however have a reputation for being unreliable if not used carefully (Noling, 2002). Furthermore, this compound is more sensitive to breakdown and loses its biocidal activity, when it is repeatedly applied into the same site.

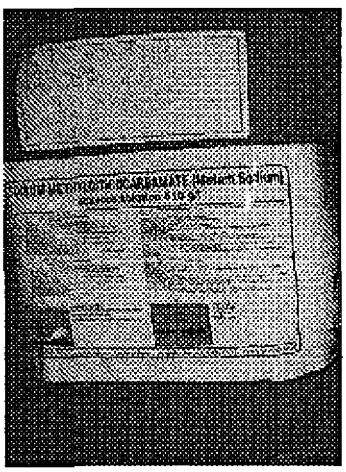

Figure.1. Metham Sodium

Other fumigants that are unregistered but have shown promising results are methyl iodide and *propargyl bromide*. These compounds have been shown a broad-spectrum of activity in the soil and are not sufficiently stable in the atmosphere to cause significant stratospheric ozone depletion. Further studies on their effectiveness against major soilborne pathogens and environmental and toxicological studies need to be carefully examined.

Unfortunately, the current registered fumigants have narrower spectrum of activity than MB. A wider spectrum of soil disinfestation with the current fumigants can be achieved by combining them. For example, treating the soil with both metham sodium (or dazomet ,or chloropicrin) and 1,3-D increases the treatment efficacy against both soilborne fungi and plant-parasitic nematodes. The combined application of formaldehyde and metham sodium could increase the treatment efficacy against plant pathogenic bacteria and fungi.

Dazomet (Basamid) is an effective fungicide and secondary herbicide especially for Portulaca sp.

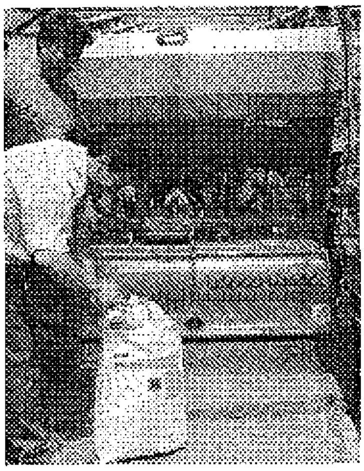

Figure.2.Dazomet machine

Efforts are also being made to increase the efficacy of existing fumigants and reduce their effects on the environment by improving application methods. Covering fumigant-treated soil with virtually impermeable plastics (VIP) has been shown to reduce fumigant emissions and increase their efficacy, even at reduced rates. Recent studies showed the application of fumigants one week after solarization, when the raised soil temperatures weak the soilborne propagules, increases the fumigant efficacy. The fumigant application by drip irrigation, which can be easily adopted into greenhouse vegetable crops, has been shown to increase the soil fumigant's efficacy. The depth of injection is another important factor affecting the efficacy of soil fumigants. Deep application may increase efficacy against plant-parasitic nematodes such as *Meloidogyne* spp. and it also reduces fumigant emission.

More research is needed on the improvement of existing compounds, the investigation of new ones and the improvement of the application methods. The use of fumigants in combination with other control measures should be further investigated.

2.1.2 Post-planting fungicides and nematicides

In contrast to soil fumigants, the post-planting pesticides can be applied during cropping system, as their phytotoxicity is usually low, in order to control specific soilborne fungi and plant parasitic nematodes (Cadusafos,Oxamyl,Fenamiphos). Fungicides can provide excellent management of some diseases, but for others they may be ineffective. In general, to control root diseases, broad-spectrum fungicides should be applied as a drench on a preventative basis. Read directions for application on pesticide labels. An application of additional water may be necessary.

However, although desirable levels of control of soil-borne pathogens can be achieved by post-planting chemical treatments, their activity is usually limited to a few weeks, leading to multiple applications.

The combination of soil fumigation and post-planting pesticides could provide effective control of soilborne pathogens but the cost of a such approach should be carefully considered at the beginning of the crop season (table 1).

Table 1. Methyl Bromide substitutes : spectrum of activity

Name	Weeds	Free nematodes	Cyst nematodes	Fungi	Bacteria	Mycorrhiza
Methyl Bromide	+++	+++	+++	+++	+	0
Telon	++	+++	+++	++	-	-
Telopic	+++	+++	+++	++	-	3
Vydate	-	+++	+++	-	-	9
Nemacur	-	+++	+++	-	-	9
Rugby	-	+++	+++	-	-	9
ForDor	+	+++	+++	++	+++	7

2.1.3 Kill-off of the harvesting plants

The application of soil fumigants at the end of the crop season and when the crop is still productive could drastically decrease the soilborne pathogen inoculum. An experiment has been recently conducted in the Bessor Regional Experiment Station in order to investigate an integrated management approach for managing the soilborne pathogens, mainly root-knot nematodes (*Meloidogyne* spp.) in the cut flower *Hypericum* spp. In this experiment, the application of 1,3-D through the drip irrigation at the end of the crop season, followed by soil disinfestation with a combined formulation of 1,3-D and chloropicrin reduced considerably the RKN inoculum and increased the crop health and performance of the following crop.

2.2 ***Non-chemical methods***

Non-chemical techniques include soil pasteurization by steam treatment or solar irradiation,cultural practices that reduce cumulative plant stresses thus decreasing the risk of disease outbreaks in crops and soil management methods which increase biodiversity and competition in the soil under crops (Littke 1994a, Littke 1994b) and biological controls which result in pest suppression.

2.2.1 Soil steaming

Steaming is a basic approach to soil disinfestation and was developed at the end of the 19th century (Figure 7). It is closer to solarization since the main principle is to raise soil temperatures to levels that are lethal or injurious to plant pathogens. Steam is generated by steam boiler and it is directed into the soil at 30 – 50 cm depth by pipes. The soil is covered with a heat resistant plastic in order to preserve heat in the soil as much as possible and to improve the efficacy of the treatment.

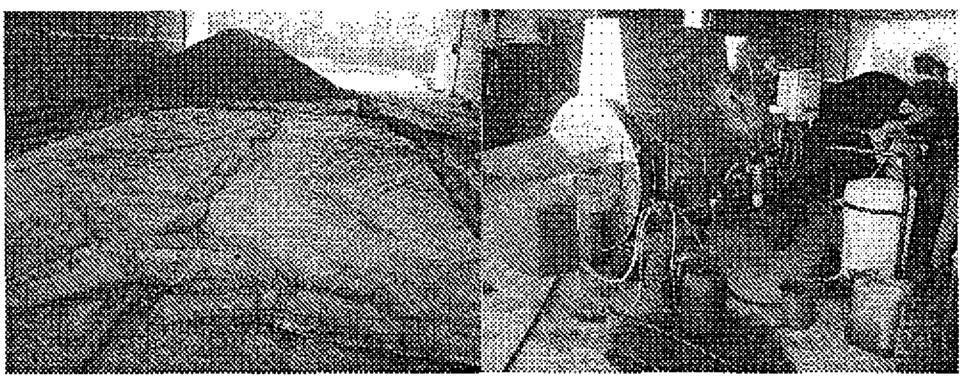

Figure 3. Soil steaming - steam boiler (left) and soil covered with a plastic sheet (right).

Various steaming machineries have been developed during the last two decades. The advantages of steaming is that it is a quick method and highly effective against almost all soilborne pathogens. However, the expensive equipment need to be introduced in the production unit and the high cost of its application are most limiting factors for its commercialization on a large scale in greenhouse production.

2.2.2 Solarization

Solarization is much more recent approach than soil fumigation, arising in 1970s in Israel. Solarization can be defined as a soil disinfestation method by using a hydrothermal process where moist soil is incubated under a transparent plastic sheet during hot weather in order to raise soil temperatures to levels that are lethal or injurious to many soilborne pathogens (Figure 1 and Figure 2). Soil solarization, a technique using clear-plastic tarps to trap solar radiation, can heat the soil profile to temperatures that effectively suppress soil-borne pests in areas with sufficient levels of solar radiation. For example, Weyerhaeuser has achieved soil temperatures sufficient to control pests in the upper 8-cm of soil in the southeastern United States. During solarization trials held in Arkansas in July and August, temperatures of 50-60 C (122-140 F) were achieved at a depth of 3 inches successfully suppressing Fusarium levels through two successive loblolly pine crops (Littke 1994).

Under normal conditions, soil temperatures in solarized soils range from 35-60°C, depending on soil depth, while most soilborne pathogens, as mesophylic organisms, are unable to grow at soil temperatures above 32 - 37°C. Therefore, the main and direct effect of solarization is the high and lethal soil temperatures achieved by soil mulching with plastic sheeting.

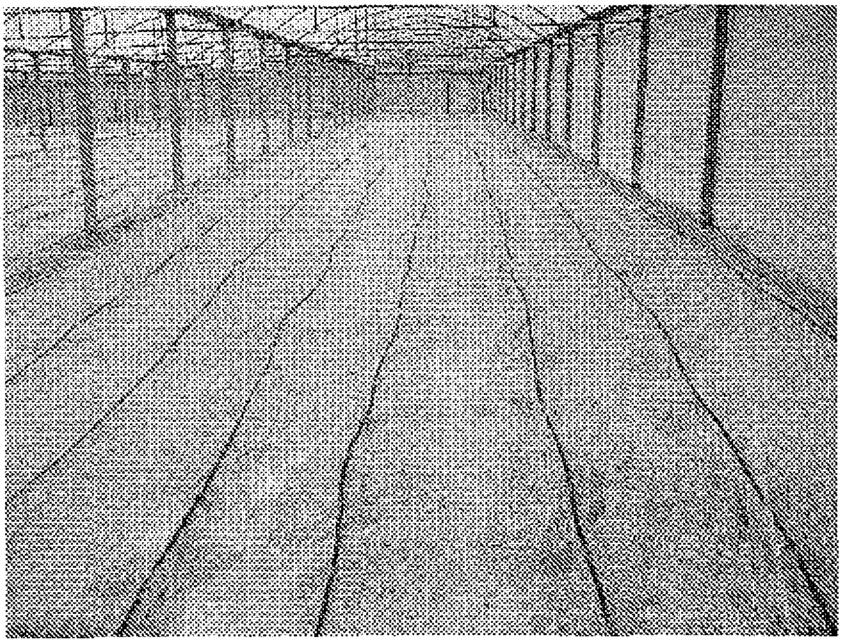

Figure 4. Soil solarization applied in greenhouse

The success of soil solarization is depended on ambient air temperature and light intensity, but other factors such as soil moisture, soil texture and the period of application are also important. Therefore, solarization is more effective during warm months whereas both light intensity and air temperatures are higher. Attempts to apply solarization at other times of the year had limited success.

Figure 5. Soil solarization applied in raised beds in greenhouse

Soil heating due to solarization also causes chemical and biological changes of soil. One of the most common changes observed in solarized soil is an increase in concentration of certain soluble mineral nutrients, which can be utilized by plants.

Biological process may be also stimulated in solarized soils as well. This can operate through reduction of pathogen populations by antagonistic microorganisms that have been enhanced by the heating process (e.g., *Bacillus* spp. and fluorescent pseudomonads).

In many cases, solarization increases plant growth and performance of vegetable crops even in the absence of major soilborne pathogens. This phenomenon, known as increased growth response, might involve several chemical and biological mechanisms, such as release of mineral compounds, stimulation of beneficial organisms and control of minor and unidentified pathogens.

Many studies have been shown that the use of solarization during hot months could effectively control many vegetable soilborne diseases caused by *Verticillium* spp., *Rhizoctonia* spp., *Pyrenochaeta* spp., *Fusarium* spp., *Sclerotium* spp. etc (Figure 3). Solarization is also effective against many annual and plant-parasitic weeds (*Orobanche* spp.) (Figure 4).

Solarization seems to be less effective against plant-parasitic nematodes, since these organisms prevail at deeper soil depths where soil temperatures are lower. Nevertheless, solarization has been reported to reduce partially the population levels and the disease severity caused by *Meloidogyne* (Figure 5), *Tylenchus*, *Heterodera*, *Xiphinema*, *Hoplolaimus*, *Pratylenchus* and *Rotylenchus* spp.

The most limiting factors for solarization are its reduced effectiveness against major plant-parasitic species such as *Meloidogyne* spp, the long time needed for its application (6 – 8 weeks) and its limitations to the warm months of countries with hot climatic conditions.


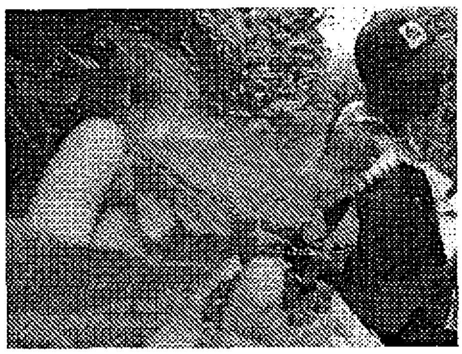
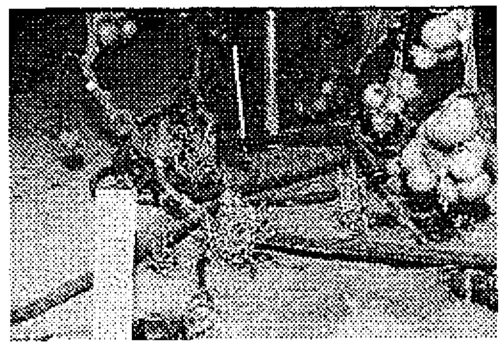

Figure 6. Symptoms on the foliage (upper left) and rooting system (upper right) of tomato crop caused by *F. oxysporum f.sp. radicis-lycopersici*. Symptoms on rooting system caused by *Pyrenochaeta lycopersici* (below left). Foliar symptoms of *Verticillium dahliae* (below right)

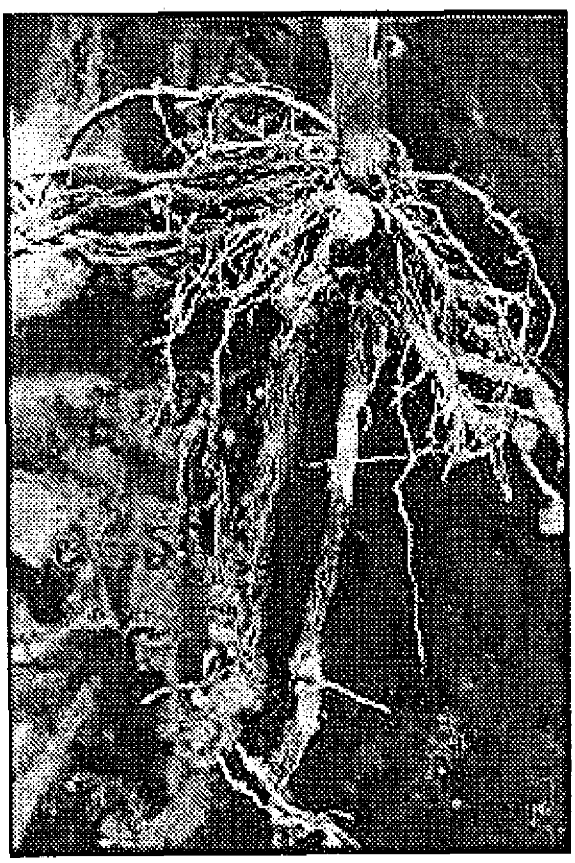
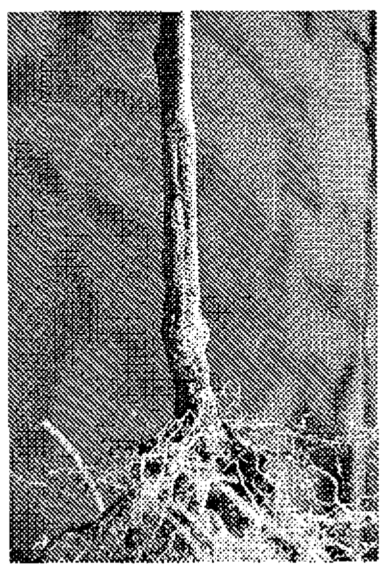

Figure 7. Tomato rooting system infected with *Meloidogyne* spp.

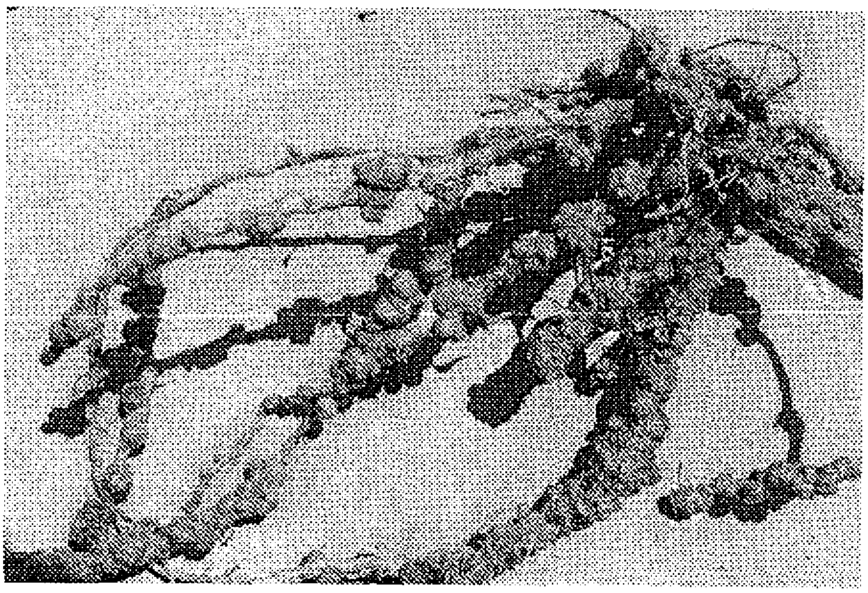

Figure 8. The plant parasiticweed Orobanche spp. growing on the plant roots.

2.2.3 Cultural practices

Cultural practices, such as farm hygiene, flooding, bare fallow and or incorporation of organic soil amendments can contribute significantly to suppressing soilborne populations. Flooding the soil, before planting, can reduce *Meloidogyne* spp. populations and the damage to the plants. The efficacy of flooding is attributed partly to anaerobic soil conditions. The incorporation of organic material, such as composts, manures and sludge derived from plant, animal or human wastes, have been demonstrated to control soilborne pathogens by stimulating soil antagonistic microorganisms. A disadvantage in incorporating organic amendments into the soil is the high volumes of material required. Sanitation is key for controlling pests in greenhouses. The goal of sanitation is to eliminate all possible sources of the pest. Weeds inside and near the outside of the greenhouse can harbor pests. It's best to pull the weeds inside the greenhouse rather than spray them, since insects may survive the spray and migrate onto crops. Bag all weeds and dispose of them outside the greenhouse. In addition, a 10-30 foot vegetation-free zone around the outside perimeter of the greenhouse-especially near vents and opening-can provide a dramatic decrease in pests. A heavy-duty geotextile weed barrier (e.g., DeWitt Sunbelt® Weed Barrier) covered with bark mulch or gravel can provide a pleasant vegetation-free zone, and eliminate the need for herbicides. Plant debris from previous crops can also be a source of both immature and adult pests. Clean up all debris from previous crops and dispose of infested plants, or any infested growth. Ideally, the greenhouse should be thoroughly cleaned and left empty for one week prior to beginning the next crop. This enables removal of all pest stages, and starves any remaining adults. Closing up the greenhouse when it is empty in summer will increase the temperature and help eradicate pests. Inside the greenhouse, a clean stock program should be in place. This includes temporary quarantine and inspection of all plants upon arrival from other greenhouses, and regular monitoring of stock plants used for propagation. If a separate section of the greenhouse can't be dedicated to this purpose, flag all incoming plants. All new plant material should be thoroughly inspected (with a 10X hand lens) for the presence of pests to ensure that no infested plants are introduced into the greenhouse. Workers in the greenhouse should avoid wearing yellow clothing, since many pests are attracted to this color and may hitch a ride on the fabric from one greenhouse to the next.

Rotation of non-host plants with plants susceptible to specific pathogens decreases the pathogen inoculum. However, crop rotation is of limited use for pathogens with wide host ranges such as *Meloidogyne* spp.

2.2.4 Plant Resistance

Plant resistance to pathogens can be defined as the ability to lessen, inhibit or overcome the attack by a pathogen. Resistance may have minor, moderate or large effect and these expression levels will largely determine the disease development. Plant resistance has been found and developed to many soilborne pathogens such as *Fusarium* spp., *Verticillium* spp, *Pyrenochaeta* spp., *Meloidogyne* spp. etc. Plant resistance is also environmentally friendly and sometimes less costly than chemical control.

Resistant varieties: Resistant crop varieties are used worldwide as a control method for soilborne pathogens. They have the advantage of providing long-term suppression of major soilborne population densities.

The use of resistant plants also has some disadvantages. The level of resistance gene expression may also be modified in the plant according to its genetic constitution, environmental effects and the virulence status of the pathogen population. For example, *Mi* gene expression is sensitive to soil temperature, with almost complete loss of expression at or above 28°C.

Resistant plants should be used carefully by farmers taking into account various factors. Before planting a vegetable crop, farmers should be aware about the potential pathogens of the crop or the pathogen status of their site. Rotation of resistant varieties with different levels of gene expression, and with other control measures will help to avoid the development of resistance-breaking soilborne populations.

Rootstocks: Commercial susceptible varieties grafted on rootstocks resistant to soilborne pathogens is another one technique used as an alternative method to methyl bromide. For example, susceptible tomato cultivars could be grafted on resistant rootstocks. Recent data showed that the grafted tomato crops provided higher yield than resistant varieties, probably due to the vigour rooting system of rootstocks. A limiting factor of the grafting technique in vegetable crops is that the compatibility between the rootstock and scion should be previously tested.

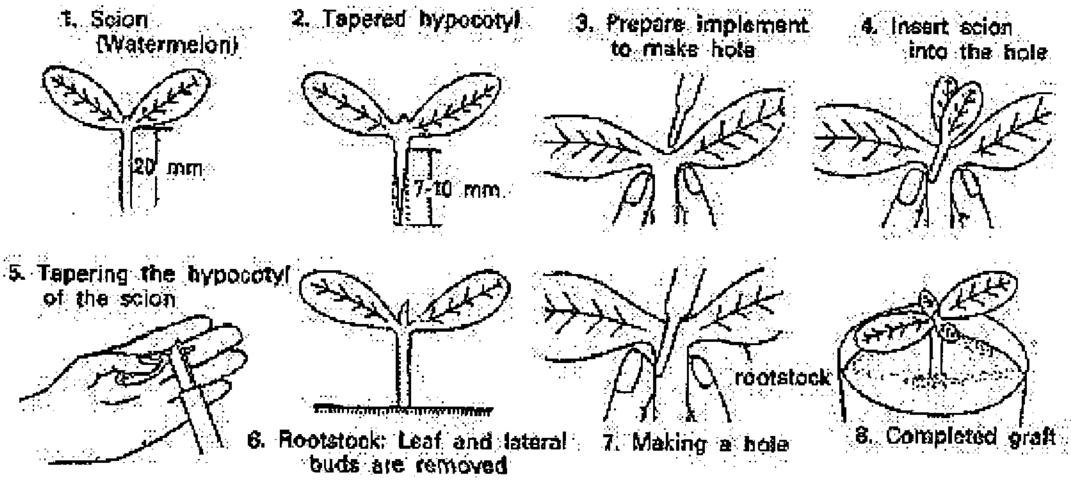

Figure.9 . High tide technology graftet plants

The most disadvantage of the grafted plants compared to resistant varieties and other control measures is their high cost, which might be double or triple than the price of a susceptible plant.

In order to reduce the cost production, the Nachla Lakhish Region (Mosav village) evaluated the effectiveness of the single- (the common one) and the double-shoot system (Figure 6). In the double shoot system, two growing shoots are growing at the same time, leaving larger space (60 or 80 cm) between the plants in the row, and, thus, minimizing the total number of the plants used to half or two thirds of the total number of plants, compared with the single-shoot system. The outcome of these studies showed that the reduced number of the double-shoot plants yielded almost equally to the double number of single-shoot plants. Therefore, by adapting the double-shoot system, the production cost of the grafted plants could be considerably reduced.

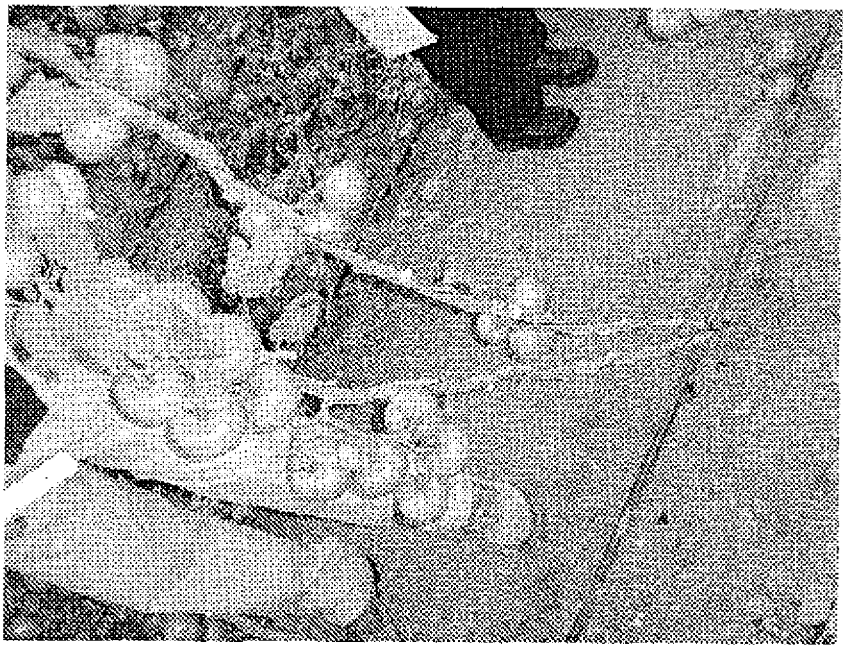

Figure 10. Tomato grafted on a rootstock using a double shoot system.

2.2.5 Biological control

The recognition of suppressive soils in which biotic factors prevent soilborne pathogen multiplication on susceptible crops has demonstrated that the biological control of plant pathogens has potential as a management strategy. The greatest success in the biological control has come from the use of bacteria and fungi that trap or parasitise the plant pathogens. Trapping fungi such as *Dactylella candida,* parasitic fungi such as *Paecilimyces lilacinus, Pochonia chlamydosporia* (formally known as *Verticillium chlamydosporium)* and parasitic bacteria such as *Pasteuria penetrans* and *Bacillus firmus* have been shown to suppress nematode populations.

Figure11.a. Nematodes

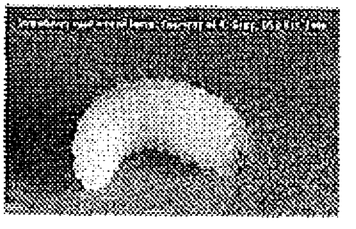

Figure11.b Parasiticlarva

A variety of composts and biological organisms are being evaluated for use as preplant soil treatments. Trials using chicken-litter, yard waste, crab processing residues, and cricket litter have been conducted to evaluate their ability to control disease and suppress pests. The composts contributed positively to soil fertility and disease suppression, but further development of the technique is necessary to increase consistency of results within and between different types of compost (Littke 1994a).

The examination of biological organisms, such as parasitic nematodes, fungi, and bacteria for controlling weeds, disease organisms, and nematodes there are new biological methods. Weyerhaeuser is investigating biological control agents along with other investigators using techniques such as boosting levels of antagonistic biocontrol agents in compost media, direct application of biocontrol agents to seed beds, and the potential for development of mycoherbicides as weed control agents. It is investigating the potential for utilizing biological control agents coupled with other cultural practices (soil pasteurization, crop rotations, and bare-fallow treatments) in the hope of intensifying their ability to combat disease.

A disadvantage of the biological control is that it is a slow-acting method but it may be effective in the long term, especially when combined with other control measurements. The development of effective biological control agents necessitates a

good understanding of the factors influencing parasitism in soil.

. The correct formulation of microbial products is also important for the success of this method. Lower costs, enhanced efficacy, compatibility with existing farm practices and safety are all important in determining the acceptability of biological control products by the grower.

2.3 An Integrated approach to control soilborne pathogens in greenhouse-grown vegetables

The limitations of all the promising MB substitutes force for the adoption of an integrated approach in order to effectively control soilborne pathogens. A such approach is described below:

- Identification of soilborne diseases in the greenhouse site by the help of governmental of private extension service.
- Killing off of the previous crop at harvesting stage by injection a soil fumigant through the drip irrigation system.
- Removing all the rooting debris from the soil.
- Incorporation of organic soil amendments such as compost to enrich the greenhouse site and promote soil suppression.
- Soil disinfestation immediately after the end of the crop season by using combined formulation of soil fumigants alone or in combination with soil solarization or steaming.
- The use of resistant varieties or rootstocks should be preferred, when this method is applicable.
- Early identification of specific soilborne diseases developed throughout the growing season and appropriate post-planting pesticides should be used for their control.
- Good hygiene in the greenhouse, and correct use of the irrigation and fertilization schedules will help the plants to withstand with plant diseases.

III. Conclusion

All the current methyl bromide substitutes and control measures for controlling soilborne pathogens in greenhouse-grown vegetables crops have limitations, compared with methyl bromide. Furthermore, the investigation of a single chemical compound as powerful as methyl bromide may cause disaster and unpredictable effects on the environment and human health. Therefore, the alternatives to methyl bromide should be based on an integrated crop management approach, implementing and alternating the various control measures described in this project. Soil disinfestation with combined fumigant formulations alone or in combination with soil solarization and steaming, and the use of plant resistance are powerful tools for vegetable growers in order to significantly reduce the soil inoculum. Some other control approaches such as the use of commercial formulations of biological control agents, the incorporation into the soil with organic soil amendments and cultural practices such as rotation, bare fallow and farm hygiene are less effective than soil disinfestation but they usually suppress the development of soilborne diseases by reducing the inoculum population in the soil.

It may be concluded that, at present, the adoption of an integrated control approach, adopting an implementation and an integration of soil fumigation, solarization, steaming and the use of plant resistance in combination with crop rotation, farm hygiene and other cultural practices serve as an alternative method to methyl bromide.

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DEDICATION

This project is dedicated to our Scientific Course Coordinator Mr. R. Ausher for his guidance and effort to convey his knowledge and experience to us.

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